

State University of New York

CHEMICAL HYGIENE PLAN

LABORATORY SAFETY AND HAZARDOUS WASTE DISPOSAL GUIDE

Prepared by

University at Albany State University of New York

Office of Environmental Health & Safety Updated SPRING 2012

http://www.albany.edu/ehs/

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PREFACE

Safety is a serious subject - especially when dealing with chemical and hazardous materials. Safe practice requires that users of chemicals and hazardous materials have a knowledge of potential hazards and a readiness to maintain safe conditions. It demands mutual responsibility and the full cooperation of everyone in the area. This cooperation means that each student, instructor, principal investigator, researcher, teaching assistant, graduate assistant, etc., must observe **ALL** safety precautions and procedures.

The University at Albany has had a long and continuous commitment in providing a safe and healthful environment for all its community members. To further promote this strong commitment, members of the Office of Environmental Health & Safety have prepared this manual with assistance from the Departments of Biology, Chemistry, Fine Arts, Geology, and Physics, and the Office for Research to serve as a guideline for safe practices and procedures in the University's laboratories, art studios, and all other areas where chemicals and hazardous materials are used or stored.* This manual is the Chemical Hygiene Plan as mandated by OSHA 29CFR 1910.1450.

The safety and well being of individuals working, learning and conducting research in these areas is directly dependent upon the information contained within this manual. Adherence to these guidelines will contribute greatly toward achieving a safe and healthful environment.

The information contained in this manual has been compiled by sources believed to be reliable. However, no warranty, guarantee, or representation is made by the University at Albany as to the correctness or sufficiency of any information herein; nor can it be assumed that all necessary warnings and precautionary measures are contained in this manual, or that other additional information or measures may not be required or desirable because of particular or exceptional conditions or circumstances, or because of new or changed legislation.

When in doubt, because of particular or exceptional conditions or circumstances, contact the Office of Environmental Health & Safety in Chemistry B73 at 442-3495.

THE NYS RIGHT-TO-KNOW LAW & THE FEDERAL HAZ-COM STANDARD

The University at Albany, State University of New York adheres to Chapter 551 of the Laws of New York State, commonly referred to as the Right-To-Know Law and 29CFR 1910.1200, entitled, The Hazard Communication Standard. Both pieces of registration require employers to institute certain safety training programs for employees and giving employees rights pertaining to information on toxic substances used in the workplace. Contact the Office of Environmental Health & Safety, if you have concerns regarding those laws.

^{*} Guidelines covering the safe handling and disposal of radioactive materials can be found in the Radiation Safety Manual. Please contact the Office of Environmental Health and Safety in Chemistry B73 - 442-3495.

FOR UNIVERSITY POLICY REGARDING:

ANIMAL WELFARE HUMAN SUBJECTS RESEARCH

ERGONOMICS INDOOR AIR QUALITY AIR EMISSIONS EMERGENCY PLANNING

CODE ADMINISTRATION BUILDING PERMITS FIRE SAFETY CODE COMPLIANCE

FIRE SAFETY FIRE SAFETY CODES LIFE SAFETY TRAINING

HAZARDOUS AND UNIVERSALWASTE CHEMICAL SAFETY CHEMICAL HYGIENE PLAN

RADIATION SAFETY RADIOACTIVE WASTE LASER SAFETY

OCCUPATIONAL SAFETY ASBESTOS

BIOSAFETY RISK COMMUNICATION BLOODBORNE PATHOGENS

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| OFFICE'S MAIN PHONE # | 442-3495 |
|------------------------------|---------------------|
| OFFICE's FAX # | |
| EHS WEBSITE | www.albany.edu/ehs/ |

RESPONSIBILITIES

Each principal investigator shall be responsible for controlling hazards in his/her research laboratories.¹ Specifically, this shall include: following the safety procedures, practices, policies and rules set forth by this manual, developing specific written safety procedures to be followed when working in a laboratory with hazardous substances, following all state and federal regulations, training employees and students in safe practices and documenting such training, correcting work errors and defective conditions, encouraging a safety attitude and culture in the laboratory, and investigating the circumstances surrounding an accident or near miss, if it occurs.^{2 & 3} Ultimately, the Principal Investigator is responsible for the safety of their laboratory.

Each laboratory worker shall be responsible for complying with the safety procedures, practices, policies and rules set by the principal investigator, state and federal governments and this manual, and shall report all accidents and near misses to their principal investigator.

Each instructor shall be responsible for controlling hazards in his/her teaching laboratories. Specifically, this shall include: following the safety procedures, practices and rules set forth by this manual, developing specific written safety procedures to be followed when working in a laboratory with hazardous substances, following all state and federal regulations, training students in safe practices and documenting such training, correcting work errors and defective conditions, encouraging a safety attitude and culture in the laboratory, and investigating the circumstances surrounding an accident or near miss, if it occurs.^{2 & 3}

Each student shall be responsible for complying with the safety procedures, practices and rules set by their instructor or principal investigator and this manual, and shall report all accidents and near misses to their instructor or principal investigator.

All University community members are responsible for reporting any perceived health or safety hazards on campus, as well as any suspected work-related illnesses or health problems to the Office of Environmental Health and Safety.

¹ A laboratory in this manual shall mean any place where hazardous materials or chemicals are used or stored.

² In all cases of personal injury/accident, a "Supervisor's Report of Employee's Alleged Accident" - Form PS-1 for faculty/staff or a "Report of Student/Public Accident or Public Injury" - Form LP-5 for students/visitors must be filled out. The employee accident form is available on-line at <u>http://www.albany.edu/hr/assets/empacc.pdf</u> Both accident reports are available in the Department Chair's Office or at the EH&S Office in Chem. B73.

³ In all cases of a lab accident or a near miss in the laboratory, a Laboratory Incident/Accident & Near Miss Report form must be filled out. This can be found on-line at <u>http://www.albany.edu/ehs/pdf/LABORATORYINCIDENTNEAR-</u><u>MISSREPORT.pdf</u>

I. EMERGENCY PROCEDURES

A. EMERGENCY PHONE NUMBERS

FIRE - POLICE - MEDICAL: 911 (If using a cell phone on the Uptown and Downtown campuses, dial 442-3131 for the University Police Department)

IN CASE OF FIRE:

Pull alarm box at nearest exit.

Evacuate building.

If no alarm box, dial 911

EAST CAMPUS – Dial 9 – 911, in the event of an emergency. East Greenbush Police will respond.



Emergency Blue Light Phones can also be used to call the police. - Just pick up the receiver and the police will respond.

Most elevators have an Emergency Call Button that links directly into UPD on the Uptown and Downtown campuses.

All laboratories must have an emergency contact sign posted outside the lab. The information on the sign is used to contact the appropriate lab personnel in the event of an emergency in that lab. It also informs emergency responders of the hazards to be found in that particular lab. For a fillable .pdf form for a lab sign, go to http://www.albany.edu/ehs/pdf/LaboratoryEntranceSign.pdf

B. MEDICAL EMERGENCY PROCEDURES

IN CASE OF MEDICAL EMERGENCY:

1. Protect yourself with the appropriate Personal Protective Equipment, if available (e.g., gloves, safety glasses.) Then give immediate First aid or CPR (Cardiopulmonary Resuscitation). See below.

2. Call 911 from an on-campus phone or 442-3131 from a cell phone to reach the University Police Department. If indicated, an ambulance will be summoned.

If on the East Campus, dial 9-911 for the East Greenbush Police.

- 3. Speak slowly and clearly.
- 4. Give the nature of the emergency.
- 5. Give the location of the emergency.
- 6. Give the number and condition of victims.
- 7. Give the phone number you are using and your name.
- 8. Hang up last, after the dispatcher does.

IN CASE OF CHEMICAL POISONING/EXPOSURE:

- 1. Follow the same procedures as for Medical Emergency above.
- 2. Take MSDS* with victim.

FIRST AID

The emergency phone number for the Uptown and Downtown campuses is:

911 for FIRE – POLICE – MEDICAL

9-911 for East Campus

(Dial 442-3131 for University Police Department, if using a cell phone on the Uptown or Downtown campuses)

*Material Safety Data Sheet (MSDS)

MEDICAL EMERGENCY PROCEDURES (Cont'd.)

GENERAL FIRST AID INSTRUCTIONS

In the event of an injury or other emergency, it is important to summon professional assistance immediately. The following instructions are intended only as guidelines for untrained people in providing assistance to the victim during the first few minutes, until professional assistance arrives. It is preferable to have a person trained in First Aid, Cardiopulmonary Resuscitation (CPR) and Automated External Defibrillators (AEDs) providing assistance during the first few minutes. The Office of Environmental Health and Safety urges each department to consider having several people trained in First Aid, CPR and AEDs . Contact Employees Benefits Office at 437-4700 for First Aid, CPR and AED training.

- 1. Effect rescue only if it can be safely done and it is necessary to prevent victim from further injury while summoning an ambulance. Otherwise, do not move the victim or allow him/her to move until the injuries have been assessed. Protect yourself with the appropriate personal protective equipment, if available (e.g., gloves, safety glasses.)
- 2. Ensure an adequate airway.
- 3. Ensure adequate breathing (give mouth-to-mouth or mouth-to-nose respiration, if necessary).
- 4. Check for circulation by feeling for a pulse at the neck or wrist, if absent begin CPR (Cardiopulmonary Resuscitation), if you are trained to do so.
- 5. Control severe bleeding by the use of direct pressure.

THERMAL BURNS

- 1. Submerge the burned area in cold water (except for third-degree burns). This will significantly reduce both swelling and pain. A third-degree burn is one in which tissue damage has occurred.
- 2. Apply a dry sterile dressing.
- 3. Do not break any blisters.
- 4. Do not use any commercial sprays or home remedies (butter, etc.).
- 5. Seek medical attention (University Health Center or Hospital.)

CYROGENIC BURNS

If exposed to liquid or cold gas, restore tissue to normal body temperature $98.6^{\circ}F(37^{\circ}C)$ as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Seek medical attention. Rapid warming of the affected part is best achieved by using water at $108^{\circ}F/42^{\circ}C$). Under no circumstances should the water be over $112^{\circ}F/44^{\circ}C$, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke, nor drink alcohol.

MEDICAL EMERGENCY PROCEDURES (Cont'd.)

Most liquid nitrogen burns are really bad cases of frostbite. We don't mean to belittle the harm that can come from frostbite, but at the same time, we wanted to keep the dangers associated with liquid nitrogen burns in perspective. Indeed, liquid nitrogen burns could be treated as frostbite.

CHEMICALS IN THE EYE

1. Flush the eye with copious amounts of water for at least 15 minutes being careful not to wash the chemical into the other eye. Use an eyewash fountain if one is available. Another person should assist the victim by holding open the victim's eye while it is being flushed.

2. Seek medical attention and have the chemical's MSDS accompany the victim.

CHEMICAL BURNS

1. Brush any chemicals off the skin with a clean cloth, gloved hand, etc. Flush the affected area with copious amounts of water for at least 15 minutes. If necessary, cut off or use tweezers to remove chemically soaked clothing; avoid touching contaminated areas of clothing. Continue to flush skin for several minutes more after clothing has been removed.

- 2. Apply a sterile dressing.
- 3. Seek medical attention and have the chemical's MSDS accompany the victim.
- 4. All chemically contaminated clothing must be thoroughly washed prior to re-wearing.

*Material Safety Data Sheet (MSDS)

NOTE

In the event of an accident or injury, *always* notify the principal investigator, instructor, supervisor or other person in charge as soon as possible. In all cases of personal injury/accident, a *"Supervisor's Report of Employee's Alleged Accident"* (Form PS-1 for faculty/staff) or a *"Report of Student/Public Accident or Public Injury*" (Form LP-5 for student/visitor) must be filled out. The employee accident form is available on-line at <u>http://www.albany.edu/hr/assets/empacc.pdf</u> These forms are also available in the Department Chair's Office or in the EH&S Office in Chem. B73.

Also, all lab accidents or near misses must be documented on a Laboratory Incident/Accident & Near Miss Report Form.

http://www.albany.edu/ehs/pdf/LABORATORYINCIDENTNEAR-MISSREPORT.pdf

MEDICAL EMERGENCY PROCEDURES (Cont'd.)

POISONING BY MOUTH: IF VICTIM IS CONSCIOUS

1. Call for medical assistance 911 or East Campus 9-911.

2. After medical help has been summoned, call the Poison Help Hotline at 1-800-222-1222.

3. Save the label or container of the suspected poison for identification and for possible transportation with the victim to a medical facility. Also, take the MSDS to the medical facility. If the victim vomits, save the vomited material for analysis.

POISONING BY MOUTH: IF VICTIM IS UNCONSCIOUS

1. Maintain an open airway, adequate breathing. Give artificial respiration or CPR (Cardiopulmonary Resuscitation) if indicated.

2. Call for medical assistance 911 or East Campus 9-911.

3. After medical help has been summoned, call the Poison Help Hotline at 1-800-222-1222.

4. **DO NOT** give liquids to an unconscious or convulsing victim.

5. Save the label or container of the suspected poison for identification and for possible transportation with the victim to a medical facility. Also, take the MSDS to the medical facility. Save all vomited material.

NOTE: Instructions on labels for treatment of poisoning may be outdated or incorrect and should only be followed after consulting a physician.

*Material Safety Data Sheet (MSDS)

POISON HELP HOTLINE 1-800-222-1222

C. EVACUATION PROCEDURES

University buildings are to be evacuated immediately under the following conditions:

a) Fire alarm;

b) Power outage affecting chemical fume hoods;

c) When notified by a senior physical plant representative, University Police Department or person of authority in the building;

d) Treat to life and health as determined by individual good judgment, e.g., hazardous material spill, dangerous gas leak, explosion, natural disaster, etc.

If you are asked to evacuate the building or hear a fire alarm, do the following:

a) Stop work immediately;

b) Put out all flames or heat sources;

c) Rapidly proceed to the nearest exit in an orderly manner and close all doors behind you;

d) NEVER USE ELEVATORS;

e) Principal investigators and instructors check to see that employees and students have vacated their workplace, if conditions permit;

f) Reconvene outside and away from the building to insure everyone has left the building;

g) If you know of someone who is having trouble leaving the building, REPORT it immediately to someone in authority who is handling the emergency;

h) NEVER re-enter the building until a senior physical plant representative and/or building fire marshal has given the okay.

TREAT ALL ALARMS AS THE REAL THING. ASSUME NOTHING!!

D. EMERGENCY PROCEDURES FOR A RADIATION CONTAMINATION OR EXPOSURE INCIDENT

I. Injuries Involving Radiation Hazards

A. Notification (day or night)

1. Call 911 from an on-campus phone or dial 442-3131 on a cell phone to reach the University Police Department. Call 9-911 on the East Campus to reach the East Greenbush Police Department.

- 2. Tell the dispatcher who answers:
 - a. Someone has been injured in ______ Building, Room ______.
 - b. Radioactivity and/or radiation exposure is involved.
 - c. Your name and telephone extension being used.
- B. Care of the Injured
 - 1. Apply first aid, if necessary.
 - 2. Measure exposed skin and clothing for contamination.
 - 3. Remove significantly contaminated clothing and, if necessary, clothe individual in an uncontaminated laboratory coat.
 - 4. Stay with individual with assistance arrives and advise on the extent of the contamination.
- C. Contamination control procedures while awaiting assistance:
 - 1. For a localized non-volatile liquid spill:
 - a. Cordon off or guard spill area against re-entry; drop absorbent paper onto spill.
 - b. Assemble potentially contaminated persons in one location of the laboratory and monitor them for contamination.
 - c. Require everyone possibly involved to wait until the Radiation Safety Officer or designee arrives.
 - 2. For a release of powdered material, volatile liquid, or gaseous activity:
 - a. Evacuate personnel immediately, turning off any equipment that normally needs constant attention, **if** time permits.
 - b. Assemble personnel immediately outside the room and instruct them to stay in one location, to prevent the spread of contamination.
 - c. Close and, if possible, lock the room doors to prevent re-entry. If the hood fans are off, try to seal accessible openings into the laboratory to prevent further escape of airborne activity to the corridor.
 - d. Isolate the adjacent corridors against traffic and spectators.
 - e. Wait for the Radiation Safety Officer or designee to arrive.
- II. Contamination Incident Without Injury
 - A. Notification (day or night)

1. Call 911 from an on-campus phone or dial 442-3131 on a cell phone to reach the University Police Department. Call 9-911 on the East Campus to reach the East Greenbush Police Department.

- 2. Tell the person who answers:
 - a. Radiation contamination incident in _____ Building, Room _____.
 - b. Your name and telephone extension being used.
- B. Contamination control procedures while awaiting assistance: SEE I.C. above.

E. CHEMICAL SPILL PROCEDURES

EMERGENCY SPILLS - VOLATILE, FLAMMABLE, FUMING OR TOXIC MATERIALS

1. Leave the bottle, carton, etc., right where it falls. **DO NOT** attempt to handle the substance with bare hands

2. Alert room occupants, turn off all ignition sources, and immediately evacuate the area. Close the door behind you to prevent further building contamination.

3. Pull the building fire alarm box at the nearest exit to alert other building occupants and to summon aid (University Police Department and Power Plant).

Leave the building and call 2-3444. Give your name, building name, room number of spill and nature and extent of the spill. State if medical aid is needed.

4. As soon as possible, notify the Office of Environmental Health and Safety at 2-3495. Give the name of the chemical spilled, the amount spilled, manufacturer and any other pertinent information available.

5. The Office of Environmental Health and Safety will supervise cleanup by properly trained and equipped personnel.

6. No one is to enter the area for general housekeeping cleanup until the EH&S Office has declared the area to be decontaminated and safe.

NON-EMERGENCY SPILLS

1. Leave the bottle, carton, etc., right where it falls.

2. DO NOT attempt to handle the substance with bare hands.

3. Alert room occupants to the spill. If flammable liquid is involved, turn off ignition sources.

4. Contact the Office of Environmental Health and Safety at 2-3495.

5. Give the name of the chemical spilled, manufacturer, the amount spilled, and any other pertinent information available.

6. The Office of Environmental Health and Safety will advise on the correct cleanup procedures. In special instances, the Office of Environmental Health and Safety may perform minor cleanup procedures in the interest of safety. These cleanup procedures will be performed in conjunction with the personnel involved.

*Spill cleanup kits for small spills are available for free through the Office of Environmental Health and Safety.

CHEMICAL SPILL PROCEDURES (Cont'd.)

CHEMICAL SPILL FIRST AID PROCEDURES

If an individual becomes contaminated with a spilled chemical, particularly if the words TOXIC, ACID, CAUSTIC or CORROSIVE appear:

1. Brush any dry chemicals off the skin and clothing with a clean cloth, gloved hand, etc.

2. Flush the affected area with copious amounts of water for at least 15 minutes, using the nearest safety shower, or in the case of eye contamination, the nearest eye wash fountain. If necessary, cut off or use tweezers to remove chemically contaminated clothing, being careful not to touch contaminated areas. Continue to flush skin for several minutes after clothing has been removed. NOTE: You may have to bodily hold the individual under the running water. If the individual's eyes are affected, you may have to hold their eyes open while they are being flushed.

DO NOT BECOME CONTAMINATED YOURSELF!

3. Seek medical help by calling 911 (or if on the East Campus 9-911) or by taking the individual to the University Health Center.

4. Later, have the individual fill out a personal injury/accident form, LP-5 form for students/visitors and PS-1 form for faculty/staff. These forms are available in the Department Chair's Office or in the EH&S Office in Chemistry B73. The employee accident form is available on-line at http://www.albany.edu/hr/assets/empacc.pdf

5. All contaminated clothing must be thoroughly washed before being worn again. If the clothing is heavily contaminated, depending on what was spilled, it may have to be disposed of as hazardous waste.

*All lab incidents/accidents and near misses, must be reported on a Laboratory Incident/Accident & Near Miss Report form, in addition to a personal injury/accident form:

http://www.albany.edu/ehs/pdf/LABORATORYINCIDENTNEAR-MISSREPORT.pdf

*Always read a chemical's Material Safety Data Sheet (MSDS) before using. The MSDS will review chemical spill first aid procedures.

II. FIRE SAFETY

A. FIRE PROTECTION

One of the more serious problems that can confront an individual in a laboratory is the spectra of a fire. Electrical equipment, open flames, static electricity, burning tobacco, lighted matches and hot surfaces can all cause ignition of flammable materials. Flammable liquids, powders of combustible solids, compressed and liquefied gases are always prevalent; and therefore, caution should be exercised whenever an open flame is required for any particular experiment. Fire falls into four main classes:

Class A - ordinary solid combustibles, such as paper, wood, textiles, etc.

Class B - flammable liquids, such as gasoline, oil, solvents, etc.

Class C - A fire where an electrical current is present, or where a shock hazard could be a reality

Class D - burning metals, such as sodium, potassium, metal hydrides, etc.

Each type of fire requires an extinguisher specifically applicable to controlling that particular fire:

Class A - water extinguisher or an ABC dry chemical fire extinguisher

Class B - carbon dioxide, BC dry chemical or ABC dry chemical fire extinguisher

Class C - carbon dioxide, BC dry chemical or ABC dry chemical fire extinguisher

Class D - met-1-x fire extinguisher (available on the second and third floors of Chemistry)

Flammable substances are those that readily catch fire and burn in air. A flammable liquid does not itself burn; it is the vapors from the liquid that burn. The rate at which different liquids produce flammable vapors depends on their vapor pressure, which increases with temperature. The degree of fire hazard depends also on the ability to form combustible or explosive mixtures with air, the ease of ignition of these mixtures, and the relative densities of the liquid with respect to water and of the gas with respect to air. These properties can usually be found on a chemical's Material Safety Data Sheet (MSDS).

These concepts can be evaluated and compared in terms of a number of properties:

Flash Point:

The lowest temperature, as determined by standard tests, at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid within the test vessel. Many common laboratory solvents and chemicals have flash points that are lower than room temperature.

FIRE PROTECTION – (Cont'd.)

Ignition Temperature:

The minimum temperature required to initiate or cause self-sustained combustion independent of the heat source.

Limits of Flammability:

a) Lower Flammable Limit (Lower explosive limit LEL) is the minimum concentration (percent by volume) of the vapor in air below which a flame is not propagated when an ignition source is present. Below this concentration, the mixture is too lean to burn.

b) Upper Flammable Limit (Upper explosive limit UEL) is the maximum concentration (percent by volume) of the vapor in air above which a flame is not propagated when an ignition source is present. Above this concentration, the mixture is too rich to burn.

Autoignition:

Takes place when a substance reaches its ignition temperature without the application of external heat. Materials susceptible to autoignition include oily rags, dust accumulations, organic materials mixed with strong oxidizing agents (such as nitric acid, chlorates, permanganates, peroxides, and persulfates), alkali metals such as sodium and potassium, finely divided pyrophoric metals, and phosphorus. See Appendix A.

The basic precautions for the safe handling of flammable materials include the following: 1. Flammable substances should be handled only in areas free of ignition sources.

2. Flammable substances should never be heated by using an open flame. Preferred heat sources include steam baths, water baths, oil baths, heating mantles, and hot air baths.

3. Before lighting a flame, remove all flammable substances from the immediate area. Check all containers of flammable materials in the area to ensure that they are tightly closed.

4. When transferring flammable liquids in metal equipment, static generated sparks should be avoided by bonding from container to container and the use of ground straps. The grounding straps must go to an earth ground. Be sure the clamps on all straps are hitting metal and not just the paint on the containers.

5. Notify other occupants of the laboratory in advance of lighting a flame.

6. A flame-resistant lab coat should be worn by any individual in a lab using flammable materials. If handling pyrophoric materials in the lab, a flame-resistant lab coat is mandatory.

7. Store flammable materials properly. Use a flammable liquid storage cabinet whenever possible. Flammable liquid storage cabinets can be requested through the Office Environmental Health & Safety. See Section V.A. for guidelines on the proper storage of flammable liquids.

8. When volatile, flammable materials may be present, use only non-sparking electrical equipment.

9. Ventilation is one of the most effective ways to prevent the formation of flammable mixtures. An exhaust hood should be used whenever appreciable quantities of flammable substances are transferred from one container to another, allowed to stand in open containers, or handled in any other way.

FIRE PROTECTION – (Cont'd.)

Compressed or liquefied gases present hazards in the event of fire because the heat will cause the pressure to increase and may rupture the container. Leakage or escape of flammable gases can produce an explosive atmosphere in the laboratory. Acetylene, hydrogen, ammonia, hydrogen sulfide and carbon monoxide are especially hazardous. When a liquefied gas is used in a closed system, pressure may buildup, so that adequate venting is required. If the liquid is flammable (i.e., hydrogen), explosive concentrations may develop. Any, or all, of the three problems, flammability, toxicity, and pressure buildup, may come serious.

Suspensions of oxidizable particles (such as magnesium powder, zinc dust, or flowers of sulfur) in the air constitute of powerful explosive mixture. Care should be exercised in handling these materials to avoid exposure to ignition sources. See Appendix A.

B. PHYSICAL PROPERTIES OF COMMON FLAMMABLE LIQUIDS

| | | | | | Flammable Volume | Limit % by in air |
|---------------------|-------|------------------------|--------------------------|--------------------------|---------------------|----------------------|
| Chemical | Class | Flash Point (°C) | Boiling Point (°C) | lgnition Temp (°C) | Upper | Lower |
| Acetaldehyde | 1A | -37.8 | 21.1 | 175 | 4 | 60 |
| Acetone | 1B | -17.8 | 56.7 | 465 | 2.6 | 12.8 |
| Benzene | 1B | -11.1 | 80 | 560 | 1.3 | 7.1 |
| Carbon disulfide | 1B | -30 | 46.1 | 80 | 1.3 | 50 |
| Cyclohexane | 1B | -20 | 81.7 | 245 | 1.3 | 8 |
| Diethyl ether | 1A | -45 | 35 | 160 | 1.9 | 36 |
| Ethyl alcohol | 1B | 12.8 | 78.3 | 365 | 3.3 | 19 |
| n-Heptane | 1B | -3.9 | 98.3 | 215 | 1.05 | 6.7 |
| n-Hexane | 1B | -21.7 | 68.9 | 225 | 1.1 | 75 |
| Isopropyl alcohol | 1B | 11.7 | 82.8 | 398.9 | 2 | 120 |
| Methyl alcohol | 1B | 11.1 | 64.9 | 385 | 6.7 | 360 |
| Methyl ethyl ketone | 1B | -6.1 | 80 | 515.6 | 1.8 | 10 |
| Pentane | 1A | -40 | 36.1 | 260 | 1.5 | 7.8 |
| Styrene | 1B | 32.2 | 146.1 | 490 | 1.1 | 6.1 |
| Toluene | 1B | 4.4 | 11.06 | 480 | 1.2 | 7.1 |
| p-Xylene | 1C | 27.2 | 138.3 | 530 | 1.1 | 7 |

C. IN THE EVENT OF A FIRE, FOLLOW THESE PROCEDURES

1. Notify laboratory occupants to evacuate.

2. Pull the building alarm box at the nearest exit. Evacuate the building.
DO NOT USE ELEVATORS. Close all doors behind you.¹ If no alarm box, dial 911 or if on the East Campus, dial 9-911

3. Notify the Office of Environmental Health and Safety at 2-3495 as soon as possible regarding the nature of the fire and materials involved.

4. If a person's clothing should catch fire, douse the individual with water (use a safety shower or eyewash drench hose, if one is readily available) or have the individual, cover their face and drop to the floor and roll. If necessary, physically restrain the person and roll them around the floor to smother the flames.

5. Learn the location and the use of the nearest fire extinguisher, types of fire extinguishers available and the procedures for exiting during a fire. Look in building corridors for appropriate evacuation routes.² Only use a fire extinguisher after you have established a safe exit route and you feel you are capable of putting out the fire.

PLAY IT SAFE! Know your limitations; do not compromise you life in a hazardous situation.

6. Contact the Office of Environmental Health and Safety for any problems concerning fire safety related items at 2-3495.

REMEMBER THE ACRONYM "RACE", IN THE EVENT OF A FIRE:

RACE

1. **R**ESCUE – those in imminent danger

2. ACTIVATE – the building's fire alarm system

3. CONTAIN - the fire and smoke by closing fire doors

4. **E**XTINGUISH – the fire only if the fire is small, contained and you are trained in fire extinguisher usage

*All lab incidents/accidents and near misses, must be reported on a Laboratory Incident/Accident & Near Miss Report form, in addition to a personal injury/accident form. http://www.albany.edu/ehs/pdf/LABORATORYINCIDENTNEAR-MISSREPORT.pdf

This includes all lab fires.

¹ The doors within a building, especially in stairwells and in corridors, are required to meet State Fire Code. Doors in stairwells must never be propped open. Open doors will allow the spread of smoke and fire to the exits, rendering them useless. Doors in corridors are smoke partitions; they separate areas limiting the spread of smoke, fire, or fumes to adjacent areas. This serves two purposes: limiting damage and/or contamination and extending escape time. Do not prop them open.

² Building corridors and stairwells are fire exits. **NO material shall be placed in any exitway**. This includes furniture, equipment, boxes, etc.

D. FIRE EXTINGUISHER USAGE PROCEDURES:

Pull the alarm box - this will evacuate the building and summon aid.
 Remember RACE:

 Rescue – those in imminent danger
 Activate – the building's fire alarm system
 Contain – the fire and smoke by closing fire doors
 Extinguish – only if the fire is small, contained and you are trained in fire extinguisher usage

2. Fight a small fire only (rule of thumb-no larger than a small trash can) and only use a fire extinguisher, if you have been trained and feel confident in using one. Always place the fire extinguisher between you and the fire. If the fire gets large, get out! Close doors to slow the fire spread. Stay between the fire and an exit. **Do not let fire block your escape path in case it goes out of control.**

3. Make sure you use the correct type of fire extinguisher (see page 20). Make sure you do not use one type extinguisher on another type fire; it may make the fire worse.

4. Learn how to **PASS**.

P ULL

Pull the pin. Some units require the releasing of a lock latch, pressing a puncture lever, or other motion.

A IM

Aim the extinguisher nozzle (horn or hose) at the base of the fire.

S QUEEZE

Squeeze or press the handle.

S WEEP

Sweep from side to side at the base of the fire until it goes out. Shut off the extinguisher. Watch for re-flash and reactivate the extinguisher, if necessary. Foam and water extinguishers require slightly different action. Read the instructions.

*All lab incidents/accidents and near misses, must be reported on a Laboratory Incident/Accident & Near Miss Report form, in addition to a personal injury/accident form. http://www.albany.edu/ehs/pdf/LABORATORYINCIDENTNEAR-MISSREPORT.pdf

This includes all lab fires.

III. SAFETY PROCEDURES FOR LABORATORY OPERATIONS

A. GENERAL SAFETY PROCEDURES

1. New York State Education Law Section 409-A requires the use of eye protection when working in a laboratory. Chemical splash goggles should be worn wherever chemicals are used or stored. Contact lenses are prohibited. Particulate matter, liquids, vapors, and gases can lodge behind contact lenses and cause considerable eye damage before they can be washed out with water from an eyewash fountain. Visitors must wear eye protection while in laboratories.

2. Adult visitors in laboratories must be accompanied by a faculty or staff member or a graduate student. Children are **PROHIBITED** in all laboratories. **All laboratories must be locked when unattended. Magnetic stirrers must not be used to hold lab doors open.**

3. Avoid unnecessary exposure to all chemicals. Wear lab coats or aprons and gloves to protect clothing and skin. Lab coats are preferable to aprons as they cover your arms. If handling pyrophoric or flammable liquids or solids, flame-resistant lab coats must be worn. Outside of the laboratory, except when transporting chemicals and/or hazardous materials, lab coats and gloves serve no purpose, could spread contamination and should be left behind in the laboratory. Shorts, cut-offs, capris, halter tops sandals, flip flops, and open toe shoes **MAY NOT** be worn in the laboratory area. Long hair and dangling jewelry should be contained.

4. Label all containers of chemicals, including waste chemicals. Include your name, the chemicals used, their concentrations and date prepared on the label of all solutions. Put the opening date and disposal date on all materials that degrade such as peroxides and ethers. Never use any substance from an unlabeled or inadequately labeled container.

5. Use laboratory fume hoods when handling flammable, toxic, or noxious agents. Before conducting any work in a fume hood, first check to see if the fume hoods is operating.*

IF NO AIR MOVEMENT IS EVIDENT, IMMEDIATELY CONTACT THE POWER PLANT AT 2-3444.

6. Eating, drinking, and smoking are **PROHIBITED** in the laboratory areas.

7. Know the location of the nearest safety shower, eyewash station, fire extinguisher and spill kits. Keep them clean and unobstructed.

8. Mouth suction must NEVER be used to fill pipettes, start siphons, or for any other purpose.

9. Never perform experimental work in the laboratory alone, or at least without another person within easy call. Make sure that person knows you are working alone and have that person check up on you periodically. No undergraduate laboratory work is to be carried out in the absence of an instructor. Perform only authorized experiments. Unapproved variations are prohibited. Research people who are responsible for their own experimental programs should inform others working in the area of the chemicals being used and the possible hazards involved. All reactions are to be attended or made fail-safe if left alone or overnight. Reactions should be labeled with the name and phone number of the contact person in case of an emergency.

*Vaneometers are available through the Office of Environmental Health and Safety.

GENERAL SAFETY PROCEDURES (Cont'd.)

10. Work with materials only when you know their flammability, reactivity, corrosiveness and toxicity. Before working with any chemical, review the manufacturer's Material Safety Data Sheet (MSDS) (for additional information contact the Office of Environmental Health and Safety - Chemistry B73). Read all labels thoroughly.

