

POLICY AND PURPOSE

Policy

It is the policy of The Miriam Hospital to provide a safe and healthy workplace in compliance with the Occupational Safety and Health Act of 1970 and regulations of the Department of Labor, including 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories". The full text of the standard is in **APPENDIX A**.

Purpose

This document presents the Chemical Hygiene Plan required by the above regulation. The purpose of the Plan is to describe proper practices, procedures, equipment and facilities for staff members, students, or visitors working in each laboratory at The Miriam Hospital in order to protect them from potential health hazards presented by chemicals used in the laboratory workplace, and to keep exposures below specified limits. It is the responsibility of administration, research and supervisory personnel to know and to follow the provisions of this Plan. Affected departments are all those maintaining laboratories containing hazardous chemicals, as defined by law. "Hazardous chemical" means any chemical which is a physical hazard or a health hazard. The term "health hazard" includes chemicals for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees and /or which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes. The term "physical hazard" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water reactive.

RESPONSIBILITY, AUTHORITY, AND RESOURCES

- A. **The Division/Lab Chief** has the overall responsibility for the implementation of all Safety policies and procedures in his/her department.
- B. **The Chemical Hygiene Officer (CHO)** is the Safety Manager who has the responsibility and the authority to see that the Chemical Hygiene Plan is written, updated and implemented by those responsible in the laboratory.

REQUIREMENTS:

The OSHA laboratory standard requires designation of a Chemical Hygiene Officer.

DEFINITION:

The Chemical Hygiene Officer (CHO) is a staff member designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the written Chemical Hygiene Plan (CHP).

DUTIES:

The Chemical Hygiene Officer will assist responsible laboratory supervisors to accomplish the following:

1. Monitor safe procurement, use, and disposal of chemicals.
2. Perform required safety audits and their documentation (which includes documentation of training).
3. Advise staff concerning adequate facilities and procedures under the regulation.
4. Seek ways to improve the Chemical Hygiene Program
5. Participate on the Biohazards and Laboratory Safety Committee

RESOURCES:

The Chemical Hygiene Officer may call upon laboratory administrative support staff, as well as upon Principal Investigators (P.I.s) to provide specific information concerning their laboratories.

- C. **Laboratory Supervisors** (P.I.s Clinical supervisors) are responsible for ensuring that personnel in their laboratories follow all safety policies and procedures outlined in the CHP. They are further responsible for ensuring that all staff under their direction is trained in safe work practices appropriate to their areas.

DUTIES:

1. Ensure that all work is conducted in accordance with the Chemical Hygiene Plan;
2. Define the location of work areas where toxic substances and potential carcinogens will be used, and ensure that the inventory of these substances is properly maintained;
3. Obtain, review, and approve standard operating procedures, detailing all aspects of proposed research activities that involve hazardous agents;
4. Prepare a Standard Operating Procedure (S.O.P.) for use of substances when this use involves procedures not otherwise specified in these guidelines. The S.O.P. shall include a description of the procedure to be performed, and an assessment of controls that will be used;
5. Define hazardous operations by designating safe practices, and selecting protective equipment;
6. Ensure that support staff receive instructions and training in safe work practices, use of personal protective equipment, and in procedures for dealing with accidents involving hazardous substances;
7. Ensure that staff members understand the training received;
8. Ensure that all personnel obtain the medical examinations and protective equipment necessary for the safe performance of their job;
9. Monitor the safety performance of the staff to ensure that the required Safety practices and techniques are being employed;
10. Arrange for workplace air samples, swipes, or other tests to determine the amount and nature of airborne and/or surface contamination, inform staff members of the results, and use data to aid in the evaluation and maintenance of appropriate laboratory conditions;
11. Assist the Safety Manager, Radiation Safety Officer when necessary;
12. Conduct formal laboratory inspections to ensure compliance with existing laboratory S.O.P.'s;
13. Familiarize all staff with procedures for dealing with accidents that may result in the unexpected exposure of personnel, or the environment, to a hazardous substance;
14. Investigate accidents and report them to Employee Health Services (X3-3123) and the Chemical Hygiene Officer.
15. Include procedures that will minimize the reoccurrence of that type of accident;
16. Report to Employee Health Services and the Chemical Hygiene Officer incidents that cause (1) personnel to be seriously exposed to hazardous chemicals or materials, such as through the inoculation of a chemical through cutaneous penetration, ingestion of a chemical, or probable inhalation of a chemical, or that (2) constitute a danger of environmental contamination;
17. Ensure that action is taken to correct work practices and conditions that may result in the release of hazardous chemicals;
18. Properly dispose of unwanted and/or hazardous chemicals and materials;
19. Document and maintain compliance with all local, state, and federal regulatory requirements.

D. Staff members, Students, and Volunteers: Staff members, as defined by The Miriam Hospital Chemical Hygiene Plan, are those staff under the direction of the Supervisor, as defined by the Plan. Staff members not under the direction of the Supervisor, but who are in an area under the direction of the Supervisor, are also subject to The Miriam Hospital Chemical Hygiene Plan and Standard Operating Procedures in effect in that area. Non-staff members, such as students, are equally subject to the plan, as described below. The primary responsibility of the staff member is to follow the procedures outlined in The Miriam Hospital Chemical Hygiene Plan. Including the following:

1. Understanding and following all Standard Operating Procedures; if anything is unclear, asking questions;
2. Understanding all training received;
3. Understanding the function and proper use of all Personal Protective Equipment (PPE). Wearing PPE when mandated or necessary; checking with the Safety Office to ensure that appropriate PPE has been selected;
4. Reporting, in writing, to one's supervisor, any significant problems arising from the implementation of the Standard Operating Procedures;
5. Reporting to one's supervisor all facts pertaining to every accident that results in the exposure to hazardous chemicals, and any action or condition that may exist that could result in an accident;
6. Contacting one's supervisor, the Chemical Hygiene Officer, Employee Health Services or the Safety Office if any of the above procedures are not clearly understood.

E. Safety Office: The primary function of the Safety Office is ensuring the safe operation of all aspects of The Miriam Hospital. More specifically, Safety handles hazardous waste disposal, Safety training and orientation, laboratory Safety inspections, and advice and consultation on any safety issue as well as review accident /incident reports. Safety also serves as a liaison with regulatory agencies on the local, state and federal levels, as well as non-regulatory accrediting groups. The Safety Manager can

evaluate any type of hazard, and provide hazard or toxicity information, protective equipment, including respirator fit testing or obtain the proper gloves for laboratory operations.

Responsibility

The Safety Office is responsible for oversight and control of physical and chemical hazards in the workplace, including fire protection, electrical and other safety hazards, and chemical waste disposal arising from work at The Miriam Hospital.

Authority

The Safety Office has authority to stop any activity, which is immediately hazardous to life or health. In addition, the Radiation Safety Office has regulatory authority as part of The Miriam Hospital's license to use radioactive materials from the Rhode Island Department of Health. All granting agencies require compliance with federal, state and local regulations. Apart from these conditions, the Safety Office acts in an advisory capacity to the individual Department/Divisions, etc., to help them provide a safe and healthful workplace.

Resource

The Safety Office can be called upon for advice and help on all aspects of safety and environmental health problems. These include the following services:

Safety

Safety evaluates and implements Safety policies and reviews new and existing equipment and operating practices to minimize hazards to The Miriam Hospital community and visitors from fire, electricity, explosion, pressure, and machinery. Safety conducts accident investigations, suggest remedial measures and procedures. In addition, chemical waste rooms are maintained and any questions regarding the handling or disposal of chemicals can be addressed.

Industrial Hygiene

Safety can evaluate possible chemical exposures to The Miriam Hospital staff through the use of licensed laboratory contractors for sampling of substances, whether they are in the gaseous, particulate or mist state. If it is found that staff are being overexposed to chemicals in the work environment, Safety can make recommendations for reducing exposures, either through engineering controls (e.g. chemical fume hoods, local exhaust ventilation), the use of personal protective equipment, or through changing the procedure or work practices being performed.

Emergencies

The Safety Office provides 24-hour on-call service to respond to off-hours emergency spills or exposures. They should be reached through the switchboard emergency number 3-5111.

F. Information Contacts

Biohazards and Laboratory Safety Committee: is a diverse committee with a variety of expertise to review the information submitted for safety considerations. The members are selected by an institutional official and include members from Safety, Research Administration, Laboratory, Attending Vet, Plant Engineering, RM, CRF, Infectious Diseases, Emergency Medicine, Radiation Safety, Cell and Molecular Biology.

Duties:

1. Issue approvals or indicate recommendations to be met for approval on research protocols and the agents/chemicals to be utilized.
2. Develop policies and procedures to address safety precautions to be taken for use with special agents or activities.
3. Assess and minimize risks of laboratory activities to the population.
4. Ensure compliance with pertinent codes and regulations
5. Assist in training for research staff.

CHEMICAL HYGIENE PLAN

A. Development and Implementation

1. The Chemical Hygiene Officer has developed The Miriam Hospital's Chemical Hygiene Plan.
2. The Biohazards and Laboratory Safety Committee, in conjunction with the Chemical Hygiene Officer are responsible for the implementation of the CHP.
3. The Chemical Hygiene Officer is responsible for ensuring the review and revision of the CHP as needed on an annual basis.

B. Identification and Classification of Hazardous Chemicals

1. All laboratories annually submit a written inventory of their hazardous chemicals to the Safety Office, as part of the Rhode Island Right To Know Law. Based on these lists, the Safety Office has prepared a table of the 50 most commonly used hazardous chemicals (**APPENDIX M**). Included in the chart for each substance are the OSHA Permissible Exposure Limit (PEL) for the substance, its odor threshold (if known), signs and symptoms of overexposure, and the most appropriate selection of glove material.
2. Hazardous chemicals can be easily classified into generic categories (e.g., corrosive, reactive, flammable, etc) and are labeled on the primary container as such. See **APPENDIX B** for definitions of specific hazard classifications.
3. Other means of identifying hazardous chemicals include:
 - a. Lists of known or suspect human carcinogens, as evaluated by the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP), are available through the Safety Office. (See **APPENDIX Q** for a list of known/suspect human carcinogens, and standard operating procedures for work with such materials).
 - b. Lists of reproductive hazards as evaluated by 1.) Shepard and 2.) The Oak Ridge Toxicology Information Resource Center are available through the Safety Office.
 - c. The National Fire Protection Agency (NFPA) has classified a wide variety of chemicals, widely found in the industrial setting. The chemicals are rated on the basis of the degree of health, flammability and reactivity hazard. It is available through the Safety Office.
 - d. Material Safety Data Sheets (MSDS), as required by the OSHA Hazard Communication Standard, are sent to the purchaser for each new chemical ordered at The Miriam Hospital. These are filed in the department for reference by the all staff, as well as any other staff who request copies. This is part of all staff members' "Right to Know". MSDSs cover identity, hazardous ingredients, physical and chemical characteristics, physical hazards, reactivity, health hazards, precautions for safe handling and use and control measures. **In addition, any chemical that meets the definition of TOXIC: when the LD50 for any given substance is less than **50 mg/kg** or if the PEL is less than **10 ppm**, the user is required to fill out a form outlining special precautions to be taken when this extremely hazardous substance is used (See **APPENDIX C**) and present to the Biohazards Laboratory Safety Committee for approval.
 - e. Manufacturers and manufacturers' associations can have valuable information. See **APPENDIX K** for a list of Chemical Information Resources.

C. Selection of Required Control Methods, Authority for Chemical Use

1. The MSDS'S for many chemicals used in the laboratories will state recommended limits (e.g., Threshold Limit Value or **TLV**) or OSHA-mandated limits (e.g., Permissible Exposure Limit or **PEL**, Short-Term Exposure Limit or **STEL**, and Action Limit or **AL**), or both, as guidelines for exposure. When such limits are stated, they will be used by the Chemical Hygiene Officer and should be used by the Laboratory Supervisor to assist in determining the Safety precautions and control measures to require when handling toxic materials.
 - a. When its TLV or PEL is less than **50 ppm**, the chemical must be used in a chemical fume hood or ductless fume hood, which are certified routinely by the Safety Office.
 - b. If a TLV or PEL is not available for that substance, the animal or human median lethal dose, LD50, or the median inhalation lethal dose, LC50, will be used. If that number is less than **500 mg/kg** (LD50) or **200 ppm** (LC50), then the material must be used in a chemical fume hood or ductless fume hood, which are certified routinely by an outside contractor and overseen by Central Research Facility.
2. Whenever laboratories will be handling toxic or malodorous materials (e.g. 2-mercaptoethanol) with moderate vapor pressures, all work must be done in a chemical fume hood or ductless fume hood, certified by outside contractor.
3. Whenever any hazardous chemical is used in the laboratory, the Laboratory Supervisor must assure that appropriate types and sizes of gloves are readily available to all staff and that they are worn. Further, it is recommended that Safety goggles or glasses be worn in the laboratory; it is **required** that they be worn when the pouring or handling of hazardous liquids will occur. The Safety glasses must meet the requirements of the American National Standards Hospital (ANSI) Z87.1. Information on types of gloves and eye protection which should be worn are available through the Safety Office.

Generic charts are also included in **APPENDIX I**.

4. Laboratory coats should be worn in the laboratory. Shorts, short skirts, short-sleeved shirts, sandals, and other clothing that does not protect the laboratory worker from accidental spills or splashes are not allowed in the laboratory.
5. Respirators are not to be used in any area at The Miriam Hospital without prior investigation and approval of the Safety Office. N95s are the only approved respirators in use as well as the full-face positive pressure masks utilized as part of the ED decontamination program. A complete respirator program is kept in the Safety Office and is included as part of the EOC Management Plan.
6. Staff members must obtain prior approval from their Laboratory Supervisor and the Chemical Hygiene Officer whenever use of an extremely toxic (NFPA health rating of 3 or 4), carcinogenic, or physically hazardous agent is considered. (***)

D. Special Provisions for Particularly Hazardous Substances (Carcinogens, Reproductive Toxins, Acutely and Extremely Toxic Chemicals) (For a list of known/suspect carcinogens and more complete standard operating procedures for working with such materials, see **Appendix Q**) The procedures described in this section must be followed when performing laboratory work with greater than **10 mg** of any carcinogen, reproductive toxin, substance with a high degree of acute toxicity or chemicals whose toxic properties are unknown.

1. These substances must be used and stored only in areas of restricted access. Use of these materials must be in a designated area, which is defined as a hood, glove box, portion of a laboratory, or an entire laboratory designated as the only area where work can be done with these chemicals. A designated area must be clearly posted with signs warning that a specific, extremely hazardous material is in use and that only those trained to work with it are allowed to enter the area while procedures using it are being done. The boundaries of the designated area must be clearly defined. **Please note:** A designated area may be posted with a removable sign if work with extremely hazardous agents is not continuous in the laboratory.
2. The smallest amount of chemical that is required by the procedure should be used or stored; purchase orders must not be based on financial savings. Whenever possible, the required material should be ordered in amounts equal to that required in a given procedure, to avoid unnecessary weighing out of the material.
3. Spill procedures must be developed and posted in the designated area. If possible, staff should be familiar with and have available materials that will inactivate the extremely hazardous chemical.
4. Long-sleeved clothing and gloves known to be impermeable to the reagent in question must be worn whenever working in designated areas. Because decontamination of jewelry may be difficult, jewelry must not be worn when working in a designated area.
5. The designated area must always be decontaminated when work is completed. Solid waste must be disposed of in yellow chemical waste bags labeled with the name of the chemical used. Liquid wastes must be put into screw-top containers that are compatible with the chemical. Solid and liquid waste should be disposed of through the Hazardous Chemical Waste stream.

E. Elimination or Substitution

The first step in evaluating a new experiment, process or operation is to investigate the possibility of eliminating the use of hazardous materials or substituting a less hazardous material. For example, instead of using an organic solvent or chromic acid-based material for washing glassware, one should substitute an aqueous-based detergent. Aromatic compounds (e.g., benzene) and chlorinated hydrocarbons (e.g., methylene chloride) in some experiments should be replaced with aliphatic compounds or non-chlorinated hydrocarbons, if possible. The particular process, experiment or operation may also be modified to reduce the quantity of the hazardous material(s) necessary or to limit the potential emission rate or exposure time. For example, the use of microscale techniques may be applicable in measuring boiling points of a material. Another example is the substitution of closed systems for open vessels. The use of a secondary containment device such as a pan is helpful in preventing or minimizing the effects of chemical spills. The Safety Office (3-5060) should be consulted for advice.

F. Education and Training

The Chemical Hygiene Officer (CHO) or other designated individual(s) shall provide Train the Trainer information and training to PIs concerning handling of hazardous chemicals in the laboratory. New staff members receive training on general safety during New Employee Orientation,*** Laboratory Safety Orientation through the department PI is mandatory for all new laboratory staff, volunteers and students.

Included in this training are contents of the OSHA Lab Standard, the applicable details and location of the Chemical Hygiene Plan, emergency and personal protective equipment training, physical and chemical properties of hazards used in the work place along with proper handling to minimize exposure, signs and symptoms of exposure associated with appropriate chemicals plus location and availability of reference material. (See current **Laboratory Safety Flipchart** for materials given to all new

employees.) PIs and or representative of BLSC provide General Lab Safety Orientation. A supervisor or other knowledgeable member of the laboratory staff should provide any specific training. Staff members shall be informed of the presence of hazardous chemicals when assigned to a work area and prior to new exposure situations by the Laboratory Supervisor. The training should be provided immediately for new employees in the workspace and annually for other personnel. It is the Principal Investigator's responsibility to assure that all laboratory staff, whether they are on The Miriam Hospital payroll or not, attend these sessions. Further, if English is not the primary language spoken by the staff member, the Laboratory Supervisor should ensure that an interpreter accompanies the non-English speaking staff member.

G. General Work Practices and Standard Operating Procedures for Classes of Chemicals

1. General Work Practices

- a. **Spills:** Alert people in the area. Use the spill kit for small spills. For large spills, or spills of stench producing or extremely toxic chemicals, call 3-5111.
- b. **Eye Contact:** Eyes should be promptly flushed with water for 15 minutes. The eyewashes are located in the hallways of each lab floor. Medical help should then be sought.
- c. **Skin Contact:** Contaminated clothing should be removed as quickly as possible and the affected area should be flushed with water. Safety showers are located in the hallways of each lab floor. Medical attention should then be sought.
- d. **Clean up:** If no one is injured, the emergency number 3-5111 should be called for connection to the contracted response team.
- e. If anyone is injured, that person should seek medical assistance; someone else should call the emergency number 3-5111. (**NOTE:** See **APPENDIX D** for medical emergency response at The Miriam Hospital; see **APPENDIX E** for spill response. Both of these are also part of the Laboratory Safety Flipchart.)

