FORDHAM UNIVERSITY

LABORATORY

SAFETY

PLAN

September, 2008

This document describes the Chemical Hygiene Plan for

_____

(department or laboratory name, building, room number(s))

at FordhamUniversity, as required by Title 29 Code of Federal Regulations Part 1910, Subpart Z, Section .1450 (29 CFR 1910.1450), "Occupational Exposures in Laboratories" referred to as the "Laboratory Standard".

In order to comply with the Laboratory Standard, FordhamUniversity has established a chemical hygiene plan to ensure that employees are protected from health hazards associated with hazardous materials in the laboratory and to ensure that exposures are kept below the permissible exposure limits specified in 29 CFR part 1910, subpart Z. Questions regarding this plan should be directed to:

Kenneth M. McCarthy, EHS Officer, Rose Hill Campus, (718) 817-5829

(name, title, campus address and campus phone number).

This plan is made readily available to the employees of Fordham and upon request to the Assistant Secretary of the Occupational Safety and Health Administration.

A review and evaluation of this Chemical Hygiene Plan is conducted at least annually and this Chemical Hygiene Plan is updated as necessary.

The person responsible for implementation of this Plan, including the assignment of the Departmental Chemical Hygiene Officer, is:

_____

(name, title, campus address and campus phone number).

The Departmental Chemical Hygiene Officer for this plan is:

_____

(name, title, campus address and campus phone number).

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CHAPTER 1.0 - EMERGENCY RESPONSE

During the course of normal laboratory operations there is always the potential for an emergency situation to arise. These emergencies can be the result of a chemical spill, fire, or the need for medical assistance. In the event of an emergency, an emergency response plan should be implemented. This plan would include evacuation of the facility if such action is deemed appropriate. Internal communication is very important during any emergency situation. It is essential that all employees know how to act and react during the emergency. To accomplish this, it is necessary that a written Emergency Response Plan be developed and that all employees are trained in its contents. All accidents, regardless of severity, should be reported and investigated.

SECTION 1.1 - CHEMICAL SPILLS

All chemical spills shall be reported in writing to the Fordham EHS Officer. The report shall include the date, time, location, chemical(s) and their volume, and names of all persons involved, including any visitors who were exposed and personnel involved in the clean up. A copy of this report shall also be kept by the Departmental Chemical Hygiene Officer.

A. Emergency Spills

A chemical spill is classified as an Emergency Spill whenever it:

1. Causes personal injury or chemical exposure that requires medical attention;

2. Causes a fire hazard or uncontrollable volatility;

3. Requires a need for breathing apparatus of the supplied air or self-contained type to handle the material involved;

4. Involves or contaminates a public area;

5. Causes airborne contamination that requires local or building evacuation;

6. Causes a spill that cannot be controlled or isolated by laboratory personnel;

7. Causes damage to university property that will require repairs;

8. Involves more than 1 cc of metallic mercury;

9. Cannot be properly handled due to lack of local trained personnel and/or equipment to perform a safe, effective cleanup;

10. Requires prolonged or overnight cleanup;

11. Involves an unknown substance; or

12. Enters the land or water.

Although the following tactics are prioritized in terms of usual preferred action sequences, each spill incident is unique and involves persons with varying levels of spill expertise and experience. Thus, for any individual incident, isolation of the spill and/or securing the area might best occur prior to or simultaneously with contacting security.

1. Contact Fordham Security. Notify security of location of the spill and, if known, the chemical spilled.

2. Don't panic! Always send for help first, if possible.

3. If the spill presents an immediate danger, leave the spill site and warn others, control entry to the spill site, and wait for Fordham Security response.

4. Remove contaminated clothing. Flush skin/eyes with water at least 15 minutes to 30; use soap for intermediate and final cleaning of skin areas.

5. Protect yourself, then remove injured person(s) to fresh air, if safe to do so.

6. Notify nearby persons and evacuate as necessary. Prevent entry, as necessary, by posting a guard in a safe area and/or shutting doors.

7. If flammable vapors are involved, do not operate electrical switches unless to turn off motorized equipment. Try to turn off or remove heat sources, where safe to do so.

8. If the substance involved is an unknown, then emergency spill response procedures are limited to self-protection, notification of Fordham Security for response, isolation of the chemical, and evacuating and securing the area involved.

9. Do not touch the spill without protective clothing.

10. Where the spill does not present immediate personal danger, try to control the spread or volume of the spill. This could mean shutting a door, moving nearby equipment to prevent further contamination, repositioning an overturned container or one that has a hole in the bottom or side, creating a dike by putting an absorbent around a spill or opening the sashes on the fume hoods to facilitate removal of vapors.

11. Never assume gases or vapors do not exist or are harmless because of lack of smell.

12. Increase ventilation by opening closed fume hood sashes to the 12 inch or full open position. Exterior doors may be opened to ventilate non-toxic vapors.

13. Use absorbents to collect substances. Reduce vapor concentrations by covering the surface of a liquid spill with absorbent. Control enlargement of the spill area by diking with absorbent.

B. Minor Spills

Minor spills are those spills which do not fit the requirements for Emergency Spills. The following general procedures should be used for all minor spills:

1. Attend to any persons who may have been contaminated. If these persons require medical attention this is an Emergency Spill (See above).

2. Notify persons in the immediate area about the spill.

3. Evacuate all nonessential personnel from the spill area.

4. If the spilled material is flammable, turn off ignition and heat sources.

5. Avoid breathing vapors of the spilled material. If respiratory protection is necessary this is an Emergency Spill (See above).

6. Leave on or establish exhaust ventilation if it is safe to do so.

7. Secure supplies to effect cleanup.

8. Don appropriate personnel protective equipment.

9. Spilled Liquids

a. Confine or contain the spill to a small area. Do not let it spread.

b. For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or diatomaceous earth). For small quantities of other materials, absorb the spill with a nonreactive material (such as vermiculite, clay, dry sand, or towels).

c. For larger amounts of inorganic acids and bases, flush with large amounts of water (providing the water will not cause additional damage). Flooding is not recommended in storerooms where violent spattering may cause additional hazards or in areas where water-reactive chemicals may be present.

d. Mop up the spill, wringing out the mop in a sink or a pail equipped with rollers.

e. Carefully pick up and clean any cartons or bottles that have been splashed or immersed.

f. If needed, vacuum the area with a HEPA filtered vacuum cleaner approved and designed for the material involved.

g. If the spilled material is extremely volatile, let it evaporate and be exhausted by the laboratory hood (provided that the hood is authorized for use with the spilled chemical).

10. Spilled Solids

Generally, sweep spilled solids of low toxicity into a dust pan and place them into a container suitable for that chemical. Additional precautions such as the use of a vacuum cleaner equipped with a HEPA filter may be necessary when cleaning up spills of more highly toxic solids.

11. Dispose of residues according to safe disposal procedures, remembering that personal protective equipment, brooms, dust pans, and other items may require special disposal procedures. (See Section 3.4 - "Chemical Waste").

12. Report the chemical spill in writing as required above.

C. Mercury Handling and Spill Clean Up

1. Mercury spills should be responded to in accordance with the Program Section VII of the Fordham University Comprehensive Waste Management Program.

SECTION 1.2 - RADIATION SPILLS

Emergencies will generally be in the nature of spills, fires, or explosions, as a result of which radioactive materials are spread around the installation. In the event of such dissemination of radioactive materials, the following general procedures are given as a guide to be adapted to the specific nature of the emergency. All spills involving radioactive material shall be reported by phone to Fordham Security with a written follow-up submitted to the EHS Officer within five working days.

A. Minor Spills Involving No Radiation Hazard to Personnel

1. Notify all other persons in the room at once.

2. Permit only the minimum number of persons necessary to deal with the spill into the area.

3. Confine the spill immediately.

Liquid Spills:

a. Don protective gloves

b. Drop absorbent paper on the spill.

Dry Spills:

a. Don protective gloves.

b. Dampen thoroughly, taking care not to spread the contamination.

4. Notify the faculty member in charge of the laboratory and the Radiological Safety Officer as soon as possible.

5. Monitor all persons involved in the spill and cleaning.

6. Decontaminate the area according to the directions of the Radiological Safety Officer.

7. Permit no person to resume work in the area until a survey is made, and approval of the Radiological Safety Officer is secured.

8. Prepare a complete history of the accident and subsequent activity related thereto for the records of the Radiological Safety Officer.

B. Major Spills Involving Radiation Hazard to Personnel

1. Notify all persons not involved in the spill to vacate the room at once.

2. If the spill is a liquid, and the hands are protected, right the container.

3. If the spill is on the skin, flush thoroughly.

4. If the spill is on clothing, discard outer or protective clothing at once.

5. Shut off air conditioning units serving the laboratory.

6. Vacate the room.

7. Notify the faculty member in charge and the Radiological Safety Officer as soon as possible.

8. Take immediate steps to decontaminate personnel involved, as necessary.

9. Decontaminate the area per the recommendations of the Radiological Safety Officer. (Personnel involved in decontamination must be adequately protected.)

10. Monitor all persons involved in the spill and cleaning to determine adequacy of decontamination.

11. Permit no person to resume work in the area until a survey is made and approval of the Radiological Safety Officer is secured.

12. Prepare a complete history of the accident and subsequent activity related thereto for the records of the Radiological Safety Officer.

C. Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases

1. Notify all other persons to vacate the room immediately.

2. Hold breath and vacate room.

3. Shut off air conditioning.

4. Notify the faculty member in charge and the Radiological Safety Officer at once.

5. Ascertain that all doors giving access to the room are closed and post conspicuous warnings or guards to prevent accidental opening of doors.

6. Report at once all known or suspected inhalations of radioactive materials.

7. The Radiological Safety Officer shall evaluate the hazard and the necessary safety devices for safe re-entry.

8. Determine the cause of contamination and rectify the condition.

9. Decontaminate the area.

10. Perform air survey of the area before permitting work to be resumed.

11. Monitor all persons suspected of contamination.

12. Prepare a complete history of the accident and subsequent activity related thereto for the records of the Radiological Safety Officer.

D. Injuries to Personnel Involving Radiation Hazard

1. Wash minor wounds immediately, under running water, while spreading the edges of the gash.

2. Report all radiation accidents to personnel (wounds, overexposure, ingestion, inhalation) to the faculty member in charge and the Radiological Safety Officer as soon as possible.

3. Call a physician. (Student Health Center)

4. Permit no person involved in a radiation injury to return to work without the approval of the Radiological Safety Officer and attendant physician.

5. Prepare a complete history of the accident and subsequent activity related thereto for the records of the Radiological Safety Officer.

SECTION 1.3 - BIOHAZARD SPILLS

A. Biological Spills

Biological spills outside biological safety cabinets will generate aerosols that can be dispersed in the air throughout the laboratory. These spills can be very serious if they involve microorganisms that require Biosafety Level 3 containment, since most of these agents have the potential for transmitting disease by infectious aerosols. To reduce the risk of inhalation exposure in such an accident, occupants should leave the laboratory immediately. The laboratory should not be reentered to decontaminate or clean up the spill for at least 30 minutes. During this time the aerosol may be removed from the laboratory via the exhaust ventilation systems, such as biological safety cabinets or chemical fume hoods, if present.

1. Spills on the Body

a. Remove contaminated clothing.

b. Vigorously wash exposed area with soap and water for one minute.

c. Obtain medical attention (if necessary).

d. Report the incident to the laboratory supervisor.

2. Biosafety Level 1 Organism Spill

a. Wear disposable gloves.

b. Soak paper towels in disinfectant and place over sill.

c. Place towels in a plastic bag for disposal.

d. Clean up spill area with fresh towels soaked in disinfectant.

3. Biosafety Level 2 Organism Spill

a. Alert people in immediate area of spill.

b. Put on protective equipment. This may include a laboratory coat with long sleeves, back-fastening gown or jumpsuit, disposable gloves, disposable shoe covers, safety goggles, mask or full-face shield.

c. Cover spill with paper towels or other absorbent materials.

d. Carefully pour a freshly prepared 1 to 10 dilution of household bleach around the edges of the spill and then into the spill. Avoid splashing.

e. Allow a 20-minute contact period.

f. After the spill has been absorbed, clean up the spill area with fresh towels soaked in disinfectant.

g. Place towels in a plastic bag and decontaminate in an autoclave.

4. Biosafety Level 3 Organism Spill

a. Attend to injured or contaminated persons and remove them from exposure.

b. Alert people in the laboratory to evacuate.

c. Close doors to affected area.

d. Call Fordham Security for emergency response.

e. Have a person knowledgeable of the incident and laboratory assist emergency personnel when they arrive.

B. Blood Spills

1. General Information

a. Universal precautions must be observed. Refer to the Campus Blood Borne Pathogens Plan or Departmental Exposure Control Plan for more information. Cleaning of blood spills should be limited to those persons who are trained for the task.

b. If an untrained person encounters a spill, he/she should limit access to the area and immediately call the person(s) assigned to this duty.

c. Only disposable towels should be used to avoid the difficulties involved in laundering.

d. If a spill involves broken glassware, the glass should never be picked up directly with the hands. It must be cleaned up using mechanical means, such as a brush and dustpan, tongs, or forceps.