11. All known poisons and known carcinogens should be handled with extreme care and kept under lock and key. All Department of Homeland Security Chemicals of Interest (COIs) must be kept secure at all times.

12. A women who works in a laboratory while pregnant should be especially careful to avoid contact with chemicals, particularly those that are embryotoxic or teratogenic. If there is any possibility that you may be pregnant or considering pregnancy, it is strongly suggested that you consult with your physician concerning possible hazards from exposure to chemicals in the laboratory.

13. Apparatus attached to a ring-stand should be positioned so that the system's center of gravity is over the base and not to one side - the lower the better, but with adequate room for removing burners or baths.

14. Provide a vent for chemicals that are to be heated. Prior to heating a liquid, place boiling stones in vessels (other than test tubes). Use a thermometer in a boiling liquid if there is the possibility of dangerous exothermic decomposition, as in some distillations. This will provide warning and may allow time to remove the heat and apply external cooling.

15. Fire polish all glass tubing and rods. Use the proper techniques for inserting and removing a glass tube from a stopper. Shortcuts can lead to a severely punctured hand. Protect hands with gloves, towel, or tubing holder when inserting or removing tubing from stoppers. Lubricate the tubing with water or glycerine. Keep hand on tubing close to the stopper and out of line with the end of the tube.

16. NEVER look down the opening of a vessel unless it is empty.

17. Use beaker covers to prevent splattering when heating liquids on a hot plate. Keep a pair of tongs conveniently at hand - a specific pair of tongs for the dish, crucible, beaker, casserole, or flask being used.

18. **NEVER** pour ether, petroleum ether, or other flammable, water-immersible liquids into sinks to be washed down with water. Fires have been caused in laboratories by vapors returning through the drainage system. It is also illegal to put most chemicals down the drain. See Hazardous Waste Disposal Procedures - Section VII.

GENERAL SAFETY PROCEDURES (Cont'd.)

19. Before opening any bottle on which the lid or top is stuck, first make sure there are no additional hazards with opening the bottle such as peroxide formation or pressure buildup in the bottle. If there are no additional hazards associated with opening the bottle, wrap the bottle with a towel and place it in a metal container before cutting the lid. Use the same precautions when opening an ampoule, and at the same time, be careful that the liquid in the ampoule is cold. NEVER open an ampoule containing a flammable liquid by heating the tip with a flame. When opening bottles which may be under pressure (e.g., hydrochloric acid, formic acid or ammonium hydroxide), cover the bottle with a towel to divert any chemical spray, and open under a fume hood.

20. When transferring chemicals, make certain the container is compatible with the chemical.

21. Adequate traps must be used in vacuum systems in which mechanical pumps are used, to prevent corrosion of the pump. Do not release the vacuum in any apparatus when the temperature is above 150° C. The hot vapors may explode.

22. Use only the necessary length of rubber or other flexible tubing and keep it to the rear of the set-up. The water pressure at the University may occasionally vary and in the past has caused several water supply lines to pop off and flood laboratories, causing various degrees of damage. Thus, all connecting hoses, especially water supply lines, **MUST** be fastened with either clamps or wires. If the water lines are not secured and a flood occurs, the department and/or principal investigator may be charged for any damages caused by the flood.

23. Do not mix incompatible chemicals. If in doubt, always check the chemical's Material Safety Data Sheet (MSDS) or a source book before mixing chemicals. Always add a reagent slowly; never "dump it in." Observe what takes place when the first amount is added and wait a few moments before adding more; some reactions take time to start.

ALWAYS ADD ACIDS TO WATER CAUTIOUSLY, WHILE STIRRING. NEVER POUR WATER INTO ACID

24. Appropriate eye protection must be worn when working with lasers or other optical sources. Contact the Radiation Safety Officer (Chemistry B73) at 2-3495 for additional information.

25. REMEMBER THAT THE PHYSICAL HAZARDS OF A CHEMICAL ARE JUST AS IMPORTANT AS KNOWING AS ITS HEALTH HAZARDS. Physical hazard means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, corrosive, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

B. HOUSEKEEPING

1. Set up and label separate waste receptacles for paper and glass. Oily rags and other oil-impregnated materials should be stored in an approved, covered, metal container and disposed of by calling the EH&S Office at 2-3495. DO NOT PUT NOXIOUS MATERIALS IN THE TRASH. Contact the Office of Environmental Health and Safety for proper disposal.

2. Empty chemical containers are to be triple rinses with water, or the appropriate solvent depending on the chemical, and taken down to the C.A.S. Scientific Stores for disposal. The custodial staff is not responsible for the disposal of these containers. See Section VII.D.

3. Aisles and hallways should not be obstructed. Benches, tables, desks, and fume hoods are work areas, not storage space. Keep work areas clean. Keep drawers and cabinets closed. **Keep all chemicals off the floor. Do not store chemicals overhead.**

4. Equipment with moving parts (gears, belts, pulleys) MUST be equipped with protective guards. DO NOT REMOVE Machine Guards.

5. Centrifuge tubes should be in good condition - no chips or other flaws. Tubes should be balanced when in use.

6. Oven temperature regulators should be checked periodically to ensure that they are working reliably.

7. Use undamaged, clean glassware - no chips or other flaws.

8. Dewar flasks should be taped when in use or enclosed in metal mesh to protect personnel from flying glass. In general, if apparatus is likely to shatter, either because of pressure or vacuum, surround it with mesh or cloth to limit the travel of particles and to protect personnel.

9. Do not attempt to catch glassware, if it is dropped or knocked over. Glass apparatus should be set well back from the front edge of the work bench to lessen the risk of injury, if there is an accidental breakage of glass.

10. Sink traps and floor drains should be kept filled with water at all times to prevent escape of sewer gases into the laboratory. Such gases may be toxic or flammable and may be ignited, causing flash fires. A little vegetable oil may be poured down drains that are not used on a regular basis. This will prevent their traps from drying out and odors from escaping.

11. Chemicals should not be poured down the drain or put in the trash. See Hazardous Waste Disposal Procedures - Section VII.

12. Each water supply outlet within the laboratory should be equipped with either a vacuum breaker or a back-flow prevention device. No auxiliary plumbing should be connected to a water distribution line, unless adequate back-flow prevention is provided.

HOUSEKEEPING (Cont'd.)

13. Keep all safety showers and eyewash stations clean and unobstructed. **INSPECT AND FLUSH EYEWASH STATIONS WEEKLY and denote date on the attached inspection tag.** If the eyewash is not working properly, contact the Shop Coordinator's Office at 2-3480. If you need an eyewash and/or safety shower installed, contact the Office of Environmental Health and Safety in Chemistry B73.

14. A sign should be fastened on the outside of the door of every laboratory and chemical storage area. This sign should contain the names and phone numbers of the people who should be notified in the event of an emergency. These signs are available on-line at http://www.albany.edu/ehs/pdf/LaboratoryEntranceSign.pdf

15. Appropriate warning signs should be posted near any dangerous equipment, reaction, experiment or condition. See Appendix on Designated Areas.

16. Keep laboratory doors closed at ALL times. Leaving a laboratory door open interferes with the air flow of the fume hoods, disrupts the building's air handling system and allows various odors to circulate around the building. Laboratory doors must be locked, if the laboratory is unattended. Also, keep building fire doors CLOSED at all times.

17. Clean up all spilled chemicals, water, and broken glassware immediately. Keep floors unobstructed, dry, and free from slippery materials. DO NOT STORE CHEMICALS IN GLASS CONTAINERS ON THE FLOOR.

18. Keep caps and lids of chemical containers closed when not in use as this prevents contamination and vapor escape.

19. Before leaving the laboratory, turn off all services not in use such as water, electricity, gases and vacuums. Bunsen burners should not be left burning when not in use. They should be turned off at the petcocks. Do not depend upon turning a gas burner off at its base.

20. Use only the necessary length of rubber or other flexible tubing and keep it to the rear of the set-up. All connecting hoses, especially water supply lines MUST be fastened with either clamps or wire.

NOTE: Water pressure may increase at night.

21. The contents of refrigerators in laboratories should be reviewed and inspected at regular intervals with should not exceed six months. Do not store materials in open containers in the refrigerator. Food and chemicals must NOT be stored together in a refrigerator because of the possibility of contamination. Refrigerators/Freezers should be explosion proof if storing flammable materials. See Refrigerators-Section V.F.

22. Keep all air vents unobstructed at all times. DO NOT COVER THEM. It will affect the air flow of the fume hoods.

23. DO NOT BLOCK WINDOWS IN DOORS, particularly on laboratory doors, as this poses a potential life threatening hazard in the event of a fire or chemical spill. In the event of an emergency evacuation, personnel checking the building for occupants cannot see into the rooms.

C. TRANSPORTATION OF HAZARDOUS MATERIALS

Transporting hazardous substances from one location to another within the University can be a serious safety and health problem. Individuals could be unduly exposed through carelessness or neglect. For these reasons, extra precautions are not only prudent, but necessary.

RULES FOR TRANSPORTING HAZARDOUS MATERIALS

1. Unbreakable containers must be used to transport bulk amounts of chemicals.

2. All liquid chemicals in glass containers MUST be transported in bottle carriers. These carriers are available either for loan or purchase from CAS Scientific Stores. The Stores will not release any toxic or hazardous chemical unless it is in an unbreakable carrier or in a bottle carrier.

3. All compressed gas cylinders, including empties, MUST be secured upright to a cylinder hand truck with the cylinder valve cap in place. This includes cryogenic tanks.

4. Whenever transporting liquid nitrogen tanks (or any cryogenic that is venting) in elevators, make sure another person is waiting for you when you exit the elevator. This will ensure that you have someone available to summon help should the elevator break down and/or you are overcome by the over-venting of the gas. If at all possible, no one should ride in an elevator with a venting cryogenic tank.

5. When transporting chemicals and/or compressed gases for University use in vehicles, on or off-campus, contact the Office of Environmental Health & Safely for the appropriate procedures and paper work. **Chemicals and/or compressed gasses should not be transported in personal vehicles.**

6. Do **not** transport unstable materials, e.g. old peroxide-forming chemicals. Contact EHS at 2-3495 for assistance.

D. FUME HOOD PRACTICES

Improper fume hood practices often render the hood useless and unsafe. The hoods are only *secondary safety devices* and must be used in conjunction with good laboratory safety practices. The following information will help the user attain a higher degree of safety:

1. Prior to fume hood usage, become familiar with the location of the nearest exit, emergency shower, eyewash station and fire extinguisher, and be sure the pathways to these locales are unobstructed.

2. Verify that the hood is operating properly before each usage. Use the installed airflow monitor, a vaneometer, or a piece of tissue to check for airflow. A reading of 80 - 150 fpm on the monitor or vaneometer indicates good airflow. DO NOT USE THE HOOD IF ADEQUATE AIRFLOW IS NOT INDICATED. Notify the other occupants in the lab of the problem and immediately contact the Power Plant at 2-3444 (24 hours). If you need a vaneometer, contact the Office of Environmental Health and Safety in Chemistry B73.

3. **DO NOT USE HOODS ON FRIDAY MORNINGS BETWEEN 7:30 am & NOON.** Every Friday morning between 7:30 am and noon the Academic HVAC crew inspects the machinery in the air monitors in the Biology, Chemistry including the Ion Implanter, Earth Science, Fine Arts and Physics buildings. (If Friday is a holiday, Monday is the inspection day.) In order to protect the HVAC maintenance crew while they are in the monitors where the fume hood exhaust fans are located, it is mandated that on Friday mornings the fume hoods not be used until noon. Be sure all chemicals in the hood are in sealed containers. Also, do not send anything toxic up the vacuum lines that exhaust on the roof during this time frame.

4. Always wear safety goggles, gloves and a lab coat when working around the hood.

5. KEEP THE HOOD UNCLUTTERED; THE MORE CLUTTERED A HOOD, THE MORE AIR FLOW DISTURBANCES POSSIBLE. Keep the hood as clean as possible.

6. Keep experimental apparatus away from the edge of the hood - at least four (4) inches behind the face of the hood, and well away from the back (blocking the baffles will disturb the airflow pattern.)

7. Position the sash appropriately to ensure a minimum face velocity of 80 - 100 feet per minute (fpm). Reducing the open face will increase the face velocity plus provide protection to the user. Keep your head outside the hood and keep the sash closed when the hood is not in use.

8. Try not to store chemicals in the hood - chemicals stored inside the hood disturb the airflow pattern (especially when blocking baffles), and reduce the available working space. Evaporation of chemical waste up the fume hood is an illegal form of hazardous waste disposal. All hazardous waste containers in a hood should be kept sealed, unless they are actively being used (actually pouring waste into the container.)

9. **Do not use perchloric acid in laboratory fume hoods.** Perchloric acid must only be used in hoods designed especially for it. Perchloric acid, especially when heated and volatized, can form shock sensitive metal perchlorates in metal duct work. Contact the Office of Environmental Health and Safety for proper perchloric acid usage procedures.

E. DISTILLATION PROCEDURES

Performing a distillation is a common procedure in laboratories. But the fact that it is common, means that people tend to overlook the inherent hazards. In order to keep distillations safe, the following rules should be followed:

1. Always use either round-bottomed flasks or kettles of Pyrex supported with a tripod or bench jack, with a neck clamp for added security. To prevent an over-violent reaction, place boiling chips or an ebullator in the distillation flask or bottle.

2. Provide a vent in every distillation system and check to see that it does not become plugged. Otherwise, an explosion may occur.

3. Before starting a distillation process, check all joints and connections to see that they are greased and tight. Secure glass joints with wire or clamps to prevent vapor leakage. Be certain that the coolant is flowing and that a receiver of adequate capacity is in place.

4. Perform all flammable liquid distillations, extractions, and washing operations in a fume hood. Use an electric heating mantel or a water or steam bath for heating - never use an open flame or hot plate. Before distilling ethers or acetal, destroy all peroxides that may be present. See Appendices A and G.

5. When distillations are performed under reduced pressure, inert gas should be introduced by an ebullator. On vacuum stills, be certain that the contents of the system have cooled below the boiling point before releasing the vacuum.

6. Avoid overheating still bottoms at end of distillation. When stopping a distillation, first shut off the heat. Turn off the coolant only after all vapors disappear from the condenser.

7. Wear the appropriate PPE, when performing distillations. This includes a flame-resistant lab coat, chemical splash goggles and the appropriate chemically resistant gloves.

Taken from the M.I.T. Accident Prevention Guide, Vol. 4

F. ELECTRICAL SAFETY

1. All electrical connections should be grounded.

2. Electrical equipment service cords should be in good condition. **Frayed cords or exposed wires should be repaired by qualified personnel, as soon as they are detected.** Control switches and thermostats should also be in good working order. Special attention should be paid to cables from the power supply to the gels in the gel electrophoresis equipment. These cables must be in good condition, otherwise there is potential for electric shock. Check the cables periodically, and replace when they are worn.

3. Avoid overloading circuits. Do not use multiple outlet plugs for additional connections. Approved UL listed power strips should be used in place of extension cords or multiple outlet plugs.

4. Do not handle any electrical connections with wet hands or when standing in or near water. The placement of connections should be such that there is no danger or chemical or water spillage on wires or equipment. Do not allow electrical cords to drape down into the troughs between lab benches (as in the Biology building), as they often have water running through them.

5. Do not use electrical equipment, such as mixers or hotplates, around flammable liquids.

6. Do not try to repair equipment yourself. All repairs should be done by qualified personnel.

7. Never try to bypass any safety device on a piece of electrical equipment.

8. In case of fire on or near any electrical equipment, pull building fire alarm box and if possible, dial 911.

9. Use only BC or ABC fire extinguishers for fires on or near any electrical equipment.

10. Temporary electrical connections should be carefully placed - they should not be run across the floor without protective covering nor left hanging overhead. **Temporary connections should not take the place of installing permanent connections**. Heavy items should not be placed on top of electrical cords.

11. Do NOT store flammable or volatile liquids in refrigerators/freezers that are not labeled by the manufacturer as being explosion proof and for the storage of flammable materials.

ELECTRICAL SAFETY (Cont'd.)

IN THE EVENT OF ELECTRICAL SHOCK:

1. Do not touch victim until victim is out of contact with live current.

2. Unplug or turn off current or circuit breaker, if possible.

3. Immediately call 911 or if on the East Campus, dial 9-911. State that you have a possible electrocution and request the Fire Department and Medical Assistance.

4. Follow Medical Emergency Procedures.
G. APPROVALS FOR RESEARCH

The principal investigator must obtain **prior** approval from the Office of Environmental Health and Safety, and when necessary, the Department Chair, Radiation Safety Committee, Animal Welfare Committee, Human Subjects IRB, Biomedical IRB, Biosafety Committee (IBC), etc., for particular laboratory operations, procedures, or activities that involve the following:

1. BEFORE ANY CHEMICAL THAT IS REGULATED BY THE U.S. DEPARTMENT OF HOMELAND SECURITY (CHEMICALS OF INTEREST OR COIs), CAN BE PURCHASED OR OTHERWISE BOUGHT ONTO ANY UNIVERSITY AT ALBANY CAMPUS, EHS MUST BE NOTIFIED AND GIVE THE APPROPRIATE APPROVAL. ONCE APPROVAL HAS BEEN GRANTED AND THE CHEMICAL IS ON-SITE, THE P.I IS THEN RESPONSIBLE FOR UPDATING THEIR CHEMICAL INVENTORY. A COPY OF THIS INVENTORY MUST THEN BE FORWARDED TO EHS IN CHEMISTRY B73; Please go to Appendix L for a modified list of these Chemicals of Interest.

2. A newly introduced hazardous chemical substance of moderate chronic or high acute toxicity or a chemical that is highly reactive;

3. Working with a substance of known high chronic toxicity;

4. Working with the 25 OHSA regulated chemicals listed in Section VI.A.;

5. Working with radioactive materials.

6. Working with drugs, animals, human subjects, human pathogens, human cell lines, human bodily fluids, etc.

7. Working with any substances on APHIS and CDC's Select Agents and Toxins List. These may have to be registered with APHIS/CDC before purchase. See link below and Appendix O for the list.

 $\frac{http://www.selectagents.gov/resources/List\%20of\%20Select\%20Agents\%20and\%20Toxins\%2009-19-2011.pdf$

Consultation with the above bodies may be appropriate to ensure that the toxic material can be approved for purchase, effectively contained during the experiments, safety protocols are established and that the waste material can be and is disposed of in a safe and legal manner. See page 6 of this Plan.

H. RESPIRATORY PROTECTION

Respiratory protective equipment should not be used as a substitute for adequate exhaust ventilation or other engineering control methods. But when it is clearly impractical to remove harmful dusts, fumes, mists, vapors, or gases at their source, or when emergency protection against occasional and brief exposure is needed, people should have respiratory protective equipment available and should be trained on how to use it.

There are several types of situations for which respiratory protection should be used:

a) oxygen deficient atmospheres;

- b) gaseous toxic contaminant is present;
- c) particulate toxic contaminant is present;
- d) both particulate and gaseous toxic contaminants are present;
- e) nuisance dusts;
- f) gaseous contaminant is present below toxic levels.

There are a variety of respirators available and each has a particular application. For example, a dust mask is not effective where a toxic gas or an oxygen deficient atmosphere is present. Therefore, it is important to understand the hazardous situation and to choose suitable respiratory protective equipment. The University has a Respiratory Protection Program managed by the Office of Environmental Health and Safety involving medical exams, training, and the proper selection and fitting of respirators. If you need a respirator, contact the EH&S Office in Chemistry B73. Medical approval by a doctor is required before an employee or student can wear a respirator, as respirators put a strain on the respiratory and cardio-vascular system. The EH&S Office as part of the University's Respiratory Protection Program will make arrangements for this medical approval.

The types of respirators currently available at the University include the following:

Chemical Cartridge Respirators

These consist of a half or full facepiece connected directly to cartridge filters. Air contaminated by a toxic gas or vapor is purified by the chemicals in the cartridges. The length of time that a chemical cartridge respiratory provides protection depends upon the type of cartridge, the concentration of the gas or vapor, and the activity of the user. The respirator offers resistance to breathing.

Particulate Filter Respirators

These consist of a half or full facepiece either with particulate filters attached or the respirator itself may be made out of the filter material. The filter removes toxic particulates but offers resistance to breathing.

RESPIRATORY PROTECTION (Cont'd.)

Combination Respirators

These respirators offer protection against both particulate and gaseous contaminants but present breathing resistance.

If Departments suspect that a situation exists in their laboratories that require either the emergency or routine use of respiratory protection, they should contact the Office of Environmental Health and Safety for an evaluation of the need for respirators and the type to be used.

Departments may request respirators from the Office of Environmental Health and Safety to be used on a short-term or emergency basis. If the need for respirators is expected to be long-term, Departments should consider purchasing respirators, on the advice and approval of the Office of Environmental Health and Safety. In either case, respirators should be available at all times to the people who work in hazardous locations or situations where respiratory protection is required. Only people who have gone through the University's Respiratory Protection Program will be allowed to use them.

I. MEDICAL CONSULTATION AND MEDICAL EXAMS

Any laboratory personnel who works with hazardous chemicals has the right to receive medical attention, including any follow-up examination which the examining physician determines to be necessary, under the following circumstances:

1. Whenever a lab worker develops signs or symptoms associated with a hazardous chemical to which they were exposed to in the laboratory. A material's MSDS is a good place to start for signs and symptoms of overexposure.

2. When exposure monitoring reveals an exposure level routinely above the action level or the permissible exposure level (PEL), where no action level exists. See Appendix C.

3. Whenever an event takes place in the work area such as a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure.

4. Whenever an employee is required to wear a respirator as part of their job duties. See H. Respiratory Protection above.

J. PROVISIONS FOR EMPLOYEE INFORMATION AND TRAINING

INFORMATION

The Chemical Hygiene Plan contains all of the *information* requirements described in Paragraph F of 1910.1450.

TRAINING

There are various on-going training activities for laboratory personnel:

The EHS Office routinely offers EHS Safety Training for lab personnel. It is mandatory training for any individual, including faculty, staff and students, working in a research lab on campus. The following topics are covered under this training: chemical safety, laboratory safety, hazard communication, biosafety, radiation safety, fire safety, emergency procedures, hazardous and universal waste disposal procedures, plus other related safety topics.

If you have a need for customized training or require training on a particular safety topic, please contact the Office of Environmental Health and Safety at 2-3495. We will try to accommodate your training request as soon as possible.

IV. MATERIAL SAFETY DATA SHEETS

A. HOW TO READ AND UNDERSTAND AN MSDS

Remember the physical hazards of a chemical are just as important as its health hazards.

A Material Safety Data Sheet is written by the company that creates a chemical or a company that blends different chemicals into a chemical product. Although the intent is the same for all MSDS, to comply with the regulations and convey hazard information, there are several reasons why MSDSs may vary widely in appearance.

MSDS do not have a standard format. Although the Federal government requires MSDS to contain certain information, the producer of the hazardous material may present this information in their own format. The original suggested OHSA format had 10 sections. The new suggested ANSI format has the 15 sections described below.

Some of MSDS come from manufacturers in other countries. Although these documents still satisfy U.S. requirements, they may be more directed toward the requirements of another government. The Canadian WHMIS (Workplace Hazardous Materials Information System) is common as well as hazard information based on EEC (European Economic Community) Directives. A Glossary of MSDS Terms is available on the EHS web site, under Chemical Safety. The United Nations, in cooperation with other international organizations, has created a <u>Global Harmonization System</u> (GHS) of Classification and Labeling of Chemicals. It is designed to replace the various classification and labeling standards used in different countries by using consistent criteria for classification and labeling on a global level, thus creating one universal standard. The GHS should be globally in place by 2015. For more information on GHS go to http://www.osha.gov/dsg/hazcom/ghs.html

Only chemicals that are considered hazardous by OSHA are required to have a MSDS. Many manufactures will create a MSDS for a non-hazardous chemical but these are being discouraged. This concept may also be noted in the components section when only some of the ingredients are identified and the remainder just as non-hazardous.

The following are the 15 sections recommended by ANSI (formerly the American National Standard Institute).

<u>Chemical product and Manufacturer Identification</u>: the name that should appear on the chemical's label and a name and address for the manufacturer. Other forms of identification may be noted such as a chemical family, synonyms, formula, or trade name. There might also be a product or catalog number that may be critical in distinguishing between different grades or mixes of the same chemical.

<u>Composition</u>: information on ingredients. Only the hazardous ingredients need to be identified, down to 1% for a hazardous chemical and 0.1% for a chemical considered to cause cancer. Exposure limits are usually listed here.

<u>Physical Data:</u> measurements obtained by standardized tests. Common parameters like color and appearance will help identify the product and bring attention to a chemical that may be decomposing. Boiling point, vapor density, and evaporation rate will indicate how easily the chemical may become and inhalation exposure. Odor then becomes a detection method for this exposure. For specific definitions and advice on each of these parameters, see the MSDS Glossary located on the EHS web site, under Chemical Safety. Some physical hazards may be found here.

<u>Fire Fighting Measures:</u> what to use to extinguish this chemical should it start to burn and also special hazards when the chemical burns such as the release of toxic smoke. Flash point and flammability limits directly determine the classification for fire hazard. Much of the information here is directed toward First Responders such as the Albany Fire Department.

<u>Hazardous Identification and First Aid Measures:</u> the health hazards for this specific chemical and what to do if exposed. There may be numerous medical terms used in this section. These will be defined in the MSDS Glossary. Just as important are the conditional words such as "may cause" vs. "will cause". Also note the route of entry for an exposure. That is, a health affect may be caused if the chemical is inhaled or swallowed (ingested) but not by skin contact, for example. Also note the target organ mentioned, that is, the part of the body that will experience these adverse

health effects and that may seem unconnected to the route of entry. For example, alcohols, absorbed through the skin may damage the liver and central nervous system. The symptoms of overexposure mentioned in this section are, along with odor, first warning signs that there is a problem.

HOW TO READ AN MSDS (Cont'd.)

<u>Stability and Reactivity:</u> unstable chemicals will form new chemicals out of themselves and atmospheric ingredients in uninitiated reactions. This unintended reaction might generate a health risk such as the release of energy or may lead to the creation of a new chemical with very different potential hazards that the original. Conditions to avoid relate specialized storage conditions that should be used to inhibit unstable chemicals. A shelf life, reaction inhibitor, or hazardous decomposition products may be mentioned. Some physical hazards are found here.

Accidental Release Measures: Spill cleanup materials, techniques, or precautions.

<u>Handling and Storage Measures:</u> types of containers, special storage conditions, and chemical incompatibilities. The most common chemical segregation issues are: Segregate reactives from flammables and combustibles. Segregate acids (low pH) from caustics (high pH). Segregate corrosives (both acids and caustics) from flammables. Segregate oxidizers from everything.

<u>Exposure Controls/Personal Protection:</u> Recommended engineering controls such as a fume hood as well as the correct eye protection, gloves and other PPE (personal protective equipment. Pay attention to the specific glove material (rubber vs. nitrile, etc) A glove resistance chart can be found in many supply catalogs or from the link: http://www.cdc.gov/od/ohs/manual/pprotect.htm

<u>Toxicological Information</u>: the results of tests on animals or documented case studies for the chemical or for its components. This information is directed at medical or occupational health specialists. Certain thresholds in standardized toxicological tests are used establish warning terms such as "Toxic" vs. "Extremely Toxic". Specific forms of toxicity are also noted here and may include carcinogenicity (ability to cause cancer) teratogen.

<u>Ecological Information</u>: the potential impacts of this chemical once released into the environment. Many chemicals have very different health effects on plants and other animals. Ecotoxicdity data may include information on acute and chronic toxicity to fish and invertebrates, or plants and microorganism toxicity. Characteristics that might be used to assess a spill of this chemical might be noted such as soil mobility, bioaccumulation, or photolytic stability.

<u>Disposal Considerations</u>: usually just a general reference to disposal according to local, state, or federal regulations. The University at Albany is mandated by U.S. EPA and NYS DEC to identify, segregate, and properly dispose of any chemicals defined as "hazardous waste". Information on how to identify, label and store hazardous waste is available from the EHS web page.

<u>Transport Information</u>: packaging and labeling requirements based on the US DOT (Department of Transportation) shipping tables.

<u>Regulatory Information</u>: notation if this chemical is on a list of chemicals specifically covered by an OSHA or EPA regulation. Even though a chemical may be listed, the regulation may only be in effect at a certain RQ (Reportable Quantity) or TPQ (Threshold Planning Quantity).

Other Information: open to any additional information such as references or MSDS revision dates.

For an excellent MSDS database, go to: <u>http://siri.org/msds/</u>

B. TOXIC CHEMICALS

A toxic chemical is one that has the potential for injuring the human body or its systems by direct chemical action. Almost any substance is toxic when taken in excess of "tolerable" limits. See Appendix C.

A person may be exposed to a toxic chemical in a number of different ways. The four **PRIMARY ROUTES OF ENTRY** are:

1. *Absorption* - Direct chemical contact with the skin or eyes is the most common type of chemical exposure. The substance can enter the bloodstream through the outer layers of the skin, contact with eyes, through hair follicles, or surface openings from cuts and bruises.

2. Inhalation - Inhalation of chemicals into the respiratory passages and lungs.

3. *Ingestion* - Ingestion of chemicals either directly or indirectly by contamination of hands, food, or drink.

4. *Injection* - Injection of the chemicals into the body through syringes, puncture wounds, or broken glassware.

The effects of the toxic chemical may be *local* or *systemic*, *acute* or *chronic*. Knowing what these terms mean is useful and can usually be found on the chemical's MSDS.

Local Toxicity

The effect a substance has on the body tissues directly exposed to it. For example, an acid exhibits local toxicity because it can cause burns of the skin, eyes, mouth, or stomach, if it comes in contact with them and can cause irritation of the respiratory tract.

Systemic Toxicity

The effect a substance has on body tissues after it has been absorbed into the bloodstream. For example, mercury exhibits systemic toxicity because it effects the brain, kidneys, gums, and teeth after it has been inhaled or ingested.

Acute Effect

Short term exposure. A single dose in which the body's ability to protect itself is overcome by the substance. Acute exposures are usually reversed over a period of time. Benzene is an example of a substance with an acute toxic effect, causing irritation of skin and eyes and narcosis.

Chronic Effect

Long term exposure. Chronic effect is defined as low level exposure over a long period of time in which the rate of exposure is greater than the body's ability to protect itself. Chronic effects often do not appear until years later. Benzene also exhibits chronic toxicity, producing severe anemia and possibly cancer.

* REMEMBER THE PHYSICAL HAZARDS OF A CHEMICAL ARE JUST AS IMPORTANT AS KNOWING THE HEALTH HAZARDS OF A CHEMICAL. Always consult a chemical's MSDS before using that chemical for the first time.

C. CATEGORIES OF RELATIVE TOXICITY OF CHEMICALS AND ASSOCIATED SIGNAL WORDS

CATEGORIES OF ACUTE TOXICITY

| Catagories of Relative Toxicity | Signal Word on Chemical Label | Oral LD50 a mg/kg | Dermal LD50 b mg/kg | Inhalation LC50 c mg/liter | Probable Oral Lethal Dose for 150 Ib human | | | | | |
|---------------------------------------|-------------------------------------|----------------------|---------------------------|----------------------------------|--|--|--|--|--|--|
| Highly Toxic | Danger | 0 - 50 | 0 - 200 | A few drops to a teaspoonful | | | | | | |
| Moderately Toxic | Warning | 50 - 500 | 200 - 2000 | 200 - 2000 | One teaspoonful to one once | | | | | |
| Slightly Toxic | Caution | 500 | 2000- 20000 | | One once to one pint or one pound | | | | | |
| Relatively Toxic | None | 5000 | 20000 | | Over one pint or one pound | | | | | |

 a LD50 is the commonly used measure of acute oral and dermal toxicity. It means the Lethal Dose for 50 percent of the subjects receiving the

dose is expressed in milligrams of substance per kilogram of body weight of the subject.

^b Lc₅₀ is the commonly used measure of acute inhalation toxicity. It means the Lethal Concentration of 50 percent of the subjects receiving the

dose and is expressed in milligrams of substance per liter of air breathed by the subject.

^c In addition, the word "**POISO**N" and the skull and crossbones must be displayed with the word "**DANGER**!" for highly toxic chemicals.

D. PEL'S AND TLV'S

PEL (Permissible Exposure Limit) and TLV (Threshold Limit Value) are standards or guidelines that establish certain levels of a substance to which nearly all workers may be repeatedly exposed, day after day, without adverse effects. PEL's are legal standards, established by OSHA, while TLV's are guidelines recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). These exposure limits, expressed in parts per million (ppm) or milligrams per cubic meter (mg/m 3), are based on a time weighted average for an 8 hour day/40 hour work week. These limits can be found on a chemical's Material Safety Data Sheet (MSDS). The important thing to remember about PEL's and TLV's is that the lower the number, the more dangerous the substance. (For a listing of some PEL's, see Appendix C.)

Before using a chemical, the researcher should be familiar with the hazards of the chemical. This information is most readily obtained from the chemical's label and the manufacturer's MSDS. The chemical label is provided by the manufacturer with:

a) information on the type of hazard a chemical presents, whether toxic, flammable, explosive, oxidizing, corrosive, or some other hazard;

b) a signal word indicating the relative hazard, DANGER, WARNING, or CAUTION (see previous page);

c) instructions on how to use the chemical safely; and

d) instructions on emergency measures, such as first aid, fire fighting, and spill clean up.

After becoming familiar with the properties of a toxic chemical, the researcher should plan his or her experiment to include protective clothing and equipment, special laboratory practices, and procedures for emergencies.