2. Avoidance of Routine Exposure

- a. To avoid unnecessary exposure to any chemical, work should be done in a chemical fume hood whenever possible.
- b. Smelling or sniffing of chemicals to determine their identity should be avoided.
- c. Putting one's head inside of a fume hood to check on an experiment must never be done.
- d. Gloves should be inspected before use. 5% of all gloves have holes in them.
- e. The release of toxic chemicals (including dry ice and mercury thermometers) and flammable chemicals in cold or warm rooms must be avoided, since these contain re-circulated atmospheres.
- f. The exhaust of apparatus (e.g. vacuum pumps) which may discharge hazardous chemicals should be vented into a fume hood or filter.
- g. Storage, handling or consumption of food, medication or beverages in storage areas, refrigerators, glassware, or utensils which are also used for laboratory operations is prohibited.
- h. When transporting hazardous chemicals, laboratory carts, which are designed to prevent bottles from spilling, must be used.
- i. Secondary Containment should be used when transporting hazardous materials anywhere in the Hospital.

3. Choice of Chemicals

- a. Less hazardous substances should be substituted for more hazardous ones wherever possible in your laboratory procedures.
- b. Only those amounts necessary for immediate work should be ordered.

4. Personal Hygiene

- a. There must be no eating, drinking, taking medication, smoking, or applying cosmetics or contact lenses in the laboratory.
- b. Mouth pipetting of **any** substance is prohibited.
- c. Hands must be washed with mild soap and water before leaving the laboratory.
- d. Laboratory coats and safety glasses should be worn when in the laboratory; gloves must be worn when handling chemicals.

5. Appropriate Storage of Chemicals

It is important to store chemicals in ways that eliminate or diminish the risk of accidents that might cause exposure to hazardous chemicals or hazardous byproducts from the mixing of incompatible chemicals. There are a few general rules to follow when storing chemicals:

- a. Incompatible chemicals must be segregated. (See **APPENDIX J** for lists of incompatibles)

- b. Glass bottles must not be stored on high shelves or on the floor.
- c. Chemicals should be stored in containers with which they are compatible.
- d. All bottles containing hazardous materials must be labeled with the correct chemical name for future reference. Abbreviations are not accepted as correct chemical name.
- e. Do not store hazardous liquids above eye level to avoid spilling liquid in the eyes.
- f. All bottles must be labeled with the appropriate hazard warnings, i.e., flammable, corrosive, carcinogen, etc.
- g. Do not indiscriminately store chemicals in alphabetical order. This can lead to incompatible chemicals being stored next to each other. Periodically inspect storage area. Note signs of leakage and corrosion. Make arrangements to dispose of outdated materials or those no longer needed by the laboratory.
- h. Secondary storage is the smartest and safest way to store chemicals. A pan put underneath a bottle will contain the material if it spills or breaks.
- i. Hazardous chemicals should not be stored in cold or warm rooms. Flammable or volatile material must not be stored in cold or warm rooms.
- j. Date chemicals upon arrival. Use the oldest first to avoid creating unnecessary hazardous waste.

H. Procedures for Specific Chemical Classes

1. Flammable Chemicals (for a more complete SOP on Flammable chemicals, see **Appendix N**)

a. General Use and Handling:

- i. Flammable liquids are defined as those liquids with a flash point of 140° F or less and having an absolute vapor pressure of not more than 40 pounds per square inch at 100° F. Some examples commonly found at The Miriam Hospital are: acetone, acetonitrile, butanol, carbon disulfide, ethanol, ether, propanol, pyridine, tetrahydrofuran, toluene, and xylene. All flammable liquids should be handled carefully.
- ii. Flammable substances should be handled only in areas free of ignition sources, i.e., well removed from electric ovens, burner flames, and hot surfaces.
- iii. Flammable substances should **never** be heated using an open flame. Instead, heating mantles, oil baths, safety hot plates and steam baths should be used. When heating either by steam bath or hot plate, use a filter or distilling flask as a receiver. Such distillations must be carried out in a fume hood.
- iv. Smoking must never be permitted where flammable liquids are used. **NOTE:** The Miriam Hospital is a non-smoking hospital.
- v. Motors, lights, switches, and wiring must be explosion-proof when they are used around low-boiling flammable solvents.
- vi. Boiling chips or glass beads are helpful in distilling or evaporating substances of this nature to prevent superheating and bumping.
- vii. Electrical charges are developed whenever liquids that are poor conductors are transferred from one container to another. Charges are also developed when compressed gases are released rapidly from a cylinder. When these charges become high enough, they jump air gaps forming sparks which may ignite flammable vapors or gases in concentrations within the explosive limits. Grounding of cylinders or equipment will prevent this. Connecting the container and receiver by a ground wire is also a good safety practice. This is particularly true when dealing with flammable or explosive chemicals because electrical charges can build up on personnel wearing rubber or plastic soled shoes. Discharge of these charges could cause fire or explosion.

b. Storage

- i. Bottles of volatile liquids should not be stored near heat sources or in direct sunlight.
- ii. Particularly dangerous is the lens effect of liquids in bottles, which can focus and intensify rays of sunlight.
- iii. In general, quantities of flammable solvents stored in the laboratory should be kept to a minimum. Specifically, the Fire Department limits storage based on the type of liquid and size of the laboratory. Refer to **APPENDIX F** for specifics.
- iv. Where possible, flammable liquids should be stored in approved storage cabinets; they must **never** be stored on the floor where they are subject to breakage.
- v. Adequate ventilation must be provided where flammable liquids are used. For this reason, flammables must not be stored in cold rooms, warm rooms, or walk in freezers.
- vi. If flammable liquids need to be at lower than room temperature, flammable liquids must be stored in a **Laboratory-Safe Refrigerator**. This is not the same as a domestic-type refrigerator.

- vii. Those approved for storing flammable liquids must have all electrical equipment mounted on the outside surface of the refrigerator, so that exposure of flammable vapors to a spark-generating source will be minimal.
- viii. Flammable liquids must not be stored with chemicals which are considered to be incompatible with them, e.g. oxidizers, oxidizing acids, etc

2. Reactive Chemicals (for a more complete SOP on Reactive Chemicals, see **Appendix N**)

- a. Reactive materials include oxidizers, organic peroxides, explosives, and those ranked **3** or **4** for reactivity (yellow section) by the NFPA.
- b. For peroxide-forming chemicals (e.g. ethyl and isopropyl ethers, tetrahydrofuran), the container should be dated upon opening and used up or disposed of via the Hazardous Waste Stream within 6 months. If there is an expiration date on the can, this limit rather than the one just stated should be used. **Approval from BLS Committee prior to the purchase and the use of ether in laboratories. Specific guidelines must be followed and may be obtained with the final authorization.
- c. All reactive materials must be handled with caution; personal protective equipment must be used, and, where possible, work should be done in a chemical fume hood with the sash lowered as protection.

3. Corrosive Chemicals (for a more complete SOP on corrosive chemicals, see **Appendix P**)

- a. Extreme care must be exercised in handling corrosive materials. Approved gloves, laboratory coat and safety goggles must be worn whenever pouring even small amounts of corrosive liquids.
- b. Acids and similar chemicals should not be stored on high shelves.
- c. Corrosive materials should not be heated or handled in large fragile containers (like 4-liter beakers) without providing a receptacle to catch the contents in case of collapse of the container.
- d. Porcelain dishes should not be used as cleaning baths.
- e. On storage shelves, strong alkalis should be kept from strong acids.
- f. If strong acids or alkalis come in contact with skin or clothing, affected parts should be washed quickly and thoroughly with large quantities of **water**. Spills should be neutralized on the skin. If such materials are splashed in the eyes, they should be flushed thoroughly with a continuous stream of cold water for at least 15 minutes.

4. Formaldehyde

To protect workers exposed to formaldehyde, the Occupational Safety and Health Administration (OSHA) standard (29 CFR 1910.1048) applies to formaldehyde gas, its solutions, and a variety of material such as trioxane, paraformaldehyde, and resin formulations, and solids and mixtures containing formaldehyde that serve as sources of the substance. The standard became effective in February, 1988. In addition to setting permissible exposure levels, exposure monitoring and training, the standard requires medical surveillance and medical removal, recordkeeping, regulated areas, hazard communication, emergency procedures, primary reliance on engineering and work practices to control exposure, and maintenance and selection of personal protective equipment. The training program is designed to provide appropriate training for affected staff members, to guide trainers through the required subject matter and to fulfill the training requirements of the standard. It is intended that it be used with a formaldehyde material safety data sheet (MSDS) and The Miriam Hospital Safety Manual. These materials can be obtained from the Safety Office. See **APPENDIX H** for the complete Formaldehyde Program.

5. Unknown Materials

- i. When working with a material whose properties are unknown, or with material from an unlabeled container, extreme care must be taken. Fastened lab coats should be worn to protect from accidental skin absorption and contaminating clothing. A glove suitable for use with a broad spectrum of chemicals should be worn, e.g. nitrile.
- ii. Goggles should be worn in case of accidental breakage. Prescription glasses with face shield can also be worn for protection.
- iii. If the unknown chemical is fuming or releases noxious vapors, it should be stored in a fume hood for pick up by Safety and eventual disposal by The Miriam Hospital hazardous waste hauler.
- iv. All personnel should wash their hands immediately after working with chemicals as well as before leaving the laboratory area. This will prevent any injury resulting from residual chemical on the skin, as well as prevent contamination to other areas in and out of the work area.
- v. Unknown chemicals should not be stored for long periods of time. These materials should be disposed of as hazardous waste as soon as possible.

6. Perchloric Acid

- i. If possible, perchloric acid should not be purchased in concentrations greater than 60% by weight.
- ii. Anhydrous perchloric acid **may not be stored or used** in the Hospital.
- iii. Perchloric acid in concentrations **not greater than 72%** by weight, and **quantities not in excess of 100 ml/day** may be used in fume hoods, in a **cold state only**. Heated perchloric acid can react with organic and combustible materials to cause fire or explosion. A protocol must be submitted to the Biohazards and Laboratory Safety Committee for approval before perchloric acid use is initiated.
- iv. Heated perchloric acid, or quantities greater than 100 ml/day may be used in a fume hood **only if:**
 - v. Approved by The Miriam Hospital Biohazards Laboratory Safety Committee (protocol must be submitted for review).
 - vi. The hood is provided with a special insert designed to capture perchloric acid fumes before coming in contact with the hood or ductwork.
 - vii. The maximum amounts of perchloric acid in the laboratory should not exceed two (2) 450g (1 lb.) bottles.
 - viii. Perchloric acid should be stored in a tightly sealed bottle on a glass tray (to contain spills), and be kept away from organic materials and flammable compounds. The acid should be inspected periodically and if discolored, should be properly disposed of.
 - ix. Spills of perchloric acid should be cleaned up by neutralizing the acid first with sodium bicarbonate or lime water, then soaking it up with paper towels. The paper towels should be kept wet, sealed in a plastic bag and put into a non-flammable container for disposal.
 - x. Perchloric acid should be disposed of in the chemical waste stream.

7. Ether Restrictions

- i. Where permission has been granted, ether must be purchased directly through Central Research Facilities in 1-liter units.
- ii. The ether may be only stored in a safety cabinet approved by the hospital safety officer and be used in an adjacent explosion proof hood.
- iii. Transportation of the ether can only be done by the Safety Officer or their designee.
- iv. Ether, even when treated to eliminate peroxides, must be handled as a flammable liquid.
- v. Each approved investigator may not have an inventory greater than 2 liters of ether. This includes the waste and unused ether.
- vi. The date a container of ether was opened should be recorded on the container and the unused ether disposed of 1 year after that date.
- vii. The Safety Officer should be contacted for disposal of waste ether.
- viii. Open vaporization inside the hospital must not be used for routine disposal of flammable and combustible liquids.
- ix. When ether in metal containers is allowed to come in contact with air over a period of time, organic peroxides are formed which are explosive. Containers that show signs of crystals are extremely hazardous and are an uncontrolled explosion hazard that should not be handled by other than an explosion hazard specialist. Should such a container be discovered, contact the Hospital Safety Manager. Immediately notify the Safety Office at The Miriam Hospital (Ext 3-5060).
- x. The Biohazard and Laboratory Safety Committee reserves the right to waive a restriction or to add additional restrictions as warranted by the situation in which the ether will be used.

I. Personal Protective Equipment (PPE)

Personal safety equipment, which includes such protective devices as safety glasses, goggles, face shields, safety shields, surgical latex, rubber or thermal gloves, rubber aprons, laboratory coats, and protective creams, is designed to prevent personal injury. It is the Laboratory Supervisor's responsibility to ensure that laboratory staff uses the equipment, which is necessary for their protection. Staff members in certain job classifications and within specific work areas are required to wear personal safety equipment because of the potential hazards involved. The staff member as a condition of employment must wear the prescribed equipment. Staff members failing to wear the prescribed Safety equipment shall be subject to disciplinary action. The use of personal protective equipment shall be included in all Standard Operating Procedures. The type and level of equipment can be determined with the aid of the Safety Office. Any use of personal protective equipment should only be contemplated after the option of reducing or eliminating the hazards has been considered. If in doubt about the potential danger of any experiment or activity, all the safety devices available should be employed. Information on such devices can be obtained from the Safety Office upon request.

1. Respirators

The staff member, Laboratory Supervisor and the Safety Office shall determine the use of respirators. The Miriam Hospital respirator program must be followed. The complete The Miriam Hospital written Respirator Program is **kept in the Safety Office**. The following elements must be adhered to:

- a. Less hazardous materials should be substituted for more hazardous materials.
- b. Exposure should be controlled by the use of laboratory fume hoods or other engineering controls.
- c. If items a and b above have been considered, but added protection is still deemed necessary, respirator type shall be selected on the basis of type of chemical exposure, level of exposure, and medical examination of the user.
- d. Selection of a respirator type must be performed in consultation with the Safety Office.
- e. A medical opinion is required for each staff member before a respirator is used routinely. This will come in the form of a referral from Employee Health Services.
- f. Fit testing and training shall be performed by the Safety Office or Environmental Health Services for all negative pressure respirators before use and annually thereafter.
- g. The respirator user shall regularly maintain and clean the respirator.
- h. The respirator user shall perform a negative and positive pressure fit check before each use.

2. Eye Protection

- a. It is recommended that eye protection be worn in the laboratory at all times. Use of eye protection is mandatory when hazardous procedures are being performed.
- b. The selection as to the type of eye protection to be used shall be stated in any procedure-specific Standard Operating Procedure. Goggles are recommended for use when working with volatile substances which irritate the eyes such as bromine, chlorine, strong ammonia, maleic anhydride, phthalic anhydride, irritating dusts, as well as for protection against spattering or splashing of such hazardous materials as acids and bases.
- c. It is also advisable to wear a safety shield when distilling at high temperatures, under reduced pressures, or when distilling corrosive liquids. Safety glasses and goggles have only a limited application and do not offer full protection against all hazards. For particularly dangerous operations, full-face shields of an approved type are to be worn.

3. Protective Clothing

The use of protective clothing, including gloves, shall be determined by the staff member, lab supervisor, and the Safety Office. Protective garments are not equally effective for every hazardous chemical, therefore, garment selection is to be based on the specific material to be handled.

At a minimum:

- a. Procedure-specific Standard Operating Procedures shall include whether protective clothing is required.
- b. Protective clothing shall be chosen, with the aid of the Safety Office, on the basis of the chemical exposure and medical condition of the user.
- c. Contaminated protective clothing shall be disposed of properly and shall not be worn outside of the laboratory.
- d. Open-toed shoes, sandals, shorts, short skirts or other clothing that does not protect the wearer shall not be worn in laboratories.
- e. Laboratory coats should always be worn in the lab.

4. Protective Gloves

When handling toxic or hazardous chemicals, it is required that gloves be used. To protect against accidental spills or contamination, workers should refer to glove manufacturers' glove charts to select a glove appropriate for use with the reagent in question. (See APPENDIX I for glove selection) There is no glove currently available that will protect against all chemicals for all types of tasks. If the gloves become contaminated, they should be removed and discarded as soon as possible in the hazardous waste stream. There may be some situations in which direct handling of chemicals is unavoidable (dipping hands in a solution occasionally, where contamination is likely). Especially in cases where solvents and hazardous chemicals may be contacted, nitrile, butyl rubber, or polyvinyl alcohol gloves may be worn over latex gloves. These types of gloves offer more protection from a wide variety of solvents. However, once these, or any gloves, are contaminated, traces of the contaminant eventually can permeate the glove material and contaminate the inner lining. Staff members **must remove gloves** before leaving the immediate work site to prevent contamination of door knobs, light switches, telephones, etc. Staff members must not wear gloves in public passageways, including the cafeteria, stairwells and elevators.

5. Other Personal Protective Equipment

Other personal protective equipment shall be used, if needed. Its use shall be included in any procedure-specific Standard Operating Procedure.

6. Safety Shields

Safety shields are recommended for use whenever solvent or vacuum distillations are being run in glass equipment or whenever large glass vessels are subjected to vacuum. They should also be used between the operator and reactions of which the characteristics are unknown or contain toxic or radioactive materials, e.g., high energy emitters such as ¹²⁵I or ³²P. In general, whenever there is a possibility that breakage or violent reaction can occur with serious results, a safety shield should be employed, e.g. working with liquid Nitrogen. Ultraviolet shields and safety glasses that provide UV protection shall be used for work with transilluminators.