2. Personal Protective Equipment

a. Persons who clean blood spills should wear disposable gloves of sufficient strength so they will not tear during cleaning activities. If the gloves develop holes, tears, or splits, remove

them, wash hands immediately, and put on fresh gloves. Disposable gloves must never be washed or reused. Remove gloves one at a time by grasping the wrist opening and pulling toward the fingers so that the gloves come off as inside out. Double-bag gloves with other contaminated biomedical waste (such as towels).

3. Disinfectants

Read and follow all manufacturer's handling instructions. All spills of blood and blood-contaminated fluids should be properly cleaned using any of these three disinfectants:

a. EPA-registered "hospital disinfectant" chemical germicides that have a label claim for tuberculocidal activity. These are chemical germicides that are approved for use as hospital disinfectants and are tuberculocidal when used at recommended dilutions.

b. Products registered by the Environmental Protection Agency as being effective against human immunodeficiency virus (HIV).

c. A solution of 5.25 percent sodium hypochlorite (household bleach) diluted between 1:10 and 1:100 with water (a 1:100 dilution of common household bleach yields 500 parts per million free available chlorine - approximately ⁿ cup of bleach per gallon of tap water).

4. Cleaning Blood Spills on Hard Surfaces

To assure the effectiveness of any sterilization or disinfection process, surfaces must first be thoroughly cleaned of all visible blood or soil before a germicidal chemical is applied for disinfection.

a. Isolate the area, if possible.

b. Wear gloves and other protective apparel as needed.

c. Remove visible blood with disposable towels in a manner that will ensure against direct contact with the blood. For example, put towels over the spill to absorb the liquid.

d. Place contaminated towels in a plastic waste disposal bag.

e. The area should then be decontaminated with an appropriate germicide applied according to manufacturer's directions.

f. All contaminated towels and gloves should be double-bagged for disposal and labeled with the biohazard symbol.

5. Cleaning Blood Spills on Carpeting

Use only a registered germicide. Read and follow manufacturer's instructions. Do not use chlorine bleach solution on carpet.

a. Isolate the area--if possible.

b. Wear gloves and other appropriate apparel.

c. Procedures for small spills on carpets (smaller than a quarter) are as follows.

(1) Soak the spill with enough disinfectant to cover the spot.

(2) Let dry at least overnight to ensure that the spot is disinfected.

(3) Shampoo carpet, if needed, or use 3% hydrogen peroxide to remove discoloration.

d. Procedures for larger spills are as follows.

(1) Pour disinfectant on the spot and let stand at least 30 minutes to allow some disinfection to take place. Blot up excess liquid with disposable towels.

(2) Soak the area with additional disinfectant. Allow to dry overnight. Shampoo carpet, if needed, or use 3% hydrogen peroxide to remove discoloration.

e. All contaminated towels and gloves should be double-bagged and labeled with the biohazard symbol.

SECTION 1.5 - FIRES

Fires are a common emergency in a chemistry laboratory.

In the event of a fire, do the following things:

A. Assist any person in immediate danger to safety, if it can be accomplished without risk to yourself.

B. Immediately activate the building fire alarm system and call Fordham Security.

C. If the fire is small enough, use a nearby fire extinguisher to control and extinguish the fire. Don't fight the fire if these conditions exist:

a. The fire is too large or out of control.

b. If the atmosphere is toxic.

D. If the first attempts to put out the fire do not succeed, evacuate the building immediately.

E. Doors, and if possible, windows, should be closed as the last person leaves a room or area of a lab.

F. Do not use elevators; use building stairwells.

G. When they hear the fire alarm sound, all personnel in the affected areas shall evacuate the building immediately.

H. No personnel will be allowed to re-enter the building without permission of Fordham Security or the NYC Fire Department.

SECTION 1.6 - MEDICAL EMERGENCIES

Personal injury is not uncommon in laboratories. These injuries are usually minor cuts or burns but can be as severe as acute effects of chemical exposure or incidents such as heart attacks or strokes.

The initial responsibility for first aid rests with the first person(s) at the scene, who should react quickly but in a calm and reassuring manner. The person assuming responsibility should immediately summon medical help (be explicit in reporting suspected types of injury or illness, location of victim, and type of assistance required). Send people to meet the ambulance crew at likely entrances of the building. The injured person should not be moved except where necessary to prevent further injury.

The names of persons in your area trained in CPR and First Aid should be posted by your telephone.

The number to call for medical emergencies shall also be posted by your telephone.

All first aid, chemical exposures, and medical emergencies shall be reported as required in Section 1.7 - "Accident Reporting."

Prevention of injuries should be a major emphasis of any laboratory safety program. Proper training will help prevent injuries from glassware, toxic chemicals, burns and electrical shock. In the event of any type of injury beyond that which first aid can treat, call for medical assistance.

A. General

1. First aid is defined as any one-time treatment and any follow up visit for the purpose of observation, treatment of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care.

2. First aid equipment should be readily available in each laboratory. See Section 2.2-D, "First Aid Kits," for additional information.

3. Following any first aid, a nurse or physician qualified to handle chemical emergencies should provide further examination and treatment. The location and phone number of emergency services and the Poison Control Center should be clearly posted.

4. It is recommended that each laboratory have at least one person trained in basic first aid and cardiopulmonary resuscitation.

5. Someone knowledgeable about the accident should always accompany the injured person to the medical facility and a copy of any appropriate MSDS(s) shall accompany the victim.

6. Minor injuries requiring first aid should always be reported to a supervisor and recorded on an Accident Report Form, which must be submitted to Human Resources. Reasons for this are as follows.

a. A minor injury may indicate a hazardous situation which should be corrected to prevent a serious future injury.

b. It is important to document a minor injury as having been "work related" if the injury later leads to serious complications, such as from an infected cut.

B. Personal Protection During First Aid

1. OSHA requires adherence to "Universal Precautions" when employees respond to emergencies which provide potential exposure to blood and other potentially infectious materials. "Universal Precautions" stresses that all patients should be assumed to be infectious for HIV and other bloodborne pathogens.

2. Persons responding to a medical emergency should be protected from exposure to blood and other potentially infectious materials. Protection can be achieved through adherence to work practices designed to minimize or eliminate exposure and through the use of personal protective equipment (i.e., gloves, masks, and protective clothing), which provide a barrier between the worker and the exposure source. For most situations in which first aid is given, the following guidelines should be adequate.

a. For bleeding control with minimal bleeding and for handling and cleaning instruments with microbial contamination, disposable gloves alone should be sufficient.

b. For bleeding control with spurting blood, disposable gloves, a gown, a mask, and protective eye wear are recommended.

c. For measuring temperature or measuring blood pressure, no protection is required.

3. After emergency care has been administered, hands and other skin surfaces should be washed immediately and thoroughly with warm water and soap if contaminated with blood, other body fluids to which universal precautions apply, or potentially contaminated articles. Hands should always be washed after gloves are removed, even if the gloves appear to be intact.

SECTION 1.7 - ACCIDENT REPORTING

ALL injuries shall be reported to laboratory management and the Fordham Human Resources department. Minor injuries many times are not reported because they are perceived to be embarrassing or that "careless actions" lead to the accident. However, minor injuries can sometimes lead to more serious complications that only become evident at a later time. Liability and insurance matters will be handled more effectively if initial accident documentation exists. In addition, all minor accidents should be investigated by safety and management personnel. Taking corrective action as a result of a minor accident may keep a major incident from happening. Without knowledge of all minor accidents, the desirable investigation is circumvented.

Employees should understand that the purpose of reporting and documenting accidents is not to affix blame, but instead to determine the cause of the accident so that similar incidents may be prevented in the future.

CHAPTER 2.0 - GENERAL SAFETY

People who work in scientific laboratories are exposed to many kinds of hazards. This can be said of most workplaces; in some, the hazards are well recognized (those of ordinary fire, for example) and the precautions to be taken are obvious. Laboratories, however, involve a greater variety of possible hazards than do most workplaces, and some of those hazards call for precautions not ordinary encountered elsewhere. Therefore, this manual has been provided to inform and guide the laboratory worker in safe practices which should help to avoid injury.

This chapter sets forth those practices which are deemed good safety practices common to all laboratory operations.

SECTION 2.1 - GENERAL SAFETY AND OPERATIONAL RULES

A. General Rules of Safety

1. No running, jumping, or horseplay in laboratory areas shall be permitted.

2. No employee shall work alone in a laboratory or chemical storage area when performing a task that is considered unusually hazardous by the laboratory supervisor or safety officer.

3. Spills shall be cleaned immediately. Specifics of emergency spill tactics are provided in the Emergency Response chapter of this manual (Chapter 1.0). Water spills can create a hazard because of the slip potential and flooding of instruments (particularly on the floor below.) Small spills of liquids and solids on bench tops shall be cleaned immediately to prevent contact with skin or clothing.

4. Ladders shall be in good condition and used in the manner for which they were designed. Wooden ladders shall not be covered with paint or other coating. (Structural defects may be hidden by the coating.)

5. Lifting of heavy items must be performed in the proper fashion, using the legs to lift, and not the back.

6. It is the responsibility of everyone working in the laboratory to make certain that the laboratory is left clean after work is performed.

7. Animals, except for those that are the subject of experimentation (approved by the Institutional Animal Care and Use Committee) are to be excluded from all laboratory areas.

B. Personal Hygiene

1. Wash promptly whenever a chemical has contacted the skin. Know what you are working with and have the necessary cleaning/neutralization material on hand and readily available.

2. No sandals, open toed shoes or clogs shall be worn by laboratory personnel.

3. Clothing worn in the laboratory should offer protection from splashes and spills, should be easily removable in case of accident, and should be at least fire resistant. Nonflammable, nonporous aprons offer the most satisfactory and the least expensive protection. Lab jackets or coats should have snap fasteners rather than buttons so that they can be readily removed. These coats are to be fastened closed while working and removed prior to exit from the laboratory.

4. Laboratory clothing should be kept clean and replaced when necessary. Clothing should be replaced or laundered using appropriate decontamination procedures whenever contamination is suspected.

5. Lab coats are not to be worn outside the laboratory, especially in rest room or break facilities. Any lab coats, respirators, or other protective gear must be left in the lab areas. Employees must, as a matter of routine, be responsible for washing, cleaning, and any other decontamination required when passing between the lab and the other areas. Washing should be done with soap and water; do not wash with solvents.

6. Inhalation is one of the four modes of entry for chemical exposure. "Sniff-testing" should not be done.

7. Never pipette by mouth. Always use a bulb to pipette.

8. Do not drink, eat, smoke, or apply cosmetics in the laboratory or chemical storage areas.

9. Do not use ice from laboratory ice machines for beverages.

10. No food, beverage, tobacco, or cosmetics products are allowed in the laboratory or chemical storage areas at any time. Cross contamination between these items and chemicals or samples is an obvious hazard and should be avoided.

C. Housekeeping

As in many general safety procedures, the following listing of good housekeeping practices indicate common sense activities which should be implemented as a matter of course in the laboratory. These recommendations are designed for accident prevention.

1. THE AREA MUST BE KEPT AS CLEAN AS THE WORK ALLOWS.

2. Each laboratory employee shall be responsible for maintaining the cleanliness of his/her area.

3. Reagents and equipment items should be returned to their proper place after use. This also applies to samples in progress. Contaminated or dirty glassware should be placed in specific cleaning areas and not allowed to accumulate.

4. Chemicals, especially liquids, should never be stored on the floor, except in closed door cabinets suitable for the material to be stored. Nor should large bottles (2.5l or larger) be stored above the bench top.

5. Reagents, solutions, glassware, or other apparatus shall not be stored in hoods. Besides reducing the available work space, they may interfere with the proper air flow pattern and reduce the effectiveness of the hood as a safety device.

6. Counter tops should be kept neat and clean. Bench tops and fume hoods shall not be used for chemical storage. All work done in fume hoods shall be performed in the "Safety Zone", (6" minimum from the sash).

7. Stored items, equipment, and glass tubing shall not project beyond the front of shelf or counter limits.

8. Stored items or equipment shall not block access to the fire extinguisher(s), safety equipment, or other emergency items.

9. Stairways, hallways, passageways/aisles and access to emergency equipment and/or exits must be kept dry and not be obstructed in any fashion, including storage, equipment, phone or other wiring.

10. No combustible material such as paper, wooden boxes, pallets, etc., shall be stored under stairwells or in hallways. Hallways shall be kept free of boxes and materials so that exits or normal paths of travel will not be blocked.

11. Materials stored near aisles shall be restrained to prevent their falling.

12. Mats and carpeting shall be kept in good condition.

13. All working surfaces and floors should be cleaned regularly.

14. All containers must be labeled with at least the identity of the contents and the hazards those chemicals present to users. If the contents of all containers are known we will no longer have an unknown waste disposal problem.

D. Electrical

The typical laboratory requires a large quantity of electrical power. This increases the likelihood of electrically-related problems and hazards. One must address both the electrical shock hazard to the facility occupants and the fire hazard potential. The following recommendations are basic to a sound electrical safety program in the laboratory.

1. All electrical equipment shall be properly grounded.

2. All electrical equipment shall be U.L. listed and/or F.M. approved.

3. Sufficient room for work must be present in the area of breaker boxes. All the circuit breakers and the fuses shall be labeled to indicate whether they are in the "on" or "off" position, and what appliance or room area is served.. Fuses must be properly rated.