The Office of Environmental Health and Safety in Chemistry B73 is available to help researchers evaluate their exposure to toxic chemicals.

Good sources of information on toxic chemicals, besides the MSDS, are:

Dangerous Properties of Industrial Materials, edited by N. Irving Sax;

Registry of Toxic Effects of Chemical Substances, offered by NIOSH; and

Threshold Limit Values for Chemical Substances and Physical Agents; by ACGIH.

V. SAFE CHEMICAL STORAGE

A. CHEMICAL STORAGE GUIDELINES: IN RELATION TO NEW YORK STATE FIRE CODE REQUIREMENTS

There is no easy ABC solution to the problems associated with the storage of chemicals, including flammable and combustible liquids. The basic approach is to limit the amount of flammable liquids to reduce the risk of accidents, and more importantly, to reduce the consequences of accidents. Reducing the quantity of flammable solvents to the limits set by fire codes will enhance overall laboratory safety and minimize the risks of major fires and/or injuries.

In essence, the storage of flammable or combustible liquids are to be limited to amounts needed for the day to day operation of the labs. Laboratories were not designed or intended to be long term storage areas for large quantities of solvents. The storage of solvents for convenience unnecessarily increases the risk of accidents with severe consequences.

- 1. Maximum storage of flammable and combustible liquids shall not exceed 120 gallons (45 liters) inside a flammable storage cabinet.
- 2. The maximum number of flammable storage cabinets within a maintained fire area is three (3). A fire area is defined as a room or rooms separated from other rooms and corridors by a fire rated enclosure with opening protectives (doors, vents, slide up doors), which must self-close and latch. The fire area shall not exceed 5000 sq. ft.
- 3. Flammable and combustible liquids will not be stored in/or block egress from any lab or storage area.
- 4. The maximum amount of flammable liquids stored outside of an approved storage cabinet is 35 gallons/132.5 liters. Of these 35 gallons, 25 gallons/95 liters must be in safety cans; the remaining 10 gallons/38 liters may be in other permissible containers.
- 5. No safety can shall exceed 2 gallons/8 liters in instructional (undergraduate) labs. 5 gallon/18.9 liter safety cans may be used in any other lab using chemicals. 55 gal. drums of solvent for use in labs are prohibited from being purchased.
- 6. Solvents with a flash point (see MSDS) of 100°F or less shall not be transferred between metal containers unless the containers are electrically bonded to a ground source.
- 7. These solvents are commonly stored in laboratories in excessive quantities. This practice must be controlled.

AminesAlcoholsAldehydesKetonesEstersEthersHalides (except methylene chloride - practically nonflammable)Hydrocarbons

CHEMICAL STORAGE GUIDELINES (Cont'd.)

8. Incompatible chemicals shall be physically separated to prevent accidental contact.

Examples: Acids & Bases Acids & Solvents Organics & Inorganics Water Sensitive Chemicals Oxidizing Agents & Organics Oxidizing Agents & Flammables Organic Acids & Inorganic Acids Oxidizing Agents & Reducing Agents Oxidizing Agents & Dehydrating Agents

- 9. Containers of materials that may become hazardous upon prolonged storage should be dated when first opened. At six month intervals, the chemicals shall be evaluated or tested for continued safe use (i.e., peroxides).
- 10. One way to achieve safe storage of chemicals is to adopt a method suggested by the chemical manufacturers. For example, Fisher Scientific uses color-coding to signify groups of chemicals, which may be stored together. Whether the color code is used or not, the main idea is the separation of incompatible chemicals. Attached is a list of commonly used chemicals grouped together as compatibles. It follows that the chemicals within the group shall not be stored with chemicals within another group due to possible unfavorable reactions.
- 11. COMPRESSED OR LIQUIFIED GASES Only gas cylinders necessary for current lab requirements shall be in the lab. All Gas cylinders shall be securely restrained to prevent falling over, whether empty or full. Also, all gas cylinders must have valve caps in place when not being used, if appropriate. Regulators should be removed and valve caps put back on any gas cylinder not being used again within one week. Cylinder contents, which create a health hazard (such as neurotoxins, poisons, etc.), shall be stored so that they will not contaminate breathing air.

This table shows the maximum allowable size of various containers for flammable and combustible liquids. Always consult the MSDS for properties of the class of liquid being used. Class is based on flash point.

MAXIMUM ¹ ALLOWABLE SIZE OF VARIOUS CONTAINERS FOR FLAMMABLE AND COMBUSTIBLE LIQUIDS

| Liquid Classification | Glass or Approved Plastic | Metal (Other than DOT Drums) | Safety Cans | | |
|---|---------------------------------|------------------------------|-------------|--|--|
| Class 1A (Flash point below 22.8°C, Boiling point below 37.8° C) | 1 pint | 1 gallon | 2 gallons | | |
| Class 1B (Flash point below 22.8°C, Boiling point below 37.8° C) | 1 quart ² | 5 gallons | 5 gallons | | |
| Class 1C (Flash point below 22.8°C, Boiling point below 37.8° C) | 1 gallon | 5 gallons | 5 gallons | | |
| Class II (Flash point at or above 37.8°C and below 60°C) | 1 gallon | 5 gallons | 5 gallons | | |
| Class II (Flash point at or above 60°C and below 93.3°C) | 1 gallon | 5 gallons | 5 gallons | | |

¹Maximum Capacity - Not more than 60 gallons of Class I or Class II liquids, nor more than 120 gallons of Call III liquids may be stored in a storage cabinet.

 2 1 gallon is allowed if the substance cannot be kept in metal or if the procedure requires more. 1 pint = 473 mL; 1 quart = 946 mL; 1 gallon = 3.8 liters.

FLAMMABLE LIQUID STORAGE GUIDELINES Part I - General

MAXIMUM CAPACITY WITHIN CONTAINERS

Definition: Flammable Liquids

Class 1A = Flash Point <73°F and Boiling Point <100°F Class 1B = Flash Point <73°F and Boiling Point >100°F Class 1C = Flash Point >73°F and Boiling Point <100°F

Combustible Liquids

Class II = Flash Point - Between 100 and 140°F Class IIIA = Flash Point - Between 140° and 200°F Class IIIB = Flash Point - 200°F +

| Container | Class 1A | Class 1B | Class 1C | Class II | Class III |
|--------------|-------------------|-------------------|----------|----------|-----------|
| Glass | 1 pt ¹ | 1 qt ¹ | 1 gal | 1 gal | 5 gal |
| Non-DOT Drum | 1 gal | 5 gal | 5 gal | 5 gal | 5 gal |
| Plastic Drum | 1 gal | 5 gal | 5 gal | 5 gal | 5 gal |
| Safety Can | 2 gal | 5 gal | 5 gal | 5 gal | 5 gal |
| DOT Drum | 60 gal | 60 gal | 60 gal | 60 gal | 60 gal |
| NFPA Tank | 660 gal | 660 gal | 660 gal | 660 gal | 660 gal |

MAXIMUM CAPACITY WITHIN CONTAINERS

1 Class 1A and Class 1B may be in glass if ACS analytical reagent grade is required, then the limit is one (1) gallon.

MAXIMUM STORAGE IN CABINETS

The maximum total of Class I, II and/or IIIA liquids stored in a flammable storage cabinet may not exceed 120 gallons (454 liters). Of this MAXIMUM TOTAL (120 gallons), not more than 60 gallons may be of Class I and/or Class II liquids. The maximum number of approved flammable liquid storage cabinets per room is three (3).

FLAMMABLE LIQUID STORAGE GUIDELINES (Cont'd.)

MAXIMUM ALLOWED OUTSIDE CABINET/ FLAMMABLE LIQUID STORAGE ROOM

| Class | Quantity | | | | |
|---|---|--|--|--|--|
| Class I or II | Non-safety container shall not exceed one (1) gallon for either | | | | |
| Class I and II No more than 10 gallons in safety containers, tota | | | | | |
| Class I and II | No more than 25 gallons in safety containers plus non-safety Containers in combination | | | | |
| Class III | NOT more than 60 gallons | | | | |

- 1. Storage will be limited to that required for operation of office equipment, maintenance, demonstration and laboratory work.
- 2. Liquids used for building maintenance, painting . . . may be stored temporarily in closed containers outside of storage cabinets or separate inside storage areas . . . not to exceed a ten (10) day supply at anticipated rates of consumption.
- 3. Criteria for inside storage room.

| Automatic Protection | Rating | Maximum Area | Total per Square Feet | | | | |
|-------------------------|--------|-----------------|--------------------------|--|--|--|--|
| Yes | 2 hour | 500 sq. ft. | 10 gallons | | | | |
| No | 2 hour | 500 sq. ft. | 4 gallons | | | | |
| Yes | 1 hour | 150 sq. ft. | 5 gallons | | | | |
| No | 1 hour | 150 sq. ft. | 2 gallons | | | | |

Must Have:

- 1. Liquidtite floors;
- 2. Liquidtite wall to floor joint;
- 3. 2 hour rated walls with 1¹/₂ hour rated door assembly; OR3 hour rated walls with 3 hour rated door assembly, etc.
- 4. Non-Combustible liquidtite raised sills at doors 4" or more;
- 5. Listed electrical equipment as per NFPA-70;
- 6. Continuous exhaust system to the exterior, not less than 150 CFM, with a shut down alarm.

FLAMMABLE LIQUID STORAGE GUIDELINES (Cont'd.)

- 4. General Storage
 - A. Containers of 30 gallons plus, shall not be stacked over one container high.
 - B. Storage of any flammable or combustible liquids shall not block exits.
 - C. Class I liquids will not preclude egress from an area, should a fire occur.
- 5. Where other factors substantially increase or decrease the hazard, the authority having jurisdiction may modify the quantities specified.

FLAMMABLE LIQUID STORAGE GUIDELINES Part II - Instructional Laboratories Using Chemicals

MAXIMUM QUANTITIES OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN INSTRUCTIONAL LABORATORIES

Storage: **Maximum** amount of flammable liquids located outside of the flammable liquid storage cabinets is as follows:

35 gallons/132.5 liters

of these 35 gallons (132.5 liters), 25 gallons/ 95 liters **MUST** be in approved safety cans, the remaining 10 gallons/38 liters may be in other permissible containers.

Flammable Liquid Storage Cabinets: Maximum number of cabinets is three (3) with 120 gallons/454.2 liters of flammable liquids per cabinet.

NO individual storage container may exceed 5 gallons/19 liters.

AND

NO individual storage container for Class 1A liquids may exceed 2 gallons/8 liters.

AND

NO SAFETY CAN may ever exceed 2 gallons/8 liters.

All laboratories shall have a one hour separation from all other areas. All doors leading to the common corridor (hallway) MUST close by themselves (self-closure) and latch.

Access to all room exits shall be maintained at all times. Doors are to be kept clear and unlocked from inside the laboratory.

All laboratories shall have:

- 1. Portable Fire Extinguishers, which are immediately accessible;
- 2. The ability to hear building fire alarms;

3. An emergency evacuation plan formulated by the laboratory staff and practiced at regular intervals.

FLAMMABLE LIQUID STORAGE GUIDELINES (Cont'd.)

COMPRESSED OR LIQUIFIED GAS CYLINDER STORAGE (NFPA 45 Section 8-2)

1. The total number of cylinders shall be reduced to three (3), 10" x 50" cylinders or two (2), 9" x 30" cylinders, or ten (10), 2" x 12" cylinders or up to 25, 2" x 12" cylinders by special exception. (Stated sizes or equivalent volume is permitted.)

2. Cylinders with a Health Hazard Rating of three or four (short exposure: serious temporary or residual injury may occur) is limited to three (3), 5" x 15" cylinders.

3. ALL cylinders shall be individually secured in place to prevent falling.

4. Oxygen cylinders must be 20' from combustible materials when in storage. They shall also be 20'' from fuel gas cylinders separated by a non-combustible barrier.

5. Caps shall be in place to protect valves while not connected for use.

6. Empty containers will be properly disposed of and shall not be allowed to be stored.

7. All containers will be properly labeled as to their content. If the contents are changed, the labels must also be changed. However, this is not recommended since the chance of mixing inter-reactive materials is substantially increased.

NOTE: Above excerpts are from NFPA 45 - "LABORATORIES USING CHEMICALS" Code and Fire Code, State of New York.

OF NOTE, EMPTY GAS CYLINDERS ARE STILL CONSIDERED HAZARDOUS AND MUST BE DISPOSED OF PROPERLY. NEVER PUT A GAS CYLINDER IN THE REGULAR TRASH. CONTACT EHS FOR PROPER DISPOSAL PROCEDURES.

B. STORAGE OF CHEMICALS

1. DO NOT OVERSTOCK CHEMICALS.

2. KEEP QUANTITIES OF ALL CHEMICAL MATERIALS TO A MINIMUM.

3. Purchase ONLY the smallest quantity necessary to complete your experiment and/or research project.

4. Storage Conditions - Flammable liquids must be stored in flammable storage cabinets or explosionproof refrigerators, if refrigeration storage is necessary. Eliminate all ignition sources (flame, heat from radiators, etc.) from storage area or locate storage area away from fire hazards. See Section V.F.

5. Chemicals should be stored *with labels facing out*, in metal cabinets or on secured, level metal shelves (excluding perchloric acid). No storage on the floor or higher than eye/face level is allowed. Large containers should be stored towards the back and bottom of shelves. Keep chemicals away from shelf and counter top edges. If possible, shelves where chemicals are being stored should have protective edges to prevent chemicals from falling off. DO NOT STORE IMCOMPATIBLE CHEMICALS TOGETHER. See Sections V. C., D., E.

6. Containers of perchloric acid should be kept on trays of glass, ceramic, or polyethylene materials of sufficient capacity to hold all of the acid in case containers should leak. Perchloric acid forms a contact explosive when in contact with metals. In general, acids should be stored on trays (polyethylene) with sufficient capacity to hold a leaking container's contents. Please consult with EHS before using perchloric acid.

7. Store dichromate cleaning solutions in cool areas, away from other chemicals. Keep the bottle caps slightly loosened. See Appendix C.

8. Fume hoods should not be used as a storage area. Chemicals stored in a fume hood interfere with the hood's proper airflow.

9. Keep caps and lids of chemical containers closed when not in use as this prevents contamination and vapor escape.

10. Ethers should be stored in dark, cool, well-ventilated storage areas. Ethers with low flash points should be stored in an explosion-proof refrigerator. Be aware of which chemicals form organic peroxides use them up or dispose of them before they become a physical hazard. See Appendix G.

11. DO NOT USE THE FLOOR FOR STORAGE. DO NOT STORE CHEMICALS OVERHEAD.

12. POISONS AND DRUGS MUST ONLY BE STORED IN LOCKED CABINETS.

13. Consult a chemical's MSDS for proper storage information. Review the chemical's physical and health hazards for proper storage information.

C. SUGGESTED SHELF STORAGE PATTERN

| INORGANIC | ORGANIC |
|---|---|
| INORGANIC #10 Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide | ORGANIC #2 Alcohols, Glycols, Etc. (Store Flammables in a dedicated cabinet) |
| INORGANIC #2 Halides, Sulfates, Sulfites, Thiosulfates, Phosphates, Etc. | ORGANIC #3 Hydrocarbons, Esters, Etc (Store Flammables in a dedicated cabinet) |
| INORGANIC #3 Amides, Nitrates, (No Ammonium Nitrate), Nitrites, Etc. | ORGANIC #4 Ethers, Ketones, Etc. (Store Flammables in a dedicated cabinet) |
| INORGANIC #1 Metals and Hydrides (Store away from any water) | ORGANIC #5 Epoxy Compounds, Isocyanates |
| INORGANIC #4 Hydroxides, Oxides, Silicates, Etc. | ORGANIC #7 Sulfides, Polysulfides, Etc. |
| INORGANIC #7 Arsenates, Cyanides, Etc. (Store above acids) | ORGANIC #8 Phenol, Cresols |
| INORGANIC #5 Sulfides, Selenides, Phosphides, Carbides, Nitrides, Etc. | ORGANIC #6 Peroxides, Azides, Etc. |
| INORGANIC #8 Borates, Chromates, Managanates, Permanganates, Etc. | ORGANIC #1 Acids, Anhydrides, Peracids, Etc |
| .INORGANIC #6 Chlorates, Perchlorates, Chlorites, Perchloric Acid, Peroxides, Etc. | MISCELLANEOUS |
| INORGANIC #9 Acids, except Nitric (Acids are best stored in dedicated cabinets) | MISCELLANEOUS (Nitric Acid) |

STORE ALL POISONS IN LOCKED CABINETS.

D. COMPATIBILITY CHART

"X" Represents Unsafe Combinations CHEMICALS NOT ON CHART:

Carbon Bisulfide forms an unsafe combination with groups 1, 4, 19, 20, & epichlorohydrin.

Epichlorohydrin forms an unsafe combination with groups 1, 2, 3, 4, 14, 15, 19, 20, 23, 24, & carbon bisulfide.

Motor Fuel antiknock compounds form unsafe combinations with groups 1, 4, 5, 6, 7, 15, 19, & 20.

| Inorganic Acids | 1 | | - | | | | | | | | | | | | | | | | | | | | | |
|--------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Organic Acids | Х | 2 | | - | | | | | | | | | | | | | | | | | | | | |
| Caustics | Х | Х | 3 | | | | | | | | | | | | | | | | | | | | | |
| Amines and | x | x | | 4 | | | | | | | | | | | | | | | | | | | | |
| Alkoamines | | ^ | | - | | | | | | | | | | | | | | | | | | | | |
| Halogenated | x | | x | x | 5 | | | | | | | | | | | | | | | | | | | |
| Compounds | ^ | | ^ | ^ | 9 | | - | | | | | | | | | | | | | | | | | |
| Alcohols, Glycols, | x | | | | | 6 | | | | | | | | | | | | | | | | | | |
| and Glycol Ethers | | | | | | Ŭ | | | | | | | | | | | | | | | | | | |
| Aldehydes | Х | Х | Х | Х | | Х | 7 | | - | | | | | | | | | | | | | | | |
| Ketones | Х | | Х | Х | | | Х | 8 | | - | | | | | | | | | | | | | | |
| Saturated | | | | | | | | | ٩ | | | | | | | | | | | | | | | |
| Hydrocarbons | | | | | | | | | 3 | | - | | | | | | | | | | | | | |
| Aromatic | Y | | | | | | | | | 10 | | | | | | | | | | | | | | |
| Hydrocarbons | ^ | | | | | | | | | 10 | | _ | | | | | | | | | | | | |
| Olefins | Х | | | | Х | | | | | | 11 | | _ | | | | | | | | | | | |
| Petroleum Oils | | | | | | | | | | | | 12 | | - | | | | | | | | | | |
| Esters | Х | | Х | Х | | | | | | | | | 13 | | _ | | | | | | | | | |
| Monomers and | | | | | | | | | | | | | | | | | | | | | | | | |
| Polymerizable | Х | Х | Х | Х | Х | Х | | | | | | | | 14 | | | | | | | | | | |
| Esters | | | | | | | | | | | | | | | | | | | | | | | | |
| Phenols | | | Х | Х | | | Х | | | | | | | Х | 15 | | | | | | | | | |
| Alkylene Oxides | Х | Х | Х | Х | | Х | Х | | | | | | | Х | Х | 16 | | | | | | | | |
| Cyanohydrins | Х | Х | Х | Х | Х | | Х | | | | | | | | | Х | 17 | | _ | | | | | |
| Nitriles | Х | Х | Х | Х | | | | | | | | | | | | Х | | 18 | ĺ | | | | | |
| Ammonia | Х | Х | | | | | Х | Х | | | | | Х | Х | Х | Х | Х | | 19 | | | | | |
| Halogens | | | Х | | | Х | Х | Х | Х | Х | Х | Х | Х | Х | Х | | | | Х | 20 | ĺ | | | |
| Ethers | Х | | | | | | | | | | | | | Х | | | | | | Х | 21 | | | |
| Phosphorus, | V | v | v | | | | | | | | | | | | | | | | | v | | 22 | | |
| elemental | X | Ň | Ň | | | | | | | | | | | | | | | | | X | | 22 | | |
| Sulfur, molten | 1 | | | | | | | | Х | Х | Х | Х | | | | Х | | | | | | Х | 23 | |
| Acid Anhydrides | Х | | Х | Х | | Х | Х | | | | | | | Х | | Х | Х | Х | Х | | | | | 24 |
| | | _ | _ | _ | | | _ | | | | _ | | | | | | | | | | | | | |

E. INCOMPATIBLE CHEMICALS

Separate storage areas should be provided for "Incompatible Chemicals" - chemicals which may react together and thereby create a hazardous condition. Some examples of incompatible chemicals are listed below. MSDSs also provide information on incompatibles. NOTE: This list is not complete, nor are all incompatible substances shown.

| CHEMICAL | KEEP OUT OF CONTACT WITH: | | | | | |
|---|---|--|--|--|--|--|
| Acetic Acid | Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates. | | | | | |
| Acetone | Concentrated nitric and sulfuric acid mixtures. | | | | | |
| Acetylene | Chlorine, bromine, copper, fluorine, iodine, silver, mercury, and their compounds. | | | | | |
| Alkali and alkaline metals, i.e., powdered aluminum or magnesium, sodium, potassium, calcium, lithium | Water, carbon tetrachloride, or other chlorinated hydro- carbons, carbon dioxide, the halogens. Use only "D" <i>fire extinguishers on these chemicals.</i> | | | | | |
| Ammonia, anhydrous | Mercury (in manometers for instance), chlorine, calcium hypochlorite, iodine, bromine, and hydrofluoric acid (anhydrous). | | | | | |
| Ammonium nitrate | Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials. | | | | | |
| Aniline | Nitric acid, hydrogen peroxide. | | | | | |
| Cumene hydroperoxide | Acids, organic or inorganic. | | | | | |
| Cyanides | Acids | | | | | |
| Flammable liquids | Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, the halogens. | | | | | |

EXAMPLES OF INCOMPATIBLE CHEMICALS

EXAMPLES OF INCOMPATIBLE CHEMICALS (Cont'd.)

| CHEMICAL | KEEP OUT OF CONTACT WITH | | | | | |
|--|---|--|--|--|--|--|
| Hydrazine | Hydrogen peroxide, nitric acid, any other oxidants. | | | | | |
| Hydrocarbons (butane, propane, benzene, gasoline, turpentine, etc.) | 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, flammable liquids, combustible materials. | | | | | |
| Hydrogen sulfide | Fuming nitric acid, oxidizing gases. | | | | | |
| Hypochlorites | Acids, activated carbon. | | | | | |
| lodine | Acetylene, ammonia (aqueous or anhydrous), hydrogen. | | | | | |
| Mercury | Acetylene, fulminic acid, ammonia | | | | | |

EXAMPLES OF INCOMPATIBLE CHEMICALS (Cont'd.)

| CHEMICAL | KEEP OUT OF CONTACT WITH: | | | | | |
|----------------------------|--|--|--|--|--|--|
| Nitrates | Sulfuric acid, organic materials | | | | | |
| Nitric acid (concentrated) | Acetic acid, acetone, alcohol, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, heavy metals, tars, and nitratable substances | | | | | |
| Nitrates | 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, grease, oils, organic materials, organic amines or anti-oxidants Use only in a fume hood designed for perchloric acids | | | | | |
| Peroxides, organic | Acids (organic or mineral), flammable liquids, easily oxidized substances, avoid friction, store cold | | | | | |
| Phosphorus (white) | Air, oxygen, alkalis, reducing agents | | | | | |
| Potassium | Carbon tetrachloride, carbon dioxide, water | | | | | |

EXAMPLES OF INCOMPATIBLE CHEMICALS (Cont'd.)

| CHEMICAL | KEEP OUT OF CONTACT WITH: | | | | | | |
|--|---|--|--|--|--|--|--|
| Potassium chlorate | Sulfuric and other acids | | | | | | |
| Potassium perchlorate (see also Chlorates) | Sulfuric and other acids | | | | | | |
| Potassium permanganate | Glycerin, ethylene glycol, benzeldehyde, sulfuric acid, any free acid | | | | | | |
| Selenides | Reducing agents | | | | | | |
| Silver | Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid | | | | | | |
| Sodium | Carbon tetrachloride, carbon dioxide, water. See also alkali metals. | | | | | | |
| Sodium azide | Sodium azide is self –reactive. It will decompose at 275C. Benzoyl chloride, potassium hydroxide, bromine, carbon disulfide, chromyl chloride, copper, dibromomalononitrile, dimethyl sulfate, lead, nitric acid, silver, mercury. Reacts with lead, silver, mercury to form shock sensitive and explosive metal azides. | | | | | | |
| Sodium nitrite | Ammonium nitrate and other ammonium salts | | | | | | |
| Sodium peroxide | Any oxidizable substance, such as ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerol, ethylene glycol, ethyl acetate, methyl acetate and furfural | | | | | | |
| Sulfides | Acids | | | | | | |

This list is not all inclusive.

VI. SAFE PROCEDURES FOR GENERAL CATEGORIES OF CHEMICALS

A. CARCINOGENS

Specific regulations have been established by the Occupational Health and Safety Administration (OSHA) regarding the handling of certain compounds designated as carcinogenic. Anyone contemplating work or who are working with materials on this list should consult the Environmental Health & Safety Office in Chemistry B73 for the regulations, necessary approvals, training, working conditions, monitoring, record keeping and medical surveillance.

The Federal Government has issued very detailed regulations for the chemicals listed below. Go to OSHA website for more information. <u>http://www.osha.gov/SLTC/carcinogens/index.html</u> Any laboratory personnel who use or handle any of these chemicals should contact the Office of Environmental Health & Safety for detailed information:

2-Acetylaminofluorene Acrylonitrile **4-Aminodiphenvl** Asbestos Benzene **Benzidine bis-Chloromethyl Ether 1.3-Butadiene** Cadmium Chromium (VI) **Coke Oven Emissions** 1,2-Dibromo-3-Chloropropane 3,3'-Dichlorobenzidine (and its' salts) 4-Dimethylaminoazobenzene Ethyleneimine **Ethylene Oxide** Formaldehyde **Inorganic Arsenic Methyl Chloromethyl Ether Methylene Chloride** Methylenedianiline alpha-Naphthylamine beta-Naphthylamine **N-Nitrosodimethylamine** beta-Propiolactone Vinyl Chloride

> It is imperative that the Material Safety Data Sheet be consulted before using ANY chemical.

B. PROCEDURES FOR USING COMPRESSED GASES

Compressed gases are defined by the U.S. Department of Transportation as any material or mixtures having in the container either an absolute pressure exceeding 40 psi at 20°C (70°F) or an absolute pressure exceeding 104 psi at 54.4°C (130°F), or both; or any liquid flammable material having a Reid vapor pressure exceeding 40 psi at 37.8°C (100°F).

For the purposes of safety, all volatile materials and mixtures packaged in cylinders should be considered compressed gases. The use of compressed gases may give rise to the following hazards:

1. Equipment failure and/or leakage may occur, resulting in the diffusion of gases and contamination of the atmosphere. This contamination can cause toxic or anesthetic effects, asphyxiation, or explosive concentrations of flammable gases.

2. The flash point of a flammable gas under pressure is always lower than ambient or room temperature; thus, leaking gas can rapidly form an explosive mixture with air.

3. Upon rapid expansion, low-boiling point materials can cause frostbite on contact with living tissue.

4. Some compressed gases are corrosive, irritating, or reactive.

5. A compressed gas cylinder without a protective cylinder valve cap may release its contents with great force when dropped. If a cylinder is punctured, it may also release its contents with great force. Cylinders have been propelled through walls and roofs.

Because of these hazards, precautions need to be taken in the handling, storage, and use of compressed gas cylinders.

RULES FOR HANDLING COMPRESSED GASES

- 1. When cylinders are received, they should be inspected to determine if:
 - a. cylinder valve protection caps are in place;
 - b. cylinder and valves are in serviceable condition and show no corrosion.
- 2. *Always* use a cylinder hand truck for transport. If transporting compressed gases in a vehicle, contact the Office of Environmental Health & Safety for instructions. Personal vehicles should never be used to transport compressed gases or chemicals to be used at the University of Albany.
- 3. ALL Cylinders should be individually chained or otherwise secured in <u>an upright position</u> at all *times*. Use cylinders in an upright position only. Securing brackets and straps are available for sale in CAS Scientific Stores.
- 4. Do not drop cylinders, full or empty, or permit them to fall against each other.

PROCEDURES FOR USING COMPRESSED GASES (Cont'd.)

- 5. Leave cylinder valve caps on cylinders until secured and ready for use.
- 6. All valves should be closed when not in use.
- 7. Regulators must be used to control pressures to operating requirements. Use the proper regulator for the particular gas. Never force a regulator onto a compressed gas cylinder Only materials recommended for the particular gas service involved shall be used in piping, fittings or equipment. Regulators should be removed from a compressed gas cylinder if the gas will not be used again within a week.
- 8. Always consider cylinders to be full and handle accordingly.
- 9. The cylinders of nonliquified gases should be considered empty while positive pressure (25 psig or greater) still remains in order to prevent suck back and contamination.
- 10. Cylinders containing liquified gases should never be completely emptied in order to prevent suck back and contamination.
- 11. Oxidizers must not be used in contact with oils, grease or other hydrocarbons.
- 12. Flammables must not be exposed to flames, sparks or arcs including static electricity, hot surfaces or oxidizers. Bond and ground all cylinders and piping containing flammable gases to prevent the hazards caused by the buildup of static electricity.
- 13. Nonflammables must not be allowed to displace air in confined workspaces so that there is not sufficient oxygen for breathing.
- 14. When corrosive gases are being used, the cylinder valve stem should be worked frequently to prevent freezing.
- 15. Highly toxic gases or pyrophoric gases require special handling. Prior approval must be gotten from the Office of Environmental Health and Safety before using these gases. Safe handling protocols including emergency response procedures must be written by the lab, with consultation from the Environmental Health and Safety Office, when using these gases. These gases may require the use of vented gas handling cabinets with emergency shutoffs and gas detection monitors with alarms.
- 16. Contact the Environmental Health and Safety Office at 2-3495 for proper disposal instructions for compressed gas cylinders that are no longer wanted or that are empty. Compressed gas cylinders can **not** be thrown in the regular trash when empty, as they are still considered a hazardous material and may have to be disposed of as hazardous waste. Every effort should be made to return the empty compressed gas cylinder to the manufacturer, as disposing of compressed gas cylinders as hazardous waste is extremely expensive. This includes lecture size gas cylinders and the non-usable gas cylinders.
- 17. All non-empty aerosol cans are considered hazardous waste. If there is still product in the can, even if you can't remove it, the aerosol can't go in the regular trash and must be given to the EHS Office as hazardous waste.

Safety devices are available to prevent suck back and relieve sudden pressure increases.

PROCEDURES FOR USING COMPRESSED GASES (Cont'd.)

STORING COMPRESSED GASES:

- 1. Store cylinders in a fire-resistant, cool, dry, and adequately ventilated area. Rust will damage cylinders and will often cause the valve caps to stick. Cylinders should be adequately secured in an upright position (so that they can't fall over) while being stored.
- 2. The storage area should not contain any sources of ignition.
- 3. Storage area temperature should not exceed 100°F.
- 4. Floor should be level.
- 5. Floor should be designed to protect cylinders from dampness.
- 6. Cylinders should be protected from weather extremes and direct sunlight.
- 7. Store gases supporting combustion (O₂, C l₂, etc.) at least 25 feet from fuel gases, preferably in another storage area.
- 8. Highly toxic gases and pyrophoric gases may require storage in vented gas handling cabinets along with emergency shutoffs and gas detection monitors and alarms.

| GAS | Threshold Limit Values (ppm) | Flammability Limits in Air (Percent by Volume) | Major Hazards | | | | | |
|-------------------|---|---|---|--|--|--|--|--|
| Acetylene | Not established (nontoxic, produces anesthetic effects) | 2.5-81.0 | Flammable; asphyxiant | | | | | |
| Ammonia | 50 | 15 - 28 | Toxic | | | | | |
| Argon | Not established (nontoxic) | None | Asphyxiant | | | | | |
| Boron trifluoride | 1 | None | Toxic; causes burns | | | | | |
| 1,3-Butadiene | 1000 | 2 - 11.5 | Flammable; skin irritant | | | | | |
| Butane | Not established (nontoxic produces anesthetic effects) | 1.9 - 8.5 | Flammable | | | | | |
| Carbon dioxide | 5000 | None | Asphyxiant | | | | | |
| Carbon monoxide | 50 | 12.5 - 74.0 | Flammable; toxic | | | | | |
| Chlorine | 1 | 1 None | | | | | | |
| Ethane | Not established (nontoxic produces anesthetic effects) | Flammable; asphyxiant | | | | | | |
| Ethylene | Not established (nontoxic produces anesthetic effects) | Flammable; asphyxiant | | | | | | |
| Ethylene oxide | 50 | Flammable; toxic; can cause burns when trapped by clothing or shoes | | | | | | |
| Helium | Not established (nontoxic) | None | Asphyxiant | | | | | |
| Hydrogen | Not established (nontoxic) | 4.0 - 75.0 | Flammable; asphyxiant | | | | | |
| Hydrogen bromide | 3 | None | Toxic; causes burns; corrosive | | | | | |
| Hydrogen chloride | 5 | None | Toxic; causes burns; corrosive | | | | | |
| Hydrogen fluoride | 3 | None | Toxic; causes severe slow healing burns; corrosive | | | | | |
| Hydrogen sulfide | 10 | 4.3 - 45.0 | Toxic; flammable; irritant | | | | | |
| Methane | Not established (nontoxic) | 5.3 - 14.0 | Flammable; asphyxiant | | | | | |
| Methyl bromide | 20 | 13.5 - 14.5 | Toxic; causes burns | | | | | |
| Methyl chloride | 100 | 10.7 - 17.4 | Toxic; flammable | | | | | |
| Methyl mercaptan | 0.5 | Unknown | Toxic; flammable | | | | | |
| Nitrogen | Not established (nontoxic) | None | Asphyxiant | | | | | |
| Nitrogen dioxide | 5 | None | Toxic; corrosive | | | | | |
| Oxygen | Nontoxic | None | Highly reactive | | | | | |
| Phosgene | 0.1 | None | Toxic | | | | | |
| Propane | PropaneNot established (nontoxic produces anesthetic effects)2.2 - 9.5 | | | | | | | |
| Sulfur dioxide | 5 | None | Toxic; causes burns | | | | | |
| Vinyl chloride | 500 | Flammable; causes burns | | | | | | |

HAZARD DATA FOR COMMON COMPRESSED GASES

Source: Manufacturing Chemists Association, Guide for Safety in the Chemical Laboratory (New York, Van Nostrand Reinhold Company, 1972). Copyright 1972 by Manufacturing Chemists Association; reprinted by permission of the publisher.