J. Ventilation, Fume Hoods, and Proper Operations

Local exhaust ventilation is the primary method used to control inhalation exposures to hazardous substances. The laboratory fume hood is the most common local exhaust method used in laboratories. Other types of local exhaust include vented enclosures for large pieces of equipment or chemical storage, and snorkel types of exhaust for capturing contaminants near the point of release. Local exhaust systems consist of some type of hood, duct work, and a fan located on the roof. Some systems are equipped with air cleaning devices (HEPA filters or carbon absorbers). In most cases individual fans service each hood. A laboratory fume hood should be used when working with hazardous substances. A properly operating and correctly used fume hood will control the vapors released from volatile liquids as well as dust and mists. An outside contractor is available to inspect the hoods annually. A report is maintained at CRF. The hoods are evaluated for adequate performance to protect those using them from the hazardous or toxic materials contained within them and a list of all chemical fume hoods at The Miriam Hospital, with dates of last inspection are maintained at CRF. If air flow into any given hood averages less than 100 feet per minute, the hood is labeled with a failure notification form, and CRF and Safety are notified. Facilities will be contacted to make repairs and the outside contractor will reinspect/ reevaluate the hood. The hood is labeled with the date, inflow velocity and proper sash height. Fume hood operation and maintenance are key components to protecting staff. Proper operation of a fume hood involves setting the sash to a "safe", designated height, indicated by the position of the sticker. Only the Facilities Department can make modifications to the hood or ductwork. A fume hood should not be used for large pieces of equipment unless the fume hood is dedicated for this use, since it will change the airflow patterns and render the fume hood unsafe for other uses. It is generally more effective to install a specially designed enclosure for large equipment so the fume hood can be used for its intended purpose. All procedures for labeling with radioactive iodine (¹²⁵I or ¹³¹I) shall be conducted only in fume hoods specially designated for iodinations, which have been approved by the Radiation Safety Office. A fume hood should not be used for chemical or other storage, as this restricts airflow. Chemicals should be stored in a chemical storage cabinet since a hood cluttered with bottles may not contain releases effectively. Some of the basic guidelines for working safely in a chemical fume hood are listed in the Flipchart and include the following:

1. If it is absolutely necessary to store materials in a fume hood, they should be elevated about 6 inches so air can pass under them.
2. Work with materials should be done at least 6 inches into the hood. Traffic in the area of the fume hood must be avoided as this can create local eddying behind the person working in the hood and disturb airflow.
3. When working in the hood, investigators must **never** put their faces inside the hood to check their experiment. This defeats the purpose of a hood!
4. Work should be done with the sash in the lowest position possible. The sash will then act as a barrier and provide containment should something go wrong with the reaction.
5. An effective hood must not be cluttered with bottles or equipment. Only materials actively in use should be in the fume hood. This will provide optimal containment and reduce risk of extraneous chemicals being involved in fire or explosions which may occur in the hood.
6. Any suspected hood malfunctions should be reported to Safety (3-5060).

K. Housekeeping

It is essential for both safety and efficiency that the facilities be kept neat and orderly. Floors, shelves, and benches should be free from dirt and unnecessary apparatus and tools. Equipment should never be allowed to obstruct exits or passages - even for a short while. Care should be exercised with regard to what is put into trash containers. Flammable or toxic, or otherwise hazardous materials must not be placed in regular trash containers, but rather put into special containers for proper disposal. See **APPENDIX G** regarding waste disposal. General guidelines for good housekeeping include:

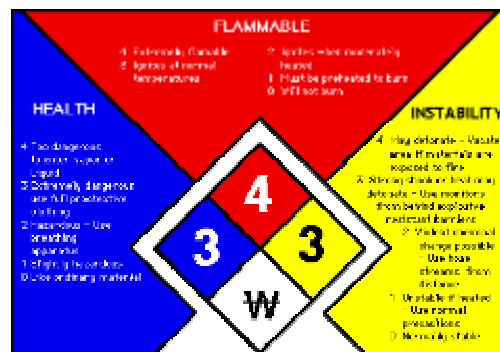
1. Access to emergency equipment, showers, eyewashes, and exits should never be blocked by **anything**, not even a temporarily parked laboratory cart.
2. All chemical containers must be labeled with at least the identity of the contents and the hazards those contents present to users.

3. All work areas, especially laboratory benches and hoods, should be kept clear of clutter.
4. All aisles, hallways, and stairs must be kept clear; they serve as means of egress in case of fire.
5. All chemicals should be returned to their proper storage area at the end of the day.
6. Liquid wastes should be kept in spill-proof containers, properly labeled as to chemical content and hazard, and stored off the floor in the closest Satellite Accumulation Area.
7. Dry chemical waste goes into **yellow**, properly labeled, closed waste bags, and are disposed of via the hazardous chemical waste stream.
8. Small spills should be cleaned up promptly; clean-up materials should be treated as chemical waste. Clean-up materials can be found in the spill kit. Spill kit information is available through the Safety Office and in Flipchart

L. Signs, Labels and Material Safety Data Sheets

1. Signs

- a. Emergency Signage
***NFPA diamonds



- b. Other signs
 - i. Radioactive and some Biohazardous substances used in laboratories also require special signs. These are discussed in The Miriam Hospital Radiation Safety and Research (rDNA) Manuals, respectively.
 - ii. No Smoking signs should be posted in areas where flammable liquids or gases are stored. The Miriam Hospital is a no-smoking institution.
 - iii. Signs indicating the location of fire blankets, safety showers, eyewash stations, fire extinguisher, and other safety devices are also required.
 - iv. Examples of severe or unusual hazards that may require signs are unstable chemicals, toxic or carcinogenic materials, chemical spills, high powered lasers (level IV and above), water reactive chemicals, and radioactive materials. Signs warning of these are available in Laboratory Safety Catalogs or contact Safety Office for information.

2. Chemical Container Labeling

- a. All containers must be labeled as to content and principal hazards. Chemicals received from outside vendors or from Stores will have labels indicating the name and other physical and chemical data., including toxicity warning signs or symbols. All containers of chemicals which are decanted from the original container, must be labeled with the chemical name, primary hazard(s), person responsible and the date at the time of transfer. All containers of chemical waste must be labeled as they are being filled. The label should contain the full chemical name, the primary hazard(s), and the name of the generating lab and the date.
- b. All containers of chemicals prepared in the laboratory must be marked with the chemical name, primary hazard(s), person responsible and date. Labeling must be provided for chemicals synthesized in the laboratory or prepared by other processes such as distillation or extraction. Hazard labels are available through the Stores. Chemicals developed in the laboratory must be assumed to be toxic if no data on toxicity are available, and suitable handling procedures must be prepared and implemented, including training of users in controls necessary to handle safely.
- c. If the substance is produced for another user outside of the laboratory, a Material Safety Data Sheet and labels must be prepared and provided to such users (in accordance with provision of OSHA Hazard Communication Standard, 29 CFR 1910.1200).

3. Material Safety Data Sheets

Material Safety Data Sheets (MSDS) are provided for each hazardous chemical by its supplier. A complete file of MSDS for hazardous chemicals, substances, or other materials used at The Miriam Hospital is kept by the individual departments. These are accessible to any laboratory staff member, student, staff or visiting professional. Material Safety Data Sheets, (MSDS) are bulletins prepared by manufacturers to summarize the health and Safety information about their products.

Material Safety Data Sheets, pertaining to chemicals found in The Miriam Hospital laboratories can be obtained from the SAFETY Office, 3-5060.

Material Safety Data Sheets come in many formats and present the information in different ways. Regardless of the format, the information that is required by OSHA includes:

- a. Product Identity
- b. Reactivity Hazards
- c. Hazardous Ingredients
- d. Spill Clean-Up
- e. Physical/Chemical Properties
- f. Protective Equipment
- g. Fire and Explosion Hazards
- h. Handling Precautions/First Aid Health Hazard

A User's Guide to Material Safety Data Sheets follows and is also available from the Safety Office. Consult with the Safety Office to apply this general information to your work situation.

USER'S GUIDE TO MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets (abbreviated MSDS) are prepared by manufacturers to summarize the Health and Safety information about their products.

TO OBTAIN AN MSDS

- Ask your Supervisor/PI for your laboratory MSDS file.
- Or, call the Safety Office (3-5060).
- Or, call the manufacturer.
- Or, go to <http://hazard.com/msds/>

COMPONENTS OF AN MSDS

SECTION ONE: IDENTITY

- Trade name used on the label and inventory list
- Manufacturer's name, address, and emergency telephone number
- Preparation and revision dates

SECTION TWO: HAZARDOUS INGREDIENTS

- Chemical and Common Names** of all the hazardous components
- Exposure Limits**

- ACGIH TLV: 8-hour time-weighted average
- OSHA PEL : 8-hour time-weighted average

These are not necessarily proven safe levels of exposure. If the exposure limit is not listed, don't assume that a chemical is safe. Contact the Safety Office.

- Percentage of the Mixture** (optional). The percentages do not usually add up to 100% since only the hazardous ingredients have to be listed.

SECTION THREE: PHYSICAL/CHEMICAL CHARACTERISTICS

- Vapor Pressure**--a measure of a liquid's tendency to evaporate
- Vapor Density**--reflects whether a vapor or gas is lighter or heavier than air
- Appearance and Odor**--These are *warning properties* that allow you to detect when you are being exposed to a material.

SECTION FOUR: FIRE AND EXPLOSION HAZARD DATA

- Flash Point**--the lowest temperature at which a liquid gives off enough vapors, which when mixed with air, can be easily ignited by a spark. The lower the flash point, the greater the risk of fire or explosion. Remember, it's the vapors that burn, not the liquid.

SECTION FIVE: REACTIVITY DATA

Reactivity, in this context, is the tendency for a material to chemically change or breakdown and to become more dangerous. Precautions include:

- Conditions to Avoid**--such as light or heat
- Materials to Avoid**--for example: sodium and water will react vigorously to generate hydrogen, creating a fire hazard

SECTION SIX: HEALTH HAZARD DATA

- If you need health hazard information that is not on an MSDS, contact Safety 3-5060.
- Routes of Entry**-- How a hazardous material can enter your body: Inhalation, Skin Absorption, and Ingestion.²²
- Short-Term Health Effects (ACUTE)**--symptoms which may be felt immediately after the first brief contact, like burns, watery eyes, sore throat
- Long-Term Health Effects (CHRONIC)**--symptoms which may be felt after repeated contact with the same hazardous material over a long period of time
- References** that list a chemical as a carcinogen or potential carcinogen
- Signs and Symptoms of Exposure**
- Medical Conditions Generally Aggravated by Exposure**
- Emergency and First-Aid Procedures**

If you are concerned about a chemical exposure you may have had, report to the Employee Health Services Office and bring the MSDS with you, if possible.

SECTION SEVEN: PRECAUTIONS FOR SAFE HANDLING AND USE

- Spill and Leak Procedures**--*The Safety Office (3-5060) can advise you on specific procedures and provide protective equipment.* According to The Miriam Hospital policy, the person or laboratory who creates a spill is responsible for assisting in the clean-up if he/she is not injured.
- Waste Disposal** -At The Miriam Hospital, call 3-5060 for information on how a particular chemical should be disposed. See **APPENDIX G** for the Waste Disposal Procedures at The Miriam Hospital.

SECTION EIGHT: CONTROL MEASURES

The Safety Office can answer specific questions regarding ventilation and personal protective equipment for normal working conditions and emergencies. Suitable control measures are based on how a material is used.

M. Monitoring and Staff Assessment

1. Safety with the assistance of a certified laboratory and qualified consulting service providers will perform exposure monitoring in accordance with paragraph (d) of 29 CFR 1910.1450, OSHA's Lab Standard.
 - a. **Initial monitoring** will be performed if there is reason to believe that exposure levels for a substance routinely exceed the OSHA action level (or in the absence of an action level, the PEL).
 - b. **Periodic monitoring** will be performed if the initial monitoring performed discloses staff member exposure over the action level (or in the absence of an action level, the PEL) for a substance for which OSHA requires monitoring; Safety will arrange for monitoring in accordance with the provisions of the relevant standard.
 - c. Monitoring may be terminated in accordance with the relevant standard.
 - d. Within 15 working days after the receipt of any monitoring results, the staff member will be notified of these results in writing, either individually or by posting results in an appropriate location that is accessible to staff members.
2. Anyone with a reason to believe that exposure levels for a substance routinely exceed the action level, or in the absence of an action level, the PEL, may request that Safety initiate the monitoring process.
3. The Safety Office will maintain and make available exposure monitoring records in accordance with the Recordkeeping requirements of the OSHA Lab Standard, 29 CFR 1910.20:23
 - a. Safety shall establish and maintain for each staff member an accurate record of any measurements taken to monitor staff member exposures and any medical consultation and examinations including tests or written opinions required by this standard.
 - b. The employer shall assure that such records are kept, transferred, and made available in accordance with 29
 - c. CFR 1910.20.
4. Records from monitoring done by consultants will be maintained by the Safety Office.

N. Hazardous Waste Disposal Policy (For complete program, see APPENDIX G)

It is The Miriam Hospital's policy, established both to ensure the safety of all staff members as well as to maintain compliance with all local, state, and federal regulations, to segregate hazardous waste at the point of generation into appropriately labeled, colored, and leakproof bags and containers. The color-coding has been introduced for easy recognition by all that come into contact with hazardous waste.

Sharps

Needles and other sharps (scalpels or razor blades, glass Pasteur pipettes, pipette tips etc.), regardless of whether they are contaminated or not, must be disposed of in the rigid BIOSYSTEM containers in use in all laboratory and clinical areas. These boxes are available through Environmental Services Department. This is to ensure their proper ultimate disposal, which is incineration in an "infectious waste" incinerator. To prevent unnecessary needlesticks, needles must not be clipped or recapped, but rather disposed of "as is" into the needle boxes. General service removal/replacement is provided 1-2X per week regardless of the quantity of materials in the container. However, if a container becomes full prior to the scheduled removal/replacement, contact ESD (3-2440) for service. Please do not leave them in the corridors, but rather, have Environmental Services pick them up in the lab or clinical area. Where possible, glass Pasteur pipettes should be replaced by plastic transfer pipettes, which are not considered as sharps and, if not contaminated can be disposed of as normal waste. Please refer to the summary chart on the next page to clarify the handling and segregation of the different waste streams at The Miriam Hospital. If you have any questions, please feel free to contact Safety 3-5060.

THE MIRIAM HOSPITAL SUMMARY OF WASTE DISPOSAL REQUIREMENTS

BATTERY DISPOSAL	Must have to be used ONLY for batteries and no other type of waste. Label " Batteries Only ". Full containers are removed by ESD. ***All 9-volt battery leads must be taped.
BLOOD BAGS and TUBES And OTHER REGULATED WASTE	Dispose in a red-lined covered waste container. This container should be used for materials that are contaminated with blood or other body substances. This includes items that are saturated, could drip, spill or splash, or dried blood that could flake off.
CHEMOTHERAPY WASTE	<ul style="list-style-type: none"> • Dispose of syringes, bags, bottles and tubing with trace/residual waste in the yellow, plastic receptacles with covers, which must be labeled as "chemotherapy waste" and covers must remain on the containers at all times. These are disposed of as REGULATED MEDICAL WASTE. Gloves used for treatment administration may also be discarded into these receptacles. Full containers are removed by ESD. Unit personnel are responsible for maintaining and ordering a supply of these units from the Storeroom. <i>Chemo Spill Kits are maintained on 4B, Outpatient Heme/Onc FHC 3 and Pharmacy and are available from the Storeroom.</i> • Grossly contaminated items and stock solutions are to be disposed of as HAZARDOUS CHEMICAL WASTE. These items should be placed in a yellow chemical bag and labeled with a hazardous waste label, both available through Stores: examples are: incomplete infusions, expired, or improperly prepared doses of chemo agents in IV bags, bottles, burretes, syringes. Also non linen contaminated materials from clean-up of a chemo spill or pt bodily fluid (w/in 48hours of treatment). Needles must be removed and placed in proper receptacles. ESD will pick-up the waste when notified.
MERCURY THERMOMETERS/ Elemental Hg	Hg Thermometers longer in use at TMH.
REUSABLE	Place reusable scissors, clamps and other instruments in clearly labeled blue receptacles filled with a soaking solution. These

INSTRUMENTS	instrument containers should be located in a central “dirty” utility area, and are picked up and replaced by CSR personnel.
SHARPS	Syringes with or without needles or blunt cannulas, scalpels and other sharps must be discarded into a clearly designated puncture-proof “sharps receptacle” from BIOSYSTEMS. No other waste should be added to these containers. Containers are removed by Biosystems on a weekly basis. If containers are $\frac{3}{4}$ filled before the THURSDAY pick-up by the contractor, call ESD for removal and replacement.
SUCTION CANISTERS	Full canisters should be securely covered and removed from the room then placed into a leak proof red-lined waste receptacle (Steri-tub). The unit should not be emptied prior to disposal.

Waste Management

Procedures for waste disposal must be planned before a project is started. Waste must be properly labeled. It is up to each department, group, or experimenter to identify waste materials properly before disposal; inadvertent mixing of incompatible materials could have serious consequences.

Protection of the environment makes the disposal of large quantities of chemical and solid wastes a difficult problem. It is in everyone's best interest to keep quantities of waste to a minimum. The following suggestions may help:

1. Only the amount of material needed for a project or experiment should be ordered, even if twice as much chemical can be bought for the same money. Leftover hazardous waste is far more costly.
2. Only the amount of material that is needed for conclusive results should be used.
3. Storage of excess material should be avoided, particularly if it is an extremely toxic or flammable material.
4. All samples and products to be disposed of must be properly identified, labeled with the chemical name and primary hazard, and then containerized. They must not be left for others to clean up.

Types of Chemicals and Their Disposal

1. Regulations that apply to The Miriam Hospital's sewer system prohibit the discharge of most organic solvents to the sewer system. Small amounts of some water-soluble, non-flammable materials may be discharged down the drain; the Safety Office must be consulted to determine which chemicals can be disposed of this way. In general, sink disposal is approved for dilute acids and bases and for aqueous solutions of non-toxic and non-hazardous chemicals. Organic solvents should be placed in suitable containers where there is no danger that vapors or the liquid will escape. Containers shall be capped tightly, and labeled prominently. They can then be disposed of through the Hazardous Waste Program. Mixtures of organic solvents that are compatible and combined in one container must be identified with an estimated proportion in fractions or percentages of each solvent in the mixture. Acids and alkaline solutions may be neutralized and put down the drain providing that they do not contain heavy metals or hazardous contaminants. Concentrated acids and caustics must be disposed of through the Hazardous Waste program, in compatible containers tightly capped and labeled. Inorganic and organic solids in their original containers that are designated as waste because they are contaminated, old, or of questionable purity must be disposed of through the Hazardous Waste program.
2. Mercury must be removed from lab apparatus and put into jars or bottles before disposal in the Hazardous Waste program. Clean up materials from a mercury spill may be containerized, labeled and then disposed of via the Hazardous Waste program. ESD has mercury spill kits to clean up mercury spills if needed. Please note that mercury in wastewater is a serious problem in Rhode Island. Many common chemicals and lab reagents contain small amounts of mercury (including the preservative thimerosal) that if disposed of via the sanitary sewer, will contaminate The Miriam Hospital's wastewater stream. The Miriam Hospital wastewater is regulated at <1.0 parts per billion of mercury. Cyanide compounds, pesticides, arsenic, lead, and heavy metal wastes should be placed in screw-cap bottles and containers, sealed tightly, labeled, and disposed of via the Hazardous Waste program. These empty containers are also considered hazardous waste and should be discarded through the Hazardous Waste program. Alkali metals such as sodium and potassium should be placed in a suitable container, covered with Nujol (mineral oil), labeled properly, sealed so that there is no possibility of their coming in contact with water, and disposed of via the Hazardous Waste program.