4. Equipment, appliance and extension cords shall be in good condition.

5. Extension cords shall not be used as a substitute for permanent wiring.

6. Electrical cords or other lines shall not be suspended unsupported across rooms or passageways. Do not route cords over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc. Do not run cords through holes in walls or ceilings or through doorways or windows. Do not place under carpet, rugs, or heavy objects. Do not place cords on pathways or other areas where repeated abuse can cause deterioration of insulation.

7. Multi-outlet plugs shall not be used unless they have a built-in circuit breaker. This causes overloading on electrical wiring, which will cause damage and possible overheating.

8. Most of the portable multiple outlets are rated at 15 amps. Employees shall check when all connections are made to determine that the total input average will never exceed 15 amps. (The amperage on electrical equipment is usually stamped on the manufacturer's plate).

9. All building electrical repairs, splices, and wiring shall be performed by the Facilities Operations Department.

10. Electrical standards may be obtained by referencing NFPA 70 - NATIONAL ELECTRICAL CODE.

E. Vacuum Operations

In an evacuated system, the higher pressure is on the outside, rather than the inside, so that a break causes an implosion rather than an explosion. The resulting hazards consist of flying glass, spattered chemicals, and possibly fire.

A moderate vacuum, such as 10 mm Hg, which can be achieved by a water aspirator, often seems safe compared with a high vacuum, such as 10-5 mm Hg. These numbers are deceptive, however, because the pressure differences between the outside and inside are comparable. Therefore any evacuated container must be regarded as an implosion hazard.

1. When working with a vacuum be aware of implosion hazards. Apply vacuum only to glassware specifically designed for this purpose, i.e., heavy wall filter flasks, desiccators, etc.

2. Never evacuate scratched, cracked, or etched glassware. Always check for stars or cracks before use.

3. Vacuum glassware which has been cooled to liquid nitrogen temperature or below should be annealed prior to reuse under vacuum.

4. Rotary evaporator condensers, receiving flasks, and traps should be taped or kept behind safety shields when under a vacuum.

5. All condensers connected to rotary evaporators should at least be cooled with circulating ice water.

6. The use of a vacuum for the distillation of the more volatile solvents, e.g. ether, low boiling petroleum ether and components, methylene chloride, etc., should be avoided whenever possible. In situations requiring reduced pressure, two alternatives should be considered; 1) Utilization of Rotovac System, or 2) Solvent recovery via atmospheric pressure distillation (preferred method).

7. Water, solvents, or corrosive gases should not be allowed to be drawn into a building vacuum system.

8. When a vacuum is supplied by a compressor or vacuum pump to distill volatile solvents, a cold trap should be used to contain solvent vapors. Cold traps should be of sufficient size and low enough temperature to collect all condensable vapors present in a vacuum system. If such a trap is not used, the pump or compression exhaust must be vented to the outside using explosion proof methods.

9. After completion of an operation in which a cold trap has been used, the system should be vented. This venting is important because volatile substances that have been collected in the trap may vaporize when the coolant has evaporated and cause a pressure buildup that could blow the apparatus apart.

10. After vacuum distillations, the pot residue must be cooled to room temperature before air is admitted to the apparatus.

11. All desiccators under vacuum should be completely enclosed in a shield or wrapped with friction tape in a grid pattern that leaves the contents visible and at the same time guards against flying glass should the vessel collapse. Various plastic (e.g., polycarbonate) desiccators now on the market reduce the implosion hazard and may be preferable.

F. Handling Glassware

1. Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.

2. Discard or send for repair all broken, chipped, starred or badly scratched glassware. Hand protection should be used when picking up broken glass. For disposal of broken glass see Section 2.5 - "Safety Practices for Disposal of Broken Glassware".

3. Clean all glassware before sending for repair.

4. When using glass tubing, all ends should be fire polished. Lubricate tubing with glycerin or water before inserting into rubber stoppers or rubber tubing.

5. Protect hands with leather gloves when inserting glass tubing. Hold elbows close to the body to limit movement when handling tubing.

6. Do not store glassware near the edge of shelves. Store large or heavier glassware on lower shelves.

7. Use glassware of the proper size. Allow at least 20% free space. Grasp a three-neck flask by the middle neck, not a side neck.

8. Do not attempt to catch glassware if it is dropped or knocked over.

9. Conventional laboratory glassware must never be pressurized.

SECTION 2.2 - GENERAL SAFETY EQUIPMENT

Workers in a laboratory environment are surrounded by physical and chemical hazards, and the potential for accident and injury is always present. Adequate safety equipment in good working order shall be provided to prevent accidents and injury.

A. Fire Extinguishers

1. Laboratory personnel should be adequately trained regarding pertinent fire hazards associated with their work. (See Section 7.1 - "Training")

2. Fire extinguishers must be clearly labeled to indicate the types of fire they are designed to extinguish. The following codes as presented in NFPA 10 "Portable Fire Extinguishers" are:

- Class A-fires in ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics.

- Class B-fires in flammable liquids, oils, greases, tars, oil-base paints, lacquers and flammable gases.

- Class C-fires that involve energized electrical equipment where the electrical conductivity of the extinguishing medium is of importance; when electrical equipment is de-energized, extinguishers for class A or B fires may be safely used.

- Class D-Fires of combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.

3. Fire extinguishers of the "Halon" type are specially designed so they leave no residue that could damage instruments or computers. (However, the area should be thoroughly ventilated before being reoccupied.)

4. Fire extinguishers should never be concealed from general view or blocked from access.

B. Safety Showers

If all protective measures fail and an employee receives a chemical splash to their body, then safety showers should be provided throughout the laboratory for immediate and thorough washing of the body.

1. Employees should familiarize themselves with the location of the nearest safety shower.

2. Employees should be familiar with the operation of the safety showers.

3. Safety showers are designed to flood the entire body in the event of a clothing fire or a major spill of a chemical. In either case, an employee should simply stand under the shower and activate the shower. Flood the affected area for a minimum of 15 to 30 minutes.

4. In the case of a corrosive liquid spill, the employee should remove the affected portion of clothing to reduce potential contact. Removal of clothing should be done while the individual is under the activated shower.

5. The departmental chemical hygiene officer or laboratory supervisor should be notified as soon as possible if the employee required the use of the safety shower.

6. Safety showers are to be tested annually.

C. Eyewash Fountains

If all protective measures fail and an employee receives a chemical splash to their eyes, then eye wash fountains should be provided throughout the laboratory for immediate and thorough washing of the eyes.

1. Employees should familiarize themselves with the location and operation of the nearest eyewash fountain.

2. If the employee is wearing contact lenses: See Section 2.3.A-4.

3. Always flood the eyes for at least 15 to 30 minutes to be sure there is no residue of the corrosive liquid. Flush from the eye outward.

4. After thorough washing, the proper authorities should be notified and subsequent medical care for the employee should be seriously considered. This is because serious damage may have already occurred before the eye was thoroughly rinsed and/or the damage may not be immediately apparent.

5. Eyewash fountains should be tested weekly by laboratories for proper operation and to prevent formation of bacteria.

D. First Aid Kits

1. First aid kits, which should be located in conspicuous places (with location clearly marked) in the laboratory, are to be used for the immediate response to minor injuries, such as cuts or minor burns. All injury victims have the option of obtaining medical treatment or consultation.

2. Minor injuries requiring first aid shall always be reported to a supervisor:

a. A minor injury may indicate a hazardous situation which should be corrected to prevent a more serious injury.

b. It is important to document a minor injury as having been "work related" for the purpose of obtaining Worker's Compensation, should the injury lead to later, more serious, complications.

3. The location and phone number of emergency services and the Poison Control Center should be clearly posted.

4. A designated party should be responsible for monitoring and maintaining the first aid kit(s). There should be a log attached to the kit indicating the last inspection date and by whom the kit was inspected.

5. First aid kit contents should include items such as Band-aids®, sterile gauze pads, bandages, scissors, antiseptic wipes or ointments, and a first aid card. All kits should also contain examination gloves for response to emergencies in which blood is present. Pocket masks for CPR procedures are also recommended.

6. The following items are not recommended for use in a first-aid kit:

a. Iodine - Tissue damage can be caused by improper use.

b. Ice Pack Compress - If there is swelling of soft tissue, or other need for an ice pack, the person should be examined by a physician.

c. Ammonia Inhalants - If an individual is unconscious, obtain help -- do not use ammonia.

d. Tourniquet - Not required for minor injuries; use the pressure technique until medical assistance is available.

7. Laboratories where high-voltage equipment is in use should have available an emergency electrical response board. This will contain an instruction card and a non-conductive stick to turn off the equipment and remove the shock victim from contact with the source

E. Explosion-Proof Refrigerators

If there is a need to refrigerate a substance that is flammable, it shall be refrigerated in an U.L. listed or F.M. approved explosion-proof refrigerator. This refrigerator is designed as such that any flammable vapors in the refrigerator do not contact sparks.

This refrigerator must not be used for the storage of food.

F. Ventilation Hoods

1. Laboratory Hoods

Work that involves hazards and noxious materials which are toxic, odoriferous, volatile or harmful shall be conducted within a laboratory hood.

The primary purpose of a laboratory hood is to keep toxic or irritating vapors and fumes out of the general laboratory working area. A secondary purpose is to serve as a shield between the worker and equipment being used when there is the possibility of an explosive reaction. This is done by lowering the sash of the hood.

a. Hood ventilation systems are best designed to have an airflow of not less than 60 ft/min (linear) and not more than 120 ft/min (linear) across the face of the hood. Flow rates of higher than 125 ft/min can cause turbulence problems and are not recommended. If possible, a mark will have been placed on the hood so the sash can be drawn to a point where 100 linear ft/min can be achieved.

b. Avoid creation of strong cross drafts (100 fpm) caused by open doors and windows, air conditioning and/or heating vents, or personnel movement. Drafts will pull contaminants from the hood and into the laboratory.

100 FPM is generally not perceptible (100 fpm is approximately 3 mph, a normal walking pace). Air conditioning and heating vents and personnel traffic all create airflows in excess of 200 FPM, often much higher. Therefore, laboratory activity in the hood area should be minimized while the hood is in use.

c. DO NOT ADJUST BAFFLES unless you have been instructed to do so by your departmental CHO. Do not remove baffles. If ventilation problems develop, contact the Facilities Operations Department.

d. When not in use, the sash of the hood should be kept closed. While performing work in the hood, the sliding sash should be kept at the height designated to provide the minimum face velocity required (usually 100 lfm). This will ensure maximum velocity of air flow into the hood and out of the laboratory.

e. Work should be performed as deeply within the fume hood as possible. Equipment, reagents, and glassware should be placed as far back in the hood as is practical without blocking the rear baffle. Solid objects placed at the face of the hood cause turbulence in the air flow. Therefore, each hood should have a clearly marked "safety zone" in which no work should be conducted or equipment placed.

f. ONLY ITEMS NECESSARY TO PERFORM THE PRESENT EXPERIMENT SHOULD BE IN THE HOOD. The more equipment in the hood, the greater the air turbulence and the chance for gaseous escape into the lab.

g. When instrumentation is utilized for a process inside a hood, all instruments should be elevated a minimum of two inches from the hood base to facilitate proper air movement.

h. The purpose and function of a hood is NOT to store chemicals or unused items. The fume hood is not a storage cabinet.

i. Hoods shall not be used as a means of disposing of toxic or irritating chemicals, but only as a means of removing small quantities of vapor which might escape during laboratory operations. If vaporization of large quantities of such materials is a necessary part of the operation, a means of collecting the vapor by distillation or scrubbing should be considered, rather than allowing it to escape through the hood vent. The collected liquid can then be disposed of as a liquid waste.

j. Some hoods are constructed of stainless steel. These are usually "perchloric acid hoods" or "radioisotope hoods." Never use perchloric acid in a hood not designed for that use. Perchloric acid hoods have a wash-down feature which should be used after each use of the hood

and at least every two weeks when the hood is not in use. Date of wash-down should be recorded by the laboratory.

k. Always look to assure fan motor power switch is in the "on" position before initiating experiment. Note: Some hoods do not have individual "on/off" switches and remain "on" continuously.

l. Do not use infectious material in a chemical fume hood.

m. Exhaust fans should be spark-proof if exhausting flammable vapors and corrosive resistant if handling corrosive fumes.

n. Controls for all services (i.e., vacuum, gas, electric, water) should be located at the front of the hood and should be operable when the hood door is closed.

o. Radioactive materials may not be used in the hoods without prior approval of the Radiological Safety Officer.

p. An emergency plan should be prepared in the event of ventilation failure or other unexpected occurrence such as fire or explosion in the hood.

ALWAYS ASSURE THE HOOD IS OPERATIONAL BEFORE INITIATING AN EXPERIMENT.

2. Biological Safety Cabinets

Biological Safety cabinets are among the most effective, as well as the most commonly used, primary containment devices in laboratories working with infectious agents.

Class I and II biological safety cabinets, when used in conjunction with good microbiological techniques, provide an effective partial containment system for safe manipulation of moderate and some high-risk microorganisms.

It is imperative that Class I and II biological safety cabinets are tested and certified in situs, any time the cabinet is moved, and at least annually thereafter. Certification at locations other than the final site may attest to the performance capability of the individual cabinet or model but does not supersede the critical certification prior to use in the laboratory.