PROCEDURES FOR USING COMPRESSED GASES (Cont'd.)

OTHER TIPS FOR SAFE HANDLING OF COMPRESSED GASES:

- 1. Oily (not specially cleaned) fittings should never be used with oxygen. Oxygen under pressure will rapidly oxidize oil or grease and result in an explosion. Equipment specifically *"cleaned for oxygen service"* must be used.
- 2. Acetylene can explode if not properly regulated. An automatic pressure regulator is the only type of recommended control. Acetylene can explode with extreme violence if ignited. It can also form explosive compounds in contact with copper or brass.
- 3. Regulators can leak and build pressure within a closed gas delivery system. A pressure relief device should be employed. A trap should be inserted in outlet lines to prevent liquid from flowing back into the cylinders.
- 4. Open the cylinder valve only after connecting the regulator to the cylinder using a proper CGA* regulator.
- 5. Only equipment suitable for pressures involved can be used with high pressure gases. The pressure ratings for all containers and hardware must be known and equipment must not be used where limits will be exceeded. Glass equipment should not be pressurized. A general rule is: do not apply pressure greater than ten (10) inches of water, if you are not wearing protective equipment.
- 6. Never mix gases in a cylinder. Explosion, contamination, corrosion, and other hazards can result. Never try to refill gas cylinders or transfer gas from one cylinder to another.
- 7. To prevent corrosion, regulators, valves, and fittings used in compressed gas systems, which conduct corrosive gases, should be flushed with nitrogen or dry air after each use.
- 8. Corrosive gases should be stored for the shortest possible time period, preferably under three months. They cylinder valve stem of corrosive gases should be worked frequently to prevent freezing.
- 9. The cylinder valve cap should always be firmly in place when the cylinder is not in use. Empty cylinders must be returned with valve protection caps on.
- 10. Any system should be leak tested before it is used. To check for leaks, spread soap over all joints. They system is leaking if any bubbles appear.
- 11. The researcher is responsible for knowing the characteristics of the gases he/she uses: toxicity, flammability, compatibility with materials and other gases. Consult the gases' Material Safety Data Sheets. See page 68 Hazard Data for Common Compressed Gases.

PROCEDURES FOR USING COMPRESSED GASES (Cont'd.)

OTHER TIPS FOR SAFE HANDLING OF COMPRESSED GASES:

- 12. When disposing of empty cylinders, contact the Office of Environmental Health & Safety for disposal procedures. Empty cylinders **DO NOT** go in the trash.
- 13. If necessary, clean out the cylinder valve opening before connecting it to an oxygen regulator or a charging line. This can be done by briefly opening the cylinder valve. Do not stand in front of the valve opening during such a *"blow out*", nor place your hand across it. A *"blow out"* must under no circumstances take place close to an open fire or any source of ignition, e.g., during welding.
- 14. When using regulators, always check that the adjustment screw has been turned far enough to allow it to move freely in its threads prior to opening the cylinder valve. With the adjustment screw in this position, the regulator is closed.
- 15. Never use pliers or a similar tool to open a cylinder valve. Some valves are opened with a special key and others are equipped with hand wheels. It is dangerous to force the valve open by knocking or heating.
- 16. Initials and stamps engraved on the cylinder shells must not be changed or obliterated. Labels and tags should not be removed.
- 17. Compressed Breathing Air must at least meet the requirements for Grade D air as described in ANSI/CGA commodity specification for air.

CGA: Compressed Gas Association

C. PROCEDURES FOR HANDLING CRYOGENICS

The principal hazards posed by the use of cryogenic liquids and systems are burns from human contact with cryogens; pressure buildup in unvented spaces; and fires, explosions, and asphyxiation, which can result from the evaporation of cryogens.

RULES FOR HANDLING CRYOGENICS

- 1. The appropriate eye and skin protection must be worn whenever cryogenic liquids are handled, to avoid splashes in the eyes and on the skin. The gloves should be rated for cryogenic liquids.
- 2. Clothing or jewelry that can trap cryogenic liquids next to the skin should be avoided; for example, wristwatches, rings, etc.
- 3. In the event of a splash, immediately flood the areas and clothing affected with water. For prolonged exposures, seek medical treatment.
- 4. Cryogenic liquids are capable of causing asphyxiation by displacing the air necessary for the support of life, especially when they are used in a confined area. **Therefore, they should be used only in well ventilated areas.** Whenever transporting tanks of cryogenics that are venting in elevators, make sure another person is waiting for you to exit the elevator. This will insure that you have someone available to summon help should the elevator break down and/or you are overcome by the over-venting of the gas. If at all possible, no one should ride in an elevator with a venting cryogenic tank.
- 5. Venting should be provided to avoid quick and violent pressure changes when cryofluids vaporize.
- 6. Exposed glass areas of glass dewars should be taped to prevent the spread of broken glass should the container implode.
- 7. Handle combustible cryogens such as liquid hydrogen and liquid natural gas (LNG) in the same way combustible gases are handled; provide ventilation, keep away from open flames and other ignition sources, prohibit smoking, and discharge vent gases to a safe location.
- 8. Handle cryogenic storage containers carefully since they are fragile and expensive.

See Appendix M for more information on the Safe Handling of Liquid Nitrogen.

D. PROCEDURES FOR HANDLING ETHERS AND PEROXIDIZABLE MATERIALS

Ethers have toxic, flammable, and explosive properties and are dangerous, if not handled properly. They are widely used in laboratories on campus. The vapors, when inhaled, produce a depression of the central nervous system.

The most common ethers, methyl and ethyl, are particularly dangerous fire hazards because of their low flash points. Thus, it is necessary to prohibit open flames, electrical sparks, heat sources, and oxidizing agents when they are being used.

Ethers and other peroxidizable materials such as dioxane and tetrahydrofuran can form explosive peroxides, especially after the container has been opened and stored for a length of time. Frequently, an inhibitor has been added by the manufacturer to retard the formation of peroxides, but peroxides may form nevertheless during storage even if the container has never been opened.

- 1. Ethers should always be handled in a fume hood. This will protect laboratory occupants from inhaling the vapors and will prevent explosive vapor concentrations from forming.
- 2. Ethers should be stored in flammable storage cabinets. Ethers with low flash points should be stored in explosion proof refrigerators. See Section V.F.
- **3.** Ethers and peroxidizable materials should be ordered only in small quantities and must be dated upon receipt and when opened. USE ETHERS AND PEROXIDIZABLE MATERIALS UP PROMPTLY AFTER OPENING. See Appendix G.

4. DO NOT STORE ETHERS IN GROUND GLASS-STOPPERED BOTTLES.

- 5. Do not *move* or *open* any bottle or can of ether or any peroxidizable compound that has exceeded its expiration date or is of questionable age. If you find such a container, immediately contact the Office of Environmental Health & Safety in Chemistry B73, which will arrange for its proper disposal. See Appendix G for the Recognition and Handling of Peroxidizable Compounds.
- 6. Ethers and peroxidizable materials, once they have gone past their expiration date, are dangerous and are extremely expensive to dispose of. A team of high hazard specialists has to be called in to handle the old peroxidizable material basically as a potential bomb. WATCH THE AGE OF YOUR **PEROXIDIZABLE MATERIALS**!!!!!
E. PROCEDURES FOR HANDLING MERCURY

Mercury and mercury-containing compounds are highly toxic to humans. Poisoning may be produced by inhaling mercury vapor, fume or dust; it may also be produced by ingestion of mercury or absorption of mercury through the skin. Organic mercury compounds are extremely toxic.

Acute mercury poisoning, caused by exposure to a high level of mercury over a short period of time, is accompanied by a metallic taste in the mouth, marked salivation, swelling of gums, vomiting, and bloody diarrhea. Consult MSDS on symptoms of mercury exposure.

Chronic mercury poisoning, caused by exposure to low levels of mercury over a long period of time, may show the same symptoms as seen in acute poisoning, but these are usually less pronounced and not always recognizable as poisoning. Chronic poisoning affects the nervous system, causing a marked tremor, unsteady gait, and personality changes.

Mercury is commonly used in labs in such items as thermometers, fluorescent lamps, manometers, recording instruments, batteries, and diffusion pumps. Exposure to mercury can arise in the following ways:

- 1. When a mercury spill occurs and is not cleaned up promptly or correctly, the mercury scatters into many droplets, thus increasing the surface area of the mercury and the rate of evaporation. The rate of evaporation may exceed the capacity of the room's ventilation to dilute it. If you accidentally spill mercury, contact the Office of Environmental Health and Safety for assistance in cleaning up the spill. The Office supplies mercury spill kits for small spills. See the following page.
- 2. When mercury is used in elevated temperatures, it evaporates quickly. A common occurrence is the breaking of thermometers in ovens by bumping or by raising the oven temperature above the thermometer's capacity, resulting in high levels of mercury vapor.
- 3. In systems where mercury is under pressure and ruptures may occur, mercury can impact at high velocities. This atomizes the mercury, which could result in high levels of mercury vapor being released, should a rupture occur in the system.
- 4. Mercury and mercury contaminated materials are considered hazardous wastes by the EPA and must be disposed of as such. See Section VII Hazardous Waste Disposal Procedures.
- 5. The University at Albany is in the process of trying to go to a mercury free environment whenever possible. The Environmental Health and Safety Office will replace mercury thermometers with mercury free thermometers, free of charge, whenever possible. Contact the Assistant Director of EH&S for details.
- 6. All fluorescent tubes, thermostats, computer monitors and batteries, because of their mercury, lead or heavy metal content, are NOT to go out in the trash and are regulated by NYS DEC and U.S. EPA as Universal Waste. Contact the Environmental Health and Safety Office for disposal procedures. See Appendix N Universal Waste Disposal Policy and Guidelines plus Electronics Recycling.

PROCEDURES FOR HANDLING MERCURY (Cont'd.)

GUIDELINES FOR HANDLING MERCURY

- 1. Place a tray or other container under all mercury sources to contain any spills that may occur.
- 2. If a spill should occur, clean it up promptly and properly:
 - a. Pick up all visible mercury by gentle sweeping and a trapped vacuum line attached to a tapered glass tube or needle-nose pipette. Avoid scattering or breaking up the mercury droplets.
 - b. Spread a mercury-spill product over the affected area to pick up any microscopic droplets that may remain; sweep up the waste and dispose of as a hazardous waste. Mercury "sponges" may also be used. These spill cleanup items are available through the Office of Environmental Health & Safety in Chemistry B-73.
 - c. Call the Office of Environmental Health & Safety at 2-3495 so that the room can be surveyed for persistent mercury contamination.
 - d. Do not use a broom or an ordinary vacuum cleaner to clean up the spill. They will only scatter the droplets further. The Office of Environmental Health & Safety has a mercury vacuum cleaner designed specifically to clean up mercury spills.
- 3. Store mercury in unbreakable plastic bottles. Keep containers sealed in a cool, well ventilated area.
- 4. Use mercury only in a well ventilated area. Practice good housekeeping to prevent spilled mercury from accumulating.
- 5. Always wear personal protective equipment when handling mercury, especially protective gloves and goggles, and never eat, drink or smoke where mercury is being used.
- 6. Organic mercury compounds are extremely toxic and can be absorbed through the skin with fatal results. Always consult an MSDS before handling any mercury or mercury compound.

F. PROCEDURES FOR HANDLING ACIDS & ALKALIS

Acids and alkalis are corrosive and reactive chemicals. They can cause corrosion of the materials with which they are in contact, including metal containers, structures, and equipment. They can also cause serious burns and eye damage to the people working with them. When in contact with certain metals or chemicals, they can react, releasing toxic fumes or hydrogen.

Acids and alkalis should be stored in cool, well ventilated areas, away from each other, metals, flammables, and oxidizing materials. Their storage areas should be regularly checked for spills and leaks, and suitable spill cleanup materials should be readily available. (Spill cleanup kits are available in the Office of Environmental Health & Safety in Chemistry B73). Protective clothing should be worn whenever acids or alkalis are handled.

SUGGESTIONS FOR SAFE USE AND STORAGE

- 1. When combining an acid with water, *pour the acid into the water stirring slowly*, never the reverse.
- 2. Cap bottles securely and store them on lower shelves to reduce the chance of accidental breakage. **Do not store acids and alkalis together. Do not store organics with acids or alkalis. Do not store organic acids with inorganic acids. See Section V.**
- 3. Do not leave residues on a bottle or a laboratory bench where another person may come in contact with them. Clean up spills promptly.
- 4. Wear protective clothing when handling acids or alkalis this includes the appropriate gloves, apron, chemical splash goggles and/or a face shield.
- 5. If you have been splashed with acids or alkalis, immediately remove any clothing that may have been saturated. If the splash is in your eye, flush the eye immediately and gently for at least 15 minutes with copious amounts of water. If the splash is on the body, flood the area with copious amounts of running water for at least 15 minutes a safety shower is intended for this purpose. When alkaline materials have been splashed in the eye, immediate and repeated washings are necessary in order to prevent the alkali from penetrating deeply. Seek medical assistance. See Section I-E.

PROCEDURES FOR HANDLING ACIDS & ALKALIS (Cont'd.)

FOUR ACIDS REQUIRING SPECIAL HANDLING BECAUSE OF THEIR EXTREME HAZARDS

- 1. *Nitric Aci*d: *Nitric acid* is corrosive and its oxides are highly toxic. *Nitric acid* is also an oxidizing agent that forms flammable and explosive compounds with many materials for example, ethers and other flammable materials, acetone, and combustible materials. Paper towels used to wipe up a *nitric acid* spill can ignite spontaneously when dry. *Nitric acid* should be used only in a hood and should be stored away from combustible materials. Consult a MSDS on *Nitric Acid* and its many hazards.
- 2. *Perchloric aci*d: *Perchloric acid* forms highly explosive and unstable compounds with many combustible materials and with metals. Unstable perchlorate compounds may collect in the duct work of improperly installed fume hoods and cause fire or violent explosions. **Therefore**, *perchloric acid* **should be used with extreme caution and only in a fume hood designed for its use a perchloric acid hood has corrosion-resistant ductwork and washdown facilities.** Only minimum quantities should be kept, with no more than a one pound bottle in the laboratory. The container should be stored on a glass tray that is deep enough to hold the contents of the bottle. No flammables or organic solvents should be used in a *perchloric acid* hood. Perchloric acid should not be kept for more than a year since explosive crystals may form. Discolored *perchloric acid* should not be touched, it is most likely contaminated and could be dangerous. Contact the Office of Environmental Health & Safety for proper disposal.
- 3. *Picric Aci*d: *Picric acid* can form explosive compounds with many combustible materials. It is especially reactive with metals or metallic salts. *Picric acid* may lose water and become unstable during extended storage periods. Never open a bottle of dry or contaminated *picric acid* as an explosion could occur from the friction produced. If you find a container of *picric acid* that appears old and dry, **DO NOT TOUCH IT**. Immediately contact the Office of Environmental Health & Safety in Chemistry B73. Picric acid should be stored away from combustible materials and should not be kept for extended periods. Do not use metal spatulas to dispense *picric acid*.
- 4. *Hydrofluoric Aci*d: *Hydrofluoric acid* is extremely corrosive and will even attack glass. It is volatile and its vapors may affect the skin and eyes. Burns from hydrofluoric acid heal slowly and with great difficulty. The Office of Environmental Health and Safety will provide calcium glutonate gel for immediate use on HF burns. Hydrofluroic acid should be used only in a fume hood while wearing protective clothing. Polyethylene containers must be used for storing hydrofluoric acid and for reactions employing *hydrofluoric acid*. Care should be taken to avoid contacting *hydrofluoric acid* with metals or ammonia since toxic fumes may result. Hydrofluoric Handling Guidelines are available from the EH&S Office.

CONSULT AN MSDS WHEN EVER WORKING WITH ANY OF THESE COMPOUNDS

G. PROCEDURES FOR HANDLING ALKALI METALS

Alkali metals react violently with water, decomposing the water to give off hydrogen which may be ignited by the heat of reaction. The alkali metals can also ignite spontaneously in air, especially when the metal is in powdered form and/or the air is moist.

SUGGESTIONS FOR SAFE USE AND STORAGE

- 1. Store alkali metals under mineral oil or kerosene in unbreakable containers or covered glass containers. Avoid using oils that contain sulfur since a hazardous reaction may occur.
- 2. Ordinary fire extinguishers are ineffective on an alkali metal fire. Use only the special, dry powder extinguisher intended for alkali metals Class D Combustible Metal. These extinguishers can be found in the corridors of the second and third floor of Chemistry. If you are using alkali metals and need a fire extinguisher, contact the Office of Environmental Health & Safety.
- 3. Any waste alkali metals should be place in a labeled, leak proof container, covered with mineral oil, and disposed of properly. See Section VII.

H. PROCEDURES FOR HANDLING NONTOXIC, NOXIOUS ODORS

In the event your laboratory produces a nontoxic, noxious odor, make certain all fume hood fans in the laboratory are on, raise the fume hoods' sashes approximately one foot, and leave the laboratory, closing the door behind you. Do not open the laboratory's windows and doors to ventilate the laboratory as this allows the odor to travel to other floors and buildings. If the procedures outlined above are followed, the fume hoods will effectively exhaust the odor out of the laboratory. Do not return to the laboratory until the odor has dissipated.

In the event your laboratory produces a nontoxic, noxious odor while using the sink, as when washing out dirty glassware, follow the same procedures outlined above and be sure to leave the water running in the sink until the odor has dissipated.

If you are aware that your work is going to create a nontoxic, noxious odor, contact the Office of Environmental Health & Safety and try to perform your experiment after normal working hours.

DO NOT DISPOSE OF NOXIOUS MATERIALS IN THE TRASH

CONTACT THE OFFICE OF ENVIRONMENTAL HEALTH & SAFETY FOR PROPER DISPOSAL PROCEDURES

VII. LABORATORY WASTE DISPOSAL

A. HAZARDOUS WASTE DISPOSAL PROGRAM UNIVERSITY AT ALBANY, STATE UNIVERSITY OF NEW YORK

The U.S. Environmental Protection Agency (EPA) has developed, under the Resource Conservation and Recovery Act of 1976 (RCRA), a complex set of regulations to control hazardous wastes. The University is currently holding a permit issued by the EPA as a hazardous waste generator. This permit allows the University, within strict EPA and DEC guidelines, to manage all hazardous waste on campus. The Office of Environmental Health & Safety has instituted the following Hazardous Waste Disposal Program, in order to handle the hazardous waste generated on campus. This program is coordinated by the University's Chemical Hygiene Officer/ Hazardous Waste Specialist.

State law (Chapter 719 of the laws of 1981) established criminal penalties for the unlawful possession, handling, and disposing of hazardous wastes. Representation and indemnification under section 17 of the Public Officer's Law would not be available in cases of liability imposed under criminal statues. Because of the possibilities of personal liability and prison terms, campus personnel are advised to familiarize themselves with the University's Hazardous Waste Disposal Program for the proper storage and disposal of hazardous wastes. The procedures stated below are to be followed by campus generators when identifying, storing and disposing of hazardous waste:

1. IDENTIFICATION

The responsibility for the identification of hazardous waste (waste chemicals, waste chemical containing products, and out-of-date chemicals) within the University necessarily rests with the faculty and staff who have created the waste (generators) in research and instruction. See the following pages for the definitions of generator and hazardous waste. The Chemical Hygiene Officer/ Hazardous Waste Specialist will provide assistance in the identification of hazardous waste.

2. LABELING AND STORAGE

All containers of hazardous waste must be properly labeled with free labels provided by the Office of Environmental Health & Safety in Chemistry B73. The waste chemicals must be identified by their **proper chemical name (not formulas)**, including proportions of a mixture. The label must say **"HAZARDOUS WASTE"**. *The label must be completed before it will be accepted for disposal by the Office of Environmental Health & Safety*. The University is liable for the mislabeling of hazardous waste. Do not date the waste as the EHS Office will date it, when it is put into the Hazardous Waste Room. Once a container is **full**, you must call the EHS Office at 2-3495 **as soon as possible**. All waste must be kept in **sealed containers** at all times, unless you are actively pouring into the container. Zip-loc bags for dry debris must also be labeled and sealed. **It is illegal to evaporate waste.** Do not mix incompatible wastes. Ensure the waste container is compatible with the waste and use the appropriately sized container, as our disposal costs are somewhat determined by the container size.

HAZARDOUS WASTE DISPOSAL PROGRAM (Cont'd.)

3. UNKNOWNS

Unknown chemicals cannot be accepted for disposal by the Office of Environmental

Health & Safety. The EHS Office has no way of disposing of unknowns. If the person wishing to dispose of the waste chemicals cannot trace down the identity of the waste, the Office of Environmental Health & Safety can have the University's Hazardous Waste Disposal Company identify them for a substantial cost to the generator. For this reason, the Office of Environmental Health & Safety strongly encourages Departments and Researchers, that have either departing faculty, staff or students, to have these departing persons identify any waste they may have generated before they leave. The Office of Environmental Health & Safety will assist in the identification of hazardous waste and arranging for its storage and ultimate disposal. The Office of Environmental Health & Safety is not responsible for cleaning abandoned laboratories of waste chemicals.

4. STORAGE, PACKAGING AND COORDINATING DISPOSAL

All chemical wastes must be packaged by the generator in a manner, which will allow them to be transported and stored without danger of spillage, escape of dangerous vapors, or hazardous reaction. Again, all wastes must be properly labeled. Once a container of hazardous waste is **full** or ready to be disposed of, the Hazardous Waste Specialist **must be contacted as soon as possible** at 2-3495. The Hazardous Waste Specialist will then pick up the waste container as soon as possible and will either put it into storage or pour if off in the Hazardous Waste Room. Another container of the same waste stream can **not** be utilized, until the full waste container has been picked up. Do not accumulate any waste in your lab for longer than 2 months. This does not include full containers of waste, which must be disposed of immediately. **Routine disposal of hazardous waste through the EH&S Office is encouraged and it's free!**

5. TRANSPORTATION

The Hazardous Waste Specialist in the Office of Environmental Health & Safety **must** be contacted at 2-3495, in order to arrange for a pickup of hazardous waste..

6. CHARGE BACK

The Office of Environmental Health and Safety pays for the disposal of routinely generated hazardous waste. The EHS Office tries to reduce the cost of hazardous waste disposal in many ways: by bulking waste chemicals when possible, disposing of full lab packs, using a bid process for contracting with a waste disposal company and by brokering usable chemicals. Even with these combined efforts, the cost for the disposal of waste chemicals far exceeds their original purchase price. It is thus recommended that the researcher order only the amount of a particular chemical that can be used within a year and/or by a particular research project. This will ultimately save the University money and it is definitely safer to store smaller amounts of chemicals. <u>The researcher and/or researcher's Department is responsible for all associated costs for the clean out of a researcher's lab when they leave the University.</u> Chemical clean outs of labs or other areas are not considered routinely generated hazardous wastes.

B. DEFINITIONS

GENERATOR

A generator is anyone who disposes of waste that is defined by the Environmental Protection Agency (EPA) to be a "hazardous waste". You are a generator if, in your work/research at the University, you produce or find a hazardous chemical that you intend to discard. It is your responsibility to ensure that this waste is handled correctly as described in the above Hazardous Waste Disposal Program. Be aware that there are substantial civil and criminal penalties for any person, company, corporation, institution, association, etc. who improperly disposes of hazardous waste.

HAZARDOUS WASTE

A waste is defined by EPA to be hazardous, if it meets ANY of the following:

- 1. It is a "solid waste or a combination of solid wastes (a solid waste includes semi-solid, liquid, or contained gaseous material) which, because of its concentration, quantity, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality, or an increase in serious irreversible or incapacitating illness, or may pose a substantial present or potential hazard to human health, or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."
- 2. It is included in lists of specifically identifiable compounds published by EPA. See Appendix F EPA Hazardous Waste List.
- 3. It is a listed waste mixed with nonhazardous materials.
- 4. It has the characteristics of being ignitable, corrosive, reactive, or EP Toxicity, as defined by EPA. See below.
- 5. It is personally known to you to be hazardous based upon knowledge of the materials or processes used in producing the waste.
- 6. The four characteristics that determine if a waste is hazardous are as follows: a. *Characteristic of Ignitability*
 - 1. It is a liquid, other than an aqueous solution containing less than 24% alcohol by volume, and has a flash point of less than 60°C (140°F).
 - 2. It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes and when ignited burns so vigorously and persistently that it creates a hazard.
 - 3. It is an ignitable compressed gas; any material or mixture having in the container an absolute pressure exceeding 40 p.s.i. at 70°F or any liquid flammable material having a vapor pressure exceeding 40 p.s.i. absolute at 100°F.

HAZARDOUS WASTE DEFINITIONS (Cont'd.)

4. It is an oxidizer; a substance such as a chlorate, permanganate, inorganic peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter.

b. Characteristic of Corrosivity

- 1. It is aqueous and has a pH less than or equal to 2, or greater than or equal to 12.5, as determined by a pH meter.
- 2. It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 inches) per year at a test temperature of 55°C (130°F) as determined by test methods specified by the National Association of Corrosion Engineers.

c. Characteristic of Reactivity

- 1. It is normally unstable and readily undergoes violent change without detonating,
- 2. It reacts violently with water,
- 3. It forms potentially explosive mixtures with water,
- 4. When mixed with water, it generates toxic gases or vapors in a quantity sufficient to present a danger to human health or the environment,
- 5. It is a cyanide or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases or vapors in a quantity sufficient to present danger to human health or the environment,
- 6. It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement,
- 7. It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure,
- 8. It is a forbidden explosive, a Class A explosive or a Class B explosive as defined in 49 CFR 173.51 and 173.53 (see section 370.1(e) of this Title).

d. Characteristic of EP (Extraction Procedure) Toxicity

(1) A solid waste exhibits the characteristic of toxicity if, using the Toxicity Characteristic Leaching Procedure, Test Method 1311 in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in subdivision 370.1(e) of this Title, the extract from a representative sample of the waste contains any of the contaminants listed in Table 1 at a concentration equal to or greater than the respective value given in that Table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering using the methodology outlined in Method 1311, is considered to be the extract for the purpose of this subdivision.

All solid wastes containing 50 parts per million (ppm) by weight (on a dry weight basis for other than liquid wastes) or greater of polychlorinated biphenyls (PCBs) are listed hazardous wastes. There are a very few exceptions to this, small capacitors and drained PCB articles as defined in NYS DEC's regulations Part 371. Please contact the EHS Office with any questions on PCB wastes.

<u>All non-empty aerosol cans are considered hazardous waste, as are all compressed gas cylinders,</u> <u>whether they are empty or not.</u>

| Contaminant Concentration for Toxicity | | | |
|--|------------------------------|----------------------|-------------------------|
| EPA HW No. ¹ | Contaminant | CAS No. ² | Regulatory Level (mg/L) |
| D004 | Arsenic | 7440-38-2 | 5.0 |
| D005 | Barium | 7440-39-3 | 100.0 |
| D018 | Benzene | 71-43-2 | 0.5 |
| D006 | Cadmium | 7440-43-9 | 1.0 |
| D019 | Carbon tetrachloride | 56-23-5 | 0.5 |
| D020 | Chlordane | 57-74-9 | 0.03 |
| D021 | Chlorobenzene | 108-90-7 | 100.0 |
| D022 | Chloroform | 67-66-3 | 6.0 |
| D007 | Chromium | 7440-47-3 | 5.0 |
| D023 | o-Cresol | 95-48-7 | ⁴ 200.0 |
| D024 | m-Cresol | 108-39-4 | ⁴ 200.0 |
| D025 | p-Cresol | 106-44-5 | ⁴ 200.0 |
| D026 | Cresol | | ⁴ 200.0 |
| D016 | 2,4-D | 94-75-7 | 10.0 |
| D027 | 1,4-Dichlorobenzene | 106-46-7 | 7.5 |
| D028 | 1,2-Dichloroethane | 107-06-2 | 0.5 |
| D029 | 1,1-Dichloroethylene | 75-35-4 | 0.7 |
| D030 | 2,4-Dinitrotoluene | 121-14-2 | ³ 0.13 |
| D012 | Endrin | 72-20-8 | 0.02 |
| D031 | Heptachlor (and its epoxide) | 76-44-8 | 0.008 |
| D032 | Hexachlorobenzene | 118-74-1 | ³ 0.13 |

Table 1. -- Maximum Concentration of Contaminants for the Toxicity Characteristic

| D033 | Hexachlorobutadiene | 87-68-3 | 0.5 |
|------|-----------------------|-----------|------------------|
| D034 | Hexachloroethane | 67-72-1 | 3.0 |
| D008 | Lead | 7439-92-1 | 5.0 |
| D013 | Lindane | 58-89-9 | 0.4 |
| D009 | Mercury | 7439-97-6 | 0.2 |
| D014 | Methoxychlor | 72-43-5 | 10.0 |
| D035 | Methyl ethyl ketone | 78-93-3 | 200.0 |
| D036 | Nitrobenzene | 98-95-3 | 2.0 |
| D037 | Pentrachlorophenol | 87-86-5 | 100.0 |
| D038 | Pyridine | 110-86-1 | ³ 5.0 |
| D010 | Selenium | 7782-49-2 | 1.0 |
| D011 | Silver | 7440-22-4 | 5.0 |
| D039 | Tetrachloroethylene | 127-18-4 | 0.7 |
| D015 | Toxaphene | 8001-35-2 | 0.5 |
| D040 | Trichloroethylene | 79-01-6 | 0.5 |
| D041 | 2,4,5-Trichlorophenol | 95-95-4 | 400.0 |
| D042 | 2,4,6-Trichlorophenol | 88-06-2 | 2.0 |
| D017 | 2,4,5-TP (Silvex) | 93-72-1 | 1.0 |
| D043 | Vinyl chloride | 75-01-4 | 0.2 |

FOOTNOTE 1: Hazardous waste number. FOOTNOTE 2: Chemical abstracts service number. FOOTNOTE 3: Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level. FOOTNOTE 4: If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.

(2) A solid waste that exhibits the characteristic of toxicity has the EPA Hazardous Waste Number specified in Table 1 which corresponds to the toxic contaminant causing it to be hazardous.

C. HAZARDOUS WASTE LABEL



These labels are provided for free by the Office of Environmental Health and Safety in Chemistry B73. All Hazardous Waste should be labeled with the words "Hazardous Waste" and the container's contents should be listed, no abbreviations or chemical formulas allowed. DO NOT DATE YOUR WASTE. EHS dates it when it is put into the Hazardous Waste Room.

D. EMPTY CHEMICAL CONTAINER AND GLASSWARE DISPOSAL POLICY

In order to dispose of empty chemical containers (bottles, used glassware or cans), they must be:

1. Triple rinsed, with water or the appropriate solvent, depending on the chemical residues in the containers.* This is done in order to prevent a potential hazardous materials incident, when the containers are transported and crushed for disposal;

2. The containers' labels made illegible;

3. The tops taken off the clean containers and the containers taken to the C.A.S. Stores in Chemistry B13 for disposal. Call C.A.S. Stores at 2-4409 before you bring down your empty containers, so you can be sure someone is there to receive them. You must sign the log book In C.A.S. Stores when you are dropping off empty chemical containers.

Empty chemical containers MUST NOT be left in the tunnel or in corridors. The C.A.S. Stores personnel will handle the disposal of all clean, empty chemical containers. Small pieces of clean glassware or broken glassware should be placed in a container specifically for glassware disposal. They should not be placed in the regular trash. Cardboard boxes, lined with plastic bags, specifically for glassware disposal, can be gotten for free from C.A.S. Stores. Once these boxes are full, they can be taken back down to C.A.S. Stores for disposal. The custodial staff is not responsible for the disposal of empty chemical containers or broken glassware.

A compressed gas cylinder is considered empty when the pressure in the cylinder approaches atmospheric. Compressed gas cylinders are still considered hazardous materials even when empty. If you have empty lecture size gas cylinders or smaller to dispose of, contact the Office of Environmental Health & Safety. Disposal of larger size gas cylinders is handled through C.A.S. Stores in Chemistry B13.

If you have any questions on the disposal of any type of waste or container, call the Office of Environmental Health & Safety at 2-3495.

^{*} The rinsate from Acute Hazardous Waste Containers (P Listed Wastes) is also considered a hazardous waste. The solvent you use to rinse a container may also be considered a hazardous waste.