Pyrophoric metals such as magnesium, strontium, thorium, and zirconium, and other pyrophoric chips and fine powders should be placed in a metal container, sealed tightly, labeled, and disposed of via the Hazardous Waste program.

3. Waste Oil - small quantities of vacuum pump oil or lubricating oils in 1 gallon containers or less and disposed of via the Hazardous Waste program. Waste oil is considered a hazardous substance in Rhode Island and must be labeled and stored in the same manner as any hazardous waste.
4. The Safety Office (3-5060) may be consulted if there is any question concerning the toxicity or packaging of any hazardous wastes. They **must** be contacted **before** any laboratories are moved, either within The Miriam Hospital or to another facility.

Other Waste Types - Special Procedures Required

1. Gas cylinders are to be returned to the proper vendor. Some small lecture bottles are the non-returnable type which become a disposal problem when empty or near empty with a residual amount of gas. Ensure when ordering that they **are** returnable. Call the Safety Office for information on the disposal of non-returnable cylinders.
2. Controlled drugs to be disposed of as waste must be disposed of according to DEA regulations. The handling, records, and disposal of controlled drugs are the responsibility of the department involved. For more information on these regulations, contact the Safety office at 3-5060.
3. Radioactive material disposal is handled in accordance with procedures established by the Radiation Safety Officer. For more information please see The Miriam Hospital Radiation Safety Manual.
4. Biological Waste and Sharps are decontaminated and disposed of according to procedures set forth by the Safety Office and are outlined in the Laboratory Flipchart.

Identification

All waste chemicals must be identified by chemical name, including the proportions of a mixture. Do not use symbols or abbreviations. All containers must be labeled prominently because the safe transportation of chemicals is possible only when everyone who handles the containers know the identity of the contents. All containers of waste chemicals must have an orange Hazardous Waste label attached to them. This identifies the type of waste, the associated hazards and the laboratory or department that created the waste. The labels are available from Stores.

Storage

1. Waste chemicals stored in containers of one gallon or larger size shall be break-resistant whenever possible.
2. Waste chemicals stored in breakable containers of one gallon or larger size shall be kept within approved secondary containers.
3. Secondary containment is encouraged for all waste chemical storage.
4. BREAK-RESISTANT means a container made of metal, plastic, plastic-coated glass, or metal overpack of glass. APPROVED SECONDARY CONTAINER means a commercially available bottle carrier made of rubber, metal or plastic with carrying handle(s) and which is of large enough volume to hold the contents of the chemical container.
5. Lids or covers are desirable but not necessary. Rubber or plastic should be used for acids/alkalies; and metal, rubber, or plastic for organic solvents.

Packaging

Wastes must be packaged and containerized in a manner that will allow them to be transported without the danger of spillage, explosion, or hazardous vapors escaping. Wastes that have not been properly packaged and identified will not be accepted for disposal.

O. Medical Surveillance

Medical consultations/examinations are offered to The Miriam Hospital staff through Employee Health Service under the following circumstances:

1. Whenever a staff member develops signs or symptoms associated with a hazardous chemical to which the staff member may have been exposed in the laboratory.
2. Where exposure monitoring reveals an exposure level routinely above OSHA's Action Level or Permissible Exposure Limit for an OSHA regulated substance which requires such monitoring and medical surveillance.
3. Whenever an event occurs such as a chemical spill, leak, explosion which results in the likelihood of a hazardous exposure.

P. Exposure Reporting

Any staff member who believes they have had an exposure should contact Employee Health Services (3-3123) or the Safety Office 3-5060 for evaluation. If any staff member exhibits adverse health effects they should report immediately to the Employee

Health Service (7:30-4:30, Monday through Friday) or the Hospital Emergency Room. (Off-hours and weekends). The Safety Office will try to determine actual exposures. The results of all hazard evaluations and any airsampling data will be available to all occupants of the affected areas.

Q. **Emergency Situations**

Emergencies that can occur in a laboratory include fire, explosion, chemical spill or release, medical or other health threatening accidents. General procedures to be followed in any emergency are:

1. Render assistance to person(s) involved and remove them from exposure to further injury if necessary and if this can be done safely.
2. Notify nearby persons who may be affected and call 3-5111 to report the emergency and seek assistance.
3. Evacuate the area until help arrives.
4. Wait for emergency responders and assist them in handling the emergency.
5. Assist in the follow-up investigation of the emergency.

Specific procedures for response to chemical, radioactive, and biohazard spills are found in **APPENDIX E**.

R. **Emergency Equipment**

In any emergency, it is crucial that all staff members are familiar with the use and location of emergency equipment. These include fire extinguishers, fire alarms, safety showers, and eyewash stations. In addition, it is critical that this equipment be maintained and that it functions as it was designed in an emergency situation. Therefore, all emergency equipment is on a preventive maintenance schedule. Fire alarms are tested monthly; extinguishers are inspected monthly by Facilities. Safety showers are tested bi-annually and eyewash stations are checked weekly by the department.

S. **Oversight, Annual Review, Recordkeeping, Compliance, Enforcement**

1. The **Laboratory Supervisor** (or appointed personnel) is responsible for establishing and maintaining records for staff member training. Records of staff member and environmental monitoring are kept in the Safety Office. All Laboratory Supervisors should maintain current inventories of chemicals stored in the work place.
2. The **Laboratory Supervisor** (or appointed personnel) should enforce the Chemical Hygiene Plan by making sure the Chemical Hygiene rules are known, and followed.
3. The **Chemical Hygiene Officer** will assist with chemical hygiene and Environmental Services inspections. When there are significant changes in existing policies or work practices, an inspection should be conducted soon after the new process is implemented.
4. The **Chemical Hygiene Officer** will review the Chemical Hygiene Plan annually and update as needed.
5. BLSC will review all policy and procedures that warrant committee approval and aid in training for laboratory staff.

Appendices.

APPENDIX A

"The OSHA Lab Standard: 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories; Final Rule 55FR21, pp3327-3335, January 31, 1990.

TITLE 29--LABOR

PART 1910--OCCUPATIONAL SAFETY AND HEALTH STANDARDS (Continued)--Table of Contents

Subpart Z--Toxic and Hazardous Substances

Sec. 1910.**1450** Occupational exposure to hazardous chemicals in laboratories.

(a)

Scope and application.

(a)(1)

This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(a)(2)

Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(a)(2)(i)

For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(a)(2)(ii)

Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

(a)(2)(iii)

Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

(a)(3)

This section shall not apply to:

..1910.1450(a)(3)(i)

(a)(3)(i)

Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart 2, even if such use occurs in a laboratory.

(a)(3)(ii)

Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

(a)(3)(ii)(A).31

Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

(a)(3)(ii)(B)

Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b)

Definitions -"

"Action level" means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Carcinogen" (see "select carcinogen").

"Chemical Hygiene Officer" means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

"Chemical Hygiene Plan" means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

"Combustible liquid" means any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flashpoints of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

"Compressed gas" means:

- (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or
- (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg. C) regardless of the pressure at 70 deg. F (21.1 deg. C); or
- (iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

"Designated area" means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

"Emergency" means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

"Employee" means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

"Explosive" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature..32

"Flammable" means a chemical that falls into one of the following categories:

(i) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) "Gas, flammable" means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) "Liquid, flammable" means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

"Flashpoint" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 - 1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

"Hazardous chemical" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

"Laboratory" means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

"Laboratory scale" means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

"Laboratory-type hood" means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

"Laboratory use of hazardous chemicals" means handling or use of such chemicals in which all of the following conditions are met:

- (i) Chemical manipulations are carried out on a "laboratory scale;"
- (ii) Multiple chemical procedures or chemicals are used;
- (iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and
- (iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

"Medical consultation" means a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

"Organic peroxide" means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

"Oxidizer" means a chemical other than a blasting agent or explosive as defined in 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

"Physical hazard" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.

"Protective laboratory practices and equipment" means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

"Reproductive toxins" means chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

"Select carcinogen" means any substance which meets one of the following criteria:

- (i) It is regulated by OSHA as a carcinogen; or
- (ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or.34
- (iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or
- (iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - (A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
 - (B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or
 - (C) After oral dosages of less than 50 mg/kg of body weight per day.

"Unstable (reactive)" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"Water-reactive" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(c)

Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

..1910.1450(d)

(d)

Employee exposure determination

(d)(1)

Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

(d)(2)

Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

(d)(3)

Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

(d)(4)

Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

(e)

Chemical hygiene plan - General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

(e)(1)

Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

(e)(1)(i)

Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(e)(1)(ii)

Capable of keeping exposures below the limits specified in paragraph (c) of this section.

(e)(2)

The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

(e)(3)

The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(e)(3)(i)

Standard operating procedures relevant to Safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

(e)(3)(ii)

Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(e)(3)(iii)

A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

(e)(3)(iv)

Provisions for employee information and training as prescribed in paragraph (f) of this section;

(e)(3)(v)

The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(e)(3)(vi)

Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

(e)(3)(vii)

Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

(e)(3)(viii)

Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:..36

(e)(3)(viii)(A)

Establishment of a designated area;

(e)(3)(viii)(B)

Use of containment devices such as fume hoods or glove boxes;

(e)(3)(viii)(C)

Procedures for safe removal of contaminated waste; and

(e)(3)(viii)(D)

Decontamination procedures.

(e)(4)

The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

(f)

Employee information and training.

(f)(1)

The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

(f)(2)

Such information 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. The frequency of refresher information and training shall be determined by the employer.

(f)(3)

Information. Employees shall be informed of:

(f)(3)(I)

The contents of this standard and its appendices which shall be made available to employees;

(f)(3)(ii)

the location and availability of the employer's Chemical Hygiene Plan;

(f)(3)(iii)

The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

(f)(3)(iv)

Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(f)(3)(v)

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 received from the chemical supplier.

(f)(4)

Training

(f)(4)(i)

Employee training shall include:

(f)(4)(i)(A)

Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(f)(4)(i)(B)

The physical and health hazards of chemicals in the work area; and

(f)(4)(i)(C)

The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

(f)(4)(ii)

The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

(g)

Medical consultation and medical examinations.

(g)(1)

The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

(g)(1)(i)

Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

(g)(1)(ii)

Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

(g)(1)(iii)

Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

(g)(2)

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

(g)(3)

Information provided to the physician. The employer shall provide the following information to the physician:

(g)(3)(i)

The identity of the hazardous chemical(s) to which the employee may have been exposed;

(g)(3)(ii)

A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

(g)(3)(iii)

A description of the signs and symptoms of exposure that the employee is experiencing, if any.

(g)(4)

Physician's written opinion.

(g)(4)(i)

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

(g)(4)(i)(A)

Any recommendation for further medical follow-up;

(g)(4)(i)(B)

The results of the medical examination and any associated tests;

(g)(4)(i)(C)

Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and

(g)(4)(i)(D)

A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

(g)(4)(ii)

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

(h)

Hazard identification.

(h)(1)

With respect to labels and material Safety data sheets:

(h)(1)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

(h)(1)(ii)

Employers shall maintain any material Safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

(h)(2)

The following provisions shall apply to chemical substances developed in the laboratory:

(h)(2)(i).39

If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

(h)(2)(ii)

If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

(h)(2)(iii)

If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material Safety data sheets and labeling.

(i)

Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

(j)

Recordkeeping.

(j)(1)

The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

(k)

Dates **-(k)(1)**

Effective date. This section shall become effective May 1, 1990.

(k)(2)

Start-up dates.

(k)(2)(i)

Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.

(k)(2)(ii)

Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan..40

APPENDIX B - HAZARDOUS PROPERTIES/HEALTH EFFECTS OF CHEMICALS

The kinds of adverse health effects that can be suffered are generally classified into 8 categories. The extent of the damage to the body will depend on the concentration and duration of the exposure. It is also important to recognize that some chemicals may exhibit more than one hazardous property: this must all be considered when choosing protective equipment.

Poisons - interfere with vital bodily processes. Some examples are:

1. Cyanide ions interfere with tissue oxidation by combining with cytochrome oxidase. Overdose leads to death
2. by chemical asphyxiation.
3. Arsenic compounds combine with enzyme sulfhydryl groups and interfere with enzymatic action.
4. Methyl butyl ketone and acrylamide can cause peripheral neuropathy.
5. Chromates, fluorides and corrosive gases absorbed or particles can act as poisons.
6. Silica and asbestos are considered poisonous particulates as they form fibrosis (scar tissue formation) in the lung, which then interferes with normal pulmonary functions.

Irritants - cause immediate pain or reddening of exposed areas. The most common sites of exposure are the eyes, skin, throat and breathing passages. Their major long-term effect is scar tissue formation at the site of injury. Site of action depends on solubility.

Examples are:

1. Upper respiratory irritants - soluble gases such as ammonia, hydrogen chloride, sulfur dioxide, ethylene oxide (nose, throat).
2. Upper respiratory/lung tissue irritants - Bromine, chlorine, cyanogen bromide, dimethyl sulfate, ozone.
3. Lung tissue irritants - poorly soluble agents such as nitrogen dioxide, phosgene, arsenic trichloride.

Asphyxiants - interfere with oxygen and/or availability:

1. Simple asphyxiants may not normally be dangerous (e.g. nitrogen, argon, helium, nitrous oxide) but if present in high enough concentrations can displace oxygen in air and cause suffocation.
2. Chemical asphyxiants chemically combine with oxygen carrying sites (carbon monoxide) or interfere with oxygen utilization (cyanide).

Anesthetics/narcotics - depress the central nervous system. Many solvents have an anesthetic effect (chloroform, ether).

Sensitizers - do not harm the body upon first exposures, but upon re-exposure can do so and often at extremely low levels. Response is generally of an allergic nature, with skin, eye, or lung reaction. Examples are toluene diisocyanate (TDI), used to make urethane materials, epoxy resins, formaldehyde.

Corrosives - cause rapid death of body cells they contact. Exposure may cause pain, burning, bleeding and fluid loss. Acids and bases are such corrosives, as is phenol. Bases and some acids may cause pain only after the exposure. Any contact with acids or bases requires careful washing for at least 15 minutes.

Reproductive Toxins - defines a broad class of chemicals that can:

1. affect the reproductive organs (e.g. atrophied testicles, enlarged breasts, etc.)
2. affect adult sexual functions (e.g. libido, fertility, menstruation, ovulation, etc.)
3. affect the offspring of males or females who were exposed by causing structural abnormality, functional
4. deficiencies, altered growth or death of the conceptus.

Some **mutagens** can affect the offspring due to parental exposures before conception takes place.

Teratogens affect the developing embryo or fetus due to exposures in the womb. Exposure to teratogens during the first 3 weeks of pregnancy may result in severe damage or death of the embryo. Exposure to teratogens during weeks 4 - 9 may result in birth defects since this is the period of organogenesis. Special precautions may be needed to ensure that exposures do not occur during these critical periods.

Carcinogens cause cancer, which is the irreversible, uncontrolled growth cells in an organ or tissue. It is believed that there is no known minimum dose which can remove **all** danger of cancer. Benzene is a known carcinogen.

When will health effects occur? Another factor should be considered in evaluating the health hazards of chemicals is when will an effect occur; immediately after the exposure, or some time after.

Acute effects - An acute reaction is one that occurs in the body as an immediate response to exposure. Effects are apparent and can often be traced without difficulty. Acute reactions are normally short lived, and may be followed by recovery or occasionally be permanent damage.

Chronic effects - Unlike an acute effect, a chronic effect may not be obvious. The onset of symptoms is gradual. It is much harder to trace the cause of a chronic effect, since the exposure could have been as long as 20 - 30 years after exposure.

APPENDIX C- **BLSCS FORM???**

****Approval Form for Work with Extremely Hazardous Chemicals**

1. What procedures incorporate usage of this particular reagent and where are the procedures being performed?
2. What is the concentration and amount used per procedure?
3. Who will be working with the reagent?
4. What protective clothing is used during procedures (e.g. gloves, goggles, etc)?
5. Where is the reagent stored?
6. How is generated waste disposed of?
7. In the event of an accidental, **minor** spill, how is the substance detoxified and ultimately cleaned up?
8. How will you inform others that extremely hazardous materials are in use?

Name of chemical _____ Date _____

Person completing form _____ Dept. _____

****Request for Approval to Work with Toxins In Animals**

You have recently submitted a request for animal use to the Animal Care and Use Committee. As part of your protocol, you indicate that toxins or carcinogens will be used. In order that I may understand how the specific chemical will be used and any associated Safety hazards to you and your staff as well as to the animal handlers, I would appreciate your filling out the following questionnaire.

1. What procedures incorporate usage of this particular reagent and where are the procedures being performed?
2. What is the concentration and amount used per procedure?
3. Who will be working with the reagent?
4. What protective clothing is used during procedures (e.g. gloves, goggles, etc)?
5. Where is the reagent stored? How will it be transported to the Redstone/Mayer?
6. How is generated waste disposed of?
7. In the event of an accidental, **minor** spill, how is the substance detoxified and ultimately cleaned up?
8. How will you inform others that toxic materials are in use?
9. Please list the name and address of the supplier of the chemical in question.
10. Do you feel that there are any special precautions that the animal handlers need to take when handling animals or bedding contaminated with this compound?

Approved _____ BLSC _____ Date _____.

APPENDIX D

EMERGENCY RESPONSE FOR LABORATORY ACCIDENTS RESPONSE TO SPECIFIC INCIDENTS

Splash to the eye/body contamination

CHEMICAL

EYE – Immediately flush the eye with a gentle stream of clean, temperate water for 15 minutes. Hold the eyelids open. Be careful not to wash the contaminant into the other eye. Use an emergency eyewash/shower if one is accessible.

BODY – Immediately drench skin with water and remove contaminated clothing. Flush the area for 15 minutes. Use an emergency drench shower if one is accessible.

Notify Employee Health (3-3125) to obtain follow-up medical care. Go to Emergency Room for treatment if Employee Health is closed.

Fill out Incident Report.