As with any other piece of laboratory equipment, personnel must be trained in the proper use of the biological safety cabinets. Of particular note are those activities which may disrupt the inward directional airflow through the work opening of Class I and II cabinets. Aerosol particles can escape the cabinet in various ways. Among these are repeated insertion and withdrawal of workers' arms in and from the work chamber, opening and closing doors to the

laboratory or isolation cubicle, improper placement or operation of materials or equipment within the work chamber, or brisk walking past the cabinet while it is in use. Strict adherence to recommended practices for the use of biological safety cabinets is as important in attaining the maximum containment capability of the equipment as is the mechanical performance of the equipment itself. Always decontaminate the hood using procedures adopted by the laboratory after each use or at the end of the work day.

BIOLOGICAL SAFETY CABINETS ARE NOT CHEMICAL FUME HOODS AND SHALL NOT BE USED AS SUCH.

3. Specialized Local Ventilation

Some instruments such as atomic absorption spectrophotometers (AA's) or inductively coupled argon spectrometers (ICP's) emit small quantities of hazardous materials during use. To prevent excessive accumulations of these materials, each of these instruments should be provided with an individual ventilation exhaust duct (as required by the manufacturer and ASHRAE). Gas chromatography equipment using thermal conductivity detection should be kept in a hood or have a vent over the column outlets.

G. Flammable-Liquid Storage Cabinets

Cabinets designed for the storage of flammable liquids should be properly used and maintained. Read and follow the manufacturer's information and also follow these safety practices:

a. Store only compatible materials inside a cabinet.

b. Do not store paper or cardboard or other combustible packaging material in a flammable-liquid cabinet.

c. The manufacturer establishes quantity limits for various sizes of flammable-liquid storage cabinets; do not overload a cabinet.

NFPA Guidelines and OSHA Standards on Flammable Liquids are utilized as standards for Worker/Fire Protection at FordhamUniversity. In all laboratory work with flammable liquids the requirements of 29 CFR (H)-(L), NFPA 30, and NFPA 45 should be consulted and followed.

H. Safety Shields

Safety shields should be used for protection against possible explosions, implosions or splash hazards. Laboratory equipment should be shielded on all sides so that there is no line-of-sight exposure of personnel.

Provided its opening is covered by closed doors, the conventional laboratory exhaust hood is a readily available built-in shield. However, a portable shield should also be used when manipulations are performed, particularly with hoods that have vertical-rising doors rather than horizontal-sliding sashes.

Portable shields can be used to protect against hazards of limited severity, e.g., small splashes, heat, and fires. A portable shield, however, provides no protection at the sides or back of the equipment and many such shields are not sufficiently weighted and may topple toward the worker when there is a blast (permitting exposure to flying objects). A fixed shield that completely surrounds the experimental apparatus can afford protection against minor blast damage.

SECTION 2.3 - PERSONAL PROTECTIVE EQUIPMENT

OSHA's standard on personal protective equipment, 29CFR 1910 132, Subpart I (here-after referred to as the standard), imposes several new and important requirements relating to basic safety and health programs. The standard adds new general requirements for the selection and use of personal protective equipment (PPE). Included in these requirements are the following:

- Employers must conduct a hazard assessment to determine if hazards present necessitate the use of PPE.
- Employers must certify in writing that the hazard assessment was conducted.
- PPE selection must be made on the basis of hazard assessment and affected workers properly trained.
- Defective or damaged PPE must not be used.
- Established training requirements for employees using PPE must be established. This should include requirements for employees to demonstrate an understanding of the training.
- Employer must certify in writing that training programs were provided and understood.

At FordhamUniversity, the EHS Officer may be contacted to assist departments with their hazard assessment and the required PPE training.

A variety of laboratory personal protective equipment is commercially available and commonly used in laboratories. However, for the equipment to perform the desired function, it must be used and managed properly. Laboratory supervisors and/or departmental chemical hygiene officers shall determine a need for such equipment, monitor its effectiveness, train the employees, and monitor and enforce the proper use of such equipment.

A. Eye Protection

Eye protection is mandatory in all areas where there is potential for injury. This applies not only to persons who work continuously in these areas, but also to persons who may be in the area only temporarily, such as maintenance or clerical personnel. All eye protective equipment shall comply with the requirements set forth in the American National Standard for Occupational and Educational Eye and Face Protection, Z 87.1-1968.

1. The type of eye protection required depends on the hazard. For most situations, safety glasses with side shields are adequate. Where there is a danger of splashing chemicals, goggles are required. More hazardous operations include conducting reactions which have potential for explosion and using or mixing strong caustics or acids. In these situations, a face shield or a combination of face shield and safety goggles or glasses should be used.

2. Plastic safety glasses should be issued to employees who do not require corrective lenses.

3. For persons requiring corrective lenses, safety glasses ground to their prescription are available in a safety frame. Please note that the wearing of safety glasses does not excuse the employee from the requirement of wearing safety goggles.

4. It is recommended that contact lenses not be permitted in the laboratory. The reasons for this prohibition are:

a. If a corrosive liquid should splash in the eye, the natural reflex to clamp the eyelids shut makes it very difficult, if not impossible, to remove the contact lens before damage is done.

b. The plastic used in contact lenses is permeable to some of the vapors found in the laboratory. These vapors can be trapped behind the lenses and can cause extensive irritation.

c. The lenses can prevent tears from removing the irritant.

If the Departmental Chemical Hygiene Officer chooses to allow contact lenses to be worn, they shall be protected by goggles designed specifically for use with contact lenses. (The protective goggles for use with contact lenses fit loosely around the eyes and have no vents for access by vapors.) If chemical vapors contact the eyes while wearing contact lenses, these steps should be followed:

(1) Immediately remove the lenses.

(2) Continuously flush the eyes, for at least 15 to 30 minutes.

(3) Seek medical attention.

5. Although safety glasses are adequate protection for the majority of laboratory operations, they are not sufficient for certain specific operations where there is danger from splashes of corrosive liquids or flying particles. Examples are: washing glassware in chromic acid solution, grinding materials, or laboratory operations using glassware where there is significant hazard of explosion or breakage (i.e., in reduced or excess pressure or temperature). In such cases, goggles or face shields shall be worn if there is need for protection of the entire face and throat.

6. If, despite all precautions, an employee should experience a splash of corrosive liquid in the eye, the employee is to proceed (with the assistance of a co-worker, if possible) to the nearest eyewash fountain and flush the eyes with water for at least 15 to 30 minutes. Flush from the eye outward. During this time, a co-worker should notify the proper authorities.

7. Visitors shall follow the same eye protection policy as employees. If they do not provide their own eye protection, it is the laboratory's responsibility to provide adequate protection. It should be the responsibility of the employee conducting the tour to enforce this policy. After use safety glasses/goggles used by visitors should be cleaned prior to reuse.

B. Clothing

The following guidelines for laboratory clothing are offered strictly from a safety standpoint.

1. Due to the potential for ignition, absorption, and entanglement in machinery, loose or torn clothing should be avoided unless wearing a lab coat.

2. Dangling jewelry and excessively long hair pose the same type of safety hazard.

3. Finger rings or other tight jewelry which is not easily removed should be avoided because of the danger of corrosive or irritating liquids getting underneath the piece and producing irritation.

4. Lab coats should be provided for protection and convenience. They should be worn at all times in the lab areas. Due to the possible absorption and accumulation of chemicals in the material, lab coats should not be worn in the lunchroom or elsewhere outside the laboratory.

5. Where infectious materials are present, closed (snapped) lab coats and gloves are essential.

6. Shoes shall be worn at all times in the laboratories. Sandals, open-toed shoes, and shoes with woven uppers, shall not be worn because of the danger of spillage of corrosive or irritating chemicals.

7. Care should be exercised in protective clothing selection; some protective clothing has very limited resistance to selected chemicals or fire.

8. Consult the MSDS for a chemical to find out the recommended clothing or PPE for a particular chemical. (Examples are latex, nitrile, or PVC gloves, or aprons.)

C. Aprons - Rubber or Plastic

Some operations in the laboratory, like washing glassware, require the handling of relatively large quantities of corrosive liquids in open containers. To protect clothing in such operations, plastic or rubber aprons may be supplied. A high-necked, calf- or ankle-length, rubberized laboratory apron or a long-sleeved, calf- or ankle-length, chemical- and fire-resistant laboratory coat should be worn anytime laboratory manipulation or experimentation is being conducted. Always wear long-sleeved and long-legged clothing; do not wear short-sleeved shirts, short trousers, or short skirts.

D. Gloves

When handling chemicals, it is recommended that the correct gloves be used to protect the worker from accidental spills or contamination. If the gloves become contaminated they should be removed and discarded as soon as possible. There is no glove currently available that will protect a worker against all chemicals.

Protection of the hands when working with solvents, detergents, or any hazardous material is essential in the defense of the body against contamination. Exposure of the hands to a potentially hazardous chemical could result in burns, chafing of the skin due to extraction of essential oils ("de-fatting"), or dermatitis. The skin could also become sensitized to the chemical and once sensitized, could react to lesser quantities of chemicals than otherwise would have any effect. It is well documented that primary skin irritations and sensitizations account for significantly greater numbers of lost time incidents on the job than any other single type of industrial injury.

Proper selection of the glove material is essential to the performance of the glove as a barrier to chemicals. Several properties of both the glove material and the chemical with which it is to be used should influence the choice of the glove. Some of these properties include: permeability of the glove material, breakthrough time of the chemical, temperature of the chemical, thickness of the glove material, and the amount of the chemical that can be absorbed by

the glove material (solubility effect). Glove materials vary widely in respect to these properties; for instance, neoprene is good for protection against most common oils, aliphatic hydrocarbons, and certain other solvents, but is unsatisfactory for use against aromatic hydrocarbons, halogenated hydrocarbons, ketones, and many other solvents.

Gloves of various types are available and should be chosen for each specific job for compatibility and breakthrough characteristics. An excellent information is Guidelines for the Selection of Chemical Protective Clothing published by the American Conference of Governmental Industrial Hygienists (ACGIH) or information provided by glove manufacturers.

1. Selection

For concentrated acids and alkalis, and organic solvents, natural rubber, neoprene or nitrile gloves are recommended. For handling hot objects, gloves made of heat-resistant materials (leather or Nomex) should be available and kept near the vicinity of ovens or muffle furnaces. A hot object should never be picked up with rubber or plastic gloves. Special insulated gloves should be worn when handling very cold objects such as liquid N2 or CO2. Do not use asbestos containing gloves.

2. Inspection

Before each use, gloves should be inspected for discoloration, punctures, and tears. Rubber and plastic gloves may be checked by inflating with air and submersing them in water to check for air bubbles.

3. Usage

Gloves should always be rinsed with a compatible solvent, soap and water prior to handling wash bottles or other laboratory fixtures.

4. Cleaning

Before removal, gloves should be thoroughly washed, either with tap water or soap and water.

5. Removal

Employees shall remove gloves before leaving the immediate work site to prevent contamination of door knobs, light switches, telephones, etc. When gloves are removed, pull the cuff over the hand.

E. Respirators

Respirator use should be avoided if at all possible (and is usually not required if adequate precautions are taken). Where possible, engineering controls (fume hoods, etc.) should be utilized to minimize expFordhamre. If respirators are worn because OSHA PELs are being exceeded or other reasons, a respirator program must be established in accordance with OSHA 29 CFR 1910.134. Your Departmental Chemical Hygiene Officer should be consulted for additional information and guidance.

SECTION 2.4 - COMPRESSED GAS SAFETY

Many laboratory operations require the use of compressed gases for analytical or instrument operations. Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be combustible, explosive, corrosive, poisonous, inert, or a combination of hazards. If the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion (which allow for fast permeation throughout the laboratory) present a danger of fire or explosion. Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation, can be caused by high concentrations of even "harmless" gases such as nitrogen. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb. In summary, careful procedures are necessary for handling the various compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas glow, and the piping used to confine gases during flow.

A. Identification

1. The contents of any compressed gas cylinder shall be clearly identified for easy, quick, and complete determination by any laboratory worker. Such identification should be stenciled or stamped on the cylinder or a label, provided that it cannot be removed from the cylinder. Commercially available three-part tag systems can be very useful for identification and inventory. No compressed gas cylinder shall be accepted for use that does not legibly identify its contents by name. Color coding is not a reliable means of identification; cylinder colors vary with the supplier, and labels on caps have little value as caps are interchangeable. If the labeling on a cylinder becomes unclear or an attached tag is defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer.

2. All gas lines leading from a compressed gas supply should be clearly labeled to identify the gas, the laboratory served, and the relevant emergency telephone numbers. The labels should

be color coded to distinguish hazardous gases (such as flammable, toxic, or corrosive substances) (e.g., a yellow background and black letters). Signs should be conspicuously posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions (e.g., HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES).

B. Handling and Use

1. Since gas cylinders are tall and narrow, they shall be secured at all times to prevent tipping . Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non-tip base attached.

2. When new cylinders are received, they should be inspected. During this inspection, one should insure the proper cap is securely in place and the cylinder is not leaking. Cylinders shall have clear labels indicating the type of gas contained. If the cylinders are acceptable, they shall be stored in a proper location. If a leaking cylinder is discovered, move it to a safe place (if it is safe to do so) and call the vendor as soon as possible. Under no circumstances should any attempt be made to repair a cylinder or valve.