E. DISPOSAL OF REGULATED MEDICAL WASTE

Regulated medical waste is regulated by the NYS Department of Health. For more information on Managing Regulated Medical Waste, go to http://www.health.state.ny.us/facilities/waste/

A. *Regulated Medical Waste*: "Regulated medical waste shall mean any of the following waste which is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in production and testing of biologicals, provided however, that regulated medical waste shall not include hazardous waste identified or listed pursuant to Section 27-0903 of the Environmental Conservation Law. . ." and includes those items listed below.

SUBCATEGORY

DESCRIPTION

| 1. Cultures and Stocks | "This waste shall include cultures and stocks of agents infectious to humans, and associated biologicals, cultures from medical or pathological laboratories, cultures and stocks of infectious agents from research and industrial laboratories, wastes from the production of biologicals, discarded live or attenuated vaccines, or culture dishes and devices used to transfer, inoculate or mix cultures." (This includes but is not limited to those agents that cause communicable diseases and those agents designated as requiring biosafety level II – IV in the CDC/NIH Manual for Biosafety in Microbiological and Biomedical Laboratories. (http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4s2.htm) |
|-----------------------------------|--|
| 2. Pathological Wastes | "This waste shall include tissue, organs, and body parts (except teeth and the contiguous structures of bone and gum), body fluids that are removed during surgery, autopsy, or other medical procedures, or specimens of body fluids and their containers, and discarded material saturated with such body fluids other than urine, provided that the Commissioner, by duly promulgated regulation, may exclude such discarded material saturated with body fluids from this definition if the commissioner finds that it does not pose a significant risk to public health. This waste shall not include urine or fecal materials submitted for other than diagnosis of infectious diseases." |
| 3. Human Blood and Blood Products | This waste shall include: (I) discarded waste human blood, discarded blood components (e.g. serum and plasma), containers with free flowing blood or blood components or discarded saturated material containing free flowing blood or blood components; and (II) materials saturated with blood or blood products provided that the Commissioner, by duly promulgated regulation, may exclude such material saturated |

with blood or blood products from this definition if the Commissioner finds that it does not pose a significant risk to public health." 4. Sharps "This waste shall include but not be limited to discarded unused sharps and sharps used in animal or human patient care, medical research, or clinical or pharmaceutical laboratories, hypodermic, intravenous, or other medical needles, hypodermic or intravenous syringes to which a needle or other sharp is still attached, Pasteur pipettes, scalpel blades, or blood vials. This waste shall include, but not be limited to, other types of broken or unbroken glass (including slides and cover slips) in contact with infectious agents. This waste shall not include those parts of syringes from which sharps are specifically designed to be easily removed and from which sharps have actually been removed, and which are intended for recycling or other disposal, so long as such syringes have not come in contact with infectious agents." 5. Animal Waste This waste shall mean discarded materials including carcasses, body parts, body fluids, blood, or bedding originating from animals known to be contaminated with infectious agents (i.e. zoonotic organisms) or from animals inoculated during research, production of biologicals, or pharmaceutical testing with infectious agents."

B. *"Biologicals"* means preparations made from living organisms and their products, including vaccines, cultures, etc. intended for use in diagnosing, immunizing, or treating humans or animals or in research pertaining thereto.

C. "*Laboratory*" means any research, analytical, or clinical facility that performs health care related analysis or service. This includes medical, pathological, pharmaceutical, and other research, commercial, or industrial laboratories.

D. "Infectious Agents" means any organisms that cause disease or an adverse health impact to humans, except that the Commissioner may prescribe by regulation additional infectious agents as may be necessary to protect health and the environment.

If any waste generated in your laboratories fits the definitions above, it is "regulated medical waste" and must be handled and disposed of accordingly. Regulated Medical Waste must be **red-bagged**. The red bags, which have the universal biohazard symbol are available for purchase from C.A.S. Stores in Chemistry B13. The University has an agreement with Stericycle for pick up and disposal of this type of waste. Currently, the University Health Center and the Animal Facility are the primary generators of medical waste. If you have regulated medical waste to dispose of, please contact the EH&S Office at 2-3495 for further instructions.*****REGULATED MEDICAL WASTE CAN NOT BE AUTOCLAVED AND PUT IN THE REGULAR TRASH FOR DISPOSAL AT THE UNIVERSITY AT ALBANY.**

F. HANDLING PROCEDURES FOR SHARPS, GLASS, & BIOHAZARDOUS AUTOCLAVED WASTE

SharpsNeedles, syringes, and scalpel blades, etc. appear to most always be
considered regulated medical waste under the "sharps" category
(see Section E. above), and must be disposed of in the red plastic sharps
containers available for purchase through C.A.S. Stores. C.A.S. Stores
charges a small fee for the sharps container, which includes
the cost of the container's disposal as regulated medical waste.
When the container is full, bring it back to C.A.S. Stores
for proper disposal as regulated medical waste.
This is also required to comply with the University's policy
"Guidelines for the Procurement, Storage, Use, and Destruction and
Disposal of Hypodermic Supplies". The University has a contract
with Stericycle for pick up and disposal of this type of waste.

Glass Any glass items you wish to dispose of, which do not fall into the categories of regulated medical waste and that do not need to be treated otherwise (e.g. autoclaved), should be placed in a container separate from other lab trash. Glass pipettes contaminated with biohazardous materials must go out in Sharps' containers. The glass items should be as clean as possible. Most laboratories already have some type of container dedicated to glass disposal, only. If you don't have a separate container for glass, a sturdy cardboard box lined with a heavy plastic bag is suitable. These are available for free from the C.A.S. Stores in Chemistry B13. The reason for separating glass from other trash, to avoid puncture wounds, should be obvious. All boxes used for glass disposal should be labeled "Clean Glass Only." When the lined cardboard box is full of glass, please seal the box with tape and take to C.A.S. Stores for disposal.

Biohazardous

Autoclaved Waste Any culture dishes, test tubes, Pasteur pipettes, etc., that do NOT categorize as "regulated medical waste" (See Section E. above) should be placed in an orange autoclave bag labeled with the universal biohazard symbol prior to autoclaving. When you are ready to autoclave a full, orange bag, put copious amounts of autoclave indicator tape on the bag before you run it through the autoclave. The indicator tape signals that the orange bag has been through the autoclave bag has been through the autoclave, it should be placed in a dark, opaque garbage bag for disposal in the regular trash. The orange autoclave bags, indicator tape and dark, opaque garbage bags are available for purchase from C.A.S. Stores.

***REGULATED MEDICAL WASTE CAN NOT BE AUTOCLAVED AND PUT IN THE REGULAR TRASH FOR DISPOSAL AT THE UNIVERSITY AT ALBANY.

REFER TO YOUR LAB'S BIOSAFETY MANUAL FOR SPECIFIC DECONTAMINATION AND BIOHAZARDOUS WASTE DISPOSAL PROCEDURES.

If you have questions regarding any type of waste disposal, contact the Office of Environmental Health & Safety at 2-3495.

VIII. APPENDICES

APPENDIX A. - REACTIVE CHEMICALS

Reactive chemicals are substances, which under certain ambient or induced conditions, enter into violent reactions with spontaneous generation of large quantities of heat, light, gases (flammable and nonflammable), or toxicants that can be destructive to lives and property. The types of reactive chemicals have been loosely categorized:

- 1. *Explosive* Many substances, when mixed, are potentially explosive (such as hydrazines and nitric acid). In general, protect these substances from shock, elevated temperatures, rapid temperature changes, and other reactive chemicals. Some examples: nitroglycerin, nitrocellulose, organic peroxides and metal azides.
- 2. *Oxidizing and Reducing Substances* In many oxidizing and reducing reactions, both agents must be present. However, in some cases, one or the other substance creates a hazard by coming into contact with a normally innocuous substance. The reactions tend to generate heat and are often explosive. Some oxidizing agents: oxygen, perchloric acid, nitric acid, inorganic peroxides, nitrites, nitrates, hydrides, butadiene, peracetic acid and peroxy acids. Some reducing agents: hydrogen, metallic hydrides, alkali metals, and pyrophoric agents such as activated zinc and phosphorus.
- 3. *Water Sensitive Substances* These chemicals react with water, steam, and moisture in the air to evolve heat and/or flammable or explosive gases. Isolate water-sensitive substances from other reactive compounds. Store them in a cool, waterproof area. No water should service the storage area. Some substances that liberate heat only are: strong acids and bases, acid anhydrides and sulfides. Some substances that liberate flammable gases are: alkali metals, hydrides, nitrides, carbides, and anhydrous metallic salts.
- 4. *Acid Sensitive Substances* These chemicals react with acid to evolve heat, flammable and/or explosive gases, and toxicants. Some examples are: alkali metals, hydroxides, carbonates, carbides, nitrides, arsenic and related elements, cyanides, sulfides, and structural alloys (most metals).
- 5. *Special Organic Compounds* These compounds are unstable and may decompose spontaneously or through contact with the immediate environment (air, water, and other reactants). Some examples: diazonium compounds, diazomethane, chlorination intermediates, butadiene, nitration intermediates, organic sulfates, polymerization reactions, and highly nitrated compounds.
- 6. *Pyrophoric Agents* Pyrophoric agents burn when exposed to air. In general, they require absolute protection against air. Examples: phosphorus and activated zinc.

REACTIVE CHEMICALS (Cont'd.)

The following is a list of some specific HIGHLY REACTIVE CHEMICALS and their associated hazards (Note - this is not all inclusive):

HYDROFLUORIC ACID - This is a very insidious material. After any contact with a solution of hydrofluoric acid, even if there is no immediate pain, the area should be flushed with copious amounts of water for at least 5 minutes then apply calcium glutonate gel (available from the Environmental Health and Safety Office in Chemistry B73.) <u>Consult a physician promptly.</u>

PHENOL - When phenol is dissolved in organic solvents it is readily absorbed into the blood stream, resulting in serious or fatal poisoning. If phenol is accidentally spilled, flush area with copious amounts of water for at least 15 minutes. Consult a physician promptly.

BROMINE - Bromine can be measured volumetrically with little hazard. Keep a dilute sodium bisulfite solution on hand to destroy any accidentally spilled bromine.

HYDROGEN CYANIDE - Hydrogen cyanide should always be used under a hood. Liquid hydrogen cyanide is best kept over anhydrous calcium chloride. It thus remains water-white for months. Formation of a yellow color in the liquid indicates the lot should be destroyed.

PERCHLORATES - Perchlorates should be handled only by persons thoroughly familiar with the hazards involved. Do not use magnesium perchlorate as a desiccant, except in the standard procedure for the determination of carbon and hydrogen.

DICHROMATE CLEANING SOLUTION - Dichromate cleaning solution is an extremely corrosive agent. Never transfer the cleaning solution from a pipette washer by pouring. Use a siphon. Follow these precautions when using the cleaning solution:

- a. Keep the bottle caps loosened;
- b. Store the solutions in a cool area, away from other chemicals;
- c. Keep protective equipment available in case of a spill (i.e., respirator, acid-resistant gloves, spill clean up kit, etc.);
- d. Dichromate cleaning solutions are considered hazardous waste.

PHOSPHORUS TRIHALIDES - Containing moisture, may under certain circumstances, form some phosphine when heated, and explode violently when exposed to air. Red phosphorus and hydriodic acid may also form explosive compounds. These materials should be heated in an atmosphere of carbon dioxide.

REACTIVE CHEMICALS (Cont'd.)

PHOSPHORUS OXYCHLORIDE - A serious accident occurred when this chemical was being distilled under vacuum. The vacuum changed and water ran back into the phosphorus oxychloride and the mixture exploded. This chemical should be distilled at normal pressure. If it is absolutely necessary to use a vacuum; adequate traps should be provided between the water pump and the received. (Other chemicals in the same category are: SO2C12, SOC12, S2C12, PC12, etc. Similar precautions should be employed in all vacuum distillations in which a water pump is used, because sudden loss of pressure will force water back up into the apparatus being evacuated. A Bunsen valve in the trap will avoid much of this difficulty.

BENXOYL PEROXIDE - when dry, benzoyl peroxide is easily ignited and sensitive to shock. It will decompose spontaneously at temperatures above 50°C. It must be stored in a cool place. Keep away from all sources of heat. Do not subject it to friction or grinding in the dry state, since the heat generated will cause it to explode. This chemical is desensitized by the addition of at least 20% by weight of water (from DuPont Safety Manual).

ALUMINUM CHLORIDE - Should be considered a potentially dangerous material. If moisture is present, sufficient decomposition to build up considerable pressure may result. If a bottle is to be opened after long standing, enclose it completely in a heavy towel and place the covered bottle in a metal container before opening the lid. Be sure to wear protective equipment.

AMMONIA and MERCURY - In contact, these chemicals have been known to form explosive compounds (Ind. Eng. Chem., New Edition, 1932).

HYDROXYL AMINE DERIVATIVES - Particularly those related to hydroxy aminic acid, should be treated as explosive compounds. Distillation of products in which they may be present should be conducted behind screens with all safety precautions taken. Acid salts of hydroxyl amine are explosive; hydroxyl amine is not, but may contain residual salts.

CYANOGEN BROMIDE - Is explosive in the solid state unless it is absolutely white. Do not keep bottles of it tightly stoppered.

PYRUVIC ACID - Has been reported to blow up while standing on the shelf.

o-NITROBENZOYL CHLORIDE - Has exploded violently upon attempted distillation (Ind. Eng. Chem., New Ed., 23, 2394, (1945):JACS 68, 344, (1946)).

NITRILES - Nitriles react similarly to hydrogen cyanide and should be handled under a hood. Any part of the body which has come in contact with any of these materials should be flushed with copious amounts of water for at least 15 minutes. Consult a physician promptly. Nitrile compounds in a vapor state are very toxic when inhaled and the same precautions used with hydrogen cyanide are necessary.

ACRYLONITRILE (VINYL CYANIDE) - Is a very active poison. It is fatal immediately when breathed in a concentration of 270 ppm. (In. Hygiene and Toxicology, February, 1942, pg. 255).

REACTIVE CHEMICALS (Cont'd.)

NITRIC OXIDE, NITROGEN DIOXIDE and ITS POLYMERS - Are produced when nitric acid reacts with organic materials. They are extremely dangerous because they give no warning. Never inhale them. If you do inhale them accidentally, get to fresh air, and consult a physician immediately.

DOWTHERM AND ALLIED HEAT-TRANSFER AIDS - While not active poisons, these have a cumulative effect which results in bodily changes after long exposure. They are readily absorbed by the skin and by clothing, particularly leather and wool. If exposed, wash the exposed parts and the clothing. Low concentrations of the vapor are detectable by odor when the exposure is infrequent, but continual exposure desensitizes the olfactory nerves so the odor is no longer apparent. Such exposure should be avoided.

PHOSGENE - Phosgene is extremely dangerous because its symptoms are delayed for 4 to 8 hours, when small but toxic amounts are inhaled. If accidentally inhaled, consult a physician promptly.

CYANURIC CHLORIDE - Cyanuric chloride is a lachrymator and may cause severe burns of the mucous

membranes. Use only in a well-ventilated hood. When distilling it, use of the same precautions as for other acid chlorides.

EPICHLOROHYDRIN - Undiluted epichlorohydrin is intensely irritating to the skin. Because of the potential

nephrotic effects, persons working with this materials on a continuing basis should undergo medical supervision. (Univ. Calif., the Toxicity of Epichlorohydrin, 1941, pamphlet, in Library).

DIMETHYL SULFATE - Dimethyl sulfate is an extremely reactive material, especially when it comes in contact with the skin or mucous membranes. A very short time of contact with the mucous membranes will result in painful burns. If it comes in contact with the eye, sight will be impaired if it is not removed immediately. Flush the eye and/or skin with copious amounts of water for at least 15 minutes. Consult a physician promptly.

DIOXANE - Dioxane appears to be a poisonous compound with a delayed reaction. This material should be handled cautiously and not inhaled. Dioxane can readily form dangerous peroxides. See Appendix G. In addition to precautions to be taken during its distillation, condensation of its distilled vapors should be done with water above 12°C to prevent plugging the condenser.

BENZENE, TOLUENE, and CARBON TETRACHLORIDE - These chemicals are readily absorbed through intact skin, as well as through the respiratory tract. Do not handle them carelessly. Use only in a fume hood. Benzene and carbon tetrachloride are suspected or confirmed human carcinogens.

Always consult a chemical's Material Safety Data Sheet before first using it.

APPENDIX B. GLOVE SELECTION

The following links are for companies that may supply gloves to laboratories at the University at Albany. Available on each website are chemical compatibility charts for the gloves supplied by each specific company. Please use them to verify that the gloves being used to handle a specific chemical are providing proper protection to the wearer. It is important to note that all chemicals may not be listed on the charts, and that two similar gloves supplied by two different companies may not provide the same level of protection. It is important, therefore, to use the compatibility chart for the manufacturer of the glove being used.

NORTH – <u>http://ezguide.northsafety.com/</u> BEST – <u>http://www.chemrest.com/</u> ANSELL Protective Products – <u>http://www.ansell-edmont.com/</u> MICROFLEX – <u>http://www.microflex.com/products/glovechem/a.asp</u>

Glove Suppliers Without Compatibility Charts

The following are websites for glove suppliers who at this point do not have glove compatibility charts available. Please ensure that prior to using gloves from these companies, the customer service/ technical assistance department is contacted using the links below.

Fisher Scientific – <u>http://www.fishersci.com/</u> Gaurdian – <u>http://www.guardian-mfg.com/</u>

APPENDIX C. – PEL LIST

Air contaminants. - 1910.1000 CLICK ABOVE

APPENDIX D. - OSHA

Occupational exposure to hazardous chemicals in laboratories. - 1910.1450 CLICK ABOVE

| $\underline{SI} = Schous + robichi $ $\underline{X} = 1 robichi Exists$ | = Condition is O.K. | Date of Inspection | | |
|---|--------------------------------|--------------------|--|--|
| Department: Building: Room: | Principal Investigator: Phor | ne: | | |
| AREAS OF INSPECTION COMMENTS | | CORRECTION | | |
| 1 Emergency Notification | | | | |
| 2 Other Door Signs | | | | |
| 3 Personal Protection (Goggles, gloves, aprons, | lab coats) | | | |
| 4 Fire Extinguishers | | | | |
| 5 Eyewash | | | | |
| 6 Shower | | | | |
| 7 Hoods | | | | |
| Housekeeping (Aisle/floor, shelves/cabinets, bench tops, hoods) | | | | |
| 9 Labels on Containers | | | | |
| 10 Storage(Volume of flammables, peroxides, c | orrosives,compatibles, wastes, | refrigerators) | | |
| | | | | |
| 11Compressed Gas Cylinders | | | | |
| 11Compressed Gas Cylinders 12Guarding | | | | |
| 11Compressed Gas Cylinders 12Guarding 13Food, Drink, Smoking | | | | |
| 11Compressed Gas Cylinders 12Guarding 13Food, Drink, Smoking 14Electrical Cords, Wires, Grounds | | | | |
| 11Compressed Gas Cylinders 12Guarding 13Food, Drink, Smoking 14Electrical Cords, Wires, Grounds 15Lab Doors locked when unattended | | | | |
| 11Compressed Gas Cylinders 12Guarding 13Food, Drink, Smoking 14Electrical Cords, Wires, Grounds 15Lab Doors locked when unattended 16Notes/Other Areas of Concern | | | | |
| 11Compressed Gas Cylinders 12Guarding 13Food, Drink, Smoking 14Electrical Cords, Wires, Grounds 15Lab Doors locked when unattended 16Notes/Other Areas of Concern Inspected by: | Date | | | |

(Copies (3 white -- Principal Investigator; Canary -- Office of Environmental Health and Safety; Pink -- Department Chair Principal Investigator returns White Copy with corrected problem dates to Environmental Health and Safety Office Chemistry B73

APPENDIX F. - EPA HAZARDOUS WASTE LIST

Chemical No. Hazardous Waste Abstracts No.

(e) The commercial chemical products, manufacturing chemical intermediates or offspecification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous wastes (H) and are subject to be the small quantity exclusion defined in Sec. 261.5(e).

[Comment: For the convenience of the regulated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity.]

Substance

These wastes and their corresponding EPA Hazardous Waste Numbers are:

| P023 | 107-20-0 | Acetaldehyde, chloro |
|------|---------------|---|
| P002 | 591-08-2 | Acetamide, N-(aminothioxomethyl) |
| P057 | 640-19-7 | Acetamide, 2-fluoro |
| P058 | 62-74-8 | Acetic acid, fluoro-, sodium salt |
| P002 | 591-08-2 | 1-Acetyl-2-thiourea |
| P003 | 107-02-8 | Acrolein |
| D070 | 116-06-3 | Aldicarb |
| 1070 | | Aldias the sulfana |
| P203 | | Aldicard Sullone |
| P004 | 309-00-2 | Aldrin |
| P005 | 107-18-6 | Allyl alcohol |
| P006 | 20859-73-8 | Aluminum phosphide (R,T) |
| P007 | 2763-96-4 | 5-(Aminomethyl)-3-isoxazolol |
| P008 | 504-24-5 | 4-Aminopyridine |
| P009 | 131-74-8 | Ammonium picrate (R) |
| P119 | 7803-55-6 | Ammonium vanadate |
| P099 | 506-61-6 | Argentate(1-), bis(cvano-C) |
| 2000 | 000 01 0 | notassium |
| D010 | 1 0 2 0 7 7 7 | Pressia acid |
| P010 | 1207 52 2 | Arsenic acid |
| PUIZ | 1327-33-3 | Arsenic Oxide |
| PUII | 1303-28-2 | Arsenic oxide |
| P011 | 1303-28-2 | Arsenic pentoxide |
| P012 | 1327-53-3 | Arsenic trioxide |
| P038 | 692-42-2 | Arsine, diethyl |
| P036 | 696-28-6 | Arsonous dichloride, phenyl |
| P054 | 151-56-4 | Aziridine |
| P067 | 75-55-8 | Aziridine, 2-methyl- |
| P013 | 542-62-1 | Barium cvanide |
| P024 | 106-47-8 | Benzenamine 4-chloro- |
| D077 | 100-01-6 | Bonzonamino, A-pitro- |
| | | Denzenamine, 4-nitto- |
| PU28 | 100 - 44 - 7 | Benzene, (Chloromethyl) - |
| P042 | 51-43-4 | 1,2-Benzenediol, 4-[1-hydroxy-2- |
| | | (methylamino)ethyl]-, (R)- |
| P046 | 122-09-8 | Benzeneethanamine, alpha,alpha- |
| | | dimethyl- |
| P014 | 108-98-5 | Benzenethiol |
| P127 | 1563-66-2 | 7-Benzofuranol, 2,3-dihydro-2,2- |
| | | dimethyl-, methylcarbamate. |
| P188 | 57-64-7 | Benzoic acid, 2-hvdroxy-, compd. with |
| | | (3aS-cis)-1,2,3,3a,8,8a-hexahydro- 1,3a,8-trimethylpyrrolo[2,3-b]indol- 5- vl methylcarbamate ester (1:1). |
| P001 | 181-81-2 | 2H-1-Benzopyran-2-one, 4- hydroxy-3-(3- oxo-1-phenylbutyl)-, salts, when present at concentrations greater than 0.3% |

| P028 | 100-44-7 | Benzvl chloride |
|--------------|----------------------|--|
| P015 | 7440 - 41 - 7 | Berullium powder |
| D017 | 508_31_2 | Bromoagotopo |
| FUI/ D010 | 257 57 2 | Dromodeetone |
| PUIO | 30106 10 4 | Brucine 2 Difference 2 2 diverte 1 1 |
| P045 | 39196-18-4 | 2-Butanone, 3,3-dimethyl-1- |
| | | (methylthio)-, O- |
| | | methylamino)carbonyl] oxime |
| P021 | 592-01-8 | Calcium cyanide |
| P021 | 592-01-8 | Calcium cyanide Ca(CN) |
| P189 | 55285-14-8 | Carbamic acid, [(dibutylamino)- |
| | | thiolmethyl-, 2.3-dihydro-2.2- |
| | | dimethyl- 7-benzofuranyl ester. |
| P191 | 644-64-4 | Carbamic acid. dimethyl 1- |
| 1 1 9 1 | | [(dimethy] = amino)carbony]] = 5- |
| | | methyl 10 pursgel 2 ul ester |
| D100 | 110 20 0 | Methyrin pyrazor J-yr ester. |
| P192 | 119-38-0 | Carbamic acid, dimetnyl-, 3-metnyl-1- |
| | | (1-methylethyl)-1H- pyrazol-5-yl |
| | | ester. |
| P190 | 1129-41-5 | Carbamic acid, methyl-, 3- |
| | | Methylphenyl ester. |
| P127 | 1563-66-2 | Carbofuran. |
| P022 | 75-15-0 | Carbon disulfide |
| P095 | 75-44-5 | Carbonic dichloride |
| P189 | 55285-14-8 | Carbosulfan. |
| P023 | 107-20-0 | Chloroacetaldehyde |
| P024 | 106-47-8 | n-Chloroaniline |
| P026 | 5344-82-1 | 1-(o-Chlorophenyl)thiourea |
| 1020 D027 | 542 76 7 | 2 Chloropropionitrilo |
| PU27 | 542-70-7 | S-Chioropropronitire |
| PU29 | 544-92-5 | Copper cyanide |
| PU29 | 544-92-3 | Copper cyanide Cu(CN) |
| P202 | 64-00-6 | m-Cumenyl methylcarbamate. |
| P030 | • • • • • • • | Cyanides (soluble cyanide salts), not |
| | | otherwise specified |
| P031 | 460-19-5 | Cyanogen |
| P033 | 506-77-4 | Cyanogen chloride |
| P033 | 506-77-4 | Cyanogen chloride (CN)Cl |
| P034 | 131-89-5 | 2-Cyclohexyl-4,6-dinitrophenol |
| P016 | 542-88-1 | Dichloromethyl ether |
| P036 | 696-28-6 | Dichlorophenvlarsine |
| P0.37 | 60 - 57 - 1 | Dieldrin |
| P038 | 692-42-2 | Diethylarsine |
| P041 | 311-45-5 | Diethyl-n-nitrophenyl phosphate |
| | 207-07-2 | O O-Dicthyl O-purazinyl |
| F040 | 291-91-2 | o,o-Diethyi o-pyiazinyi |
| D042 | FF 01 4 | phosphorochicate |
| P043 | 35-91-4 | 1 4 5 0 B'arthorophosphale (DFP) |
| P004 | 309-00-2 | 1,4,5,8-Dimethanonaphthalene, |
| | | 1,2,3,4,10,10-hexa- chloro- 1,4,4a, |
| | | 5,8,8a,-hexahydro-, (lalpha,4alpha, |
| | | 4abeta,5alpha,8alpha,8 abeta)- |
| P060 | 465-73-6 | 1,4,5,8-Dimethanonaphthalene, |
| | | 1,2,3,4,10,10-hexa- chloro- |
| | | 1,4,4a,5,8,8a-hexahydro-,(1alpha, |
| | | 4alpha,4abeta,5beta,8beta,8ab_eta)- |
| P037 | 60-57-1 | 2,7:3,6-Dimethanonaphth[2,3- |
| | | bloxirene. 3.4.5.6.9.9-hexachloro- |
| | | 1a.2.2a.3.6.6a.7.7a-octahydro |
| | | (laalnha 2heta 2aalnha 3heta 6heta 6a |
| | | (ladipha, 2beca, 2adipha, 5beca, 6beca, 6a |
| D051 | ¹ 72 20 9 | 2.7.2 6 Dimethanonanth [2.2 |
| TOOT | 12-20-0 | $2, 7.3, 0^{-}$ Dimethallonaphili [2, 3 ⁻ |
| | | DJOXITENE, 5,4,5,6,9,9-NEXACHIORO- |
| | | 1a, 2, 2a, 3, 6, 6a, 7, 7a-octahydro-, |
| | | Iaalpha,2beta,2abeta,3alpha,6alpha,6 |
| | | abeta,7beta, 7aalpha)-, & |
| | | metabolites |

| P044 | 60-51-5 | Dimethoate |
|--------------|-----------------------|---|
| P046 | 122-09-8 | alpha,alpha-Dimethylphenethylamine |
| P191 | 644-64-4 | Dimetilan |
| P047 | ¹ 534-52-1 | 4,6-Dinitro-o-cresol, salts |
| P048 | 51-28-5 | 2,4-Dinitrophenol |
| P020 | 88-85-7 | Dinoseb |
| P085 | 152-16-9 | Diphosphoramide, octamethyl- |
| P111 | 107-49-3 | Diphosphoric acid, tetraethyl ester |
| P039 | 298-04-4 | Disulfoton |
| P049 | 541-53-7 | Dithiobiuret |
| P185 | 26419-73-8 | 1,3-Dithiolane-2-carboxaldehyde, 2,4- |
| | | dimethyl-, O- [(methylamino)- |
| | | carbonyl]oxime. |
| P050 | 115-29-7 | Endosulfan |
| P088 | 145-73-3 | Endothall |
| P051 | 72-20-8 | Endrin |
| P051 | 72-20-8 | Endrin, metabolites |
| P042 | 51-43-4 | Epinephrine |
| P031 | 460-19-5 | Ethanedinitrile |
| P194 | 23135-22-0 | Ethanimidothioc acid, 2- |
| | | (dimethylamino) -N-[[(methylamino) |
| | | carbonyl]oxy]-2-oxo-, methyl ester. |
| P066 | 16752-77-5 | Ethanimidothioic acid, |
| | | N-[[(methylamino)carbonyl]oxy]-, |
| 5101 | 107 10 0 | methyl ester |
| PIUI | 107-12-0 | Ethyl cyanide |
| P054 | 151-56-4 | Ethyleneimine |
| P097 | 52-85-7 | Famphur |
| PU36 | 7782-41-4 | Fluorine |
| PUS/ | 640 - 19 - 7 | Fluoroacetamide |
| PU30 D100 | 02 - 74 - 0 | Fluoroacetic acia, sodium sait |
| P190 D107 | 17702-57-7 | Formparanato |
| P197 | | Fulminia acid moreury(21) calt (D T) |
| P005 P059 | 76 - 11 - 8 | Hentachlor |
| P062 | 757-58-4 | Heveethyl tetrephosphete |
| P116 | 79-19-6 | Hydrazinecarbothioamide |
| P068 | 60 - 34 - 4 | Hydrazine, methyl- |
| P063 | 74-90-8 | Hydrocyanic acid |
| P063 | 74-90-8 | Hydrogen cyanide |
| P096 | 7803-51-2 | Hydrogen phosphide |
| P060 | 465-73-6 | Isodrin |
| P192 | 119-38-0 | Isolan. |
| P202 | 64-00-6 | 3-Isopropylphenyl N-methylcarbamate. |
| P007 | 2763-96-4 | 3(2H)-Isoxazolone, 5-(aminomethyl)- |
| P196 | 15339-36-3 | Manganese, bis |
| | | (dimethylcarbamodithioato-S,S')-, |
| P196 | 15339-36-3 | Manganese dimethyldithiocarbamate. |
| P092 | 62-38-4 | Mercury, (acetato-0)phenyl- |
| P065 | 628-86-4 | Mercury fulminate (R,T) |
| P082 | 62-75-9 | Methanamine, N-methyl-N-nitroso- |
| P064 | 624-83-9 | Methane, isocyanato- |
| P016 | 542-88-1 | Methane, oxybis[chloro- |
| P112 | 509-14-8 | Methane, tetranitro- (R) |
| P118 | 75-70-7 | Methanethiol, trichloro- |
| P198 | 23422-53-9 | Methanimidamide, N,N-dimethyl-N'-[3- |
| | | [[(methylamino)-carbonyl]oxy]phenyl]- |
| | | monohydrochloride. |
| P197 | 17702-57-7 | Methanimidamide, N,N-dimethyl-N'-[2- |
| | | <pre>methyl-4-[[(methylamino) carbonyl]</pre> |
| 2050 | 115 00 5 | oxy]phenyl]- |
| 2020 | 115-29-7 | 6,9-Methano-2,4,3-benzodioxathiepin, |
| | | 6,/,8,9,10,10- hexachloro-1,5,5a,6,9, |
| | | 9a-nexanyaro-, 3-oxide |