BIOLOGICAL

EYE – Immediately flush the eye with a gentle stream of clean, temperate water for 15 minutes. Hold the eyelids open. Be careful not to wash the contaminant into the other eye. Use an emergency eyewash/shower if one is accessible.

BODY – Immediately drench skin with water and remove contaminated clothing. Flush the area for 15 minutes. Use an emergency drench shower if one is accessible.

For any exposure to blood and/or body fluids, contact Employee Health (3-3125). If Employee Health is closed, contact Nursing Supervisor by calling the operator (“O”) and asking for the Nursing Supervisor on call.

Fill out Incident Report.

RADIOACTIVE

EYE – Immediately flush the eye with a gentle stream of clean, temperate water for 15 minutes. Hold the eyelids open. Be careful not to wash the contaminant into the other eye. Use emergency eyewash if one is accessible.

BODY – Immediately drench skin with water and remove contaminated clothing. Flush the area for 15 minutes. Use an emergency drench shower if one is accessible.

Notify Employee Health (3-3125) and obtain follow-up medical care. Go to Emergency Room for treatment if Employee Health is closed.

Notify the Radiation Safety Officer at 4-5691. After hours call 4-5611.

Fill out Incident Report.

Thermal Burns

1. If skin is broken, submerge the burned area in clean water.
2. Do not break any blisters.
3. Do not use any medications.
4. Notify Employee Health (3-3125) and obtain medical care. Go to Emergency Room for treatment when Employee Health is closed.

Poisoning by Ingestion

If the victim is conscious:

1. Notify Employee Health (3-3125) and obtain medical assistance. Go to the Emergency Room when Employee Health is closed and call Poison Control at 1-800-682-9211.
2. Save the label or the container for vital information for medical treatment.

If the victim is unconscious:

1. **Call CODE BLUE X3-5111**
2. Maintain open airway for adequate breathing.
3. Save the label of container for vital information for medical treatment.

Poisoning by Inhalation

1. Do not become a victim yourself by exposure to the same poison while rescuing the victim. If you are not sure if hazards exist, call 3-5111 for emergency spill incident.
2. Carry or drag the victim to uncontaminated air immediately. Do not let him/her walk.
3. Notify Employee Health (3-3125) for medical attention.
4. Transport to Emergency Room.

If the victim is unconscious: Call the “Medical Emergency” at 3-5111.

(i) Cuts and Abrasions

1. Immediately cleanse the wound and surrounding skin with soap and warm water, wiping away from wound.
2. Hold a sterile or clean pad firmly over the wound and apply pressure directly to the wound.
3. If person is bleeding profusely, Call the “Medical Emergency” 3-5111.
4. Keep victim lying down and raise the bleeding part higher than the rest of the body if the cut is severe.
5. Notify Employee Health (3-3125) for medical care or transport to hospital Emergency Room if Employee Health is closed.

(ii) Clothing Fire

If your clothing should catch on fire, immediately **DROP TO THE FLOOR AND ROLL**. In case of ignition of another person’s clothing, immediately knock that person to the floor and roll that person around to smother the flames. A person may panic if his/her clothing ignites and may run. This can result in more severe or fatal burn injuries.

Safety showers or fire blankets are of secondary importance. They should be used only when immediately at hand. Rolling on the floor smothers the fire; helps keep flames out the victim’s face and reduces inhalation of smoke. Improper use of fire blankets can increase the severity of smoke and injuries if the blanket is not removed after the flames have been extinguished.

Immediate medical assistance should be obtained. Call Employee Health (3-3125) or transport to Emergency Room if Employee Health is closed.

APPENDIX E

CHEMICAL SPILLS

EMERGENCY RESPONSE TO SPILLS- If spills can not be controlled/ cleaned up safely by using spill kit:

1. Evacuate Room
2. Remove contaminated clothing ASAP. Take shower.
3. Get medical attention for injured personnel.
4. Employee Health 7:30 AM – 4:30 PM
5. Emergency Room after hours
6. Medical emergencies – call 3-5111 (Code Blue)
7. Call Security for uncontrolled spills – 3-5111.
8. Post warning sign.

CHEMICALS

1. Extinguish open flame.
2. Leave hood/room exhaust on, ventilate area.
3. For large spills, call 3-5111 and follow instructions of Response Team.
4. For small spills follow instructions on spill kit.
5. Only after Safety Officer confirms or authorizes area is safe, ask Environmental Services Department to wash spill area.
6. All exposed personnel should be checked by Employee Health.

BIOHAZARDS

1. Allow aerosols to settle 30 minutes.
2. Put on protective clothing and assemble clean-up material.
3. Pick up broken glass with forceps.
4. Pour concentrated disinfectant around spill—let sit 15 minutes.
5. Dispose of all contaminated material in autoclave container and autoclave, or use liquid disinfectant.
6. Phone 3-5060 for assistance or call 3-5111.
7. For any exposure to blood and/or body fluid, contact Employee Health at 3-3125 from 7:30 AM – 4:30 PM or page the Nursing Supervisor on call.

RADIATION

1. Call Radiation Protection Officer at 4-5961 or 4-5611 (after hours).
2. Cover spill area with absorbent.
3. Mark area of spill as contaminated.
4. Start decontamination procedures only under qualified supervision.
5. Remove contaminated clothing. Go to uncontaminated control area; wash with mild soap and water by rubbing gently for 3 minutes.
6. Stay in control area until everyone has been surveyed for possible contamination.

- **ALL SPILL INCIDENTS SHOULD BE DOCUMENTED AND SENT/REPORTED TO SAFETY.**
- **KNOW LOCATION OF SPILL KIT**

**APPENDIX F
MAXIMUM QUANTITIES 1 (GALLONS) OF FLAMMABLE & COMBUSTIBLE
LIQUIDS FOR CLASS C (LOW HAZARD) LABORATORIES**

**Chart to be inserted

**FLAMMABLE AND COMBUSTIBLE LIQUIDS COMMONLY FOUND AT THE MIRIAM HOSPITAL
CHEMICAL CLASS CHEMICAL CLASS CHEMICAL CLASS**

*****Chart to be inserted**

Class I - Flash point less than 100 °F.

Class II - Flash point between 100 °F - 140 °F.

Class III - Flash point between 140 °F - 200 °F.

For maximum container sizes see NFPA 45-1982, Table 7-2.

APPENDIX G

CHEMICAL WASTE DISPOSAL

NO CHEMICAL CAN BE POURED DOWN THE DRAIN. All chemicals must be properly labeled, stored and disposed of following the guidelines below:

- Satellite accumulation area must be designated prior to generation of chemical waste.
- Be sure containers are compatible with waste (use original containers or similar).
- All containers must be labeled with a hazardous waste label (Available through Stores)
- Each hazardous waste label must contain the following information:
 1. All hazardous constituents (no formulas or abbreviations)
 2. The chemical's associated hazards (flammable, combustible, poison, carcinogen, corrosive, etc.)
 3. The date the container becomes **FULL** and ready for pick up.
- Hazardous waste containers must remain closed at all times during storage, except when waste is being added. Do not store under hood unless being used.
- All hazardous waste containers must be stored in secondary containment bins (provided by Safety – 3-5060).
- Incompatible waste **MUST** be separated (acids/bases).
- Once the container becomes full, date it, ensure label is filled out properly, and call Safety at 3-5060 for removal. *Container must be removed from satellite area within three (3) days.

Chemical Bottles: Unbroken

- Triple rinse
- Place in regular trash or in boxes labeled "Trash" for ESD pick-up.

Solid Chemical Waste-YELLOW BAG WASTE

- Gels containing hazardous chemical
- Spill clean up materials
- **MUST** be placed in YELLOW Bags available through Stores
- Label with Hazardous Waste Label

Emergency Phone Numbers: Spills/Exposures

Safety Office Ext. 3-5060

After Hours: 3-5111

Waste Pick Up Schedule:

Call Safety at 3-5060, Safety will arrange to pick-up at your location. Waste should be in containers that are clean and are properly closed and labeled. Labels are available through Stores.

Always use proper PPE when handling chemical/waste (gloves, safety glasses).

LABORATORY CLEAN OUT - If you are planning to "clean out" the laboratory and dispose of large quantities of chemicals, please schedule a special pick up by calling 3-5060. Remember **ALL** containers must be labeled even if chemical has never been opened

NEEDLE DISPOSAL POLICY

HAZARDOUS WASTE DISPOSAL POLICY

In conjunction with state, federal, and local regulations, hazardous waste must be properly labeled and disposed of through special waste streams (see THE MIRIAM HOSPITAL Safety Manual).

So that all personnel in the Hospital (as well as the different carriers and disposal firm personnel) may recognize the different types of hazardous waste being generated, a color code has been established for the waste bags. These bags are available through Stores.

The following colors denote the following hazards (and must not be interchanged):

Orange Biohazardous, autoclavable material

Yellow: Solid Chemical Waste

Transparent: Radioactive. Using black Sharpie pen, completely cross off the radioactive symbols on all tapes on vials.

DISPOSAL OF CHEMOTHERAPEUTIC, CARCINOGENIC OR TOXIC WASTE DRUGS

I Containment

A. Vials, ampules, syringes, etc., containing chemotherapeutic, carcinogenic and toxic waste drugs shall be put into plastic or glass bottles with screw tops.

NOTE: THE PLASTIC WASTE BOTTLE SHALL NOT CONTAIN SIGNIFICANT AMOUNTS OF LOOSE LIQUIDS.

B. Items contaminated with dangerous waste drugs, such as gloves, absorbent paper, etc., shall be placed into yellow chemical waste bags, preferably double-bagged, and then appropriately sealed and labeled. The bags should have the complete chemical name and hazard classification filled out on the orange hazardous waste label..

CHEMICAL WASTE DISPOSAL PROGRAM

To prevent the introduction of mutagenic, carcinogenic or toxic compounds into the general environment, the Mass. Dept. of Environmental Protection, (DEP) and the U.S. Environmental Protection Agency (EPA) require that chemicals other than innocuous aqueous solutions be disposed of by proper procedures.

- The Miriam Hospital has recognized its obligation to preserve the environment and has hospital a Hazardous Waste program to ensure the proper disposal of hazardous waste. It is the researcher's responsibility to ensure that all hazardous waste materials are properly contained and labeled at all times in the laboratory.

- Safety collects chemical waste, upon request.

- Once a quarter, a chemical waste disposal firm, licensed by the EPA, picks up and subsequently incinerates, landfills or otherwise treats these materials.

To ensure smooth handling of our chemical waste, please follow these guidelines:

1. Waste chemicals must be put into a self-standing container with a screw top. Ensure that the chemical and its container are compatible. The original shipping container is usually the best.
2. All waste containers must be labeled, as they are being filled, with an yellow hazardous waste label, which has the complete chemical name (**no abbreviations**) and applicable hazard classification(s) checked off on the label. These labels are available Stores.
3. If more than one chemical is placed in a container, assure that the mixture is compatible. Do not label "Organic Waste", but rather specify chemicals and approximate percentages.
4. Chemical waste is picked up by Safety on request.

NOTE: When possible to do so in a safe and convenient way, extremely hazardous or toxic materials should be neutralized by lab personnel before disposal. Please check with Safety for advice in waste disposal.

APPENDIX H

THE MIRIAM HOSPITAL'S FORMALDEHYDE PROGRAM

This program addresses each of the individual sections of the OSHA Formaldehyde standard (OSHA requirements in bold letters) with frequent referral to the supplementary materials mentioned above.

1. Scope and Application:

The standard applies to all occupational exposures to formaldehyde gas, formaldehyde solutions and formaldehyde-releasing substances, as more fully explained in section (d).

2. Definitions:

It is felt that the one definition in this section requiring detailed explanation is the "**action level**"(AL). The action level is defined as one-half of the permissible exposure limit, calculated as an 8-hour time weighted average. Calculating an exposure as an 8-hour time weighted average, or 8-hour TWA, means that the total amount of material collected in a sampling session is simply divided evenly over a standard 8-hour workshift. The action level is an exposure limit above which the monitoring and annual training provisions of the standard apply. Hence, employers have an incentive to keep exposures below the action level. Its use is also designed to provide an extra margin of safety for hypersensitive individuals. The action level of formaldehyde is a concentration of 0.5 parts per million (ppm) in air.

3. Permissible Exposure Limits, PELs:

There are two PELs for formaldehyde. One is an 8-hour time weighted average and is called the 8-hour TWA. No staff member may be exposed to airborne formaldehyde exceeding the 8-hour TWA of 0.75 ppm, as set by the standard. In areas where airborne formaldehyde levels exceed 1.0 ppm, the controls to be utilized must be reviewed. The second PEL is called the short-term exposure limit, or STEL. Here, exposure is averaged over 15 minutes. No staff member may be exposed to airborne formaldehyde exceeding the STEL, which is set at 2.0 ppm. Exposures to airborne formaldehyde above the STEL require the use of the controls discussed later in the program.

4. Exposure monitoring:

Employers must monitor staff members for formaldehyde exposure when exposure is to formaldehyde gas, mixtures or solutions with more than 0.1% formaldehyde or materials capable of releasing formaldehyde into the air under normal conditions where the concentration equals or exceeds 0.1 ppm. Health complaints possibly associated with formaldehyde exposure also trigger a requirement to monitor. If objective data can document that the presence of formaldehyde cannot cause exposure above the action level or STEL, exposure monitoring is not required. Representative sampling strategies for affected job classifications are allowed if the sampling represents a full shift or appropriate short-term exposure. Changes which result in new or additional exposures require monitoring to be repeated. Where exposures exceed the action level, monitoring is to be conducted at least every six months. When the STEL is exceeded, monitoring is repeated at least once a year under worst case conditions. Monitoring can be terminated when two consecutive and statistically representative samples, at least seven days apart, show exposure to be below the action level and the STEL. Staff members must be notified of results in writing within 15 days of the employer's receiving the results. When exposure is over the 8-hour TWA or the STEL, the employer is required to write and share with staff members a plan of corrective action. Staff members have a right to observe monitoring and to have any required protective gear made available by the employer while doing so. Although many laboratories work routinely for brief periods of time with HCHO, most perform their work in a chemical fume hood, which are checked annually for proper inflow velocity. It was therefore felt that there was little likelihood of exposure to HCHO at or above the AL due to the containment of the fumes in the fume hood. In a few areas, work is being performed, again for brief periods of time, on the open lab bench. It was felt that during these procedures there was a potential for exposure to HCHO at or above the STEL; therefore STEL monitoring was conducted in these areas. None of the staff members monitored had exposures in excess of the STEL. Since the procedures monitored were the only ones done during any given work-day with HCHO, and the STEL's were not exceeded, the 8-hour PEL could not be exceeded and therefore 8-hour air sampling was not conducted. Results of the monitoring were reported to the affected staff members, and copies of the air monitoring are kept in the Safety Office.

5. Regulated Areas

When formaldehyde exposure exceeds to the 8-hour TWA or STEL, the area is to be designated as a regulated area. Entrances must be posted as described in the standard and access restricted to authorized personnel with appropriate formaldehyde training. These restrictions must be communicated to staff members of other employers, such as construction contractors, with operations at the worksite in question. As mentioned in (d) above, no exposures exceeded the 8-hour TWA or STEL.

6. Methods of Compliance:

These methods must be used when either the 8-hour TWA or STEL is exceeded. These methods include, engineering controls and respirators and other personal protective equipment. When feasible, engineering and other personal protective equipment shall be

used When not feasible for engineering and work practice controls to reduce exposure below either of the PELs, respirators may be used as a supplement. Again, neither the 8-hour TWA nor the STEL was exceeded. However, all staff members are encouraged to work with HCHO in a chemical fume hood. See the THE MIRIAM HOSPITAL Laboratory Flipchart for information about hoods and personal protective equipment. Supervisors should explore work practice controls with staff members.

7. Respiratory Protection:

Such equipment, when required, must be supplied at no cost to the staff member and the employer must assure proper use. The Safety Department must be consulted before respirators are selected. At that time, fit testing and cartridge/canister selection and replacement will be discussed. The Miriam Hospital Safety Manual should be consulted for general information regarding respiratory equipment.

8. Protective Equipment and Clothing:

This equipment also must be provided at no cost to the staff member and the employer must assure its use.

All contact of eyes and skin with liquids containing 1% or more of formaldehyde must be prevented by the use of this equipment. Formaldehyde impervious clothing (i.e. tyvek coveralls), goggles and face shields appropriate to the operation must be used. Contact the Safety Department for help in proper selection, usage and equipment maintenance.

9. Hygiene Protection:

Changing facilities, eyewashes and drench showers are addressed by this section. Access to such equipment must be provided.

10. Environmental Services:

Regular visual inspections for leaks and spills should be conducted. Provisions must be made for spill containment, work area decontamination and waste disposal. Sealed containers holding debris from spills must be labeled to indicate the presence and associated hazards of formaldehyde.

The Miriam Hospital Safety Manual describes spill procedures.

11. Emergencies:

Emergency responses for accidents of various types are described in the THE MIRIAM HOSPITAL Laboratory Flipchart. Specific staff member duties and assignments are delineated as well. The MSDS also contains relevant information and is handed to all new laboratory staff members at Safety Orientation.

12. Medical Surveillance:

The employer shall maintain hospital medical surveillance programs for all staff members who are exposed to formaldehyde at concentrations at or exceeding the AL or the STEL. The occupational health hazards of formaldehyde are primarily due to its toxic and irritant effects after inhalation, direct contact with the skin or eyes or after ingestion. Acute effects of exposure by ingestion would produce severe irritation and inflammation of the mouth, throat and stomach. Inhalation of formaldehyde would lead to irritation of the upper respiratory tract and eyes. Concentrations above 20 ppm would lead to heavy tearing, difficult breathing, cough and burning of the nose and throat and could lead to severe respiratory injury. Dermal contact causes white discoloration, smarting, drying and possible cracking and scaling of the skin. Previously exposed persons may react to future exposure with an allergic eczematous

dermatitis or hives. Eye contact by splashing can result in severe permanent corneal clouding and possible loss of vision. Transient irritation may result from high ambient air levels. Air sampling conducted showed no exposures above the AL or the STEL

13. Hazard Communication

All sections of the formaldehyde MSDS must be reviewed in detail at this point. The MSDS will contain the following information specific to formaldehyde.

- material identification
- toxicity hazards *
- health hazards *
- physical data
- fire and explosion hazard
- reactivity
- spill or leak procedures
- handling and storage precautions

* Emphasize these sections, especially formaldehyde's potential carcinogenicity.