3. Cylinders containing flammable gases such as hydrogen or acetylene shall not be stored in close proximity to open flames, areas where electrical sparks are generated, or where other sources of ignition may be present. Cylinders containing acetylene shall never be stored on their side. An open flame shall never be used to detect leaks of flammable gases. Hydrogen flame is invisible, so "feel" for heat. All cylinders containing flammable gases should be stored in a well-ventilated area.

4. Oxygen cylinders, full or empty, shall not be stored in the same vicinity as flammable gases. The proper storage for oxygen cylinders requires that a minimum of 20 feet be maintained between flammable gas cylinders and oxygen cylinders or the storage areas be separated, at a minimum, by a fire wall five feet high with a fire rating of 0.5 hours. Greasy and oily materials shall never be stored around oxygen; nor should oil or grease be applied to fittings.

5. Standard cylinder-valve outlet connections have been devised by the Compressed Gas Association (CGA) to prevent mixing of incompatible gases. The outlet threads used vary in diameter; some are internal, some are external; some are right-handed, some are left-handed. In general, right-handed threads are used for non-fuel and water-pumped gases, while left-handed threads are used for fuel and oil-pump gases. To minimize undesirable connections, only CGA standard combinations of valves and fittings should be used in compressed gas installations; the assembly of miscellaneous parts should be avoided. The threads on cylinder valves, regulators and other fittings should be examined to ensure they correspond and are undamaged.

Cylinders should be placed with the valve accessible at all times. The main cylinder valve should be closed as soon as it is no longer necessary that it be open (i.e., it should never be left open when the equipment is unattended or not operating). This is necessary not only for safety when the cylinder is under pressure, but also to prevent the corrosion and contamination resulting from diffusion of air and moisture into the cylinder after it has been emptied.

Cylinders are equipped with either a hand wheel or stem valve. For cylinders equipped with a stem valve, the valve spindle key should remain on the stem while the cylinder is in service. Only wrenches or tools provided by the cylinder supplier should be used to open or close a valve. At no time should pliers be used to open a cylinder valve. Some valves may require washers; this should be checked before the regulator is fitted.

Cylinder valves should be opened slowly. Main cylinder valves should never be opened all the way.

When opening the valve on a cylinder containing an irritating or toxic gas, the user should position the cylinder with the valve pointing away from them and warn those working nearby.

6. Regulators are gas specific and not necessarily interchangeable. Always make sure that the regulator and valve fittings are compatible. If there is any question as to the suitability of a regulator for a particular gas, check with Environmental Health Services or call your vendor for advice. After the regulator is attached, the cylinder valve should be opened just enough to indicate pressure on the regulator gauge (no more than one full turn) and all the connections checked with a soap solution for leaks. Never use oil or grease on the regulator of a cylinder valve.

7. Piping material shall be compatible with the gas being supplied. Copper piping shall not be used for acetylene, nor plastic piping for any portion of a high pressure system. Do not use cast iron pipe for chlorine; do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an accident. Distribution lines and their outlets should be clearly labeled as to the type of gas contained. Piping systems should be inspected for leaks on a regular basis. Special attention should be given to fittings as well as possible cracks that may have developed.

8. A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi) (the residual contents may become contaminated if the valve is left open). When work involving a compressed gas is completed, the cylinder must be turned off, and if possible, the lines bled. When the cylinder needs to be removed or is empty (see above), all valves shall be closed, the system bled, and the regulator removed. The valve cap shall be replaced, the cylinder clearly marked as "empty," and returned to a storage area for pickup by the supplier. Empty and full cylinders should be stored in separate areas.

9. Where the possibility of flow reversal exists, the cylinder discharge lines should be equipped with approved check valves to prevent inadvertent contamination of cylinders connected to a closed system. "Sucking back" is particularly troublesome where gases are used as reactants in a closed system. A cylinder in such a system should be shut off and removed from the system when the pressure remaining in the cylinder is at least 172 kPa (25 psi). If there is a possibility that the container has been contaminated, it should be so labeled and returned to the supplier.

10. Liquid bulk cylinders may be used in laboratories where a high volume of gas is needed. These cylinders usually have a number of valves on the top of the cylinder. All valves should be clearly marked as to their function. These cylinders will also vent their contents when a preset internal pressure is reached, therefore, they should be stored or placed in service where there is adequate ventilation. If a liquid fraction is removed from a cylinder, proper hand and eye protection must be worn and the liquid collected in a Dewar flask.

11. Always use safety glasses (preferably a face shield) when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines.

12. All compressed gas cylinders, including lecture-size cylinders, shall be returned to the supplier when empty or no longer in use.

C. Transportation of Cylinders

The cylinders that contain compressed gases are primarily shipping containers and should not be subjected to rough handling or abuse. Such misuse can seriously weaken the cylinder and render it unfit for further use or transform it into a rocket having sufficient thrust to drive it through masonry walls.

1. To protect the valve during transportation, the cover cap should be screwed on hand tight and remain on until the cylinder is in place and ready for use.

2. Cylinders should never be rolled or dragged.

3. When moving large cylinders, they should be strapped to a properly designed wheeled cart to ensure stability.

4. Only one cylinder should be handled (moved) at a time.

D. Cryogenic Liquids

A number of hazards may be present from the use of cryogenic liquids in the laboratory. Employees should be properly trained in these hazards prior to use. The transfer of liquefied gases from one container to another should not be attempted for the first time without the direct supervision and instruction of someone experienced in the operation.

1. Fire/Explosions

a. Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air and lead to a potentially explosive condition.

b. Adequate ventilation must always be used to prevent the build-up of vapors of flammable gases such as hydrogen, methane, and acetylene.

c. Adequate ventilation is also required when using gases such as nitrogen, helium, or hydrogen. In these cases, oxygen can be condensed out of the atmosphere creating a potential for explosive conditions.

2. Pressure

Cylinders and other pressure vessels used for the storage and handling of liquefied gases should not be filled to more than 80% of capacity, to prevent the possibility of thermal expansion and the resulting bursting of the vessel by hydrostatic pressure.

3. Embrittlement of Structural Materials

Appropriate impact-resistant containers must be used that have been designed to withstand the extremely low temperatures.

4. Contact With and Destruction of Living Tissue

Even very brief contact with a cryogenic liquid is capable of causing tissue damage similar to that of thermal burns. Prolonged contact may result in blood clots that have potentially serious consequences. In addition, surfaces cooled by cryogenic liquids can cause severe damage to the skin. Gloves and eye protection (preferably a face shield) should be worn at all times when handling cryogenic liquids. Gloves should be chosen that are impervious to the fluid being handled and loose enough to be tossed off easily. Appropriate dry gloves should be used when handling dry ice. "Chunks" or cubes should be added slowly to any liquid portion of the cooling bath to avoid foaming over.

5. Asphyxiation

As the liquid form of gases warm and become airborne, oxygen may be displaced to the point that employees may experience oxygen deficiency or asphyxiation. Any area where such materials are used should be well ventilated. For this same reason, employees should avoid lowering their heads into a dry ice chest. (Carbon dioxide is heavier than air, and suffocation can result.)

SECTION 2.5 - SAFETY PRACTICES FOR DISPOSAL OF BROKEN GLASSWARE

Inspect all glassware before use. Do not use broken, chipped, starred or badly scratched glassware. If it cannot be repaired, discard it in containers specifically designated for broken glass. All broken glass requires special handling and disposal procedures to prevent injury not only to lab personnel, but members of the custodial staff as well.

All broken glass shall be disposed in rigid, puncture proof containers such as a cardboard box with taped seams, or a plastic bucket or metal can with a sealing lid. All broken glass disposal containers shall be clearly marked "DANGER - BROKEN GLASS" Limit quantities to no more than approximately 15 to 20 pounds so that lifting of the container will not create a situation that could cause back injury.

1. Food, beverage, and uncontaminated glassware: Dispose in a rigid, puncture proof container such as a box with sealed or taped edges or a metal or thick plastic can or bucket with a sealing lid. Label container "DANGER - BROKEN GLASS".;

2. Radioactive glassware: Contact the Radiological Safety Officer for specific instructions.

3. Glassware with biological contamination: Glassware that has been in contact with infectious agents may include: used slides, cover slips, test tubes, beakers, pipettes, etc. Contaminated glassware shall be disinfected before disposal. Dispose in a rigid, puncture proof container such as a box with sealed or taped edges or a metal or thick plastic can or bucket with a sealing lid. Label container "DANGER - BROKEN GLASS". Contact the Biological Safety Officer if you require further information.

4. Glassware with chemical contamination: Empty the contents of the glassware into a suitable container if safe to do so. (See Section 3.4 - "Chemical Waste" for disposal procedures.)

CHAPTER 3.0 - CHEMICAL HYGIENE PLAN

29 CFR 1910.1450, "Occupational Exposures to Hazardous Chemicals in Laboratories", referred to as the "Laboratory Standard", specifically addresses mandated regulatory requirements. Many educational institutions, colleges, universities, industry, and other organizations that use hazardous chemicals in their laboratories are required by the Laboratory Standard to develop Chemical Hygiene Plans.

The development of a detailed written chemical hygiene plan is necessary to establish continuity, to train personnel, and to help ensure that all employees recognize and comply with work place safety. It is extremely difficult to effectively communicate and enforce requirements without a detailed written chemical hygiene plan.

An effective chemical hygiene plan necessitates that mechanisms be in place and functioning to ensure that safety policies and procedures are being adhered to, personnel are meeting their safety responsibilities, and an effective form of monitoring and documentation is in place for confirmation purposes.

Laboratories are well advised to develop their written chemical hygiene plans in a manual form. This manual should provide policies and procedures that are feasible, specific, and encompass all the elements of laboratory activities in which the laboratory is engaged. The written safety manual should be distributed to appropriate employees and be a requirement of employee training programs.

The basic Fordham University Laboratory Safety Manual is intended to serve primarily as a general safety document for compliance with various state and federal environmental and occupational health and safety rules and regulations. It is neither feasible nor technically valid to attempt to provide specific procedures or protocols in a general safety document. However, individual laboratories should be able to develop their own specific chemical hygiene plans by augmenting the Fordham University Laboratory Safety Manual.

The development of a detailed written chemical hygiene plan and the implementation of this plan within employee training programs should result in a safer working environment and contribute to a reduction in work place accidents and injuries.

SECTION 3.1 - LABORATORY CHEMICAL SAFETY POLICY

A. Introduction

FordhamUniversity is required by 29 CFR 1910.1450 to develop a chemical hygiene plan for certain laboratories.

The Laboratory Standard (29 CFR 1910.1450) does not apply to all laboratories, but where it applies, it supersedes the Hazard Communication Standard 29 CFR 1910.1200. Even though FordhamUniversity has already implemented the Hazard Communication Standard, the Laboratory Standard takes precedence in those areas to which it applies. There is no option of choosing between the two standards. If the Laboratory Standard applies to an area, it must be implemented. If the Laboratory Standard does not apply, then the Hazard Communication Standard does apply.

It is therefore the intent of this Laboratory Chemical Safety Policy to define the guidelines for the implementation of the Laboratory Standard.

B. Scope and Definitions

The Fordham Laboratory Safety Chemical Policy applies only to certain laboratories. Many laboratories use hazardous chemicals. OSHA defines a hazardous chemical as a substance for which there is a statistically significant evidence, based on at least one scientific study, showing that acute or chronic harm may result from exposure to that chemical. This broad definition clearly applies to almost all of the chemicals typically used in laboratories.

The purpose of the Fordham Laboratory Safety Chemical Policy is to protect laboratory employees, while they are working in a laboratory, from harm due to potential exposure to hazardous chemicals. In addition to employees who ordinarily spend their full time working in a laboratory space, for the purposes of this policy "laboratory employee" also includes office, custodial, maintenance, and repair personnel, and others who, as part of their duties, regularly spend a significant amount of their time within a laboratory environment.

The Fordham Laboratory Chemical Safety Policy does not apply to all places where hazardous chemicals are used. Only laboratories meeting the following four criteria are subject to the Fordham Laboratory Chemical Safety Policy:

1. Chemical manipulations are carried out on a laboratory scale. That is, the work with chemicals is in containers of a size that could be easily and safely manipulated by one person.

2. Multiple chemical procedures or chemicals are used.

3. Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

4. The procedures involved are not part of a production process whose function is to produce commercial quantities of materials, nor do the procedures in any way simulate a production process.

Some laboratories may also be required to meet the requirements of substance-specific federal standards in addition to the Laboratory Standard. One set of such standards is contained in OSHA's 29 CFR 1910.1000 - 1999.

C. University Responsibilities

FordhamUniversity has certain obligations. Among these the University must:

1. Keep records of employee exposures to hazardous chemicals:

a. Records should include measurements made to monitor exposures, if any, as well as any medical consultations and examinations, including written opinions.

2. Provide University employees with:

a. Training and information regarding chemical and physical hazards.

b. Identification of other hazards (see Subparts D through T of 29 CFR).

c. Access to medical consultation and examinations. (See part F of this policy)

d. Respirators when necessary (see item 6 of this list).