| P059 | 76-44-8 | 4,7-Methano-1H-indene, 1,4,5,6,7,8,8- |
|------------|--------------------|--|
| 5100 | 0000 65 7 | neptachioro-3a,4,7,7a- tetranydro |
| P199 | 2032-65-7 | Methiocarb |
| P066 | 16/52-77-5 | Methomyl |
| P068 | 60-34-4 | Methyl hydrazine |
| P064 | 624-83-9 | Methyl isocyanate |
| P069 | 75-86-5 | 2-Methyllactonitrile |
| P071 | 298-00-0 | Methyl parathion |
| P190 | 1129-41-5 | Metolcarb |
| P128 | 315-8-4 | Mexacarbate |
| P072 | 86-88-1 | alpha-Naphthylthiourea |
| D072 | 12462 20 2 | Nigkol gorbonyl |
| P073 | 13403-39-3 | Nickel Carbonyi |
| PU/3 | 13463-39-3 | Nickel carbonyl Ni(CO)(T-4)- |
| P0/4 | 557-19-7 | Nickel cyanide |
| P074 | 557-19-7 | Nickel cynaide Ni(CN) |
| P075 | 54-11-5 | Nicotine, salts |
| P076 | 10102-43-9 | Nitric oxide |
| P077 | 100-01-6 | p-Nitroaniline |
| P078 | 10102-44-0 | Nitrogen dioxide |
| P076 | 10102-43-9 | Nitrogen oxide NO |
| P078 | 10102-44-0 | Nitrogen oxide NO |
| D081 | 55-63-0 | Nitroglycerine (P) |
| D082 | 62-75-9 | Niciogrycerine (N) N-Nitrosodimothylamino |
| F U 0 Z | 02-75-9 | N-Nitrosoullechylamine |
| PU84 | 4549-40-0 | N-Nitrosometnyivinylamine |
| P085 | 152-16-9 | Octamethylpyrophosphoramide |
| P087 | 20816-12-0 | Osmium oxide OsO(T-4)- |
| P087 | 20816-12-0 | Osmium tetroxide |
| P088 | 145-73-3 | 7-Oxabicyclo[2.2.1]heptane-2,3- |
| | | dicarboxylic acid |
| P194 | 23135-22-0 | Oxamyl |
| P089 | 56-38-2 | Parathion |
| P0.34 | 131-89-5 | Phenol. 2-cvclohexvl-4.6-dinitro- |
| P048 | 51-28-5 | Phenol 2 4-dinitro- |
| D047 | $^{1}534 - 52 - 1$ | Phonol 2-mothul-4 6-dinitro- solts |
| 2047 | 554-52-1 | rnenor, z-meenyr-4,0-arnitro-, sarts |
| P020 | 88-85-7 | Phenol, 2-(1-methylpropyl)-4,6- |
| | | dinitro- |
| P009 | 131-74-8 | Phenol, 2,4,6-trinitro-, ammonium |
| | | Salt (R) |
| P128 | 315-18-4 | Phenol, 4-(dimethylamino)-3,5- |
| | | dimethyl-, methylcarbamate (ester) |
| P199 | 2032-65-7 | Phenol. (3.5-dimethyl-4-(methylthio). |
| 1 1 9 9 | 2002 00 / | methylcarbamate |
| D202 | 61-00-6 | $\frac{1}{2} \frac{1}{2} \frac{1}$ |
| FZUZ | 04-00-0 | Filehor, 5-(1-mechyrechyr)-, mechyr |
| 1 | 0.001 05 0 | |
| P201 | 2631-37-0 | Phenol, 3-methyl-5-(1-methylethyl)-, |
| | | methyl carbamate |
| P092 | 62-38-4 | Phenylmercury acetate |
| P093 | 103-85-5 | Phenylthiourea |
| P094 | 298-02-2 | Phorate |
| P095 | 75-44-5 | Phosgene |
| P096 | 7803-51-2 | Phosphine |
| P041 | 311-45-5 | Phosphoric acid diethyl 4- |
| 1011 | 011 10 0 | Nitrophenyl ester |
| 020 | | Dhoapharadithiaid acid 0 0 diathul |
| F039 | 298-04-4 | Phosphorodichioic acid, 0,0-diethyi |
| DOO | | S-[2-(etnylthio)etnyl] ester |
| P094 | 298-02-2 | Phosphorodithioic acid, 0,0-diethyl |
| | | S-[(ethylthio)methyl] ester |
| P044 | 60-51-5 | Phosphorodithioic acid, 0,0-dimethyl |
| | | <pre>S-[2-(methylamino)-2-oxoethyl] ester</pre> |
| P043 | 55-91-4 | Phosphorofluoridic acid, bis(1- |
| | | methylethyl) ester |
| P089 | 56-38-2 | Phosphorothioic acid, 0,0-diethvl 0- |
| | | (4-nitrophenyl) ester |
| | | |

| P040 | 297-97-2 | Phosphorothioic acid, 0,0-diethyl 0- |
|--------------|------------|--|
| P097 | 52-85-7 | Phosphorothioic acid, O-[4- [(dimethylamino)sulfonyl]phenyl] O,O- |
| P071 | 298-00-0 | Phosphorothioic acid, 0,0,-dimethyl 0-(4-nitrophenyl) ester |
| P204 | 57-47-6 | Physostiamine. |
| P188 | 57-64-7 | Physostigmine salicylate |
| P110 | 78-00-2 | Plumbane, tetraethyl- |
| P098 | 151-50-8 | Potassium cvanide |
| P098 | 151-50-8 | Potassium cyanide K(CN) |
| P090 | 506-61-6 | Potassium silver ovanide |
| D201 | 2631-37-0 | Promecarb |
| D070 | 116-06-3 | Propagal 2-mothul-2-(mothulthio)- |
| P070 | 110-00-3 | Piopanai, 2-methyl=2-(methyltnio)-, |
| 2020 | 1616 00 1 | Dropapal 2 mothul 2 (mothul |
| P203 | 1040-00-4 | Propanar, z-metnyr-z-(metnyr- |
| | | sulfonyi)-,0-[(metnyiamino)carbonyi] |
| 5101 | 107 10 0 | oxime |
| PIOI | 107-12-0 | Propanenitrile |
| P027 | 542-76-7 | Propanenitrile, 3-chloro- |
| P069 | 75-86-5 | Propanenitrile, 2-hydroxy-2-methyl- |
| P081 | 55-63-0 | 1,2,3-Propanetriol, trinitrate (R) |
| P017 | 598-31-2 | 2-Propanone, 1-bromo- |
| P102 | 107-19-7 | Propargyl alcohol |
| P003 | 107-02-8 | 2-Propenal |
| P005 | 107-18-6 | 2-Propen-1-ol |
| P067 | 75-55-8 | 1,2-Propylenimine |
| P102 | 107-19-7 | 2-Propyn-1-ol |
| P008 | 504-24-5 | 4-Pvridinamine |
| P075 | 54-11-5 | Pyridine. 3-(1-methy]-2- |
| 1070 | 01 11 0 | pyrrolidinyl) = (S) = salts |
| P204 | 57-47-6 | Pyrrolo[2 3-blindo]-5-ol |
| 1204 | 57 47 0 | 1 2 3 3 2 8 8 - hevelver - 1 3 2 8 - |
| | | trimethyl- methylcarhamate (ester) |
| | | (328-cic) = |
| 111 | 12020 52 0 | (JdS-CLS) Colonious said dithellium(1+) solt |
| P114 D102 | 12039-52-0 | Selenious acia, dithallium(1+) sait |
| P103 | 550-10-4 | |
| P104 | 506-64-9 | Silver Cyanide |
| P104 D105 | 506-64-9 | Silver cyanide Ag(CN) |
| P105 | 26628-22-8 | Sodium azide |
| PI06 | 143-33-9 | Sodium cyanide |
| PI06 | 143-33-9 | Sodium cyanide Na(CN) |
| P108 | 57-24-9 | Strychnidin-10-one, salts |
| P018 | 357-57-3 | Strychnidin-10-one, 2,3-dimethoxy- |
| P108 | 57-24-9 | Strychnine, salts |
| P115 | 7446-18-6 | Sulfuric acid, dithallium(1+) salt |
| P109 | 3689-24-5 | Tetraethyldithiopyrophosphate |
| P110 | 78-00-2 | Tetraethyl lead |
| P111 | 107-49-3 | Tetraethyl pyrophosphate |
| P112 | 509-14-8 | Tetranitromethane (R) |
| P062 | 757-58-4 | Tetraphosphoric acid, hexaethyl ester |
| P113 | 1314-32-5 | Thallic oxide |
| P113 | 1314-32-5 | Thallium oxide |
| P114 | 12039-52-0 | Thallium(I) selenite |
| P115 | 7446-18-6 | Thallium(I) sulfate |
| P109 | 3689-24-5 | Thiodiphosphoric acid, tetraethvl |
| | | ester |
| P045 | 39196-18-4 | Thiofanox |
| P049 | 541-53-7 | Thioimidodicarbonic diamide |
| | | [(H2N)C(S)]NH |
| P014 | 108-98-5 | Thiophenol |
| P116 | 79-19-6 | Thiosemicarbazide |
| P026 | 5344-82-1 | Thiourea, (2-chlorophenvl)- |
| - | | |

| P072 | 86-88-4 | Thiourea, 1-naphthalenvl- |
|---|--|---|
| P093 | 103-85-5 | Thiourea, phenvl- |
| P185 | 26419-73-8 | Tirpate |
| P123 | 8001-35-2 | Toxaphene |
| P118 | 75-70-7 | Trichloromethanethiol |
| P119 | 7803-55-6 | Vanadic acid, ammonium salt |
| P120 | 1314-62-1 | Vanadium oxide V205 |
| P120 | 1314-62-1 | Vanadium pentoxide |
| P084 | 4549-40-0 | Vinylamine, N-methyl-N-nitroso- |
| P001 | 181-81-2 | Warfarin, salts, when present at |
| P205 | 137-30-4 | concentrations greater than 0.3% Zinc, bis(dimethylcarbamodithioato- S,S') |
| P121 | 557-21-1 | Zinc cyanide |
| P121 | 557-21-1 | Zinc cyanide |
| P122 | 1314-84-7 | Zn(CN)2 Zinc phosphide Zn3P2, when present at |
| P205 | 137-30-4 | Ziram |
| ¹ CAS Number g | iven for parent compound only. | |
| intermediates referred to i identified as subject to th (a) and (g). [Comment: For hazardous pro letters T (To (Corrosivity) listed for to | , or off-specification commercia n paragraphs (a) through (d) of toxic wastes (T), unless otherw e small quantity generator exclu the convenience of the regulated perties of these materials have 1 xicity), R (Reactivity), I (Igni . Absence of a letter indicates xicity.] | l chemical products this section, are ise designated and are sion defined in Sec. 261.5 d community, the primary been indicated by the tability) and C that the compound is only |
| These wastes | and their corresponding EPA Haza | rdous Waste Numbers are: |
| Chemical No. | Hazardous Waste Abstracts No. | Substance |
| | | |
| U394 | 30558-43-1 | AZZI3 |
| 1001 | 75-07-0 | Acetaldenyde (1) Naetaldehyde trichlere |
| UU34 11107 | | Acetandenyde, trichioro- |
| 1005 | 53-96-3 | Acetamide, $N = (4 = e choxyphenyl) =$ |
| 11240 | $^{1}94 - 75 - 7$ | Acetic acid (2 4-dichlorophenoxy)- |
| 0210 | 51757 | Salts, esters |
| U112 | 141-78-6 | Acetic acid ethyl ester (I) |
| U144 | 301-04-2 | Acetic acid, lead(2+) salt |
| U214 | 563-68-8 | Acetic acid, thallium(1+) salt see F027 93-76-5 Acetic acid, (2,4,5- |
| 1002 | 67-64-1 | Acetone (I) |
| U003 | 75-05-8 | Acetonitrile (I.T) |
| U004 | 98-86-2 | Acetophenone |
| U005 | 53-96-3 | 2-Acetylaminofluorene |
| U006 | 75-36-5 | Acetyl chloride (C,R,T) |
| U007 | 79-06-1 | Acrylamide |
| U008 | 79-10-7 | Acrylic acid (I) |
| U009 | 107-13-1 | Acrylonitrile |
| U011 | 61-82-5 | Amitrole |
| U012 | 62-53-3 | Aniline (I,T) |
| U136 | 75-60-5 | Arsinic acid, dimethyl- |
| U014 | 492-80-8 | Auramine |

| U015 | 115-02-6 | Azaserine Azirino[2 3 ls-thn-eq 3 41 pyrrolo |
|----------------|-----------------------|---|
| 0010 | 30-07-7 | [1,2-a]indole-4,7-dione, 6-amino-8- [[(aminocarbonyl)oxy]methyl]- |
| | | 1,1a,2,8,8a,8b-hexahydro-8a-methoxy- |
| | | S-metnyi-, [las-(laalpha, sbeta, 8aalpha.8balpha)]- |
| U280 | 101-27-9 | Barban |
| U278 | 22781-23-3 | Bendiocarb |
| U364 | 22961-82-6 | Bendiocarb phenol |
| UZ71 11157 | 1/804-35-2 56-49-5 | Benz[j]aceanthry]ene 1 2-dihydro-3- |
| | | methyl- |
| UU16 TI017 | 98-87-3 | Benzal chloride |
| U192 | 23950-58-5 | Benzamide, 3,5-dichloro-N-(1,1- |
| | | dimethyl-2-propynyl)- |
| U018 | 56-55-3 | Benz[a]anthracene |
| U094 | 5' - 9' - 6 | Benz[a]anthracene, 7,12-dimethyl- |
| 11014 | 492-80-8 | Benzenamine, 4,4- |
| 0011 | 192 00 0 | carbonimidoylbis[N,N-dimethyl- |
| U049 | 3165-93-3 | Benzenamine, 4-chloro-2-methyl-, |
| | | hydrochloride |
| 0093 | 60-11-7 | Benzenamine, N,N-dimethyl-4- |
| U328 | 95-53-4 | (phenyiazo)- Benzenamine, 2-methyl- |
| U353 | 106-49-0 | Benzenamine, 4-methyl- |
| U158 | 101 - 14 - 4 | Benzenamine, 4,4-methylenebis[2- |
| | | chloro- |
| U222 tt1 81 | 636-21-5 | Benzenamine, 2-methyl-, hydrochloride Benzenamine, 2-methyl-5-nitro- |
| U019 | 71-43-2 | Benzene (I.T) |
| U038 | 510-15-6 | Benzeneacetic acid, 4-chloro-alpha- |
| | | (4-chlorophenyl)-alpha-hydroxy-, ethyl ester |
| U030 | 101-55-3 | Benzene, 1-bromo-4-phenoxy- |
| U035 | 305-03-3 | Benzenebutanoic acid, 4-[bis(2- |
| 11027 | 108 00 7 | chloroethyl)aminoj- Benzene chlere |
| U221 | 25376-45-8 | Benzenediamine, ar-methyl- |
| U028 | 117-81-7 | 1,2-Benzenedicarboxylic acid, bis(2- |
| | | ethylhexyl) ester |
| 0069 | 84-74-2 | 1,2-Benzenedicarboxylic acid, dibutyl |
| U088 | 84-66-2 | 1,2-Benzenedicarboxylic acid, diethyl |
| | | ester |
| U102 | 131-11-3 | 1,2-Benzenedicarboxylic acid, Dimethyl ester |
| U107 | 117-84-0 | 1,2-Benzenedicarboxylic acid, dioctyl ester |
| U070 | 95-50-1 | Benzene, 1,2-dichloro- |
| U071 | 541-73-1 | Benzene, 1,3-dichloro- |
| U072 | 106-46-7 | Benzene, 1,4-dichloro- |
| 0060 | /2-54-8 | Benzene, 1,1-(2,2-dichloroethylidene) bis[4-chloro- |
| U017 | 98-87-3 | Benzene, (dichloromethyl) - |
| UZZ3 | 264/1-62-5 | Benzene, 1,3-dllsocyanatomethyl- (R,T) |
| U239 | 1330-20-7 | Benzene, dimethyl- (I,T) |
| U201 | 108-46-3 | 1,3-Benzenediol |
| U127 II056 | ⊥⊥♂−/4−⊥ 110-82-7 | Benzene, nexaChloro- Benzene, bevahudro- (T) |
| U220 | 108-88-3 | Benzene, methyl- |
| | | · 4 |

| U105 | 121-14-2 | Benzene, 1-methyl-2,4-dinitro- |
|--------|----------------------|--|
| U106 | 606-20-2 | Benzene, 2-methyl-1,3-dinitro- |
| U055 | 98-82-8 | Benzene, (1-methylethyl)- (I) |
| U169 | 98-95-3 | Benzene, nitro- |
| U183 | 608-93-5 | Benzene, pentachloro- |
| U185 | 82-68-8 | Benzene, pentachloronitro- |
| U020 | 98-09-9 | Benzenesulfonic acid chloride (C,R) |
| U020 | 98-09-9 | Benzenesulfonyl chloride (C,R) |
| U207 | 95-94-3 | Benzene, 1,2,4,5-tetrachloro- |
| U061 | 50-29-3 | Benzene, 1,1-(2,2,2- |
| | | trichloroethvlidene)bis[4-chloro- |
| U247 | 72-43-5 | Benzene, 1,1-(2,2,2- |
| 021/ | | trichloroethylidene)bis[4- methoxy |
| 11023 | 98-07-7 | Benzene (trichloromethyl) - |
| 11234 | 99-35-4 | Benzene 1 3 5-tripitro- |
| 11021 | 92-87-5 | Benzidine |
| 11202 | 1 91_07_2 | 1 2 - Ponziaothizzol = 3 (2 U) = ono 1 1 = |
| 0202 | 81-07-2 | l, 2-Bell2ISOULLAZOI-S(ZR)-OHe, I, I- |
| | 00701 00 0 | dioxide, salts |
| 0278 | 22/81-23-3 | 1,3-Benzodioxol-4-ol, 2,2-dimethyl-, |
| | | methyl carbamate |
| U364 | 22961-82-6 | 1,3-Benzodioxol-4-ol, 2,2-dimethyl-, |
| U203 | 94-59-7 | 1,3-Benzodioxole, 5-(2-propenyl)- |
| U141 | 120-58-1 | 1,3-Benzodioxole, 5-(1-propenyl)- |
| U367 | 1563-38-8 | 7-Benzofuranol, 2,3-dihydro-2,2- |
| | | dimethyl- |
| U090 | 94-58-6 | 1,3-Benzodioxole, 5-propyl- |
| U064 | 189-55-9 | Benzo[rst]pentaphene |
| U248 | ¹ 81-81-2 | 2H-1-Benzopvran-2-one, 4-hvdroxv-3-(3- |
| | | oxo-1-phenvl-butvl)-, salts, when |
| | | present at concentrations of 0 3% or |
| | | |
| 11022 | 50-32-8 | Benzolalnurene |
| 1107 | | |
| 11000 | | p-benzoquinone |
| UU23 | 98-07-7 1464 ED E | Benzotrichloride (C,R,T) |
| 0085 | 1464-53-5 | 2,2-Bloxirane |
| 0021 | 92-87-5 | [1,1-Bipheny1]-4,4-diamine |
| 0073 | 91-94-1 | [1,1'-Biphenyl]-4,4'-diamine, 3,3'- |
| | | dichloro- |
| U091 | 119-90-4 | [1,1'-Biphenyl]-4,4'-diamine, 3,3'- |
| | | dimethoxy- |
| U095 | 119-93-7 | [1,1'-Biphenyl]-4,4'-diamine, 3,3'- |
| | | dimethyl- |
| U225 | 75-25-2 | Bromoform |
| U030 | 101-55-3 | 4-Bromophenyl phenyl ether |
| U128 | 87-68-3 | 1,3-Butadiene, 1,1,2,3,4,4- |
| | | hexachloro- |
| U172 | 924-16-3 | 1-Butanamine, N-butvl-N-nitroso- |
| U031 | 71-36-3 | 1-Butanol (T) |
| 11159 | 78-93-3 | 2 = Butanone(T, T) |
| U160 | 1338-23-4 | 2 - Butanone perovide (P T) |
| 11053 | 1170-30-3 | 2-Butonal |
| 1074 | 764 41 0 | 2 Dutena 1 (dichlana (I II) |
| UU / 4 | | 2-Butene, 1,4-dichioro- (1,1) |
| 0143 | 303-34-4 | 2-Butenoic acid, 2-metnyl-, /-[[2,3- |
| | | dihydroxy-2-(1-methoxyethy1)-3- |
| | | metny1-1-oxobutoxy]methy1]-2,3,5, 7a- |
| | | tetrahydro-1H-pyrrolizin-1-yl ester, |
| | | [1S-[1alpha(Z),7(2S*,3R*),7aalpha]] |
| U031 | 71-36-3 | n-Butyl alcohol (I) |
| U136 | 75-60-5 | Cacodylic acid |
| U032 | 13765-19-0 | Calcium chromate |
| | | |
| U372 | 10605-21-7 | Carbamic acid, 1H-benzimidazol-2-yl, |
| | | methyl ester |
| U271 | 17804-35-2 | Carbamic acid, [1- |

| | | [(butylamino)carbonyl]-1H- benzimidazol-2-yl] methyl ester |
|--------|-----------------------|---|
| U280 | 101-27-9 | Carbamic acid, (3-chlorophenyl)-, 4- |
| U238 | 51-79-6 | Carbamic acid, ethyl ester |
| U178 | 615-53-2 | Carbamic acid, methylnitroso-, ethyl ester |
| U373 | 122-42-9 | Carbamic acid, phenyl-, 1-methylethyl |
| U409 | 23564-05-8 | Carbamic acid, [1,2-phenylenebis (iminocarbonothioyl)]bis- dimethyl ester |
| U097 | 79-44-7 | Carbamic chloride, dimethyl- |
| U389 | 2303-17-5 | Carbamothioic acid, bis(1- methylethyl)S-(2,3,3-trichloro-2- propenvl)ester |
| U387 | 52888-80-9 | Carbamothioic acid, dipropyl-, S- |
| U114 | ¹ 111-54-6 | Carbamodithioic acid, 1,2- |
| 110.62 | 2303-16-4 | Carbamothioic acid, bis(1- |
| 0002 | | methylethyl)-, S-(2,3-dichloro-2- |
| | | propenyl) ester |
| U279 | 63-25-2 | Carbaryl |
| U372 | 10605-21-7 | Carbendazim |
| U367 | 1563-38-8 | Carbofuran phenol |
| U215 | 6533-73-9 | Carbonic acid, dithallium(1+) salt |
| U033 | 353-50-4 | Carbonic difluoride |
| 0156 | /9-22-1 | Carbonochloridic acid, methyl ester |
| 11033 | 353-50-1 | (L, L) Carbon oxyfluorido (P T) |
| 1211 | 56-23-5 | Carbon tetrachloride |
| 11034 | 75-87-6 | Chloral |
| U035 | 305-03-3 | Chlorambucil |
| U036 | 57-74-9 | Chlordane, alpha/ gamma isomers |
| U026 | 494-03-1 | Chlornaphazin |
| U037 | 108-90-7 | Chlorobenzene |
| U038 | 510-15-6 | Chlorobenzilate |
| U039 | 59-50-7 | p-Chloro-m-cresol |
| U042 | 110-75-8 | 2-Chloroethyl vinyl ether |
| U044 | 67-66-3 | Chloroform |
| U046 | 107-30-2 | Chloromethyl methyl ether |
| | 91-58-7 | beta-Chloronaphthalene |
| 11049 | 3165-93-3 | 4-Chloro-o-toluidine bydrochloride |
| 11032 | 13765-19-0 | Chromic acid calcium salt |
| U050 | 218-01-9 | Chrvsene |
| U051 | | Creosote |
| U052 | 1319-77-3 | Cresol (Cresylic acid) |
| U053 | 4170-30-3 | Crotonaldehyde |
| U055 | 98-82-8 | Cumene (I) |
| U246 | 506-68-3 | Cyanogen bromide (CN)Br |
| U197 | 106-51-4 | 2,5-Cyclohexadiene-1,4-dione |
| UU56 | 110-82-7 | Cyclohexane (I) |
| 0129 | 58-89-9 | Cyclonexane, 1,2,3,4,5,6-hexachloro-, (lalpha,2alpha,3beta,4alpha,5alpha,6 |
| U057 | 108-94-1 | Cyclohexanone (I) |
| U130 | 77-47-4 | 1,3-Cyclopentadiene, 1,2,3,4,5,5- |
| | | hexachloro- |
| U058 | 50-18-0 | Cyclophosphamide |
| U240 | ¹ 94-75-7 | 2,4-D, salts, esters |
| U059 | 20830-81-3 | Daunomycin |
| U060 | 72-54-8 | DDD |
| U061 | 50-29-3 | DDT |
|------|--------------|---------------------------------------|
| U062 | 2303-16-4 | Diallate |
| U063 | 53-70-3 | Dibenz[a,h]anthracene |
| U064 | 189-55-9 | Dibenzo[a,i]pyrene |
| U066 | 96-12-8 | 1,2-Dibromo-3-chloropropane |
| U069 | 84-74-2 | Dibutyl phthalate |
| U070 | 95-50-1 | o-Dichlorobenzene |
| U071 | 541-73-1 | m-Dichlorobenzene |
| U072 | 106-46-7 | p-Dichlorobenzene |
| U073 | 91-94-1 | 3,3'-Dichlorobenzidine |
| U074 | 764-41-0 | 1,4-Dichloro-2-butene (I,T) |
| U075 | 75-35-4 | 1,1-Dichloroethylene |
| U079 | 156-60-5 | 1,2-Dichloroethylene |
| U025 | 111 - 44 - 4 | Dichloroethyl ether |
| U027 | 108-60-1 | Dichloroisopropyl ether |
| U024 | 111-91-1 | Dichloromethoxy ethane |
| U081 | 120-83-2 | 2,4-Dichlorophenol |
| U082 | 87-65-0 | 2,6-Dichlorophenol |
| U084 | 542-75-6 | 1,3-Dichloropropene |
| U085 | 1464-53-5 | 1,2:3,4-Diepoxybutane (I,T) |
| U108 | 123-91-1 | 1,4-Diethyleneoxide |
| U028 | 117-81-7 | Diethylhexyl phthalate |
| U395 | 5952-26-1 | Diethylene glycol,dicarbamate. |
| U086 | 1615-80-1 | N,N'-Diethylhydrazine |
| U087 | 3288-58-2 | 0,0-Diethyl S-methyl dithiophosphate |
| U088 | 84-66-2 | Diethyl phthalate |
| U089 | 56-53-1 | Diethylstilbesterol |
| U090 | 94-58-6 | Dihydrosafrole |
| U091 | 119-90-4 | 3,3'-Dimethoxybenzidine |
| U092 | 60-11-7 | p-Dimethylaminoazobenzene |
| U094 | 57-97-6 | 7,12-Dimethylbenz[a]anthracene |
| U095 | 119-93-7 | 3,3'-Dimethylbenzidine |
| U096 | 80-15-9 | alpha,alpha- |
| | | Dimethylbenzylhydroperoxide (R) |
| U097 | 79-44-7 | Dimethylcarbamoyl chloride |
| U098 | 57-14-7 | 1,1-Dimethylhydrazine |
| U099 | 540-73-8 | 1,2-Dimethylhydrazine |
| U101 | 105-67-9 | 2,4-Dimethylphenol |
| U102 | 131-11-3 | Dimethyl phthalate |
| U103 | 77-78-1 | Dimethyl sulfate |
| U105 | 121-14-2 | 2,4-Dinitrotoluene |
| U106 | 606-20-2 | 2,6-Dinitrotoluene |
| U107 | 117-84-0 | Di-n-octyl phthalate |
| U108 | 123-91-1 | 1,4-Dioxane |
| U109 | 122-66-7 | 1,2-Diphenylhydrazine |
| U110 | 142-84-7 | Dipropylamine (I) |
| U111 | 621-64-7 | Di-n-propylnitrosamine |
| U041 | 106-89-8 | Epichlorohydrin |
| U001 | 75-07-0 | Ethanal (I) |
| U404 | 121-44-8 | Ethanamine, N,N-diethyl- |
| U174 | 55-18-5 | Ethanamine, N-ethyl-N-nitroso- |
| U155 | 91-80-5 | 1,2-Ethanediamine, N,N-dimethyl-N'-2- |
| | | pyridinyl-N'-(2-thienylmethyl)- |
| U067 | 106-93-4 | Ethane, 1,2-dibromo- |
| U076 | 75-34-3 | Ethane, 1,1-dichloro- |
| U077 | 107-06-2 | Ethane, 1,2-dichloro- |
| U131 | 67-72-1 | Ethane, hexachloro- |
| U024 | 111-91-1 | Ethane, 1,1'-[methylenebis(oxy)]bis |
| | | [2-chloro- |
| U117 | 60-29-7 | Ethane, 1,1'-oxybis-(I) |
| U025 | 111 - 44 - 4 | Ethane, 1,1'-oxybis[2-chloro- |
| U184 | 76-01-7 | Ethane, pentachloro- |
| U208 | 630-20-6 | Ethane, 1,1,1,2-tetrachloro- |
| U209 | 79-34-5 | Ethane, 1,1,2,2-tetrachloro- |

| U218 U226 | 62-55-5 71-55-6 | Ethanethioamide Ethane, 1.1.1-trichloro- |
|---------------|-----------------------|---|
| U227 | 79-00-5 | Ethane, 1,1,2-trichloro- |
| U410 | 59669-26-0 | Ethanimidothioic acid, N.N'- |
| | | [thiobis[(methylimino)carbonyloxy]] |
| | | bis-dimethyl ester |
| 0394 | 30558-43-1 | Ethanimidothioic acid, 2- |
| | | (dimetnylamino)-N-nydroxy-2-oxo-, |
| 11250 | 110 00 5 | metnyi ester Ethanol 2 othowy |
| USU9 11172 | 110-00-5 | Ethanol, 2-ethoxy- |
| 11305 | 5052-26-1 | Ethanol 2.21-ovubia- dicarbamato |
| 11004 | 98-86-2 | Ethanone 1-phenyl- |
| 1043 | 75 - 01 - 4 | Ethene chloro- |
| 11042 | 110-75-8 | Ethene $(2-chloroethoxy) -$ |
| 11078 | 75-35-4 | Ethene 1 1-dichloro- |
| 11079 | 156-60-5 | Ethene 1 2-dichloro- (E)- |
| 11210 | 127-18-4 | Ethene, tetrachloro- |
| 11228 | 79-01-6 | Ethene, trichloro- |
| U112 | 141-78-6 | Ethyl acetate (I) |
| U113 | 140-88-5 | Ethyl acrylate (I) |
| U238 | 51-79-6 | Ethyl carbamate (urethane) |
| U117 | 60-29-7 | Ethyl ether (I) |
| U114 | ¹ 111-54-6 | Ethylenebisdithiocarbamic acid, |
| | | salts, esters |
| U067 | 106-93-4 | Ethylene dibromide |
| U077 | 107-06-2 | Ethylene dichloride |
| U359 | 110-80-5 | Ethylene glycol monoethyl ether |
| U115 | 75-21-8 | Ethylene oxide (I,T) |
| U116 | 96-45-7 | Ethylenethiourea |
| U076 | 75-34-3 | Ethylidene dichloride |
| U118 | 97-63-2 | Ethyl methacrylate |
| U119 | 62-50-0 | Ethyl methanesulfonate |
| U120 | 206-44-0 | Fluoranthene |
| U122 | 50-00-0 | Formaldehyde |
| U123 | 64-18-6 | Formic acid (C,T) |
| U124 | 110-00-9 | Furan (I) |
| 0125 | 98-01-1 | 2-Furancarboxaldehyde (I) |
| 0147 | 108-31-6 | 2,5-Furandione |
| 0213 | 109-99-9 | Furan, tetrahydro-(1) |
| U125 | 98-01-1 | Furiural (1) |
| U124 H20C | 10000-9 | Furiuran (1) |
| 0206 | 18883-66-4 | Glucopyranose, 2-deoxy-2-(3-metny1-3- |
| 11206 | 10002 66 4 | D Clusses 2 deeue 2 |
| 0200 | 10002-00-4 | [(methylnitrosoamino) -carbonyl] |
| | | aminol- |
| U126 | 765-34-4 | Glycidylaldehyde |
| U163 | 70-25-7 | Guanidine, N-methyl-N'-nitro-N- |
| | | nitroso- |
| U127 | 118-74-1 | Hexachlorobenzene |
| U128 | 87-68-3 | Hexachlorobutadiene |
| U130 | 77-47-4 | Hexachlorocyclopentadiene |
| U131 | 67-72-1 | Hexachloroethane |
| U132 | 70-30-4 | Hexachlorophene |
| U243 | 1888-71-7 | Hexachloropropene |
| U133 | 302-01-2 | Hydrazine (R,T) |
| U086 | 1615-80-1 | Hydrazine, 1,2-diethyl- |
| U098 | 57-14-7 | Hydrazine, 1,1-dimethyl- |
| U099 | 540-73-8 | Hydrazine, 1,2-dimethyl- |
| U109 | 122-66-7 | Hydrazine, 1,2-diphenyl- |
| UI34 | 1004-39-3 | Hydrofluoric acid (C,T) |
| U134 | /664-39-3 | Hydrogen fluoride (C,T) |
| UI35 | //83-06-4 | Hyarogen sulfide |