All formaldehyde containers must be labeled to identify formaldehyde and its hazards. MSDSs must be kept up-to-date. As stated in #11 above, the MSDS for HCHO is included in the Orientation II session, mandatory for all new laboratory workers. Labeling is also discussed at this time.

14. Training:

This training must describe specific operations in the work area where formaldehyde is present and must explain safe work practices appropriate for limiting formaldehyde exposure in each job. In areas where exposure exceeds the action level or STEL, the training

must be repeated at least annually. Workers are shown specific operations in the workplace involving HCHO by their supervisors. General chemical safety and safe handling of all chemicals is discussed in Orientation II, mandatory for all new laboratory workers.

15. Record Keeping:

Records, as defined by the standard, must be kept for exposure measurements, medical surveillance and respirator fit testing.

Exposure records must be kept for 30 years, medical records for the duration of employment plus 30 years and respirator fit testing records for the period until a more recent record is generated. These records must be made available according to the provisions specified in the standard.

APPENDIX I

EFFECTIVE USE OF GLOVES

Reasons for Wearing Gloves

The hands are the part of the body most likely to come into contact with chemicals at work. Skin contact can result in dermatitis resulting from chemical or allergic irritation of the skin. In addition, some chemicals penetrate the skin and can cause illness in other parts of the body. Wearing gloves helps to protect workers from skin irritation and other effects of chemical exposure.

Choosing the Right Gloves

Material Safety Data Sheets detail appropriate gloves for use with each chemical. The chart below may also be consulted. Choosing the right gloves includes selecting the right thickness: heavy gloves for more protection, light gloves for delicate work.

GLOVE SELECTION CHART

** Chart to be inserted

Improper removal of gloves can also be a source of contamination. The procedure, which works for thin gloves that may have to be changed often, is as follows:

1. Using the fingers of one gloved hand, pinch the material of the other glove at the base of the palm and peel off glove.
2. Continue to hold glove.
3. With the ungloved hand, reach about an inch under the other glove on the palm side of the wrist, pinch, and peel off the other glove.
4. Both gloves have now been removed without skin contact and the contaminated side of the gloves are facing in.
5. Gloves used with highly toxic materials should be disposed of as hazardous waste before leaving the work area. Studies have shown that up to 5% of new gloves have holes in them. Substances leaking through gloves are held in contact with skin, increasing absorption into the body.

Gloves which have been improperly selected or have holes in them can sometimes be worse than no gloves at all. Gloves used for especially dangerous chemicals can be tested for leaks by filling them with air and immersing them in water. This should not be done with PVA laminated gloves, since they may not be water resistant. If certain types of gloves leak consistently, the manufacturer should be notified.

APPENDIX J

SAFE CHEMICAL STORAGE

1. Acids

- Store large bottles of acids on low shelf or in acid cabinets.
- Segregate oxidizing acids from organic acids, flammables and combustible materials.
- Segregate acids from bases and active metals such as sodium, potassium, etc.
- Use bottle carriers for transporting acid bottles.
- Have spill control pillows or acid neutralizers available in case of spill.

Strong Oxidizing Acids Organic Acids

Chromic Acid	Acetic Acid
Hydrobromic Acid	Benzoic Acid
Iodic Acid	Phenol
Nitric Acid	Trichloroacetic Acid
Perchloric Acid	Sulfuric Acid

2. Bases

- Segregate bases from acids.
- Store solutions of inorganic hydroxides in polyethylene containers.
- Have spill control pillows or caustic neutralizers available for spills.

Ammonium Hydroxide Calcium Hydroxide

Bicarbonates Potassium Hydroxide

Carbonates Sodium Hydroxide

3. Flammables

- Store in approved safety cans or cabinets.
- Segregate from oxidizing acids and oxidizers.
- Keep away from any source of ignition: flames, heat or sparks.
- Know where fire fighting equipment is stored and how to use it.
- Store volatile, flammable liquids in explosion-proof refrigerator.

Flammable Solids

Benzoyl peroxide Phosphorous, yellow

Calcium Carbide Picric Acids

Flammable Gases

Acetylene Ethylene Oxide

Ammonia Formaldehyde

Butane Hydrogen

Carbon Monoxide Hydrogen Sulfide

Ethane Methane

Ethyl Chloride Propane

Ethylene Propylene.

4. Oxidizers

- Store in a cool, dry place.
- Keep away from flammable and combustible materials, such as paper or wood.
- Keep away from reducing agents such as zinc, alkaline metals, formic acid.

Oxidizers - Solids

Ammonium Dichromate Ferric Trioxide Potassium Dichromate

Ammonium Perchlorate Ferric Chloride Potassium Ferricyanide

Ammonium Persulfate Iodates Potassium Permanganate

Benzoyl Peroxide Iodine Potassium Persulfate

Bromates Nitrates Sodium Chlorite,

Calcium Hypochlorite Periodic Acid Hypochlorite

Chlorates Permanganic Acid Sodium Dichromate

Chromium Trioxide Peroxides, Salts of Sodium Nitrate

Sodium Perborate

5. Pyrophoric Substances: These ignite spontaneously on contact with air.

- Store in a cool, dry place.

Boron Diborane Manganese*
Cadmium Dichloroborane Nickel*
Calcium Furaldehyde Phosphorous, Yellow*
Chromium* Iron* Titanium*
Cobalt* Lead* Zinc*

* Finely divided metals form a pyrophoric hazard.

6. Light Sensitive Chemicals

- Avoid exposure to light.
- Store in amber bottles in a cool, dry place.
Bromine Mercuric Salts Silver salts
Ethyl Ether Oleic Acid Sodium Iodide
Ferric Ammonium Citrate Potassium Ferricyanide Mercurous Nitrate
Hydrobromic Acid

7. Carcinogens

- Label all containers as Cancer Suspect Agents.
- Store according to hazardous nature of chemicals, e.g. flammable, corrosive.
- When necessary, store securely.

Chloroform
Antimony compounds Chromates, Salts of Dimethyl Sulfate
Arsenic compounds Beta-Naphthylamine Dioxane
Benzidine Vinyl Chloride Ethylene Dibromide
Beryllium Acrylonitrile Hydrazine
Cadmium compounds Benzene Nickel Carbonyl.

INCOMPATIBLE CHEMICALS - IN STORAGE AND REACTIONS

Acetaldehyde: acids, bases, phenols, alcohols, strong oxidizers, ammonia, amines, ketones, hydrogen sulfide, hydrogen cyanide. Forms peroxides on contact air.

Acetic Acid: chromic acid, nitric acid, ethylene glycol, perchloric acid, peroxides, permanganates, phosphates

Acetone: sulfuric and nitric acids, oxidizers.

Acetonitrile: strong oxidizers

Acetylene: copper (tubing), fluorine, bromine, chlorine, iodine, silver, mercury and their compounds.

Acrylamide: strong oxidizers

Alkali Metals: (e.g., potassium and sodium) with water, carbon dioxide, carbon tetrachloride, and other chlorinated hydrocarbons.

Ammonia, Anhydrous: mercury, halogens, calcium hypochlorite, hydrogen fluoride.

Ammonium Nitrate: acids, metal powders, flammable liquids, chlorates, nitrates, sulphur and finely divided organics or combustibles.

Aniline: nitric acid, hydrogen peroxide

Benzyl Chloride: oxidizers, acids, aluminum, copper, iron, magnesium, zinc

Bleach (sodium hypochlorite): ammonia containing compounds, acids, formaldehyde and other reducing agents

Bromine: ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine and finely divided metals.

Carbon: activated calcium hypochlorate - all oxidizing agents

Chlorates: ammonium salts, acids, metal powders, sulphur, finely divided organics or combustibles, carbon

Chromic Acid: acetic acid, naphthalene, camphor, alcohol, glycerine, turpentine and other flammable liquids.

Chlorine Dioxide: ammonia, methane, phosphine, hydrogen sulphide

Chlorine: ammonia, acetylene, butadiene, benzene and other petroleum fractions, hydrogen, sodium carbide, turpentine and finely divided powdered metals.

Copper: acetylene, hydrogen peroxide

Cyanides: acids and alkalies

Ethanolamine: strong oxidizers, strong acids

Ether, ethyl: strong oxidizers; forms peroxides on exposure to air and light

Ethyl acetate: nitrates, strong oxidizers, alkalis and acids.

Ethylene glycol dinitrate: acids, alkalis

Flammable liquids: ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens.

Formaldehyde: strong oxidizers, alkalis and acids (e.g. hydrogen peroxide, hydrochloric acid), phenols, magnesium carbonate, nitromethane, peroxyformic acid.

Formic Acid: strong oxidizers, strong caustics, concentrated sulfuric acid; corrosive to metals

Hexane: strong oxidizers

Hydrazine: oxidizers, acids (e.g., hydrogen peroxide, nitric acid) metallic oxides; may ignite on contact with porous organic materials (e.g., cloth, wood).

Hydrochloric acid: hydroxides, alkalis, amines; corrosive to most metals

Hydrogen Peroxide: copper, chromium, iron, most metals, or their respective salts, flammable fluids and other combustible materials, aniline and nitromethane.

Hydrogen Sulfide: fuming nitric acid, oxidizing gases.

Hypochlorites: acids, activated carbon.

Iodine: acetylene, ammonia (aqueous or anhydrous), hydrogen.

Isoamyl alcohol: strong oxidizers

Isopropyl alcohol: strong oxidizers, acids, acetaldehyde, chlorine, ethylene oxide

Mercury: acetylene, fulminic acid, ammonia, copper, chlorine dioxide.

Methanol: strong oxidizers

Methylene Chloride: strong oxidizers, caustics, nitric acid, aluminum, magnesium powders

Nitrates: sulfuric acid.

Nitric Acid (concentrated): acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals.

Nitrites: acids.

Nitroparaffins: inorganic bases, amines.

Oxalic Acids: silver, mercury.

Oxygen: oils, grease, hydrogen, flammable liquids, solids, or gases.

Perchloric Acid: acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils.

Peroxides, organic: acids, (organic or mineral), avoid friction, store cold.

Phenol: strong oxidizers, acids, bases, calcium hypochlorite, aluminum chloride, metals (aluminum, magnesium, lead, zinc are attacked by hot phenol)

Phosphoric Acid: strong caustics; reacts with most metals to produce hydrogen gas

Phosphorous (white): air, oxygen, alkalis, reducing agents.

Potassium: carbon tetrachloride, carbon dioxide, water.

Potassium chlorate: sulfuric and other acids.

Potassium perchlorate (see also chlorates): sulfuric and other acids.

Potassium permanganate: glycerol, ethylene glycol, benzaldehyde, sulfuric acid.

Propanol: strong oxidizers

Selenides: reducing agents.

Silver: acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid.

Sodium: carbon tetrachloride, carbon dioxide, water.

Sodium Hydroxide: acids, flammable liquids, organic halogens, nitromethane, corrosive to most metals

Sodium Nitrite: ammonium nitrate and other ammonium salts.

Sodium Peroxide: ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural.

Sulfides: acids.

Sulfuric Acid: organic materials, chlorates, perchlorates, permanganates, carbides, fulminates

Tellurides: reducing agents.

Toluene: strong oxidizers

Triethylamine: strong oxidizers, strong acids

Xylenes: strong oxidizers.

APPENDIX K

CHEMICAL INFORMATION RESOURCES * NEEDS TO BE REVISED**

Laboratory workers requiring health and Safety information regarding substances they plan to use or are using, may obtain this information from the following sources:

1. Container label.
2. Principal Investigator or Laboratory Director or supervisor.
3. Material Safety Data Sheet (obtained from the Department MSDS Notebook, the laboratory director of the chemical manufacturer or http
4. Manufacturer's technical service department.
5. American Chemical Society
(202) 872-4511
Chemical Health & Safety Division
1155 16th St., N.W.
Washington, D.C. 20036
www.acs.org
6. American Petroleum Hospital
(202) 682-8000
2101 L. St., N.W.
Washington, D.C. 20037
www.api.org
7. Chemical Manufacturers Association
(202) 887-1100
2501 M. St., N.W.
Washington, D.C. 20037
www.cma.org
8. Compressed Gas Association, Inc.
(703) 979-0900
1235 Jefferson Davis Highway
Arlington, VA 22202
www.cssinfo.com
9. Occupational Safety & Health Administration (OSHA)
(202) 523-7075
Health Standards
200 Constitution Ave.
Washington, D.C. 20210
www.osha.org
Regional OSHA Office
11-RI Department of Labor and Training
Division of Occupational Hygiene
(Right To Know Law Coordinator
12. RI Department of Health
14. References, such as the following:
 - (1) Dangerous Properties of Industrial Materials. Sax, N.I. Reinhold Pub. Co., New York, 1984
 - (2) Clinical Toxicology of Commercial Products. Gosselin, R.G., Smith R., and Hodge, H. Williams & Wilkins Pub. Co., Baltimore, 1984
 - (3) Registry of Toxic Effects of Chemical Substances. U.S. Dept. of Health & Human Services, CDC, NIOSH, 1983 - 1984
 - (4) Handling Chemicals Safely. Dutch Association of Safety Experts, Dutch Chemical Industry Association and the Dutch Safety Hospital, 1980.

APPENDIX L * When this is implemented**

What Will the Labels Look Like?

HAZARD LABELING ON LABORATORY DOORS

(Also container labels)

The National Fire Protection Association (NFPA) has developed a numerical system for the identification of fire hazards by materials. Each laboratory door has an NFPA Diamond label to give fire fighters a quick summary of the type of hazard in the room.

Health Hazard (Blue)

- 0 - No unusual hazard
- 1 - Can cause irritation.
- 2 - May be harmful if inhaled or absorbed.
- 3 - Corrosive or toxic. Avoid skin contact or inhalation.
- 4 - Can cause death or major injury on short exposure.

Reactivity (Yellow)

- 0 - Normally stable. Not reactive with water
- 1 - Normally stable. Unstable at high temperatures and pressure. May react with water.
- 2 - Normally unstable but will not detonate.
- 3 - Can detonate or explode but requires strong initiating force or heating under confinement.
- 4 - Readily detonates or explodes.

Fire Hazard (Red)

- 0 - Will not burn
- 1 - Ignites after preheating
- 2 - Ignites if moderately heated
- 3 - Can be ignited under almost all normal temperature conditions
- 4 - Very flammable gases or very volatile flammable liquids.

Specific Hazard (White)

POL- Polymerizes under normal conditions

OXY - Oxidizing agent

COR - Strong Corrosive

W - Water Reactive

EXP - Explosive-heat or shock sensitive.

50 Common Chemical List

CHEMICAL NAME	PEL	ROUTE OF EXPOSURE	SYMPTOMS OF EXPOSURE	ODOR THRESHOLD	GLOVE	NFPA CODE H-F-R
Acetaldehyde	100	INH ING	eye, nose, thrt irr; CNS depres, skin burns; derm; delayed pulm edema	0.00011-2.3 green, sweet, fruity	NIT NEO LTX PVC	2-4-2
acetic acid	10	INH	conj lac; irr nose, thrt; phar edema,chronic bron; burns eye, skin; skin sens; dent erosion; black skin, hyperkeratosis	1.02-102.0 sour, vinegar-like	NIT NEO LTX PVC	2-2-1
Acetone	750	INH ING CON	irr eyes, nose, thrt; head, dizz; derm	20.0-678.9 minty chemical, sweet	NIT NEO LTX	1-3-0
Acetonitrile	40	INH ING ABS CON	asphy; nau, vomit; chest pain; weak; stupor, convuls; eye irr	41.7 ether-like	NEO	2-3-1
Acrylamide	0.03 mg/m ³	INH ABS ING CON	atax; numb limbs, pares; musc weak; absent deep tendon reflex; hand sweat; ftg; lethargy; irr eye, skin		NEO	3-0-0
Benzaldehyde		ING CON	irr eye, skin, muc memb, upper resp tract	0.0002-0.04 pleasant, bitter	NIT PVC	2-2-0
benzyl chloride	1	INH ING CON	irr eyes, nose; weak; irrity; head; skin eruption; pulm edema	0.05-0.3 solvent	NIT	3-2-1
Betafluor		ING CON	irr muc memb; excitement; depres	slightly aromatic odor	LTX	
Biofluor	25	INH ING ABS	irr eyes, muc memb, upper resp tract; CNS depres; nau, dizz, head upon ingestion	slightly aromatic odor	LTX	
Butanol	100	INH ING CON	irr eye,nose, thrt; head; vert; drow; corn inflamm, blur vision, lac,photophobia; dry cracked skin	0.12-49.5 strong, pleasant odor	NIT NEO LTX	1-3-0
cacodylic acid		CON ING INH	irr eye, skin; headache; nau, vomit; dizz; GI; kidney and liver dam; CNS depress			
carbon tetrachloride	2	INH	CNS depres; nau, vomit; liver, kidney damage;	47.5-237.7	NIT	3-0-0