3. For incoming hazardous chemicals:

a. Require that the incoming hazardous chemicals have adequate labels. Do not allow the removal or defacement of these labels.

b. Require that the MSDSs for incoming hazardous chemicals be on hand prior to receipt of hazardous chemicals whenever possible. Require that MSDSs be acquired for all hazardous chemicals on hand whenever possible.

c. Keep all material safety data sheets (MSDS) that the University receives.

d. Make MSDSs accessible to employees.

e. Maintain an accurate inventory of all chemicals in University laboratories.

4. When hazardous chemicals are generated in University laboratories:

a. If the hazardous properties are known, train University employees.

b. If the hazardous properties are not known, treat the chemical as though it is hazardous and provide protection as described in the laboratory Chemical Hygiene Plan.

c. If the chemicals are produced for use elsewhere, follow 29 CFR 1910.1200 and the various Environmental Protection Agency (EPA) and Department of Transportation (DOT) regulations that apply to that chemical.

5. If there is reason to believe that the action level, or PEL if there is no action level, has been exceeded for any chemical for which a substance-specific standard has been established, the University must measure the concentration of that chemical in the air.

If the level measured is greater that the PEL or action level, then:

a. Notify all affected laboratory employees of the results of the measurement, and

b. Comply with the OSHA exposure-monitoring provisions for that chemical, as stated in 29 CFR 1910.1000 through 1910.1199.

6. If respirators are necessary to keep exposures below the PEL or action level, follow the requirements of the Respiratory Protection Standard, 29 CFR 1910.134.

7. If select carcinogens, reproductive toxins, or acute toxins that are very highly toxic are used in the laboratory, identify and post one or more areas as "designated area(s)."

8. Require that each University Department or similar University administrative unit which has laboratories subject to the Laboratory Standard appoint a Departmental Chemical Hygiene Officer (DCHO).

a. These individuals should be qualified by training and experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan. This assignment can be a second title for a person who has other responsibilities.

b. The University President has the ultimate responsibility for chemical safety. The Departmental Chemical Hygiene Officers act as the representative of the University President in this capacity.

9. Assign to the DCHO's the duty to prepare, implement, and maintain a written program for their Department, called a chemical hygiene plan (CHP), setting forth the work practices, procedures, personal protective equipment, and other equipment that will protect employees from harm arising from hazardous chemicals used in the laboratories in their Department.

a. The CHP must be capable of keeping employee exposures below the PEL of chemicals as listed in 29 CFR 1910 Subpart Z.

b. The CHP must be readily accessible to employees.

c. The CHP must be reviewed at least annually and updated as necessary.

D. Individual Responsibilities

Responsibility for chemical hygiene rests at all levels including the:

1. University President, who has ultimate responsibility for chemical hygiene within FordhamUniversity and must, with other administrators, provide continuing support for University chemical hygiene.

2. Department who is responsible for chemical hygiene in that unit.

3. Departmental Chemical Hygiene Officers, who have overall responsibility for chemical hygiene in all departmental laboratories including responsibility to:

a. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices;

b. Help project directors develop precautions and adequate facilities;

c. Ensure that workers know and follow the chemical hygiene rules and document that appropriate training has been provided;

d. Determine the required levels of protective apparel and equipment and insure that this equipment is available and in working order;

e. Monitor procurement, use, and disposal of chemicals in the lab;

f. Ensure an MSDS for all chemicals in use is maintained and available to all personnel working in the department’s labs

g. Maintain an accurate Departmental Chemical Inventory List.

h. Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;

i. Know the current legal requirements concerning regulated substances; and

j. Seek ways to improve the chemical hygiene program.

4. Project director or director of other specific operation, who has primary responsibility for chemical hygiene procedures for that operation, and is responsible for:

a. Insuring that the Departmental Chemical Hygiene Officer receives copies of all MSDSs received

b. Maintaining an accurate Laboratory Chemical Inventory List. Insure that the Departmental Chemical Hygiene Officer receives copies of this list as necessary.

c. Ensuring that workers know and follow the chemical hygiene rules,

d. Ensuring that protective equipment is available and in working odor,

e. Ensuring that all containers in the work area are properly labeled,

f. Ensuring that MSDS's are maintained for each hazardous substance in the laboratory and ensuring that they are readily accessible to laboratory employees,

g. Ensuring that appropriate training has been provided to all employees,

h. Providing regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment,

i. Knowing the current legal requirements concerning regulated substances,

j. Determining the required levels of protective apparel and equipment, and

k. Ensuring that facilities for use of any material being ordered are adequate.

5. Laboratory worker, who is responsible for:

a. Planning and conducting each operation in accordance with safe procedures; and

b. Developing and maintaining good personal chemical hygiene habits.

E. The Content of the Chemical Hygiene Plan

The chemical hygiene plan shall include each of the following elements and shall also indicate the specific measures to be taken to ensure that University employees are protected.

1. Standard operating procedures relevant to all laboratory operations, to be followed by laboratory employees.

2. Statements of the criteria that will be used to determine and implement control measures to reduce employee exposure to hazardous chemicals. These measures include engineering controls, use of personal protective equipment, and personal hygiene practices. Criteria to reduce exposure to extremely hazardous chemicals used in the laboratory shall be specifically included.

3. A requirement that fume hoods and other protective equipment shall function properly and descriptions of the methods to be taken to make sure that such equipment is functioning properly.

4. Provisions for employee training and information.

5. Circumstances under which a laboratory practice requires prior approval from a supervisor before implementation.

6. Provisions for medical consultation and examination.

7. Designation of personnel responsible for implementation of the chemical hygiene plan.

8. Provisions for additional protection for employees when working with particularly hazardous substances, including:

a. Select carcinogens.

b. Reproductive toxins.

c. Substances with a high degree of acute toxicity.

9. Specific mention of the following provisions, including when appropriate:

a. Establishment of a designated area.

b. Use of containment devices such as fume hoods or glove boxes.

c. Procedures for safe removal and disposal of contaminated and hazardous waste; and

d. Decontamination procedures.

F. Exposure Assessments, Medical Consultations, and Examinations

1. Suspected Exposures to Toxic Substances

There may be times when employees or supervisors suspect that an employee has been exposed to a hazardous chemical to a degree and in a manner that might have caused harm to the victim. If the circumstances suggest a reasonable suspicion of exposure, the victim is entitled to a medical consultation and, if so determined in the consultation, also to a medical examination. All medical examinations and consultations shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

a. Criteria for Reasonable Suspicion of Exposure

(1) It is the policy of FordhamUniversity to promptly investigate all employee-reported incidents in which there is even a remote possibility of employee overexposure to a toxic substance.

(2) Events or circumstances that might reasonably constitute overexposure include:

(a) A hazardous chemical leaked or was spilled or was otherwise rapidly released in an uncontrolled manner.

(b) A laboratory employee had direct skin or eye contact with a hazardous chemical.

(c) A laboratory employee manifests symptoms, such as headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment, etc., and some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air, and the symptoms reappear soon after the employee returns to work with the same hazardous chemicals.

(d) Two or more persons in the same laboratory work area have similar complaints.

b. Exposures

All exposure complaints and their disposition, no matter what the ultimate disposition may be, are to be documented by the respective Department Chemical Hygiene Officer using the Accident Report Form. Copies of these forms shall be sent to the human resources department.

(1) Exposure Assessment

In cases of emergency, exposure assessments are conducted after the victim has been treated, otherwise exposure assessments should be completed BEFORE medical consultations are undertaken.

NOTE: It is not the purpose of an exposure assessment to determine that a failure on the part of the victim, or others, to follow proper procedures was the cause of an exposure. The purpose of an exposure assessment is to determine that there was, or was not, an exposure that

might have caused harm to one or more employees and, if so, to identify the hazardous chemical or chemicals involved. Other investigations might well use results and conclusions from an exposure assessment, along with other information, to derive recommendations that will prevent or mitigate any future overexposures. However, exposure assessments determine facts; they do not make recommendations.

(a) Unless circumstances suggest other or additional steps, these actions constitute an exposure assessment:

i. Interview the complainant and also the victim, if not the same person.

ii. List the essential information about the circumstances of the complaint, including:

- The chemical under suspicion.

- Other chemicals used by victim.

- All chemicals being used by others in the immediate area.

- Other chemicals stored in that area.

- Symptoms exhibited or claimed by the victim.

- How these symptoms compare to symptoms stated in the materials safety data sheets for each of the identified chemicals.

- Were control measures, such as personal protective equipment and hoods, used properly?

- Were any air sampling or monitoring devices in place? If so, are the measurements obtained from these devices consistent with other information?

(b) Monitor or sample the air in the area for suspect chemicals.

(c) Determine whether the victim's symptoms compare to the symptoms described in the MSDS or other pertinent scientific literature.

(2) Notification of Results of Monitoring

Within 15 working days of receipt of the results of any monitoring, notify affected employees of those results.

2. Medical Consultation and Examination

If employees feel that they have been exposed to hazardous chemicals, employees are required to contact their respective departmental Chemical Hygiene Officer who will assist them in arranging for an Exposure Assessment if necessary. The Exposure Assessment will be utilized by the consulting physician to determine if further medical consultations and examinations are warranted.

The details of medical consultations and examinations are determined by the physician.

The purpose of a medical consultation is to determine whether a medical examination is warranted. When, from the results of an Exposure Assessment, it is suspected or known that an employee was overexposed to a hazardous chemical or chemicals, the employee should obtain medical consultation from or under the direct supervision of a licensed physician.

When warranted, employees also should receive a medical examination from or under the direct supervision of a licensed physician who is experienced in treating victims of chemical overexposure. The medical professional should also be knowledgeable about which tests or procedures are appropriate to determine if there has been an overexpFordhamre; these diagnostic techniques are called "differential diagnoses."

These provisions apply to medical consultations and examinations:

a. All employees who work with hazardous chemicals must be provided an opportunity to receive medical consultation and examination when:

(1) The employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.

(2) Monitoring, routine or otherwise, suggests that there could have been an exposure above the action level, or OSHA PEL if there is no action level, for a chemical for which an OSHA substance-specific standard has been established.

(3) There is a spill, leak, or other uncontrolled release of a hazardous chemical.

b. Provide the physician with:

(1) The identity of the hazardous chemical or chemicals to which the employee may have been exposed (Formal Exposure Assessment if available).

(2) The exposure conditions.

(3) The signs and symptoms of exposure the victim is experiencing, if any.

c. Ordinarily, physicians will furnish to the human resources department in written form:

(1) Recommendations for follow-up, if determined to be pertinent.

(2) A record of the results of the consultation and, if applicable, of the examination and any tests that were conducted.

(3) Conclusions concerning any other medical condition noted that could put the employee at increased risk.

(4) A statement that the employee has been informed both of the results of the consultation or examination and of any medical condition that may require further examination or treatment.

d. These written statements and records should not reveal specific findings that are not related to an occupational exposure.

e. Documentation

All memos, notes, and reports related to a complaint of actual or possible exposure to hazardous chemicals are to be maintained as part of the record.

f. Notification

Employees shall be notified of the results of any medical consultation or examination with regard to any medical condition that exists or might exist as a result of overexposure to a hazardous chemical.

G. Records and Recordkeeping

1. Employee Exposure and Medical Records

OSHA regulation 29 CFR 1910.20, Access to Employee Exposure and Medical Records, addresses the storage and access to employee exposure and medical records pertaining to toxic substances or harmful physical agents. The following is a summary of this regulation:

a. The medical record for each employee is to be preserved and maintained for at least the duration of employment plus thirty years.

b. Each employee exposure record shall be preserved and maintained for at least thirty years.

c. Each analysis using employee exposure or medical records shall be preserved and maintained for at least thirty years.

d. MSDSs and other descriptions of substances do not have to be retained as long as some record of the identity (chemical name if known) of the substance or agent, where it was used, and when it was used is retained for 30 years.

e. If an employee or their designated representative, requests a copy of the employee's health record, the University is to provide a copy within 15 days of the request, or provide facilities to make copies at no cost, or loan the records to employee or designated representative so that copies can be made.

SECTION 3.2 - HAZARDOUS CHEMICAL WASTE DISPOSAL POLICY

FordhamUniversity will conform to applicable regulations of the State of New York, United States Environmental Protection Agency, United States Department of Transportation, and United States Department of Labor with regard to the safe use, handling, transportation and disposal of chemical substances and waste. The Fordham University Comprehensic ve Waste Management Program includes the requirements for management and disposal of chemical wastes.

SECTION 3.3 - CHEMICAL SAFETY

Working with potentially hazardous chemicals is an everyday occurrence in a laboratory setting. Hazardous situations can occur if employees are not educated in general chemical safety, toxicological information, and procedures for handling and storage for the chemicals they are using. This section of the laboratory manual addresses these educational components and spells out specific protocols to minimize hazardous chemical exposures.