| U135 | 7783-06-4 | Hydrogen sulfide H2S |
|---------------|---------------------|---|
| U096 | 80-15-9 | Hydroperoxide, 1-methyl-1- |
| | | phenylethyl-(R) |
| U116 | 96-45-7 | 2-Imidazolidinethione |
| U137 | 193-39-5 | Indeno[1,2,3-cd]pyrene |
| U190 | 85-44-9 | 1,3-Isobenzofurandione |
| U140 | 78-83-1 | Isobutyl alcohol (I,T) |
| U141 | 120-58-1 | Isosafrole |
| U142 | 143-50-0 | Kepone |
| U143 | 303-34-4 | Lasiocarpine |
| U144 | 301-04-2 | Lead acetate |
| U146 | 1335-32-6 | Lead, bis(acetato-0)tetrahydroxytri- |
| U145 | 7446-27-7 | Lead phosphate |
| U146 | 1335-32-6 | Lead subacetate |
| U129 | 58-89-9 | Lindane |
| U163 | 70-25-7 | MNNG |
| U147 | 108-31-6 | Maleic anhydride |
| U148 | 123-33-1 | Maleic hydrazide |
| U149 | 109-77-3 | Malononitrile |
| U150 | 148-82-3 | Melphalan |
| U151 | 7439-97-6 | Mercury |
| U152 | 126-98-7 | Methacrylonitrile (I, T) |
| U092 | 124-40-3 | Methanamine, N-methyl- (I) |
| U029 | 74-83-9 | Methane, bromo- |
| U045 | 74-87-3 | Methane, chloro- (I, T) |
| U046 | 107-30-2 | Methane, chloromethoxy- |
| U068 | 74-95-3 | Methane, dibromo- |
| U080 | 75-09-2 | Methane, dichloro- |
| U075 | 75-71-8 | Methane, dichlorodifluoro- |
| U138 | 74-88-4 | Methane, iodo- |
| U119 | 62-50-0 | Methanesulfonic acid, ethyl ester |
| U211 | 56-23-5 | Methane, tetrachloro- |
| U153 | 74-93-1 | Methanethiol (I, T) |
| U225 | 75-25-2 | Methane, tribromo- |
| 0044 | 67-66-3 | Methane, trichloro- |
| U121 | 75-69-4 | Methane, trichlorofluoro- |
| 0036 | 5/-/4-9 | 4,/-Methano-IH-indene, |
| | | 1, 2, 4, 5, 6, 7, 8, 8-octachloro- |
| TT 1 F 4 | | 2,3,3a,4,7,7a-nexanydro- |
| UL34 TI1EE | 6/-56-I 01 80 E | Methanol (1) |
| U100 11140 | 91-00-0 142 EO 0 | Methapyriiene 1.2.4. Mathana 20. Gualabuta |
| 0142 | 143-50-0 | [ad]pontalon 2 ono 1 1a 2 2a |
| | | [CC]pencalen=2=One, 1,1a,5,5a, |
| 11217 | 72-13-5 | Methoyychlor |
| 1154 | 67-56-1 | Methyl alcohol (T) |
| 11029 | 74-83-9 | Methyl bromide |
| 11186 | 504-60-9 | 1-Methylbutadiene (I) |
| U045 | 74-87-3 | Methyl chloride (I.T) |
| U156 | 79-22-1 | Methyl chlorocarbonate (I.T) |
| U226 | 71-55-6 | Methyl chloroform |
| U157 | 56-49-5 | 3-Methvlcholanthrene |
| U158 | 101-14-4 | 4,4'-Methylenebis(2-chloroaniline) |
| U068 | 74-95-3 | Methylene bromide |
| U080 | 75-09-2 | Methylene chloride |
| U159 | 78-93-3 | Methyl ethyl ketone (MEK) (I,T) |
| U160 | 1338-23-4 | Methyl ethyl ketone peroxide (R,T) |
| U138 | 74-88-4 | Methyl iodide |
| U161 | 108-10-1 | Methyl isobutyl ketone (I) |
| U162 | 80-62-6 | Methyl methacrylate (I,T) |
| U161 | 108-10-1 | 4-Methyl-2-pentanone (I) |
| U164 | 56-04-2 | Methylthiouracil |
| U010 | 50-07-7 | Mitomycin C |
| U059 | 20830-81-3 | 5,12-Naphthacenedione, 8-acetyl-10- |

| | | lyxo-hexopyranosyl)oxy]-7,8,9,10- |
|---------------|--------------|--|
| | | tetrahydro-6,8,11-trihydroxy-1- |
| | | methoxy-, (8S-cis)- |
| U167 | 134-32-7 | 1-Naphthalenamine |
| U168 | 91-59-8 | 2-Naphthalenamine |
| U026 | 494-03-1 | Naphthalenamine, N,N'-bis(2- |
| | | chloroethyl)- |
| U165 | 91-20-3 | Naphthalene |
| U047 | 91-58-7 | Naphthalene, 2-chloro- |
| U166 | 130-15-4 | 1.4-Naphthalenedione |
| U236 | 72-57-1 | 2.7-Naphthalenedisulfonic acid, 3.3'- |
| | | [(3,3'-dimethy][1,1'-biphenyl]-4,4'- |
| | | divl)bis(azo)bis[5-amino-4-hydroxy] |
| | | tetrasodium salt |
| 11279 | 63-25-2 | 1-Naphthalenol, methylcarbamate |
| 11166 | 130-15-4 | 1.4-Naphthoguinone |
| 1167 | 134-32-7 | alpha-Naphthylamine |
| 11168 | 91-59-8 | heta-Naphthylamine |
| 11217 | 10102-45-1 | Nitric acid thallium(1+) salt |
| 11169 | 98-95-3 | Nitrobenzene (I T) |
| 1170 | 100-02-7 | n-Nitrophenol |
| 1171 | 79-46-9 | 2-Nitropropane (I T) |
| 1172 | 921-16-3 | N-Nitrosodi-n-butylamine |
| 1173 | 1116_54_7 | N Nitrosodi otbanolamino |
| U173 TT174 | 55-18-5 | N-Nitrosodiethulamine |
| 1176 | 750-73-0 | N-Nitroso-N-othylurop |
| 0170 | 739 - 73 - 9 | N-Nitrogo N mothulurog |
| U177 | 615 52 2 | N-Nitrogo N methylurethano |
| U170 | 100-75-4 | N-Nitrosopiporidipo |
| 1120 | Q20_55_2 | N-Nitrosopurrolidino |
| 11 0 1 | 930-55-8 | 5-Nitro-o-toluidino |
| 1102 | 1120-71-4 | 1 2-Overbioleno 2 2-diovido |
| 11058 | 50-18-0 | $2^{\mu}-1$ 3 2-0vagaphogphorin=2-amino |
| 0038 | 50-10-0 | N = his (2-ch) croothyl) totrohydro- 2- |
| | | avido |
| 1115 | 75 21 0 | Ovirano (I T) |
| 1126 | 765-31-1 | Oxiranecarboyualdebude |
| 110/1 | 106_89_8 | Ovirano (chloromothul) - |
| 0041 | 100-09-0 | 2 122 62 7 Daraldebude |
| 11103 | 608-03-5 | Z 123-03-7 Falaldenyde Pontachlorohonzono |
| 010J | 76-01-7 | Pontachloroothano |
| 1195 | 82-68-8 | Pontachloronitrobonzono (PCNP) |
| 0103 | 02-00-0 | See E027 87-86-5 Pentachlerenhonel |
| 11161 | 100 10 1 | Deptapel 4 methyl |
| 11106 | 504 60 0 | 1 2 Dontadiono (I) |
| 1197 | 62-44-2 | Phonacotin |
| 0107 | 100 05 2 | |
| | 100-93-2 | Phenol 2 chloro |
| 11020 | 50 50 7 | Phenol, 2-Chioro- |
| 0039 | 120 02 2 | Phenol, 4-Chiofo-5-methyr- |
| 1000 | 120-03-2 | Phenol, 2,4-dichloro- |
| 0082 | | Phenol, 2,6-alchloro- |
| 0089 | 36-33-1 | etherodial)his (E) |
| 11101 | 105 67 0 | Ethenediyi)Dis-, (E)- |
| | 100-07-9 | Phenol, 2,4-almethyl- |
| 0052 | 1319-77-3 | Phenol, Methyl- |
| 0132 | /0-30-4 | Phenol, 2,2'-methylenebis[3,4,6- |
| 11/11 | 11/ 06 1 | Trichioro- |
| UATT | 114-20-1 | <pre>Phenol, 2-(1-methylethoxy)-, methylechoreta</pre> |
| 11170 | 100 00 7 | Methyrcarbamate Dhonol 4 mitro Coo |
| 01/0 | 100-02-1 | FILEHUL, 4-HILLEU-SEE FO27 87.96 5 Dhonol montochlame 9 |
| | | F027 58-00-2 Phonol 2 2 4 6 |
| | | $FUZI = JU^{-}JU^{-}Z = FIEIIUI, Z_{1}J_{1}U^{-}$ |
| | | LECTACHIOLO-BEE FUZ/ 95-95-4 FILEHOL, |

[(3-amino-2,3,6-trideoxy)-alpha-L-

| | | 2,4,5-trichloro-SeeF027 88-06-2 Phenol, 2,4,6-trichloro- |
|---------------------|--------------|---|
| U150 | 148-82-3 | L-Phenylalanine, 4-[bis(2- chloroethyl)amino]- |
| U145 | 7446-27-7 | Phosphoric acid, lead(2+) salt (2:3) |
| U087 | 3288-58-2 | Phosphorodithioic acid, 0,0-diethyl |
| | 1214 00 2 | S-methyl ester |
| U189 | 1314-80-3 | Phosphorus sulfide (R) |
| UI90 | 85-44-9 | Phinalle annydride |
| U191 U170 | 109-06-8 | Z-PICOIINE Dinamidina 1 nitraaa |
| U1/9 U102 | 22050 58 5 | Propamido |
| UI 92 TT1 Q / | 23930-38-3 | 1-Propagamino (T T) |
| UI 94 III 1 1 | 621-64-7 | 1-Propanamine N-pitroso-N-propul- |
| 11110 | 142-84-7 | 1-Propanamine, N-propyl |
| 11066 | 96-12-8 | Propane 1 2-dibromo-3-chloro- |
| 11083 | 78-87-5 | Propane, 1.2-dichloro- |
| U149 | 109-77-3 | Propanedinitrile |
| U171 | 79-46-9 | Propane. 2-nitro- (I.T) |
| U027 | 108-60-1 | Propane, 2,2'-oxybis[2-chloro- |
| U193 | 1120-71-4 | 1,3-Propane sultone |
| | | See F027 93-72-1 Propanoic acid, 2- |
| | | (2,4,5-trichlorophenoxy)- |
| U235 | 126-72-7 | 1-Propanol, 2,3-dibromo-, phosphate |
| | | (3:1) |
| U140 | 78-83-1 | 1-Propanol, 2-methyl- (I,T) |
| U002 | 67-64-1 | 2-Propanone (I) |
| U007 | 79-06-1 | 2-Propenamide |
| U084 | 542-75-6 | 1-Propene, 1,3-dichloro- |
| U243 | 1888-71-7 | 1-Propene, 1,1,2,3,3,3-hexachloro- |
| U009 | 107-13-1 | 2-Propenenitrile |
| U152 | 126-98-7 | 2-Propenenitrile, 2-methyl- (I,T) |
| U008 | 79-10-7 | 2-Propenoic acid (I) |
| U113 | 140-88-5 | 2-Propenoic acid, ethyl ester (I) |
| U118 | 97-63-2 | 2-Propenoic acid, 2-methyl-, ethyl |
| | 00.00.0 | ester |
| 0162 | 80-62-6 | 2-Propenoic acid, 2-methyl-, methyl |
| C C C 11 | 100 40 0 | ester (1,T) Dranham |
| U3/3 | 122 - 42 - 9 | Propram |
| U411 11397 | 52888-80-0 | Propulfocarb |
| U 3 0 7 TT 1 Q / | 107-10-8 | Propulamino (I T) |
| 11083 | 78-87-5 | Bropulono dichlorido |
| 11148 | 123-33-1 | 3 6-Puridazinedione 1 2-dihudro- |
| U196 | 110-86-1 | Pyridine |
| U191 | 109-06-8 | Pyridine, 2-methyl- |
| U237 | 66-75-1 | 2,4-(1H,3H)-Pvrimidinedione, 5- |
| | | [bis(2-chloroethyl)amino]- |
| U164 | 56-04-2 | 4(1H)-Pyrimidinone, 2,3-dihydro-6- |
| | | methyl-2-thioxo- |
| U180 | 930-55-2 | Pyrrolidine, 1-nitroso- |
| U200 | 50-55-5 | Reserpine |
| U201 | 108-46-3 | Resorcinol |
| U202 | 181-07-2 | Saccharin, salts |
| U203 | 94-59-7 | Safrole |
| U204 | 7783-00-8 | Selenious acid |
| U204 | 7783-00-8 | Selenium dioxide |
| U205 | 7488-56-4 | Selenium sulfide |
| U205 | 7488-56-4 | Selenium sulfide SeS2 (R,T) |
| U015 | 115-02-6 | L-Serine, diazoacetate (ester) |
| | | See F027 93-72-1 Silvex (2,4,5-TP) |
| U206 | 18883-66-4 | Streptozotocin |
| UIU3 | //-/8-1 | Sulturic acid, dimethyl ester |
| 0T8A | 1314-80-3 | Su⊥tur phosphide (R) |

| | | See F027 93-76-5 2 4 5-T |
|-------------------------------|---|---|
| 11207 | 95-94-3 | $1 \ 2 \ 4 \ 5-\text{Tetrachlorobenzene}$ |
| 11208 | 630-20-6 | 1 1 1 2-Tetrachloroethane |
| 11200 | 79-34-5 | 1, 1, 2, 2-Tetrachloroothane |
| 11210 | 127_18_/ | |
| 0210 | 127-10-4 | |
| | | See 1027 $30-90-2$ $2,3,4,0-$ |
| 11010 | 100 00 0 | |
| | 109-99-9 | Teclanydroluran (1) |
| | | Thallium(I) acetate |
| | 0 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - | Thallium(I) calbonate |
| | 7791-12-0 | Thallium(I) Chioride |
| | 10102 45 1 | Thallium Chioride fici |
| | | Thalllum(I) hillale |
| U218 | | Thioacetamide |
| U410 H152 | 59669-26-0 | Thiodicarb |
| U153 | 127 26 0 | Thiomethanol (1,T) |
| 0244 | 137-26-8 | Thioperoxydicarbonic diamide |
| 4 0 0 | | [(H2N)C(S)]2S2, tetramethy1- |
| 0409 | 23564-05-8 | Thiophanate-methyl |
| 0219 | 62-56-6 | Thiourea |
| 0244 | 137-26-8 | Thiram |
| 0220 | 108-88-3 | Toluene |
| 0221 | 25376-45-8 | Toluenediamine |
| 0223 | 26471-62-5 | Toluene diisocyanate (R,T) |
| 0328 | 95-53-4 | o-Toluidine |
| 0353 | 106-49-0 | p-Toluidine |
| 0222 | 636-21-5 | o-Toluidine hydrochloride |
| U389 | 2303-17-5 | Triallate |
| U011 | 61-82-5 | 1H-1,2,4-Triazol-3-amine |
| U408 | 118-79-6 | 2,4,6-Tribromophenol |
| U227 | 79-00-5 | 1,1,2-Trichloroethane |
| U228 | 79-01-6 | Trichloroethylene |
| U121 | 75-69-4 | Trichloromonofluoromethane |
| | | See F027 95-95-4 2,4,5- |
| | | Trichlorophenol |
| | | See F027 88-06-2 2,4,6- |
| | | Trichlorophenol |
| U404 | 121-44-8 | Triethylamine |
| U234 | 99-35-4 | 1,3,5-Trinitrobenzene (R,T) |
| U182 | 123-63-7 | 1,3,5-Trioxane, 2,4,6-trimethyl- |
| U235 | 126-72-7 | Tris(2,3-dibromopropyl) phosphate |
| U236 | 72-57-1 | Trypan blue |
| U237 | 66-75-1 | Uracil mustard |
| U176 | 759-73-9 | Urea, N-ethyl-N-nitroso- |
| U177 | 684-93-5 | Urea, N-methyl-N-nitroso- |
| U043 | 75-01-4 | Vinyl chloride |
| U248 | 81-81-2 | Warfarin, salts, when present at |
| | | concentrations of 0.3% or less |
| U239 | 1330-20-7 | Xylene (I) |
| U200 | 50-55-5 | Yohimban-16-carboxylic acid, 11,17- |
| | | dimethoxy-18-[(3,4,5- |
| | | trimethoxybenzoyl)oxy]-, methyl |
| | | ester,(3beta,16beta,17alpha,18beta,20 |
| | | alpha)- |
| U249 | 1314-84-7 | Zinc phosphide Zn3P2, when present at |
| 1 | | concentrations of 10% or less |
| ⁺ CAS Number given | for parent compound only. | |
| [45 FR 78529, 7854 | 41, Nov. 25, 1980] | |
| Editorial Note: Fo | or Federal Register citations a | affecting |
| Sec. 261.33, see t | the List of CFR Sections Affect | ted in the Finding Aids |

section of this volume.

APPENDIX G. –MATERIALS LIABLE TO FORM PEROXIDES IN STORAGE

The following materials may form peroxides in storage, when in contact with air. Once a container is opened, the chemical should be tested for peroxides not less frequently than once every six months. *This list is by no means all inclusive. Always refer to the material's MSDS for more information on whether it is a peroxide former.*

- Aldehydes
- Ethers, especially cyclic ethers and those containing primary and secondary alcohol groups
- Compounds containing benzylic hydrogen atoms (particularly if the hydrogens are on tertiary carbon atoms)
- Compounds containing the allylic structure, including most alkenes.
- Vinyl and vinylidene compounds.

Among the more widely-used compounds which may form peroxides in storage are:

| • acetal | • cumene | • cyclohexene |
|-------------------------|-------------------------|--|
| • cyclooctene | • decahydronaphthalene | • decalin |
| • diacetylene | • dicyclopentadiene | • diethyl ether |
| • diethylene glycol | • diisopropyl ether | • dimethyl ether |
| • dioxane | • divinyl acetylene | • ethylene glycol dimethyl ether (glyme) |
| • isopropyl ether | • methyl acetylene | • sodium amide |
| • tetrahydrofuran (THF) | • tetrahydronaphthalene | • tetralin |
| • vinyl acetate | • vinylidene chloride | |

Updated November 21, 2000.

http://www.albany.edu/ehs/pdf/BatteryRecyclingLocations2011.pdf FOR FURTHER INFORMATION ON THE RECOGNITION AND HANDLING OF PEROXIDIZABLE COMPOUNDS, PLEASE CONTACT THE EH&S OFFICE IN CHEMISTRY B73. There are several articles available on this topic that are too long to include in this manual.

APPENDIX H. - WASTE MINIMIZATION POLICY

In accordance with Federal and state regulations, the University at Albany is required to have an on-gong hazardous waste minimization program. Hazardous Waste Minimization is the reduction, to the extent feasible, of hazardous waste that is generated or subsequently treated, stored, or disposed. Waste minimization includes any source reduction or recycling activity undertaken by a generator that results in: (1) the reduction of total volume or quantity of hazardous waste; (2) the reduction of toxicity of hazardous waste; or (3) both, as long as the reduction is consistent with the goal of minimizing present and future threats to human health and the environment.

Over the last ten years, the University has undertaken several waste minimization activities. The Chemistry Department has significantly minimized the hazardous waste generated in their teaching labs by changing the types of experiments performed, by converting to less toxic chemicals and by performing microchemistry techniques. The Office of Environmental Health and Safety has been proactive in recycling waste and providing information when asked on the toxicity of chemicals before they are ordered. The EHS Office strongly encourages waste minimization efforts on campus and suggests the following:

- 1. ALWAYS ORDER THE SMALLEST QUANTITY NEEDED OF ANY CHEMICAL as it is safer to store and less expensive to dispose of smaller quantities. For the most part, it is more expensive to dispose a chemical correctly than it is to purchase it.
- 2. Whenever possible try to order the least toxic chemical required for your research. The Material Data Safety Sheet can provide you with this information or you can contact our office in Chemistry B73 at 2-3495.
- 3. When you are finished with a chemical and you are not intending on using it for another two years or so, do **not** hang on to it. Try to broker it to a fellow researcher. Old chemicals can pose a serious safety hazard especially when peroxidizable or highly reactive. See the University's Chemical Hygiene Plan, Appendix G.
- 4. Label all Chemical containers with their contents even if non-hazardous. Unknown chemicals are expensive to identify and could pose a potentially serious health and safety hazard.
- 5. When leaving University employment, please contact the Office of Environmental Health and Safety so that we can facilitate appropriate chemical clean out of your labs.

APPENDIX I. - IDENTIFICATION, CONTROL AND PROCEDURES FOR HANDLING OF EXTREMELY HAZARDOUS CHEMICALS

Procedures for identification, control, handling and disposal of hazardous chemicals is a major part of the University's Chemical Hygiene Plan. To reduce exposure to recognized risks and for compliance with the OSHA Standard "Occupational Exposures to Hazardous Chemicals in Laboratories," this appendix for handling extremely hazardous chemicals should be added to your Chemical Hygiene Plan.

DEFINITIONS of EXTREMELY HAZARDOUS CHEMICALS:

A chemical or substance generally regarded by the scientific community as having properties that represent substantial risks to humans associated with the use, storage or disposal of the chemical. This can include select carcinogens, reproductive toxins, extremely flammable liquids, reactive materials and extremely toxic chemicals. The select carcinogens are those picked by various governmental agencies and are included on the lists attached to this appendix. Reproductive toxins are chemicals which affect the reproductive capabilities including chromosomal damage (mutations), and/or have effects on fetuses (teratogenesis). Extremely flammable liquids have an NFPA rating of 4. Reactive chemicals have an NFPA rating of 3 or 4. Extremely toxic chemicals have an NFPA health rating of 4 and/or usually have a LD 50 in rodents of less than 25 mg/kg, when administered orally, although other factors can be included. NFPA ratings can be found on the substance's Material Safety Data Sheet (MSDS).

PROCEDURES FOR HANDLING EXTREMELY HAZARDOUS MATERIALS:

- 1. The precautions and procedures described in the University's Chemical Hygiene Plan for the safe handling of chemicals must be adhered too, in addition to the following specific laboratory procedures.
- 2. Before beginning a laboratory operation, one is required to read and understand information found on the Material Safety Data Sheets for every hazardous chemical used during the laboratory operation.
- 3. If extremely hazardous chemicals are used, then it is desirable that there be two persons present in the laboratory at all times.
- 4. Protect hands and forearms by wearing a lab coat and suitable long gloves. Always wear chemical splash goggles. AVOID any contact with hazardous chemicals.
- 5. All procedures involving hazardous chemicals must be performed in a fume hood or biological cabinet (or other suitable containment device.)
- 6. After handling or working with hazardous materials, wash hands and arms immediately. NEVER eat, drink, smoke, chew gum, apply cosmetics, take medicine, or store food in areas where hazardous chemicals are being used or stored.

- 7. All hazardous chemicals should be labeled with appropriate warnings (Cancer-Suspect Agent, Reactive, etc.) Label all research vessels.
- 8. Approved DESIGNATED AREA signs must be posted in all designated areas. A designated area "means an area which may be used for work with select carcinogens' (see attached lists), reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, area of a laboratory or a device such as a laboratory fume hood." The DESIGNATED AREA signs attached to this appendix (on the next page) must be filled out with the appropriate information and posted by that area. If the chemicals used in that area change, the sign must also be changed. Additional signs are available in the Office of Environmental Health and Safety in Chemistry B73.
- 9. Written emergency procedures can be found in the MSDS for each hazardous chemical in the lab's MSDS notebook. (If the MSDS is not in the notebook, contact the Environmental Health and Safety Department for assistance in obtaining the MSDS or visit the EH&S Web page Useful Links) Persons working in the lab must be familiar with these procedures before the chemical is worked with, in case of chemical spills and accidents. Refer to the University's Chemical Hygiene Plan for Chemical Spill Procedures.
- 10. The Office of Environmental Health and Safety should review laboratory procedures or experiments using extremely hazardous chemicals first. The EH&S Office may require additional procedures or requirements. Coordination with the EHS Department is essential prior to commencement of experiments utilizing extremely hazardous chemicals.
- 11. Laboratory vacuum pumps used with hazardous chemicals should be vented into a fume hood.
- 12. Hazardous and extremely hazardous chemical waste must be turned into the Office of Environmental Health and Safety for proper disposal. Refer to the University's Chemical Hygiene Plan for proper waste disposal procedures.

DESIGNATED AREA

FOR EXTREMELY HAZARDOUS CHEMICALS/SELECT CARCINOGENS/POTENTIALLY DANGEROUS REPRODUCTIVE TOXINS

CHEMICALS:



PRINCIPAL INVESTIGATOR:_____

APPENDIX J. – FORMALDEHYDE POLICY

The Appendix reviews the OSHA standard 1910.1048 for Formaldehyde. The standard applies to all occupational exposures to formaldehyde, i.e. from formaldehyde gas, its solutions, and materials that release formaldehyde.

- 1. The University (employer) shall assure that no employee is exposed to an airborne concentration of formaldehyde which exceeds 0.75 parts formaldehyde per million parts of (0.75 ppm) as an 8-hour TWA Permissible Exposure Limit (PEL). The University shall also assure that no employee is exposed to an airborne concentration of formaldehyde, which exceeds two parts formaldehyde per million parts of air (2 ppm), as a 15-minute Short Term Exposure Limit (STEL).
- 2. The University shall monitor their employees to determine their exposure to formaldehyde. The Office of Environmental Health and Safety will conduct all monitoring for formaldehyde. All principal investigators using formaldehyde (this includes formalin) in their research, in their teaching labs, or storing specimens in formaldehyde must notify the Office of Environmental Health and Safety in Chemistry B73, so that their employees receive the appropriate monitoring to determine their exposures. Employees include faculty, staff, lab assistants, graduate students and teaching assistants. Monitoring of the employee must be repeated if there is a change in usage of the formaldehyde, which may result in new or additional exposure formaldehyde. Principal investigators must inform the Office of Environmental Health and Safety if their employees show signs or symptoms of respiratory or dermal conditions associated with formaldehyde exposure.
- 3. The University will notify in writing the employees of their monitoring results within 15 days of receiving the results. If monitoring results are over the PEL or STEL the University will take the necessary actions as defined in 1910.1048.
- 4. The Office of Environmental Health and Safety will select and provide protective clothing and equipment based upon the form of formaldehyde to be encountered, to those employees exposed to formaldehyde. All contact of the eyes and skin with liquids, containing 1 percent or more formaldehyde, shall be prevented by the usage of other chemical protective clothing made of material impervious to formaldehyde and the use of other personal protective equipment, such as goggles and face shields, as appropriate to the operation. Contact with irritating or sensitizing materials shall be prevented to the extent necessary to eliminate the hazard.
- 5. In areas where formaldehyde is used, quick drench showers and acceptable eyewash facilities must be immediately available. The Office of Environmental Health and Safety will provide the showers and eyewashes where necessary upon notification.

APPENDIX J. – Formaldehyde Policy cont'd.

- 6. The principal investigator shall routinely conduct visual inspections to detect leaks or spills in areas where formaldehyde is used or stored. The Office of Environmental Health and Safety will do periodic monitoring in the above areas.
- 7. The University shall make medical surveillance available for all employees who develop signs and symptoms of overexposure to formaldehyde and for all employees exposed to formaldehyde in emergencies. This will be arranged through the Office of Environmental Health and Safety in Chemistry B73.
- 8. All containers of formaldehyde, all mixtures or solutions composed of greater than 0.1% formaldehyde, and materials capable of releasing formaldehyde into the air, under reasonably foreseeable conditions of use, at concentrations reaching or exceeding 0.1 ppm shall be labeled with the appropriate hazard warnings. The labeling is the responsibility of the user.
- 9. The Office of Environmental Health and Safety will provide annual training on the specific health hazards of formaldehyde, on the contents of this policy and the OSHA standard to all employees exposed to formaldehyde at or above 0.1 ppm.
- 10. All areas where formaldehyde is being used should be posted as a "Designated Area" as defined in Appendix I of the University's Chemical Hygiene Plan. If a Designated Area sign is required, please contact the Office of Environmental Health and Safety.
- 11. In order to eliminate exposure of employees to formaldehyde and its solutions, it should be used in a fume hood whenever possible.

If you have any questions, regarding this policy, please contact the Office of Environmental Health and Safety in Chemistry B73.

APPENDIX K. - The Use of Controlled Substances in Research

Policy Statement

Certain research activities conducted under the auspices of the University require the use of controlled substances. Controlled substances, which are substances with high potential for abuse, are identified in the schedules contained within the "Controlled Substances Inventory List," published by the U.S. Drug Enforcement Administration (DEA). In conducting research with controlled substances, University authorized employees must comply with federal and state laws and regulations regarding their use, including DEA registration and New York State Department of Health licensure; storage requirements; inventory maintenance; substance disposal; and reporting and record keeping, in accordance with Title 21, Part 1300-1308 of the Code of Federal Regulations (CFR) and Article 33 of the New York State Public Health Law.

Responsible Party

Authorized University or Research Foundation employees, including principal investigators or supervisors of research in which controlled substances are used, bear full responsibility for complying with federal and state laws and regulations, and with University policy regarding their use. Specifically, they are responsible for:

- Obtaining and maintaining appropriate licensure from the New York State Department of Health.
- Obtaining and maintaining appropriate registration from the DEA.
- Submitting copies of the license and registration to the representative Departments, each time they are issued or renewed.
- Establishing security measures for the purchase, acceptance, use, and ultimate disposal of the controlled substances used in their research.

Principal investigators or supervisors of research, in which controlled substances will be used, are responsible for obtaining approval for their use from all applicable University committees that oversee human subject and animal subjects research (e.g., the Institutional Review Board, the Institutional Animal Care and Use Committee) and must report their intention to use controlled substances to external funding sponsors upon submission of grant applications. Individuals who have obtained relevant approvals for the use of controlled substances will be authorized to purchase, accept, and appropriately dispose of these substances.

(If the controlled item is to be used within the context of the activities of an organized research unit, which are outside of the operation of a specific sponsored project, the director of this research unit will be responsible for complying with federal and state laws and regulations regarding the use of controlled substances, and must notify the representative Departments.

(Note: The Director of the College of Arts and Sciences Technical Services Group is the University employee responsible for the purchase, acceptance, storage, use, and disposal of syringes and needles.)

Purchasing Controlled Substances

Orders for controlled substances by DEA registrants (i.e., authorized University or Research Foundation employees) must be submitted to the Office of Purchasing and Contracts on a requisition signed by the registrant or authorized designee. The requisition must be accompanied by DEA Form 222 and a copy of the DEA registration. Prior to executing the order, the Office of Purchasing and Contracts will obtain a verification from the appropriate Departments and/or Principal Investigator(s) that research, in which the ordered controlled substance is to be used, has been approved for its use and is an active project or program.

Receiving Controlled Substances

The controlled substances must be shipped to the registrant and address as indicated on the DEA registration. Once received, the controlled substances should be opened to verify the contents and any discrepancies should be rectified with the supplier. If necessary, DEA should be contacted. From the time a controlled substance is accepted on campus until it is consumed or disposed of, a record (disposition record) of the chain of custody must be kept at each point where the substance changes hands or is used. The record is completed at each point by the person delivering the substance and includes the name of the substance, the quantity, and the signature of the person receiving it. The person making the withdrawal shall sign all records of withdrawals of controlled substances from storage.

Continuing Records and Inventory

The registrant shall maintain an accurate continuing record or log of each controlled substance received, disposed of or otherwise used by him or her, in accordance with 21 CFR 1304.21 and 1304.24. The registrant for each registered location and for each independent activity for which the registrant is registered shall maintain separate records. The registrant must maintain the continuing records for 5 years.

The records shall include the following information:

- 1. Name of each substance kept at the site.
- 2. Identification of each finished form and the number of units or total volume of each finished form in each commercial container.
- 3. The number of commercial containers of each finished form received; the date of and number of containers in each receipt; and the name, address, and registration number of the source from which the containers were received.
- 4. The amount of each finished form transferred or used, including the name and address of the person(s) to whom it was given, the date of transfer, the name of the individual who used the substance, and the reason it was used.
- 5. The number of units or volume of the finished forms and/or commercial containers disposed of in any other manner, as well as the date and manner of the disposal.

Inventory

An accurate inventory of controlled substances must be maintained by each DEA registrant. The registrant will conduct an annual inventory and reconciliation as part of a self-audit. Inventories for schedule I and II controlled substances shall be maintained separately from other laboratory records. A copy of the completed inventory must be retained for 5 years and be made available to University or regulatory authorities when requested.

The inventory will include the following information:

- 1. Name of substance.
- 2. Each finished form of the substance.
- 3. Number of units or total volume of each finished form in each commercial container.
- 4. Number of commercial containers of each such finished form.

(For guidance regarding damaged, defective, or impure substance awaiting disposal, see 21CFR 1304.15(d).)

Any discrepancy in the continuing record or inventory of controlled substances must be reported to the University Police and their Departments immediately upon discovery.

Storage

All DEA registrants must provide effective controls and procedures to guard against theft and diversion of controlled substances. Controlled substances must be stored in a securely locked, substantially constructed cabinet. The following are considered in determining security requirements: the type of activity, the type and form of controlled substance, the quantity of controlled substance, the location of the premises, the type of building construction, the type of vault, safe, and secure enclosures, the adequacy of key control systems, the adequacy of electric detection and alarm systems, the extent of unsupervised public access, the adequacy of supervision over employees with access, procedures for handling visitors, the availability of local police and adequacy of the use and disposal tracking system (CFR 1301.71-1301.76).

Disposal

The registrant having custody of the controlled substance shall dispose of the controlled substance in accordance with NYS Department of Health, Bureau of Narcotic Enforcement (BNE) and the U.S. Department of Justice, Drug Enforcement Administration (DEA), Office of Diversion Control.

1st OPTION: Contact the purchasing vendor and determine if they can accept the controlled substances.

2nd OPTION: Visit the following link and dispose of your controlled substances through an approved reverse distributor.

http://www.health.state.ny.us/professionals/narcotic/pharmacies/surrender_to_independent_companies.htm

3rd OPTION: Visit the following link and request the assistance of the US Department of Justice's Drug Enforcement Administration for the disposal of your controlled substances.

http://www.deadiversion.usdoj.gov/21cfr/cfr/1307/1307_21.htm

Any questions or difficulties regarding the disposal of controlled substances should be directed to the Office of Environmental Health and Safety (EHS) at 442-3495 in Chemistry B73. They will advise the registrant on how to dispose of the controlled substance. The EHS Office is not responsible for the ultimate disposal of the controlled substances but rather the registrant.

A copy of all disposal forms should be sent to the EH&S Office in Chemistry B73 for our disposal records. The Principal Investigator should also retain copied of these disposal records for their files.