CHEMICAL NAME	PEL	ROUTE OF EXPOSURE	SYMPTOMS OF EXPOSURE	ODOR THRESHOLD	GLOVE	NFPA CODE H-F-R
		ABS ING CON	skin irr	sweet, pungent		
Chloroform	10	INH ING CON	dizz, mental dullness; nau; head; ftg; anes; hepatomegaly; eye, skin irr	51.3-205.0 pleasant, sweet	NIT	2-0-0
chromic acid and chromates	1 mg/m ³	INH ING CON	resp, nas septum irr; leucyt, leupen, monocy, eosin; eye injury, conj; skin ulcer, sens derm		NIT PVC	3-0-1
cyanogen bromide		INH ABS ING CON	eye, skin irr; muc memb, upper resp tract irr; nau, dizz, head; lung irr, chest pain and edema which may be fatal		NIT NEO LTX PVC	
Dichloroethane	100	INH ING CON	CNS depres; skin irr; drow; unconscious; liver and kidney damage	109.8-199.6 chloroform-like	NIT	2-3-0
Dimethylamine	10	ING INH CON	irr eyes, thrt; sneez, cough, dysp; pulm edema; conj; burns skin, muc memb; derm	0.05 pungent, fishy, ammonia- like	NEO PVC	3-4-0
dimethyl sulfate	1	INH ING ABS CON	burning sensation; cough; wheez, short breath; head; nau, vomit		NIT	4-2-0
dimethyl formamide	10	INH ABS ING CON	nau, vomit, colic; liver damage, hepatomegaly; high BP; face flush; derm	100.3 faint, ammonia-like	NEO LTX	1-2-0
DMSO (dimethyl sulfoxide)					NEO LTX	

ethanol	1000	INH ING ABS CON	eye, skin irr; damage to eyes, blindness; nau, dizz, head; CNS depres; liver, heart, kidney damage	0.18-5140.0 sweet, alcoholic	NEO LTX	0-3-0
Ethanolamine	3	INH ING CON	resp, skin, eye irr; lethargy	2.13-4.3 ammonia	NEO PVC	2-2-0
Ether (ethyl)	400	INH ING CON	dizz; drow; head, excited, narcosis; nau, vomit; irr eyes, upper resp, skin	0.33-0.99 sweet, ether-like, fruity	NIT NEO	2-4-1
ethidium bromide		INH ING ABS	eye, skin irr; muc memb, upper resp tract irr; may alter genetic material		NIT	
ethyl acetate	400	INH ING CON	irr eyes, nose, thrt; narcosis; derm	0.06-184.4 fruity, pleasant	NIT NEO	1-3-0
ethylene glycol dinitrate	-	INH ABS ING CON	throb head; dizz; nau, vomit, abdom pain; hypotens; flush; palp; methemoglobinemia; delirium, CNS depres; angina; skin irr	10.0 sweet	NIT NEO LTX PVC	1-1-0
EDTA (ethylenediamine tetraacetic acid)		INH ING ABS	irr eyes, skin; muc memb and upper resp tract irr		NIT NEO LTX PVC	
Formaldehyde	0.75	INH ING CON	irr eyes, nose, thrt; lac; burns nose; cough, bron spasm, pulm irr; derm; nau, vomit; loss of consciousness	1.22-59.8 pungent, hay	NIT NEO LTX PVC	2-4-0
Formamide	20	INH ING ABS	irr eyes, muc memb, upper resp tract; may cause congenital malformation of fetus	81.3	NIT NEO LTX PVC	
formic acid	5	INH ING CON	eye irr, lac; nasal discharge; thrt irr, cough, dysp; nau, skin burns, derm	0.024-20.1 pungent, penetrating	NIT NEO LTX PVC	3-2-0
Glycerol		CON ABS INH ING	eye, skin irr; nau, vomit, head		NIT NEO LTX PVC	1-1-0
Hexane	50	INH ING CON	li-head; nau; head; numb, musc weak; irr eyes, nose; derm; chem pneumonia; giddiness	mild, gasoline-like	NEO	1-3-0

Hydrazine	0.1	INH ING ABS CON	skin burns; irr eyes, muc memb, upper resp tract; nau, dizz, head; damage to eyes, kidney, liver, lungs; blood effects; CNS depres, convuls; derm	2.3-3.1 fishy, mild ammonia-like	NIT NEO LTX PVC	3-3-2
Hydrofluor		INH CON	irr muc memb; excitement; depress	slightly aromatic odor	LTX	
Hydrochloric acid	-	INH ING CON	inflamm nose, thrt, lar; cough, burns thrt, choking; burns eyes, skin; derm	4.6-32.3 irritating, pungent	NIT NEO LTX PVC	3-0-0
hydrogen peroxide	1	INH ING CON	irr eyes, nose, thrt; corn ulcer; erythema, vesicles on skin; bleaching hair;	slightly sharp	NIT NEO LTX PVC	3-0-1
isoamyl alcohol	100	INH ING CON	irr eyes, nose, thrt; narcosis; head, dizz; dysp, nau, vomit, diarr; skin cracking	10.0-35.0 alcoholic odor	NIT NEO LTX PVC	1-2-0
Isopropanol	400	INH ING CON	mild irr eyes, nose, thrt; drow; dizz; head; dry cracking skin; GI cramps; nau, diarr	3.2-199.3 pleasant	NIT NEO LTX	1-3-0
Mercaptoethanol		INH ING ABS	irritant	0.12-0.63 gas-like, pungent	NIT	2-2--
Mercury		INH ABS CON	cough, dysp, bron pneu; tremor; insom; irrity, indecision; head; ftg, weak; stomatitis; salv; GI, anor, lo-wt; prot; irr eyes, skin	odorless	LTX	
Methanol	200	INH ING CON	eye irr, head, drow, li-head, nau, vomit, vis dist, eye burns, digestive dist, failure of vision	10.0-20,465.5 sweet	NIT NEO LTX	1-3-0
methylene chloride	50	INH ING CON	ftg, weak, sleep, li-head; limbs numb, tingle; nau; irr eyes, skin; vertigo; worsen angina	155.0-620.0 chloroform-like	NEO	2-0-1

acid	2	INH ING CON	irr eyes, muc memb, skin; delayed pulm edema; pneumitis; bron; dental erosion	0.3-0.5 acrid, suffocating	NIT NEO PVC	3-0-0
Paraformaldehyde		INH ING ABS CON	cough, wheez, lar, short of breath, head, nau, vomit; chem pneu; pulm edema; inflamm lar, bron; sens		NIT NEO LTX PVC	
Phenol	5	INH ABS ING CON	irr eyes, nose, thrt, anor, low-wgt; weak, musc ache, pain; dark urine; cyan; liver, kidney damage; skin burn; derm; ochronosis; tremor, consulsvs; twitch	0.05-5.8 medicinal, sweet	NEO LTX PVC	3-2-0
Phenylmethyl Sulfonylfluoride (PMSF)		INH ING ABS CON	irr eyes, skin, and upper resp tract		NIT	
phosphoric acid	1 mg/m ³	INH ING CON	irr upper resp tract, eyes, skin; burns skin, eyes; derm	odorless	NEO LTX PVC	2-0-0
potassium hydroxide	2 mg/m ³	INH ING CON	resp tract inf; pulm edema; weak-rapid pulse; hypotension; inflamm and ulcerative changes in mouth; bronch and GI dist; burn of skin; tissue destruct; derm; burn eyes; destruct epithel; corneal opacification; iritis; vomit; diarr		NIT	3-0-1
Propanol	200	INH CON ING	mild irr eyes,nose, thrt; dry cracking skin; drow, head; ataxia; GI pain; abdom cramps; nau, vomiting, diarr	0.03-61.0 sweet, alcohol	NIT NEO LTX PVC	1-3-0
sodium hydroxide	-	INH ING CON	irr nose; pneumonitis; burns eyes, skin; temporary loss of hair	odorless	NIT NEO LTX PVC	3-0-1
sulfuric acid	1 mg/m ³	INH ING CON	eye, nose, thrt irr; pulm edema, bron emphysema; conj; stomatitis; dent erosion; trachbronc; skin, eye burns; derm	0.25	NEO LTX PVC	3-0-2
Toluene	100	INH ABS ING CON	ftg; weak; conf, euph, dizz; head; dil pup, lac; ner; musc ftg; insom; pares; derm; photo	4.6-69.6 floral, pungent	NIT	2-3-0

trichloroacetic acid	1	INH ABS ING	burning sensation; cough, wheez, lar, short of breath; head, nau, vomit; blisters on skin; eye, skin irr; GI dist		NIT	2 - -
Triethylamine	10	INH ING ABS CON	irr eyes, resp, skin	0.09-0.3 fishy, amine	NIT NEO PVC	
Trifluoroacetic Acid		INH ING CON	burning sensation; cough, wheez, laryngitis; short of breath; head, nau, vomit		NIT	
Xylene	100	ABS INH ABS ING CON	dizz, excitement, drow, staggering gait; irr eyes, nose, thrt; corn vacuolization; anor, nau, vomit, abdom pain; derm	0.08-40.1 sweet	NIT NEO	2-3-0

Reference: 1998 NIOSH Pocket Guide

PEL:

PEL: Permissible exposure limit (taken as an 8-hour time weighted average), measured in PPM

PPM: Parts per million (measured in parts of contaminant per million parts of air)

ODOR THRESHOLD:

Measured in PPM

ROUTES OF EXPOSURE:

INH: Inhalation

ABS: Skin Absorption

ING: Ingestion

CON: Skin and/or eye contact

SYMPTOMS OF EXPOSURE

abdom abdomina
anes anesthesia
anor anorexia
asphy asphyxia
blur blurred
bron bronchitis
B.P blood pressure
CNS central nervous system
conf confusion
conj conjunctivitis
convuls convulsions
corn cornea
cyan cyanosis
dam damage
dent dental
depres depressant/depression
derm dermatitis
destruct destruction
diarr diarrhea
dil dilated
dist disturbance
dizz dizziness

drow drowsiness
dysp dyspnea
eosin eosinophilia
epithel epithelial
euph euphoria
fig fatigue
GI gastrointestinal
head headache
inf infection
inflamm inflammation
insom insomnia
irr irritation
irrity irritability
lac lacrimator
lar laryngeal
leucyt leukocytosis
leupen leukopenia
li-head light-headedness
lo-wgt weight loss
monocy monocytois
muc memb mucous membrane
musc muscle

nas nasal
nau nausea
ner nervousness
palp palpitations
pares paresthesia
phar pharyngeal
photo photphobia
pneu pneumonia
pneuitis pneumonitis
prot proteinurea
pulm pulmonary
pup pupil
resp respiratory
salv salivation
sens sensitization
sleep sleepiness
thrt throat
trachbronc tracheobronchitis
verti vertigo
vis dist visual disturbance

GLOVES:

NIT: Nitrile

LTX: Latex

NEO: Neoprene

PVC: Polyvinyl chloride

APPENDIX N**STANDARD OPERATING PROCEDURE FOR: FLAMMABLE MATERIALS****I. DEFINITION:**

Flammable liquids are defined by their flash point (FP). This is the temperature at which a liquid will give off sufficient vapor concentration to ignite in the presence of a flame front. Therefore, any liquid with a FP below 100 °F; except any mixture having components with FP of 100 °F or higher, the total of which make up 99% or more of the total volume of the mixture, is flammable. Flammable materials may also be found in the physical form of solid or gas.

A flammable solid is a material that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so violently and persistently as to create a serious hazard.

A flammable gas is one which at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less; or a gas at ambient temperature and pressure, forms a range of flammable mixture with air wider than 12% of volume regardless of the lower limit.

Flammability may be only one of the hazards associated with flammable materials. Many are volatile and may be readily absorbed through the skin or inhaled which may cause serious effects.

II. EXAMPLES:

Liquids: Most solvents - acetone, alcohols, benzene, ether, toluene, xylene;

Solids: Benzoyl peroxide, calcium carbide, phosphorous yellow, picric acids;

Gases: Acetylene, ammonia, ethylene oxide, formaldehyde, hydrogen, propane.

****NOTE: The chemicals listed here represent a small number of flammable materials. To find out if the material you are working with is flammable, look for: 1) specific warnings on the chemical label, 2) the flash point, 3) ask your supervisor for the Material Safety Data Sheet (MSDS). Information concerning all hazardous substances is available to you either under the OSHA Hazard Communication Standard or the OSHA Lab Standard.**

III. PERSONAL PROTECTIVE EQUIPMENT:**A. GENERAL GARMENTS**

1. Laboratory coats - fastened lab coats should be worn when working with flammable materials to protect from accidental skin absorption and contaminating clothing.
2. Gloves - appropriate for the chemical being worked with should be worn. To choose the proper gloves, refer to glove manufacturers charts.

B. EYE/FACE:

1. Goggles should be worn when pouring flammable materials.
2. Face shields should be worn when not working in a hood that provides some splash protection. The shield provides protection for the eyes, face and neck.
3. Contact lenses should never be worn when working with flammable materials. There is an increased danger of injury due to the fact that when materials enter the eye, they may get trapped under the lens and cause a more serious problem. It is also more difficult to cleanse the impurity in the presence of the lens.
4. Safety glasses with brow bar and side shields provide minimal protection from splashes.
5. Prescription glasses alone should not be worn for splash protection. They must be worn in conjunction with either a face shield or chemical goggles to provide appropriate protection.

C. RESPIRATORY:

1. Respiratory protection from toxic flammable material may be provided by working in a certified chemical fume hood..
2. **ONLY** if there is no local exhaust available, there may be a need to participate in a respirator program.

***Supervisors or Chemical Hygiene Officers must be consulted before any respirator is used.**

D. SAFETY EQUIPMENT:

1. Eyewash station provides gentle efficient cleansing for chemical splashes to the eyes.
2. Chemical Safety showers are provided in the event of large chemical contamination.
3. Fire extinguishers and fire blankets in case of fire or explosions.

IV. LABORATORY WORK PRACTICES: Good laboratory work practices can prevent unnecessary exposure to hazardous chemical.

SPECIFIC:

1. No flames or sparking materials should be in use when working with flammables.

2. Flammable materials should never be heated or handled near hot surfaces or ordinary electrical equipment. Vapors produced from highly flammable materials may cause fire or explosion if contact is made.
3. All equipment (ie. tools, motors) involved with the use of flammable materials **MUST** be spark-free.
4. Any flammable chemical that emits harmful vapors **MUST** be used in a chemical fume hood to avoid respiratory irritation and injury.
5. Keep work area free of incompatible substances which may cause violent reactions with the material. These
6. incompatibilities are listed on the MSDS's.

GENERAL:

1. There will be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics, or storage of utensils or food in laboratory areas.
2. There will be no mouth pipetting in laboratories; mechanical aids must always be used.
3. All personnel should wash their hands immediately after working with chemicals as well as before leaving the laboratory area. This will prevent any injury resulting from residual chemical, as well as prevent contamination to other areas in and out of the work area.
4. Procedures should be performed in such a way as to minimize splash.
5. Personal protective equipment discussed in the previous section should be used when working with flammable materials.
6. Before beginning any work, all employees should be aware of the location of all Safety equipment including the eyewash station, chemical shower and fire extinguisher; and familiar with emergency procedures and numbers.

V. EMERGENCY PROCEDURES IN CASE OF CONTACT WITH FLAMMABLES:

Unfortunately, accidents happen even in the most controlled situation. If there is any contact with flammable materials, the proper procedure is:

1. Eye contact - use the eye wash station or any source of potable water; hold the eye lids open and flush with copious amounts of water for at least 15 minutes. Contact medical or emergency personnel in extreme cases. Always report incidents to supervisor and to Employee Health Services.
2. Skin contact - use the Safety shower or submerge contaminated area with cool, running water for 15 minutes. Report incident to supervisor.
3. Clothing contact - remove contaminated clothing quickly and gently wash area with copious amounts of water. Contaminated clothing not removed may cause constant contact and more damage.
4. Inhaled - quickly remove to fresh air and seek medical attention.
5. Ingested - call POISON CONTROL CENTER 232-2120. If MSDS available, look to see proper instructions on whether or not to induce vomiting. If not known, do not induce vomiting; call for emergency medical assistance.

VI. STORAGE:

1. Flammables should be stored in compatible containers. Glass containers are usually the container of choice.
2. No plastic containers are permitted in the solvent storage area.
3. Be sure all secondary containers are labeled correctly and clearly as to contents and associated hazards.
4. Incompatible chemicals should be stored separately. Flammables should be separated from oxidizing agents, water sensitive materials and acids.
5. Only refrigerators and cabinets **APPROVED FOR FLAMMABLE STORAGE** are to be used for the storage of these materials. These materials may never be stored in cold rooms, warm rooms or walk-in freezers.
6. Storage areas for flammables should be marked clearly to prevent incompatible chemical storage and to keep from heat and heat sources.
7. Keep storage to a minimum by purchasing smaller quantities. Never store flammable anywhere except in their designated area.

VII. TRANSPORT:

1. Within the work place, flammable chemicals should be transported in compatible, sturdy outer containers. The inner container must be labeled properly.
2. When shipping outside of the work place, the package must be properly labeled according to DOT specifications, and should contain some absorbent material in case of breakage. Always clearly mark the package destination and return address.

VIII. INFORMATION: To obtain information on the flammable materials you are working with:

1. Read the label
2. Look at the MSDS
3. Ask supervisor,
4. Chemical manufacturer,
5. American Chemical Association.

APPENDIX O**STANDARD OPERATING PROCEDURES FOR: REACTIVE MATERIALS****I. DEFINITION:**

Reactive materials are those which are unstable. The categories and examples of each are as follows:

A. EXPLOSIVES:

Any compound, usually containing nitrogen, that functions to readily release gas, heat and energy. These materials are shock and temperature sensitive. When subjected to these properties or a primer charge, these compounds detonate.

EXAMPLES: picric acid (trinitrophenol), trinitrotoluene, sodium azide, fulminates, styphnates, picramates

B. PEROXIDES:

Any compound containing a bivalent O-O group which tends to release atomic oxygen readily. These compounds have high oxidizing properties and can cause spontaneous combustion with organic materials.

EXAMPLES: sodium peroxide, benzyl peroxide, t-butyl peroxybenzoate, hydrogen peroxide, cumene Hydroperoxide.

C. PEROXIDIZABLE COMPOUNDS:

Materials, usually solvent in nature, that over time may form peroxides in the presence of oxygen. Peroxide formation can be detected by the presence of crystals on the inside wall of the container. These compounds are considered reactive because of their sensitivity to shock, spark, temperature or other accidental ignition.

EXAMPLES: diethyl ether, tetrahydrofuran, vinyl methyl ketone, cumene

D. OXIDIZERS:

A substance that yields oxygen readily to stimulate the combustion of organic materials.

EXAMPLES: sodium nitrate, nitrites, ammonium persulphate, calcium hypochlorite, chromic acid, nitric acid, sulfuric acid.

E. AIR REACTIVE (PYROPHORIC):

Compounds that when exposed to dry or moist air at or below 130 O F. cause spontaneous ignition.

EXAMPLES: aluminum borohydride, diethylzinc, diethylaluminum, lithium hydride, t-butyl lithium

F. WATER REACTIVE:

Usually metallic compounds that when exposed to water react violently causing fire or explosion.

EXAMPLES: calcium hydride, cesium metal, lithium metal, lithium aluminum metal, sodium metal, sodium amide.

G. EXTREMELY FLAMMABLE:

Flammable materials with flash point (FP) below 73 °F. This is the temperature at which a liquid will give off sufficient vapor concentration to ignite in the presence of a flame front. These compounds pose the greatest fire threat.

EXAMPLES: ethers, 2-isopropoxypropane, methoxy ethane, hydrochloric ether

H. POLYMERIZABLE MONOMERS:

Monomer compounds that polymerize cause extreme heat and subsequent fire.