A. Modes of Entry

There are four major modes of entry to chemicals: inhalation, skin absorption, injection, and ingestion. Inhalation and skin absorption are the predominant occupational exposures you may expect to encounter in the laboratory and will be discussed in some detail. Accidental injection of chemicals can be eliminated by good laboratory safety practices. Accidental ingestion of chemicals can be eliminated by a combination of good laboratory and hygienic practices such as washing hands and prohibiting foods, drinks, cosmetics, and tobacco products in the laboratory workplace (see Section 2.1 - "General Safety and Operational Rules"). All potential exposures, i.e., inhalation, skin absorption, injection, and ingestion, are discussed in the Material Safety Data Sheets available for each chemical or product. The hundreds of chemicals which employees are routinely exposed to during the course of their work in the laboratory can be divided into three main types: volatile solvents, corrosives, and toxic solids. The particular hazards associated with exposure to these materials, and ways to avoid them, are discussed in detail below.

B. Basic Chemical Classifications

1. Volatile Solvents

Organic solvents are perhaps the most ubiquitous chemicals found in the laboratory setting. The potential chronic health effects of some of these materials warrant special attention as one is likely to be exposed to more solvents than any other type of chemical. For safety purposes, these chemicals are generally subdivided into two categories: chlorinated and non-chlorinated. This is done mainly because the chlorinated solvents are, in general, not flammable while non-chlorinated solvents are often flammable. It should be kept in mind, however, that the chlorinated solvents do decompose when burned. This results in high concentrations of toxic vapors, such as phosgene and hydrogen chloride.

Keeping in mind the difference in flammability between these two classes of solvents, we can discuss the health effects common to both classes. The primary route of exposure to these materials is through inhalation. In general, high concentrations of the vapor, when inhaled, produce drowsiness, dizziness and headaches. This can occur quite quickly, since chemical vapors are rapidly absorbed. Most of the solvents will also act as upper respiratory and/or eye irritants. One physical property common to most solvents is odor. Unfortunately, the odor of a solvent offers little in the way of determining whether or not the environment is immediately hazardous. Solvent odor thresholds vary widely and acclimation or odor fatigue is often rapid. Odor is also not generally indicative of the degree of hazard that the material presents. Butyl mercaptan has such an extremely disagreeable odor that one cannot tolerate a concentration necessary to be injurious. Chloroform, however, has a sweet odor to many people and tolerance levels can far exceed safe levels.

Chronic effects of solvent exposure vary widely. Of most concern is the potential for lung, liver, and kidney damage posed by some solvents. This, in general, applies to solvents which are not water soluble. Examples of these solvents would be benzene, toluene, xylene, chloroform, carbon tetrachloride, and trichloroethylene. Instances of chronic disease caused by occupational exposure to these solvents have been documented. However, it must be kept in mind that everyone reacts differently and individual susceptibilities are quite variable.

Skin absorption is an additional mode of entry for which an exposure to a solvent may occur. Most commonly, solvents act to de-fat the skin. This will cause drying and cracking of the skin, and may lead to chronic dermatitis with prolonged and repeated exposue. Some solvents can also act as corrosives. Most amines and phenols act in this manner.

In addition, many of the solvents (dimethyl sulfoxide and dimethyl formamide, for example) will penetrate the skin and be absorbed into the body. In this case, the effects of exposure will be analogous to inhalation exposure. Carbon disulfide, n-butyl alcohol, and phenol are common solvents which can penetrate intact skin. For those solvents, there will be a notation of skin exposure noted on the Material Safety Data Sheet. Most skin contact with solvents can be avoided by wearing gloves suitable for that chemical. It is important that the glove be resistant

to the material being handled. Using the wrong glove can give a false sense of security and overexposure via the skin may result. If a solvent penetrates the glove, a prolonged contact will result due to slowed evaporation rates. Rubber and neoprene gloves can be classed as good general purpose gloves, but a chemical resistance chart and the MSDS should always be consulted (See also Section 2.3 - "Personal Protective Equipment").

Direct liquid contact by solvents in the eyes can be very serious. The victim could easily panic. Get them to the eye wash immediately and flush the eyes for at least 15 to 30 minutes. Medical assistance should also be summoned.

In summary, volatile solvents can pose inhalation, skin, and ingestion hazards. Some of the solvents may also be flammable, which could cause fire and/or explosion hazards. Whenever possible, use volatile solvents in a properly operating fume hood to eliminate inhalation hazards, use correct skin and eye protection and use good laboratory and hygienic technique to eliminate any possible ingestion of volatile solvents.

2. Acid and Bases

Common to all acids and bases is their corrosive action on human tissues. Minor exposures are generally reversible, although often painful for a short period of time. The reversibility of the effects of acid or base exposure will depend on three factors: the duration of exposure, concentration of the material, and the first aid methods used.

Exposure can occur through skin absorption or inhalation. With inhalation expFordhamre, remove the victim from the area (try to keep the victim from breathing too deeply, as this may exacerbate the effects) and summon medical help.

Skin contact is the most common route of expFordhamre. Here the concentration and type of acid are the most important factors. In concentrated forms, all types of corrosives may cause severe penetrating burns. Dilute solutions do not have the same warning properties as concentrated forms, so guard against exposure. One should be particularly careful with hydrofluoric acid (see Section 2.2-3).

Neoprene gloves provide the best protection from skin exposure to both acids and bases, but in all cases, follow the recommendations in the MSDS. When using or dispensing concentrated acids or bases, a lab coat or apron and a full face shield is required (see Section 2.3 - "Personal Protective Equipment").

If there is skin or eye contact with acids or bases, make sure to flush the area with water for 15 to 30 minutes and summon medical assistance.

3. Toxic Solids

Many of the chemicals used in the laboratory that are solid and toxic are used in solution, so skin absorption can be of a concern. This is particularly true when a substance is dissolved in a solvent which can penetrate the skin. Also, an oxidizing material dissolved in water can act directly on the skin causing irritation where the solid alone would be relatively less irritating. It is therefore important that proper personal protective equipment be worn (See Section 2.3 - "Personal Protective Equipment").

In the solid form, the greatest risk of exposure is through inhalation. This risk can be lessened by wearing the appropriate respirator and/or working in a fume hood.

C. Incompatible Chemicals

Certain hazardous chemicals cannot be mixed or stored safely with other chemicals due to potentially severe or extremely toxic reactions taking place. For example, keep oxidizing agents separated from reducing agents, initiators separated from monomers, and acids separated from alkalis, etc.

The chemical label and Material Safety Data Sheet will contain information on incompatibilities.

A list of incompatible chemicals is included in Appendix B.

D. Chemical Stability

Stability refers to the susceptibility of the chemical to decomposition. Ethers, liquid paraffins, and olefins can form peroxides on exposure to air and light. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have remained sealed. Some inorganic chemicals also are unstable.

Unless inhibitor was added by the manufacturer, closed containers of ethers shall be discarded after one year. Appropriate use of peroxide inhibitors is suggested.

Examples of potential peroxide forming materials are included in Appendix A.

E. Shock-Sensitive Chemicals

Shock-sensitive refers to the sensitivity of the chemical to decompose rapidly or explode when struck, vibrated, or otherwise agitated.

The label and Material Safety Data Sheet will indicate if a chemical is shock-sensitive.

Shock-sensitive chemicals should be procured as needed to minimize storage problems. Shock-sensitive materials should be considered individually and disposed of as soon as practical.

Many chemicals become increasingly shock-sensitive with age. The date received and date opened shall be clearly marked on all containers of shock-sensitive chemicals.

Inhibitors are not to be added to shock-sensitive materials unless specific instructions from the manufacturer are provided. A partial list of potential shock-sensitive materials is included in Appendix C.

F. Material Safety Data Sheets

The Material Safety Data Sheet (MSDS) is a format for describing what chemical or product you are working with, potential chemical hazards, and ways of minimizing these hazards. These sheets shall be on hand in the laboratory for people who use these chemicals. Information that is contained in the Material Safety Data Sheets is also required by law to be conveyed to employees on a chemical-by-chemical basis.

MSDSs are generally written for chemicals that are used in the industrial setting and it will become apparent that some of the information provided on the MSDS may not be applicable to laboratory usage. The use of chemicals in a laboratory is generally in a more controlled environment than in the industrial setting and much smaller quantities of the chemical are being used at any one time. Nevertheless, a great deal of information on hazards associated with laboratory chemicals can be obtained by reading the MSDS.

G. Procurement of Chemicals

The achievement of safe handling, use, and disposal of hazardous substances begins with the persons who requisition such substances and those who approve their purchase orders. These persons must be aware of the potential hazards of the substances being ordered, know whether or not adequate facilities and trained personnel are available to handle such substances, and should ensure that a safe disposal route exists.

Before a new substance is received, information concerning its proper handling methods, including proper disposal procedures, should be given to all those who will be working with it. It is the responsibility of the laboratory supervisor to ensure that the facilities are adequate and that those who will handle any material have received proper training and education to do so safely.

For most substances, Material Safety Data Sheets, which give physical property data and toxicological information, can be obtained by request to the vendor. However, the quality and depth of information on these sheets varies widely.

The US Department of Transportation (DOT) requires that shippers furnish and attach DOT prescribed labels on all shipment of hazardous substances. These labels indicate the nature of the hazard(s) of the substance(s) shipped and thus provide some indication to receiving personnel of the type of hazard received.

No container or cylinder should be accepted that does not have an identifying label. For chemicals, it is desirable that this label correspond to ANSI Z129.1, which requires, at a minimum, the following components:

1. Identification of contents of container;

2. Signal word and summary description of any hazard(s);

3. Precautionary information - what to do to minimize hazard or prevent an accident from happening;

4. First aid in case of expFordhamre;

5. Spill and cleanup procedures; and

6. If appropriate, special instructions to physicians.

Every effort should be made to ensure that this label remains on the container and legible.

H. Spill Prevention

A hazardous chemical spill means that an uncontrolled release of a hazardous chemical has occurred. The release may involve a gas, liquid, or solid, and usually requires some action be taken to control the point of release or the spread of the chemical. A chemical is hazardous if it possesses a physical or health threat to humans, the environment, or property. More specifically, a substance is considered hazardous when:

a. It is flammable, explosive, or reactive;

b. It generates harmful vapor or dust;

c. It is a carcinogen;

d. It is a corrosive and attacks skin, clothing, equipment, or facilities;

e. It is poisonous by ingestion, inhalation or absorption.

Spills involving hazardous materials will require different tactics depending on the magnitude of the spill, the material's toxicity, reactivity, and flammability, routes of entry of the material into the body, and the promptness with which the spill can be safely managed.

For information on handling of chemical spills see Section 1.1 - "Chemical Spills."

Many spills can be prevented or controlled by careful planning, use of trays, and absorbent paper. (Remember, hoods don't prevent or control spills; they just relocate them!)

Proper techniques for transporting hazardous chemicals and proper storage techniques may help prevent spills.

I. Handling and Transportation of Chemicals

Many laboratory accidents occur through the simple operation of carrying chemicals from one place to another or transferring them from one container to another. The chemicals used in a laboratory are often corrosive, toxic, or flammable and any accident involving these has the potential for personal injury. Therefore, it is good practice to assume that all chemicals are potentially hazardous.

1. When large bottles of acids, solvents, or other liquids are transported within the laboratory without a cart, only one bottle should be carried at a time. The bottle should be carried with both hands, one on the neck of the bottle and the other underneath. Avoid the temptation to hook a finger through the glass ring on top of the bottle, allowing it to dangle while being transported. Never carry or attempt to pick up a bottle by the cap.

2. When transporting bottles within the laboratory, a wheeled cart may be used. Carts should be stable under load and have wheels large enough to negotiate uneven surfaces (such as expansion joints and floor drain depressions) without tipping or stopping suddenly. Do not place the bottles near the edge of the cart, nor should they be touching each other or other glassware during transport. Be cautious rolling the cart over door sills or other possible obstructions. Incompatible chemicals should not be transported on the same cart. A list of incompatible chemicals is included in Appendix B.

3. Freight-only elevators should be used, if possible, when transporting chemicals, to avoid exposure to persons on passenger elevators.

4. Special padded or rubber bottle carriers, pails, or carts should be used to prevent breakage by accidental striking against walls or floor, and to contain the material if breakage does occur.

5. Large quantities of concentrated mineral acids, e.g., sulfuric, nitric and hydrochloric acids, shall be kept in storage rooms, in cabinets for corrosive substances, or chemical transfer rooms. Bottles of concentrated acids must be carried from the aforementioned areas in an approved acid bottle carrier.

6. Organic solvents shall also be stored in specialized flammable storage areas. These solvents shall be carried from storage areas in special rubber carriers. Organic solvents can present fire hazards as well as inhalation hazards.

7. For information on transportation and storage of compressed gases see Section 2.4 - "Compressed Gas Safety."

J. Chemical Storage

The principle concerns in achieving proper storage are to maximize employee safety with regard to chemical compatibility, spill control, fire/explosion control, to provide security, identification, and provide a "user friendly" system with respect to point-of-use.

1. Every chemical in the laboratory should have a definite storage place and should be returned to that location after each use.

2. Storage must conform to compatibility restrictions as described in Appendix B. Typically, solvents, acids, bases, reactives, oxidizers, and toxins will be stored separately. Separation basically refers to physical separation of containers and isolation of potential spills and releases with the goal of preventing chemical reactions. Ideally, separate cabinets or isolated areas within a central storage area should be utilized for segregated storage of incompatibles.

3. Adequate containment for spills and accidental releases shall be provided.

4. Hazardous chemicals should never be stored on the floor. Containers should be kept on low shelves or in cabinets. The shelves should have a lip on the forward edge to prevent bottles from slipping off. Chemicals tend to "creep" toward and over the edge of a shelf. Shelving units should be securely fastened to the wall or floors. Shelves should not be overloaded.