Relevant Federal and State Regulations concerning Controlled Substances

Federal: <u>Title 21 CFR Part 1300</u> State: <u>NYS Department of Health, Statutory Authority: Public Health Law, Sec. 225, NYCRR Title 10,</u> <u>Part 80 - Rules and Regulations on Controlled Substances</u>

APPENDIX L - UALBANY SHORTENED DEPARTMENT OF HOMELAND SECURITY COI LIST

| U.S. Dept. of Homeland Security's Chemicals of Interest List (shortened version) - see back page of list | | | | |
|--|-------------|------------|-------------|----------------------|
| Principal Investigator Name: | Bldg. And I | Rm #: | | |
| | | 1 | If Present | |
| | | | in Any Amt. | |
| Chemical of Interest | CAS # | STOS | Check (| Amount |
| acetone cyanohydrin, stabilized [2-methyllactonitrile] | 75-86-5 | Any Amt | (v) | 7 uno uno |
| aluminum (powder) | 7429-90-5 | 100 lbs | | |
| aluminum phosphide | 20859-73-8 | Any Amt | | |
| arsenic trichloride [arsenous trichloride] | 7784-34-1 | 22 lbs | 1 | |
| arsine | 7784-42-1 | 15 lbs | | |
| 1,4-bis(2-chloroethylthio)-n-butane | 142868-93- | 7 CUM 100a | | |
| bis(2-chloroethylthio)methane | 63869-13-6 | CUM 100g | | |
| bis(2-chloroethylthiomethyl)ether | 63918-90-1 | CUM 100g | | 1.1114.20.00 |
| 1,5-bis(2-chloroethylthio)-n-pentane | 142868-94-8 | 3 CUM 100a | | |
| 1,3-bis(2-chloroethylthio)-n-propane | 63905-10-2 | CUM 100g | | |
| boron tribromide | 10294-33-4 | 45 lbs | | |
| boron trichloride [borane, trichloro] | 10294-34-5 | 45 lbs | | |
| boron trifluoride [borane, trifluoro] | 7637-0-7-2 | 45 lbs | | |
| bromine chloride | 13863-41-7 | 45 lbs | | |
| bromine pentafluoride | 7789-30-2 | Any Amt. | | |
| bromine trifluoride | 7787-71-5 | 45 lbs | | |
| calcium phosphide | 1305-99-3 | Any Amt. | | |
| carbonyl fluoride | 353-50-4 | 45 lbs | | |
| chlorine dioxide [chlorine oxide, (CIO2)] | 10049-04-4 | Any Amt. | 1 | |
| chlorine pentafluoride | 13637-63-3 | 15 lbs | | |
| chlorine trifluoride | 7790-91-2 | 45 lbs | | |
| chloroacetyl chloride | 79-04-9 | Any Amt. | | |
| 2-chloroethylchloromethylsulfide | 2625-76-5 | CUM 100g | | |
| chlorosarin [o-isopropyl methylphosphonochloridate] | 1445-76-7 | CUM 100g | | |
| chlorosoman [o-pinacolyl methylphosphonochloridate] | 7040-57-5 | CUM 100g | | 1.1.7.7.7.7.7.7.7.7. |
| chlorosulfonic acid | 7790-94-5 | Any Amt. | | |
| cyanogen [ethanedinitrile] | 460-19-5 | 45 lbs | | |
| cyanogen chloride | 506-77-4 | 15 lbs | | |
| DF (methyl phosphonyl difluoride) | 676-99-3 | CUM 100g | | |
| diborane | 19287-45-7 | 15 lbs | | |
| dichlorosilane [silane, dichloro-] | 4109-96-0 | 45 lbs | | |
| N,N-(2-diethylamino)ethanethiol | 100-38-9 | 2.2 lbs | | |
| o,o-diethyl S-[2-(diethylamino)ethyl] phosphorothiolate | 78-53-5 | 2.2 lbs | | |
| diethyl methylphosphonite | 15715-41-0 | 2.2 lbs | | (17) (19) (19) (19) |
| N,N-diethyl phosphoramidic dichloride | 1498-54-0 | 2.2 lbs | | 6 6252250 |
| N,N-(2-diisopropylamino)ethanethiol (N,N-diisopropyl-(beta)-aminoethane thiol) | 5842-07-9 | 2.2 lbs | | |
| N,N-diisopropyl phosphoramidic dichloride | 23306-80-1 | 2.2 lbs | | |
| N,N-(2-dimethylamino)ethanethiol | 108-02-1 | 2.2 lbs | | |
| N,N-dimethyl phosphoramidic dichloride [dimethylphosphoramidodichloridate] | 677-43-0 | 2.2 lbs | | |
| dinitrogen tetroxide | 10544-72-6 | 15 lbs | | |
| N,N-(2-dipropylamino)ethanethiol | 5842-06-8 | 2.2 lbs | | |
| N,N-dipropyl phosphoramidic dichloride | 40881-98-9 | 2.2 lbs | | |
| ethyl phosphonyl difluoride | 753-98-0 | CUM 100g | | |
| ethylphosphonothioic dichloride | 993-43-1 | 2.2 lbs | | |
| Tluorine | 7782-41-4 | 15 lbs | | |
| germane | 7782-65-2 | 45 lbs | | |
| germanium tetratiuoride | 7783-58-6 | 15 lbs | | |
| | 684-16-2 | 45 lbs | | |
| (nitrogen mustard-1) [bis(2-chloroethyl)ethylamine] | 538-07-8 | CUM 100g | 1 | |
| HN2 (nitrogen mustard-2) [bis(2-chloroethyl)methylamine] | 51-75-2 | CUM 100g | | |
| (nitrogen mustard-3) [tris(2-chloroethyl)amine] | 555-77-1 | CUM 100g | | |
| nydrogen cyanide [nydrocyanic acid] | 74-90-8 | 15 lbs | | |
| hydrogen nuoride (annydrous) | 7664-39-3 | 45 lbs | | |
| nyarogen seleniae | 7783-07-5 | 15 lbs | | |
| nyarogen sunide | 7783-06-4 | 45 lbs | | 7 |

PLEASE contact EHS before ordering any of the chemicals on DHS's COI LIST.

| Principal Investigator Name: | Bldg. And Rm #: | | | |
|--|-----------------|------------|-------------|---|
| | | | If Present | ***** |
| | | | in Any Amt. | |
| Chemical of Interest | CAS # | STQs | Check (| Amount |
| isopropylphosphonothioic dichloride | 1498-60-8 | 2.2 lbs | | |
| isopropylphosphonyl difluoride | 677-42-9 | CUM 100a | | |
| lewisite 1 [2-chlorovinyldichloroarsine] | 541-25-3 | CUM 100g | | |
| lewisite 2 [bis(2-chlorovinyl)chloroarsine] | 40334-69-8 | CUM 100g | | |
| lewisite 3 [tris(2-chlorovinvl)arsine] | 40334-70-1 | CUM 100g | | |
| lithium amide | 7782-89-0 | Any Amt | | |
| lithium nitride | 26134-62-3 | Any Amt | | |
| magnesium (powder) | 7439-95-4 | 100 lbs | | |
| magnesium phosphide | 12057-74-8 | Any Amt | | |
| methylchlorosilane | 993-00-0 | 45 lbs | | |
| methyldichlorosilane | 75-54-7 | Any Amt | | |
| methylphosphonothioic dichloride | 676-98-2 | 2.2 lbs | | |
| sulfur mustard (mustard gas (H)) [bis(2-chloroethyl)sulfide] | 505-60-2 | CLIM 100g | | • |
| O-mustard (T) [bis(2-chloroethylthioethyl)ether] | 63918-89-8 | CUM 100g | | |
| nitric acid | 7697-37-2 | 400 lbs | | |
| nitric oxide [nitrogen oxide (NO)] | 10102-43-9 | 15 lbs | | |
| nitrobenzene | 98-95-3 | 100 lbs | | |
| nitrogen mustard hydrochloride [bis(2-chloroethyl)methylamine hydrochloride] | 55-86-7 | 2.2 lbs | | |
| Initrogen frioxide | 10544-73-7 | 2.2 IDS | | |
| nitrosvi chloride | 2696-92-6 | 15 lbs | | ****** |
| oxygen difluoride | 7783-41-7 | 15 lbs | | G 1 1 W 100 W 1 |
| perchloryl fluoride | 7616.04.6 | 15 lbs | | - |
| phoseene [carbonic dichloride] or [carbonyl dichloride] | 75-11-5 | 45 lbc | | |
| nhosnhine | 7803 51 2 | 15 lbc | | |
| phospharus avychlaride [phosphory] chlaride] | 1003-51-2 | Any Amt | | |
| phosphorus pentasulfide [phosphorus sulfide] | 1314-80.3 | Any Amt | | |
| phosphorus trichloride | 7710 12 2 | Any Ant. | | |
| potassium phosphide | 20770.41.6 | Any Amt | | |
| propylphosphonothioic dichloride | 2524 01 8 | 2.2 lbc | | |
| propylphosphonyl difluoride | 600.14.2 | CUM 100a | | |
| OL [0-ethyl-0-2-dijsopropylaminoethyl mothylphophopito] | 57056 11 0 | CUM 100g | | ***** |
| sarin [o-isonropy] methylphosphoneflueridata] | 107 14 9 | CUM 100g | | |
| selenium hexafluoride | 7702 70 1 | LE lbo | | |
| sesouimustard [1 2-bis/2-chloroethylthio)ethane] | 2562 26 9 | CLIM 100g | | |
| silicon tetrafluoride | 7702 61 1 | 45 lbo | | |
| | 7703-01-1 | 40 Ibs | | |
| sodium phoenhide | 120020-22-0 | 400 ibs | | |
| soman [o-pinacoly] methylphosphonof[upridate] | 12000-00-4 | Ally Alli. | | |
| stihing | 7002 50 2 | | | |
| strontium nhosphide | 12504 16 4 | 10 IDS | | |
| sulfur tetrafluoride (sulfur fluoride (SEA) /T.4).1 | 7792 60 0 | Any Amil. | | |
| sulfund chloride | 7701 25 5 | 10 IDS | | |
| tabun [a.ethy] N. Alimethylphosphoramida avanidata] | 77 91 6 | Any Ami | | |
| tellurium hevofluoride | 7792 00 4 | | | |
| thiodialycal [his/2-hydroyyethy])sulfide] | 1100-00-4 | 10 IDS | | |
| tifanium tetrachloride [fitanium chloride (TiCIA) (T.A) 1 | 7550 45 0 | Z.Z IUS | | |
| trichlorosilana [silana trichloro] | 10005 70 0 | | | |
| trifluoroacetul chloride | 10020-78-2 | ANY AML | | |
| tunasten bezafluoride | 7782 82 6 | 40 IDS | | |
| VX [o-ethyl-S-2-diisopropylaminoethyl methyl phosphonothiolate] | 50782-69-9 | CUM 100g | | |
| **** | | | | |
| ACG - A Commercial Grade | | | | |
| TOAS - Chemical Abstract Service | | | | |
| *STQ - Screening Threshold Quantity | | | | |
| | | | | |
| Principal Investigator Signature: | | Date Forms | Completed: | |

APPENDIX M - SAFE HANDLING OF LIQUID NITROGEN

Use only liquid nitrogen in liquid nitrogen dewars. Do not ever use liquid air or liquid oxygen in these dewars because either of which could present a combustion hazard with some materials used in the construction of these dewars, or materials stored in them.

Introduction

The safe handling and use of liquid nitrogen in liquid nitrogen dewars or flasks is possible only by knowing the potential hazards and using common-sense procedures based on that knowledge. There are two important properties of liquid nitrogen that present potential hazards:

- 1. It is extremely cold. At atmospheric pressure, liquid nitrogen boils at -320°F / -196° C.
- 2. Very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes 24.6 ft3/0.7 m3 of gas.

The safety precautions as outlined must be followed to avoid potential injury or damage which could result from these two characteristics. Do not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions. Keep a print out of this webpage handy for ready reference and review.

Maintenance:

Keep the unit clean and dry at all times. Do not use strong alkaline or acid cleaners that could damage the finish and corrode the metal shell.

Handling Liquid Nitrogen

Contact of liquid nitrogen or any very cold gas with the skin or eyes may cause serious freezing (**frostbite**) **injury.** Protect hands at all times when working with liquid nitrogen with Cryo Gloves. **Handle liquid nitrogen carefully**

The extremely low temperature can freeze human flesh very rapidly. When spilled on a surface the liquid tends to cover it completely and intimately, cooling a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face.

Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen. Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. Use tongs, preferably with insulated handles, to withdraw objects immersed in the liquid, and handle the object carefully.

Wear protective clothing

Protect your eyes with a face shield or safety goggles (safety glasses without side shields do not give adequate protection). Always wear cryo gloves when handling anything that is, or may have been, in immediate contact with liquid nitrogen. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them. When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuffless if possible) should be worn outside the shoes. Any kind of canvas shoes should be avoided because a liquid nitrogen spill can be taken up by the canvas resulting in a far more severe burn, in fact that would occur if the feet were essentially open or bare! Now we don't advocate going bare foot when using liquid nitrogen, but we also don't think that the wearing of canvas shoes is a safe practice either.

APPENDIX M – Safe Handling of Liquid Nitrogen (Cont'd.)

Use only containers designed for low-temperature liquids

Cryogenic containers are specifically designed and made of materials that can withstand the rapid changes and extreme temperature differences encountered in working with liquid nitrogen. Even these special containers should be filled slowly to minimize the internal stresses that occur when any material is cooled. Excessive internal stresses can damage the container.

Do not ever cover or plug the entrance opening of any liquid nitrogen dewar. Do not use any stopper or other device that would interfere with venting of gas.

These cryogenic liquid containers are generally designed to operate with little or no internal pressure. Inadequate venting can result in excessive gas pressure which could damage or burst the container. Use only the loose-fitting necktube core supplied or one of the approved accessories for closing the necktube. Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.

Use proper transfer equipment

Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar. The top of the funnel should be partly covered to reduce splashing. Use only small, easily handled dewars for pouring liquid. For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device. When liquid cylinders or other large storage containers are used for filling, follow the instructions supplied with those units and their accessories.

Do not overfill containers

Filling above the bottom of the necktube (or specified maximum level) can result in overflow and spillage of liquid when the necktube core or cover is placed in the opening.

Never use hollow rods or tubes as dipsticks

When a warm tube is inserted into liquid nitrogen, liquid will spout from the bottom of the tube due to gasification and rapid expansion of liquid inside the tube. Wooden or solid metal dipsticks are recommended; avoid using plastics that may become very brittle at cryogenic temperatures which then become prone to shatter like a fragile piece of glass.

Nitrogen gas can cause suffocation without warning. Store and use liquid nitrogen only in a well ventilated place.

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because nitrogen gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 19 percent oxygen can cause dizziness and quickly result in unconsciousness and death.

Note:

The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture, not the gas itself. The gas actually causing the condensation and freezing is completely invisible. Never dispose of liquid nitrogen in confined areas or places where others may enter.

APPENDIX M – Safe Handling of Liquid Nitrogen (Cont'd.)

First Aid Notice

If a person seems to become dizzy or loses consciousness while working with liquid nitrogen, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.

If exposed to liquid or cold gas, restore tissue to normal body temperature 98.6°F (37°C) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 108°F/42°C). Under no circumstances should the water be over 112°F/44°C, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke, nor drink alcohol.

Most liquid nitrogen burns are really bad cases of frostbite. We don't mean to belittle the harm that can come from frostbite, but at the same time, we wanted to keep the dangers associated with liquid nitrogen burns in perspective. Indeed, liquid nitrogen burns could be treated as frostbite.

Handling Liquid Nitrogen Dewars

Keep unit upright at all times except when pouring liquid from dewars specifically designed for that purpose.

Tipping the container or laying it on its side can cause spillage of liquid nitrogen. It may also damage the container and any materials stored in it. If tipping is anticipated, be sure to purchase a dewar that can be outfitted with a tipping stand.

Rough handling can cause serious damage to dewars.

Dropping the container, allowing it to fall over on its side, or subjecting it to sharp impact or severe vibration can result in partial or complete loss of vacuum. To protect the vacuum insulation system, handle containers carefully. Do not "walk", roll or drag these units across a floor. Use a dolly or handcart when moving containers, especially the larger dewars. Large units are heavy enough to cause personal injury or damage to equipment if proper lifting and handling techniques are not used.

When transporting a liquid nitrogen dewar, maintain adequate ventilation and protect the unit from damage.

Do not place these units in closed vehicles where the nitrogen gas that is continuously vented from unit can accumulate. Prevent spillage of liquids and damage to unit by securing it in the upright position so that it cannot be tipped over. Protect the unit from sever jolting and impact that could cause damage, especially to the vacuum seal.

Keep the unit clean and dry

Do not store it in wet, dirty areas. Moisture, animal waste, chemicals, strong cleaning agents and other substances which could promote corrosion should be removed promptly. Use water or mild detergent for cleaning and dry the surface thoroughly. Do not use strong alkaline or acid cleaners that could damage the finish and corrode the metal shell.

Protect Dewar Contents

Materials stored in a liquid nitrogen dewar with a wide mouth are protected by the extremely low temperature of the liquid nitrogen or the gas that issues from the evaporating liquid nitrogen. When all of the liquid nitrogen has evaporated, the temperature inside the unit will rise slowly to ambient. The rate at which the liquid nitrogen will evaporate depends upon the pattern of container use and the age and condition of the container. Evaporation increases as insulation efficiency deteriorates with age and rough handling. Opening and closing to insert and remove materials and moving the unit will also increase the evaporation rate.



State University of New York APPENDIX N- Universal Waste Disposal Policy and Guidelines plus Electronics Recycling

6 NYCRR Subpart 374-3 from the NYS Department of Environmental Conservations sets the Standards for Universal Wastes. The University at Albany incorporates these standards into their Universal Waste Disposal Policy and Guidelines.

Subpart 374-3 establishes requirements for managing Batteries, Pesticides, Thermostats and Lamps as Universal Waste as described in subdivision 374-3.1.

BATTERIES:

All used or unwanted batteries generated at the University at Albany must be disposed as either universal waste or hazardous waste. Spent lead-acid batteries not handled as hazardous waste, must go out as universal waste. Vendors supplying lead-acid batteries to the University at Albany shall be required to remove and dispose of these batteries when discarded by the University at Albany as universal waste in accordance with Subpart 374-3 and state contract requirements. Anyone disposing of lead-acid batteries through the state contracts must keep on file all signed shipping papers for at least three years. All other types of batteries, such as alkaline, nickel cadmium, nickel iron, nickel metal hydride, carbon zinc, zinc air, mercuric oxide, button cells, silver oxide, zinc carbon (mercury-containing), mercury, alkaline (mercury-containing), lithium metal, ion and magnesium, lead-acid and sealed lead -acid (nonautomotive), are all considered to be universal wastes when discarded and to be handled in accordance with Subpart 374-3. Batteries should be sorted by type for disposal. The Office of Environmental Health and Safety is responsible for coordinating the disposal of universal waste at the University at Albany. Contact the Office of Environmental Health and Safety at 442-3495 in Chemistry B73, if you have any questions about battery disposal, if you need waste battery containers or if you have batteries that need to be discarded. Please use the link below to locate battery recycling locations on campus: http://www.albany.edu/ehs/pdf/BatteryRecyclingLocations2011.pdf

PESTICIDES:

All discarded or recalled pesticides at the University at Albany are to be handled as either universal waste or hazardous waste, depending on the pesticide. The Office of Environmental Health and Safety coordinates the disposal of discarded or recalled pesticides and must be contacted at 442-3495 in Chemistry B73, whenever pesticides are ready for disposal or when a pesticide has been recalled as defined in Subpart 374-3.

MERCURY THERMOSTATS:

All discarded mercury thermostats must be handled as either universal waste or hazardous waste at the University at Albany. The Office of Environmental Health and Safety at 442-3495 in Chemistry B73 will coordinate the disposal of any mercury thermostats generated at the University at Albany. Mercury

APPENDIX N- Universal Waste Disposal Policy and Guidelines plus Electronics Recycling – (Cont'd.)

thermometers are disposed of as hazardous waste through the EH&S Office. The EH&S Office will swap out, at no charge, any mercury-containing thermometers for non-mercury containing ones. Please contact the office in advance, to arrange a swap out.

LAMPS:

All lamps/bulbs, excluding incandescent, are to be handled as either universal or hazardous waste at the University at Albany, due to their mercury content. This includes all fluorescent lamps (including U-shaped, circular and compact), High Intensity Discharge (HID), metal halide, mercury-containing bulbs from instruments, such as microscopes (HBO short arc lamps), etc. The Office of Environmental Health and Safety coordinates the disposal of all discarded lamps (except incandescent) at the University at Albany. The Environmental Health and Safety Office (EH&S) must be contacted at 442-3495 in Chemistry B73 for proper packaging instructions and turnover to EH&S. It is important to prevent breakage of any lamp/bulb prior to disposal, in order to not release minor amounts of mercury into the air.

COMPUTER MONITORS AND ELECTRONIC COMPONENTS/EQUIPMENT:

Though not technically considered universal waste, computer monitors and electronic components/equipment may contain heavy metals, such as lead, that are hazardous to the environment when disposed of incorrectly. The University at Albany recycles all computer monitors and electronic components/equipment, once Equipment Management has declared it as surplus equipment. Contact the EH&S Office at 442-3495 in Chemistry B73 for more information.

APPENDIX O - APHIS/CDC SELECT AGENTS AND TOXINS LIST (from the National Select Agency Registry)

Select Agents and Toxins List

The following biological agents and toxins have been determined to have the potential to pose a severe threat to both human and animal health, to plant health, or to animal and plant products. An attenuated strain of a select agent or an inactive form of a select toxin may be excluded from the requirements of the Select Agent Regulations. The list of excluded agents and toxins can be found at: http://www.selectagents.gov/Select%20Agents%20and%20Toxins%20Exclusions.html.

HHS SELECT AGENTS AND TOXINS

Abrin Botulinum neurotoxins Botulinum neurotoxin producing species of Clostridium Cercopithecine herpesvirus 1 (Herpes B virus) Clostridium perfringens epsilon toxin Coccidioides posadasii/Coccidioides immitis Conotoxins Coxiella burnetii Crimean-Congo haemorrhagic fever virus Diacetoxyscirpenol Eastern Equine Encephalitis virus Ebola virus Francisella tularensis Lassa fever virus Marburg virus Monkeypox virus Reconstructed replication competent forms of the 1918 pandemic influenza virus containing any portion of the coding regions of all eight gene segments (Reconstructed 1918 Influenza virus) Ricin Rickettsia prowazekii Rickettsia rickettsii Saxitoxin Shiga-like ribosome inactivating proteins Shigatoxin South American Haemorrhagic Fever viruses Flexal Guanarito Junin Machupo Sabia Staphylococcal enterotoxins T-2 toxin Tetrodotoxin Tick-borne encephalitis complex (flavi) viruses Central European Tick-borne encephalitis Far Eastern Tick-borne encephalitis Kyasanur Forest disease **Omsk Hemorrhagic Fever** Russian Spring and Summer encephalitis

OVERLAP SELECT AGENTS AND TOXINS

Bacillus anthracis Brucella abortus Brucella melitensis Brucella suis Burkholderia mallei (formerly Pseudomonas mallei) Burkholderia pseudomallei (formerly Pseudomonas pseudomallei) Hendra virus Nipah virus Rift Valley fever virus Venezuelan Equine Encephalitis virus

USDA VETERINARY SERVICES (VS) SELECT AGENTS

African horse sickness virus African swine fever virus Akabane virus Avian influenza virus (highly pathogenic) Bluetongue virus (exotic) Bovine spongiform encephalopathy agent Camel pox virus Classical swine fever virus Ehrlichia ruminantium (Heartwater) Foot-and-mouth disease virus Goat pox virus Japanese encephalitis virus Lumpy skin disease virus Malignant catarrhal fever virus (Alcelaphine herpesvirus type 1) Menangle virus Mycoplasma capricolum subspecies capripneumoniae (contagious caprine pleuropneumonia) Mycoplasma mycoides subspecies mycoides small colony (Mmm SC) (contagious bovine pleuropneumonia) Peste des petits ruminants virus Rinderpest virus Sheep pox virus Swine vesicular disease virus Vesicular stomatitis virus (exotic): Indiana subtypes VSV-IN2, VSV-IN3 Virulent Newcastle disease virus¹

List continues on next page.

Variola major virus (Smallpox virus) Variola minor virus (Alastrim) *Yersinia pestis*

USDA PLANT PROTECTION AND QUARANTINE (PPQ) SELECT AGENTS AND TOXINS

Peronosclerospora philippinensis (Peronosclerospora sacchari) Phoma glycinicola (formerly Pyrenochaeta glycines) Ralstonia solanacearum race 3, biovar 2 Rathayibacter toxicus Sclerophthora rayssiae var zeae Synchytrium endobioticum Xanthomonas oryzae Xylella fastidiosa (citrus variegated chlorosis strain)

9/19/11

¹A virulent Newcastle disease virus (avian paramyxovirus serotype 1) has an intracerebral pathogenicity index

in day-old chicks (<u>Gallus gallus</u>) of 0.7 or greater or has an amino acid sequence at the fusion (F) protein cleavage

site that is consistent with virulent strains of Newcastle disease virus. A failure to detect a cleavage site that is

consistent with virulent strains does not confirm the absence of a virulent virus.

Appendix P - Procedures for Handling Hydrofluoric Acid (HF)

HEALTH HAZARDS

Hydrofluoric acid (HF) is an extremely corrosive acid used for many purposes including mineral digestion, surface cleaning, etching, and biological staining. HF's unique properties make it significantly more hazardous than many of the other acids used on campus. This appendix discusses how to protect yourself against the dangers of HF. Attached you'll also find emergency procedures for dealing with HF exposures. Please post these procedures wherever HF is used or handled. The health hazards of HF are dependent upon the type of exposure and the concentration.

Eye and skin exposure

HF is corrosive and readily destroys tissue. Exposure of the eyes to HF may result in blindness or permanent eye damage. **HF readily penetrates human skin**, allowing it to destroy soft tissues and decalcify bone. Chemical burns from HF are typically very painful and slow to heal. Skin exposure to high concentrated HF (approximately 50% or greater) immediately results in serious and painful destruction of tissue. Not only can skin contact cause burns, but systemic fluoride poisoning may also result. One of HF's most insidious properties is that skin contact at lower concentrations may not produce pain or burning sensations until hours after the exposure. **Because of the ability of HF to produce severe delayed tissue damage without necessarily producing pain, all skin, eye, or tissue contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor or no pain is felt.**

Inhalation of HF vapor

Inhaling HF vapors can seriously damage the lungs. Delayed reactions up to and including fatal pulmonary edema (flooding of the lungs with body fluids) may not be apparent for hours after the initial exposure. OSHA limits employees' exposure to airborne concentrations of HF to an average of 3 parts per million (ppm) over an 8-hour work day. Airborne concentrations of 10 to 15 ppm will irritate the eyes, skin, and respiratory tract. Thirty ppm is considered immediately dangerous to life and health and may have irreversible health effects. At airborne concentrations above 50 ppm, even brief exposure may be fatal.

Chronic HF exposure

Long-term or chronic exposure to HF may result in fluorosis, a syndrome characterized by weight loss, bone embrittlement, anemia, and general ill health.



INFORMATION AND TRAINING

Employee Information and Training

HF is a colorless liquid with a strong irritating odor at low concentrations (3 ppm). Employees who handle HF must receive documented training on the hazards of HF and what to do in the event of an exposure or a spill by their supervisor or Principal Investigator. A Material Safety Data Sheet (MSDS) on HF should always be kept in the immediate work area where HF is used. The MSDS, together with this appendix, is an excellent basis for training employees on the hazards of HF. EHS is available for providing assistance with training upon request.

ENGINEERING CONTROLS AND PERSONAL PROTECTION

Ventilation

HF should be used with adequate ventilation to minimize inhalation of vapor. Concentrations greater than 5% should always be handled inside a properly functioning chemical fume hood. The chemical fume hood needs to have a current calibration sticker (within 1 year). Call OH&S (X5-4312) if the hood you are using has not been calibrated within 1 year.

Eye Protection

Always use chemical splash goggles together with a face shield when handling concentrated HF. Due to HF's highly corrosive nature, safety glasses with side shields do not provide adequate eye protection.

Body Protection

Wear a laboratory coat with a chemical splash apron made out of natural rubber, neoprene, or viton. Never wear shorts or open-toed shoes when handling HF or other corrosive chemicals.

Gloves

Typically, medium or heavyweight viton, nitrile, or natural rubber gloves are worn when working with HF. Always consult the manufacturer's glove selection guide when selecting a glove for HF. If you have any questions about which glove to choose, contact EHS at 2-3495. A second pair of nitrile exam gloves should be worn under the gloves for protection against leaks. Gloves that have not been contaminated with HF may be disposed of in the common trash. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands, and check your hands for any sign of contamination. Contaminated gloves must be disposed of as HF waste



Mild HF burn to thigh from commercial rust stain remover.

FIRST AID AND EMERGENCY PROCEDURES (also refer to MSDS)

Eyewash and Shower

Since HF is corrosive and rapidly damages tissue, an eyewash and shower must be nearby and accessible. *Eye exposure:*

Immediately irrigate eyes at eyewash for at least 15 minutes with copious quantities of water keeping eyelids apart and away from eyeballs. Do not apply calcium gluconate gel to eyes. In all cases of eye exposure, seek prompt medical attention.

Skin Exposure:

Immediately wash affected area of skin at sink if a small area of hand or forearm has been contaminated or at a drench shower if upper arms, torso, or legs are contaminated. If calcium gluconate gel is readily available, limit rinsing to 5 minutes so that application can be quickly initiated to limit the migration of the fluoride ion. Reapply and massage calcium gluconate gel into affected area of skin every 15 minutes. If calcium gluconate gel is not available rinse skin for a minimum of 15 minutes. Remove all contaminated clothing and place in hood or plastic bag. In all cases of skin exposure, seek prompt medical attention.

Ingestion:

Drink large amounts of water to dilute. Do not induce vomiting. Several glasses of milk or several ounces of milk of magnesia may be given for their soothing effect. In all cases of ingestion, seek prompt medical attention.

Inhalation:

Move victim to fresh air. In all cases of overexposure through inhalation, seek prompt medical attention.

Calcium Gluconate Gel

Calcium gluconate gel is a topical antidote for HF skin exposure. Calcium gluconate works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Keep calcium gluconate gel nearby whenever you're working with HF. Calcium gluconate can be ordered through Life Safety Associates <u>www.lifesafety.com</u> or Fisher Scientific, plus other vendors. Calcium gluconate has a limited shelf life and should be stored in a refrigerator, if possible and replaced with a fresh supply after its expiration date has passed. Use disposable nitrile gloves to apply calcium gluconate gel. Even after applying calcium gluconate, it is essential that a medical evaluation be made.

Note: Exposure to HF requires immediate and specialized first aid and medical treatment. Delays in first aid care or medical treatment will likely result in greater damage or may, in some cases, result in a fatal outcome.

SAFETY PRECAUTIONS FOR HANDLING AND STORAGE OF HF

Safe Work Practices

If possible, avoid working alone when you're using HF. Do not eat, smoke, or drink where HF is handled, since the chemical can be swallowed. Wash hands thoroughly after handling HF.

HF Spills

If HF is spilled outside a chemical hood, evacuate the area, close the doors, post the area with a sign to prevent others from entering, and call for assistance. Refer to section in plan on chemical spill procedures. Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff, if they have received spill cleanup training, have the correct equipment, understand the hazards, and are confident in their ability to clean up the spill safely and dispose of the waste properly as hazardous waste. Lime soda, ash, sodium bicarbonate, or a spill absorbent specified for HF should be used for cleanup. Contact EHS for free HF spill kits. **Organic spill kits that contain Floor-Dri, kitty litter, or sand should not be used because HF reacts with silica to produce silicon tetrafluoride, a toxic gas. Storage**

Store all HF and HF waste in labeled chemically compatible containers (e.g., polyethylene or Teflon). Glass, metal, and ceramic containers are not compatible with HF. HF should never be stored with incompatible chemicals such as ammonia or other alkaline materials. Always place HF on a low protected shelf or other location where it will not be accidentally spilled or knocked over.

Waste

HF waste should be placed in a chemically compatible container with a sealed lid and clearly labeled. Complete a Hazardous Waste Label and call EHS at 2-3495 for a waste pickup or if you have any questions regarding the disposal of HF waste.

Hazards Associated with Other Fluorine Compounds

Many chemicals containing fluorine, such as ammonium fluoride, sodium fluoride, sulfur tetrafluoride, and ammonium bifluoride, may react with acid or water to produce HF. Review the MSDS of all fluoride compounds carefully for safety precautions to reduce the risk of creating a HF hazard. If the manner in which the fluorine compound is used can create HF, follow the precautions for HF and keep topical antidote on hand.

Questions?

Please contact EHS at 2-3495 or in Chemistry B73, if you have any questions concerning Hydrofluoric Acid.

Additional Information:

http://www51.honeywell.com/sm/hfacid/prod-applications-sub/tech-docs.html

http://ehs.unc.edu/environmental/docs/hydrofluoricacid.pdf

Appendix Q – Signage for Lab Doors including Emergency Contact Information http://www.albany.edu/ehs/pdf/LaboratoryEntranceSign.pdf

The EHS webpage contains a fillable .pdf form for lab door signage, which is available at the above link. All lab doors must have this sign posted outside the lab, in order for the appropriate lab personnel to be contacted in the event of an emergency. It also informs emergency responders about the hazards located in that particular lab.

If you require assistance in filling out this form, please contact EHS at 2-3495 or in Chemistry B73.