5. Utilize a compatible/suitable container for experiments, stored chemicals and collected wastes. In instances of corrosive wastes or halogenated solvents, the use of metal containers is often unsuitable, even if the solvents were originally shipped in metal containers. In these instances, plastic carboys (high density polyethylene) or lined metal containers may be more suitable. See the Material Safety Data Sheet for specific information.

6. There shall be constant vigilance for any sign of chemical leakage. Containers storing chemical waste must be inspected weekly for any sign of chemical leakage. Containers of all types should be free of rust and deformation.

7. Caps and covers for containers shall be securely in place whenever the container is not in immediate use.

8. Storage shall be physically secure.

9. NFPA labeling shall appear on cabinets and room doors at approximately waist level or lower to allow adequate visualization in dense smoke conditions.

10. All containers used for storage (even short term) shall be labeled in accordance with Hazard Communication regulations and NFPA codes. At a minimum, all containers must be labeled with regard to content and general hazard.

11. Flammable liquids in quantities greater than one liter should be kept in metal safety cans designed for such storage. The cans should be used only as recommended by the manufacturer, including the following safety practices:

a. Never disable the spring-loaded closure.

b. Always keep flame-arrestor screen in place; replace if punctured or damaged.

CHAPTER 4.0 - ADMINISTRATIVE

The intent of a laboratory safety program is to provide guidance and training to all laboratory workers who use hazardous substances or engage in potentially hazardous laboratory operations. Experience in industry has shown that the laboratory can be a safe workplace, however, this achievement was accomplished ONLY by the implementation of vigorous safety planning and training sessions.

Educational activities shall be provided for all persons who may be exposed to potential hazards in connection with laboratory operations including faculty members, students, lab supervisors, lab workers, maintenance workers, cstodial and storeroom personnel. If other non-lab related offices are nearby, consideration should be given to providing these workers with the necessary knowledge to protect them (which might be as simple as telling them which door to use in case of an emergency). This training process shall be a part of new employee indoctrination or reassignment.

Institutional safety education programs shall be a regular continuous activity and not once-a-year presentations provided for groups of new students or employees.

The following sections are intended as resource documents for administrative benefit.

SECTION 4.1 - TRAINING

Federal and State Legislation require laboratories to provide health and safety training programs for their employees. Attendance at these training courses is mandatory and shall be documented.

While this section deals with only mandated Federal and State training, it is strongly advised that laboratories provide training to laboratory workers on chemical safety, glassware handling and general laboratory safety.

Employees shall also be instructed in how to respond to unsafe conditions or practices and communicate safety concerns to the appropriate individuals.

A formal session in a classroom setting is not necessary to impart information or to train a group of employees, though it is often desirable for this purpose. Informal group or individual

discussions with a supervisor, posted notices, or handout booklets can be effective. Commercially prepared programs can also be effective, especially if supplemented with details that pertain specifically to local conditions.

OSHA does not mandate the details of the instructional method to be used. OSHA requires that, if asked by an OSHA inspector, the employees must be able to answer to the issues. Hence, whatever technique or combination of techniques are used to impart information and to train, the effectiveness of the instruction should be evaluated prior to an OSHA inspection.

A. Hazard Communication Training

1. The individual Departmental Chemical Hygiene Officers are responsible for providing departmental laboratory employees with information and training to ensure that they are informed of the hazards of chemicals present in their work area.

2. Such information and training shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training shall be provided on at least an annual basis.

3. Departmental Chemical Hygiene Officers shall document performance, content and attendance of their training programs.

4. Employee Information:

a. The contents and requirements of the OSHA Laboratory Standard.

b. The content, location, and availability of the laboratory's Chemical Hygiene Plan.

c. The PEL's, action levels, and other recommended exposure limits for hazardous chemical used in their laboratories.

d. Signs and symptoms associated with exposures to the hazardous chemicals used in their laboratories.

e. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets.

5. Employee training shall include:

a. The methods and observations that may be used to detect the presence or release of a hazardous chemical.

b. The physical and health hazards of chemicals used in the work area.

c. The measures employees can use to protect themselves from these hazards, including specific procedures such as appropriate work practices, personal protective equipment to be used, and emergency procedures.

d. The Fordham Laboratory Safety Manual.

B. First Aid/CPR Training

This training shall include the following items:

1. The availability and location of First Aid equipment.

2. The names of individuals in the area who are trained in first aid and/or CPR. It is desirable that several individuals in each area be trained in basic first aid and cardiopulmonary resuscitation. The American Red Cross offers courses in Standard First Aid and CPR.

3. How to access Emergency Medical Services.

4. Someone knowledgeable about the accident should always accompany the injured person to the medical facility with a copy of the appropriate MSDS.

5. Notify the Departmental Chemical Hygiene Officer and Environmental Health Services of any chemical accident requiring first aid.

6. Consult a licensed physician qualified to handle chemical emergencies to determine if further examination and treatment is necessary following any first aid or emergency medical treatment for chemical exposure.

C. Bloodborne Pathogens Training

All employees with occupational exposure to blood or other potentially infectious material must receive training at the time of assignment to tasks where occupational exposure may take place, at least annually thereafter, and additional training must be provided and documented when changes affect employees' occupational exposure. This training must be documented.

The minimum training program must include:

1. a copy of the regulatory text,

2. a general explanation of epidemiology of and symptoms of bloodborne diseases,

3. modes of transmission of bloodborne pathogens,

4. an explanation of the Exposure Control Plan and how to get a copy of the plan,

5. appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials,

6. use and limitations of engineering controls, work practices, and PPE,

7. selection of PPE,

8. information of hepatitis B vaccine, including efficacy, safety, etc.,

9. appropriate actions in emergencies with blood or other potentially infectious materials,

10. the procedure to follow if an exposure incident occurs,

11. post-exposure evaluation information,

12. signs and labels required, and

13. questions and answer with instructor.

D. Fire Extinguisher Training

Training of employees in the use of fire extinguisher is required by OSHA 29 CFR 1910.157 (g) "where the employer has provided portable fire extinguisher for employee use in the work place." Such training shall be conducted at initial employment and annually thereafter.

E. Spill Response Training

All employees shall be trained in the proper methods for spill response. (See Section 1.1 - "Chemical Spills")

F. Respiratory Protection Training

Respirators shall be provided when such equipment is necessary to protect the health of the employee. If respirators are provided, a detailed, written "Respiratory Protection Program" as required by the Respiratory Protection Standard 29 CFR 1910.134, shall be in place and made available to employees.

Employees shall trained be to use respiratory protection in accordance with the written "Respiratory Protection Program".

CHAPTER 5.0 - STANDARD AND SPECIAL OPERATING PROCEDURES

While other chapters of this manual cover general safety requirements for a laboratory, it is recognized that each research/teaching laboratory may have unique requirements. It is the

purpose of this chapter to provide a place in the Laboratory Safety Manual for the inclusion of requirements specific to an individual laboratory.

Section 5.1 supplies a place to detail procedures for those operations in a laboratory which are considered routine for that laboratory.

Section 5.2 supplies a place to detail procedures for those operations which require special prior approval or which represent severe hazards to workers.

Section 5.3 supplies a place to insert a Respiratory Protection Program if required.

Section 5.4 supplies a place to insert details of procedures for dealing with substances for which OSHA has substance-specific standards.

CHAPTER 6.0 - FACILITY Data

This chapter is for the storage of facility information specific to a particular laboratory unit.

Section 6.1 supplies a place to install a detailed description of your laboratory facility.

Section 6.2 supplies a place to store your laboratories Chemical Inventory List

Section 6.3 explains Material Safety Data Sheets (MSDS) and supplies a place to store MSDS for your laboratory.

Section 6.4 supplies a place to store any Air Monitoring Data for your laboratory.

SECTION 6.1 - FACILITY DESCRIPTION

Each individual Laboratory Safety Manual should include a description of the facility, including a detailed floor plan. THE FLOOR PLAN SHOULD BE POSTED PROMINENTLY. This floor plan consists of the following items:

A. Physical layout of rooms, with halls and passageways noted;

B. Dimensions of the above items;

C. Locations of fire exits, major fire and safety equipment on the premises;

D. Locations of major pieces of equipment, including fume hoods as well as analytical items;

E. Locations of heating, cooling and ventilation units and outlets;

F. Location of emergency equipment -- lighting, fire extinguishers, first aid kits, eye washes, oxygen, spill control materials, emergency showers, telephones, etc.; and

G. Location of chemical storage.

A narrative description of the various building systems should be included in this section of the safety manual as well. This will include items such as the ventilation, cooling, heating, and humidifier equipment. Also, this should include descriptions of the electrical, fuel, water, and sewer systems. Descriptions should consist of a summary of the present system as well as the locations of shutoffs (water, electrical power, gas) and emergency maintenance areas.

The description of lab facilities shall identify the activities conducted in each lab, the types of chemicals and other potential hazards in each laboratory. Emergency notification forms are also available from the Fordham Environmental Health Services Department for application outside of each lab entrance.

Within each area, there should be posted a floor plan indicating exits, evacuation routes, the location of emergency equipment and the location of chemical storage areas. The posting shall also include phone numbers (work and home) of personnel to be notified in the event of an emergency.

APPENDIX A - POTENTIAL PEROXIDE-FORMING CHEMICALS

Acetal

Cyclohexene

Decahydronaphthalene

Diacetylene

Dicyclopentadiene

Diethyl Ether

Diethylene Glycol

Dimethyl Ether

para-Dioxane

Divinyl Acetylene

Ether (Glyme)

Ethylene Glycol Dimethyl Ether

Tetrahydronaphthalene

Methyl Acetylene

Isopropyl Ether

Tetrahydrofuran

Sodium Amide

Vinyl Ethers

Vinylidene Chloride

APPENDIX B - INCOMPATIBLE CHEMICALS

Chemical	Keep out of Contact With:
Acetic Acid	Nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali Metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, the halogens
Ammonia, Anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Bromine	Same as chlorine: ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Butyl lithium	Water.
Carbon, activated	Calcium hypochlorite, all oxidizing agents
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic Acid	Naphthalene, camphor, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Same as bromine: ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide

Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids, organic or inorganic
Cyanides (Na, K)	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens, other oxidizing agents
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkalis
Hydrofluoric acid	Ammonia, aqueous or anhydrous
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitric Acid	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases
Oxalic acid	Silver, mercury
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, sulfuric acid, organics
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds

Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)

APPENDIX C - POTENTIAL SHOCK-SENSITIVE CHEMICALS

- Acetylides of heavy metals
- Aluminum ophorite explosive
- Amatol explosive (sodium amatol)
- Ammonal
- Ammonium nitrate
- Ammonium perchlorate
- Ammonium picrate
- Ammonium salt lattice
- Calcium nitrate
- Copper Acetylide
- Cyanuric triazide
- Cyclotrimethylenetrinitramine
- Cyclotetramethylenetranitramine
- Dinitroethyleneurea
- Dinitroglycerine
- Dinitrophenol
- Dinitrophenolates
- Dinitrophenyl hydrazine
- Dinitroresorcinol
- Dinitrotoluene
- Dipicryl sulfone
- Dipicrylamine
- Erythritol tetranitrate
- Fulminate of silver
- Fulminating gold
- Fulminating mercury
- Fulminating silver
- Fulminating platinum
- Gelatinized nitrocellulose
- Guanyl nitrosamino guanyl tetrazene
- Guanyl nitrosamino guanylide hydrazine
- Heavy metal azides
- Hexanite
- Hexanitrodiphenylamine
- Hexanitrostilbene
- Hexogen (Cylclotrimethylenetrinitramine)
- Hydrazoic acid
- Lead azide
- Lead mannite
- Lead picrate
- Lead salts
- Lead styphnate
- Magnesium ophorite
- Mannitol hexanitrate
- Mercury oxalate
- Mercury tartrate

Fulminate of mercury

Nitrated carbohydrate

Nitrated glucoside

Nitrated polyhydric alcohol

Nitrogen trichloride

Nitrogen triiodide

Nitroglycerin

Nitroglycol

Nitroguanidine

Nitroparaffins

Nitromethane

Nitronium perchlorate

Nitrourea

Organic amine nitrates

Organic nitramines

Organic peroxides

Picramic acid

Picramide

Picratol explosive (ammonium picrate)

Picric acid

Picryl chloride

Picryl fluoride

Polynitro aliphatic compounds

Mononitrotoluene

Silver styphnate

Silver tetrazene

Sodatol

Sodium amatol

Sodium dinitro-ortho-cresolate

Sodium nitrate-potassium nitrate explosive mixtures

Sodium picramate

Styphnic acid

Tetrazene (guanyl nitrosamino guanyl tetrazene)

Tetranitrocarbazole

Tetrytol

Trimethylolethane

Trimonite

Trinitroanisole

Trinitrobenzene

Trinitrobenzoic acid

Trinitrocresol

Trinitro-meta-cresol

Trinitronaphthalene

Trinitrophenol

Trinitrophloroglucinol

Trinitroresorcinol

Potassium nitroaminotetrazole	Tritronal
Silver acetylide	Urea nitrate
Silver azide	

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