EXAMPLES: styrene monomer, acrolein, methacrylates, ethacrylates

****NOTE: The chemicals listed here represent a small number of reactive materials. To find out if the material you are working with is reactive, look for: 1) specific warnings on the chemical label, 2) the flash point, 3) the L.D. 50, 4) ask your supervisor for the Material Safety Data Sheet (MSDS). Information concerning all hazardous substances is available to you under the OSHA Hazard Communication Standard.**

II. PERSONAL PROTECTIVE EQUIPMENT:**A. GENERAL GARMENTS**

1. Laboratory coats - fastened lab coats should be worn when working with reactive materials to protect from accidental skin absorption and contaminating clothing.
2. Gloves - appropriate for the chemical being worked with should be worn. To choose the proper gloves, refer to glove manufacturers charts.

B. EYE/FACE:

1. Goggles should be worn when pouring chemicals.
2. Face shields should be worn when not working in a hood that provides some splash protection. The shield provides protection for the eyes, face and neck.

3. Contact lenses should never be worn when working with flammable or any type of hazardous materials. There is an increased danger of injury due to the fact that when materials enter the eye, they may get trapped under the lens and cause a more serious problem. It is also more difficult to cleanse the impurity in the presence of the lens.
4. Safety glasses with brow bar and side shields provide minimal protection from splashes.
5. Prescription glasses alone should not be worn for splash protection. They must be worn in conjunction with either a face shield or chemical goggles to provide appropriate protection. Goggles are available at lab Safety orientation and in general stores.

C. RESPIRATORY:

1. Respiratory protection from the toxic-reactive materials can be provided by fume hood exhaust. This will protect you from harmful vapors that may be emitted during a procedure.
2. **ONLY** if there is no local exhaust available, there may be a need to participate in a respirator program, especially when extremely toxic substances are being used. ***Supervisors, the Chemical Hygiene Officer, or Employee Health Services must be consulted before any respirator is used.**

D. SAFETY EQUIPMENT:

1. Located on designated sinks within lab, eyewash station provides gentle efficient cleansing for chemical splashes to the eyes.
2. Located in the hallways of lab floors, chemical safety showers are provided in the event of large chemical contamination.
3. Located at the door to each lab as well as the hallways, fire extinguishers in case of fire or explosions.

III. **LABORATORY WORK PRACTICES:** Good laboratory work practices can prevent unnecessary exposure to hazardous chemical.

GENERAL:

1. There will be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics, or storage of utensils or food in laboratory areas.
2. There will be no mouth pipetting in laboratories; mechanical aids must always be used.
3. All personnel should wash their hands immediately after working with chemicals as well as before leaving the laboratory area. This will prevent any injury resulting from residual chemical, as well as prevent contamination to other areas in and out of the work area.
4. Procedures should be performed in such a way as to minimize splash.
5. Personal protective equipment discussed in the previous section should be used when working with reactive materials.
6. Before beginning any work, all employees should be aware of the location of all Safety equipment including the eyewash station, chemical shower and fire extinguisher (specific for the substances being used, e.g. flammable liquids, water reactives, etc.); and familiar with emergency procedures and numbers.

SPECIFIC:

EXPLOSIVES, PEROXIDIZABLE COMPOUNDS, EXTREMELY FLAMMABLE:

1. No flames or sparking materials should be in use when working with flammable/reactive compounds.
2. Flammable/reactive materials should never be heated or handled near hot surfaces or ordinary electrical equipment.
3. Vapors produced from highly flammable materials may cause fire or explosion if contact is made.
4. All equipment (ie. tools, motors) involved with the use of flammable/reactive materials **MUST** be spark-free, or intrinsically safe.
5. Any flammable/reactive chemical that emits harmful vapors **MUST** be used in a chemical fume hood to avoid respiratory irritation and injury.
6. Keep work area free of incompatible substances which may cause violent reactions with the material. These incompatibilities are listed on the MSDS's.
7. Due to the sensitivity to mechanical shock of most of these materials, they should not be used on vibrating surfaces and must always be handled with extreme care.

PEROXIDES/OXIDIZERS:

Keep peroxides and oxidizers away from organic materials.

AIR REACTIVE:

Materials that are air reactive **MUST** be handled in atmosphere containing inert gases, with no oxygen.

WATER REACTIVE:

Keep water reactive compounds away from water.

POLYMERIZING COMPOUNDS:

These materials must be kept under low temperatures.

IV. **EMERGENCY PROCEDURES IN CASE OF CONTACT WITH REACTIVE MATERIALS:** Unfortunately, accidents happen even in the most controlled situation. If there is any contact with reactive materials, the proper procedure is:

1. Eye contact - use the eye wash station or any source of potable water; hold the eye lids open and flush with copious amounts of water for at least 15 minutes. Contact medical or emergency personnel in extreme cases. Always report incidents to supervisor and to Employee Health Services
2. Skin contact - use the Safety shower or submerge contaminated area with cool water for 15 minutes. Report incident to supervisor.
3. Clothing contact - remove contaminated clothing quickly and gently wash area with copious amounts of water. Contaminated clothing not removed may cause constant contact and more damage.
4. Inhaled – If safe to do so, quickly remove to fresh air and seek medical attention.
5. Ingested - call POISON CONTROL CENTER 232-2120. If MSDS available, look to see proper instructions on whether or not to induce vomiting. If not known, do not induce vomiting; call for emergency medical assistance.

V. STORAGE:

1. Unstable compounds should be stored in compatible containers. The original container is the best choice.
2. Be sure all secondary containers are labeled correctly and clearly as to contents and associated hazards.
3. All unstable chemicals must be stored away from incompatible chemicals or incompatible sources.
4. Reactive/flammables should be separated from oxidizing agents, heat; peroxides and oxidizers separated from organic compounds; water sensitive materials from water; air reactive materials should be stored in atmosphere containing inert gases; polymerizable compounds should be stored at low temperatures. Refer to the MSDS's for more incompatibility information.
5. Only refrigerators and cabinets APPROVED FOR FLAMMABLE STORAGE and/or EXPLOSION PROOF are to be used for the storage of reactive/flammable materials.
6. All storage areas for unstable materials should be marked clearly to prevent incompatible chemical storage and other incompatible sources, for example:
FLAMMABLE/ NO SMOKING--flammable storage
W DO NOT USE WATER--water reactive storage.
7. Shock sensitive materials should be stored on low shelves to prevent large shock if they tip/fall.
8. Keep storage to a minimum by purchasing smaller quantities. Never store unstable compounds anywhere except in their designated area.
9. Peroxide formers must be dated upon opening and tested for the formation of peroxides every six months. If the testing of peroxides is not possible, the compound must be disposed of within 6 months.

VI. TRANSPORT:

1. Within the work place, unstable chemicals should be transported in compatible, sturdy outer containers and according to their special storage conditions.
2. Polymerizing compounds should be transported at low temperature to prevent self-polymerizing; air reactive chemicals must be transported in atmosphere containing inert gas.
3. The inner container must be labeled properly according to the contents and associated hazards.
4. All unstable chemicals should be transported on carts in good working condition and with borders.
5. When shipping outside of the work place, the package must be properly labeled according to DOT specifications, and should contain some absorbent material in case of breakage. Some chemicals may require special packaging. The chemical manufacturer can detail the packaging procedure. Always clearly mark the package destination and return address.

VII. INFORMATION:

To obtain information on the reactive materials you are working with:

1. Read the label,
2. Read the MSDS,
3. Ask supervisor,
4. Chemical manufacturer,
5. American Chemical Association.

APPENDIX P**STANDARD OPERATING PROCEDURE FOR: CORROSIVE MATERIALS****I. DEFINITION:**

Corrosive materials are those which cause visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact. These materials act by injuring the skin, eyes, (causing inflammation and burns) and, if inhaled, the surface tissue of the respiratory tract (causing inflammation, edema, chemical pneumonia).

Corrosives may be found in the physical form of solid, liquid, or gas. Damage caused by these chemicals depends largely on the concentration and length of contact.

II. EXAMPLES:

Liquids: acids (nitric, sulfuric, hydrochloric, formic, acetic, chloroacetic, phenol)
alkalies (ammonium hydroxide)

Solids: caustic alkalies (sodium hydroxide, sodium carbonate, potassium carbonate, ammonium carbonate, barium hydroxide) elements and salts (sodium, potassium, antimony and its salts, copper sulfate, mercuric salts, zinc chloride)

Gases: ammonium, hydrochloric acid, formaldehyde, sulfur dioxide, chlorine, phosgene, nitrogen dioxide, acrolein)

****NOTE: The chemicals listed here represent a small number of corrosive materials. To find out if the material you are working with is corrosive, look for specific warnings on the chemical label or ask your supervisor for the Material Safety Data Sheet (MSDS). Information concerning all hazardous substances are available to you under the OSHA Hazard Communication Standard (HazCom).**

III. PERSONAL PROTECTIVE EQUIPMENT:**A. GENERAL GARMENTS**

1. Laboratory coats - fastened lab coats should be worn when working with corrosive materials to protect arms and clothing from burns that may result from contact.
2. Rubber Aprons - should be worn when pouring large amounts of concentrated corrosive material.
3. Gloves - appropriate for the chemical being worked with should be worn. To choose the proper gloves, refer to glove manufacturers charts.

B. EYE/FACE:

1. Goggles should be worn when pouring corrosive materials. Goggles are given out at Lab Safety Orientation and are available in general stores.
2. Face shields should be worn when not working in a hood that provides some splash protection. The shield provides protection for the eyes, face and neck.
3. Contact lenses should never be worn when working with corrosive materials. There is an increased danger of injury due to the fact that when materials enter the eye, they may get trapped under the lens and cause a more serious burn. It is also more difficult to cleanse the impurity in the presence of the lens.
4. Safety glasses with brow bar and side shields provide minimal protection from splashes.
5. Prescription glasses should not be worn for splash protection. They must be worn in conjunction with either a face shield or chemical goggles to provide appropriate protection.

C. RESPIRATORY:

1. Respiratory protection from the corrosive materials can be provided by fume hood exhaust. This will protect you from corrosive vapors that may be emitted during a procedure.
2. **ONLY** if there is no local exhaust available, there may be a need to participate in a respirator program. This is most common when working with corrosive gases. ***Supervisors, the Chemical Hygiene Officer or Employee Health Services must be consulted before any respirator is used.**
3. A dust/particulate respirator may be useful when dealing with finely ground corrosive solids.

D. SAFETY EQUIPMENT:

1. Located in the hallways on all lab floors, eyewash stations provide gentle efficient cleansing for chemical splashes to the eyes.
2. Located in the hallways on all lab floors, chemical safety showers are provided in the event of large chemical contamination. Diluting the corrosive material with large amounts of water, lessens corrosive effects.

IV. LABORATORY WORK PRACTICES: Good laboratory work practices can prevent unnecessary exposure to hazardous chemicals.

SPECIFIC:

1. To avoid violent reaction and splattering while diluting solutions, always pour the concentrated solution into the less concentrated solution while stirring (e.g. acid poured into water, not reverse). In this way, the heat that is produced is better distributed.

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2. Any corrosive chemical that emits harmful vapors must be used in a chemical fume hood to avoid respiratory irritation and injury.
3. Corrosive materials should never be heated or handled in fragile containers without providing a receptacle to catch the contents in case of collapse.
4. Keep work area free of incompatible substances which may cause violent reactions with the material. Also work areas should be neat to provide comfortable, safe movements.
5. Personal protective equipment discussed in the previous section should be used when working with corrosive
6. materials

GENERAL:

1. All employees should be aware of the location of all Safety equipment including the eyewash station and chemical shower; and familiar with emergency procedures and numbers.
2. There will be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics, or storage of utensils or food in laboratory areas.
3. There will be no mouth pipetting in laboratories; mechanical aids must always be used.
4. All personnel should wash their hands immediately after working with corrosives (or any hazardous substance) as well as before leaving the laboratory area. This will prevent any injury resulting from residual chemical as well as prevent contamination to other areas in and out of the work area.
5. Procedures should be performed in such a way as to minimize splash.

V. EMERGENCY PROCEDURES IN CASE OF CONTACT WITH CORROSIVES:

Unfortunately, accidents happen even in the most controlled situation. If there is any contact with corrosive materials, the proper procedure is:

1. Eye contact - use the eye wash station or any source of potable water; hold the eye lids open and flush with copious amounts of water for at least 15 minutes. Contact medical or emergency personnel in extreme cases. Always report incidents to supervisor and to Employee Health Services
2. Skin contact - use the Safety shower or submerge contaminated area with cool water for 15 minutes. If blister or reddening develops, do not scrub area, wash gently; seek medical attention. Report incident to supervisor.
3. Clothing contact - remove contaminated clothing immediately and gently wash area with copious amounts of water. Contaminated clothing not removed may cause constant contact and more damage.
4. Inhaled – If safe to do so, quickly remove to fresh air and seek medical attention.
5. Ingested - if MSDS available, look to see proper instructions on whether or not to induce vomiting. If not known, do not induce vomiting; call for emergency medical assistance. Call Poison control center at _____.

VI. STORAGE:

1. Corrosives should be stored in compatible containers. Glass containers are usually the containers of choice for acids. If in doubt, use the original container. Bases are best stored in polyethylene containers.
2. Never store corrosive materials in metal containers. This may cause corrosion of the container and other violent chemical reactions.
3. Be sure all secondary containers are labeled correctly and clearly as to contents and associated hazards.
4. Incompatible chemicals should be stored separately. Acids should be separated from bases. Oxidizing acids should be separated from organic acids and flammables.
5. Storage areas for corrosives should be marked clearly to prevent incompatible chemical storage.
6. Storage should be kept to a minimum by the purchase of small quantities.

VII. TRANSPORT:

1. Corrosive chemicals should be transported, within the work place, in compatible, sturdy outer containers. The inner container must be labeled properly.
2. When shipping outside of the work place, the package must be properly labeled according to DOT specifications, and should contain some absorbent material in case of breakage. Always clearly mark the package destination and return address.

VIII. INFORMATION: To obtain information on the corrosive materials you are working with:

1. Look at the MSDS
2. Read label
3. Ask supervisor
4. Contact Chemical manufacturer
5. Contact American Chemical Association.

**APPENDIX Q
STANDARD OPERATING PROCEDURE FOR CHEMICAL CARCINOGENS,
REPRODUCTIVE TOXINS, ACUTELY AND EXTREMELY TOXIC CHEMICALS**

Definitions:

•Carcinogen

Causes cancer, which is the irreversible, uncontrolled growth of cells in an organ or tissue. It is believed that there is no minimum dose which can remove all danger of cancer.

•Reproductive Toxin

Defines a broad class of chemicals that can:

1. Affect reproductive organs (e.g. atrophied testicles)
2. Affect adult sexual functions (e.g. libido, fertility)
3. Affect offspring of exposed males or females
4. **TERATOGENS** affect developing fetus.

•Acutely, Extremely Toxic

Immediate health hazard, or is labeled, "highly toxic", "sensitizer", "irritant", "lachrymator", that can cause an adverse effect to a target organ, and which effect usually occurs rapidly as a result of short term exposure.

Confirmed Human Carcinogens:

Aflatoxins

Alcoholic Beverage Consumption

4-Aminobiphenyl (4-Aminodiphenyl)

Analgesic Mixtures Containing Phenacetin

Arsenic and Certain Arsenic Compounds*

Asbestos*Azathioprine Benzene*Benzidine*

bis(Chloromethyl) Ether and Technical-Grade Chloromethyl*

Methyl Ether

1,3-Butadiene

1,4-Butanediol Dimethylsulfonate

Cadmium and Cadmium Compounds

Chlorambucil

1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea

(MeCCNU)

Chromium Hexavalent Compounds

Coke Oven Emissions*

Conjugated Estrogens

Cyclophosphamide

Cyclosporin A

Diethylstilbestrol

Dyes that Metabolize to Benzidine

• Direct Black 38

• Direct Blue 6

Environmental Tobacco Smoke

Erionite

Ethylene Oxide*

Melphalan

Methoxsalen with Ultraviolet A Therapy (PUVA)

Mustard Gas

2-Naphthylamine

Radon

Silica, Crystalline (Respirable Size)

• Quartz

• Cristobalite

• Tridymite

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Smokeless Tobacco

Solar Radiation and Exposure to Sunlamps or Sunbeds

Soots

Strong Inorganic Acid Mists Containing Sulfuric Acid

Tamoxifen

Tars and Mineral Oils * 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Thiotepa

Thorium Dioxide

Tobacco Smoking

Vinyl Chloride*.

Reasonably Suspected to be Carcinogens:

Acetaldehyde

2-Acetylaminofluorene

Acrylamide

Acrylonitrile

Adriamycin ®

2-Aminoanthraquinone

o-Aminoazotoluene

1-Amino-2-methylantraquinone

Amitrole

o-Anisidine Hydrochloride

Azacitidine

Benzotrichloride

Beryllium and Certain Beryllium

Compounds

bis(Chloroethyl) nitrosourea

Bromodichloromethane

Butylated Hydroxyanisole

Carbon Tetrachloride

Ceramic Fibers (Respirable Size)

Chlorendic Acid

Chlorinated Paraffins (C12, 60%

Chlorine)

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea

Chloroform

3-Chloro-2-methylpropene

4-Chloro-o-phenylenediamine

Chloroprene

p-Chloro-o-toluidine and p-Chloro-o-toluidine

Hydrochloride

Chlorozotocin

C.I. Basic Red 9 Monohydrochloride

Cisplatin

p-Cresidine

Cupferron

Dacarbazine

Danthron

DDT

(Dichlorodiphenyltrichloroethane)

2,4-Diaminoanisole Sulfate

2,4-Diaminotoluene

1,2-Dibromo-3-chloropropane*

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1,2-Dibromoethane
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine and 3,3'-Dichlorobenzidine
Dihydrochloride
1,2-Dichloroethane
Dichloromethane
1,3-Dichloropropene (Technical Grade)
Diepoxybutane
Diesel Exhaust Particulates
Di(2-ethylhexyl) Phthalate
Diethyl Sulfate
Diglycidyl Resorcinol Ether
3,3'-Dimethoxybenzidine and 3,3'-Dimethoxybenzidine
Dihydrochloride
4-Dimethylaminoazobenzene
3,3'-Dimethylbenzidine
Dimethylcarbamoyl Chloride
1,1-Dimethylhydrazine
Dimethyl Sulfate
Dimethylvinyl Chloride
1,4-Dioxane
Disperse Blue 1
Epichlorohydrin
Estrogens (Not Conjugated): Estradiol-17 β
Estrogens (Not Conjugated): Estrone
Estrogens (Not Conjugated):
Ethinylestradiol
Estrogens (Not Conjugated): Mestranol
Ethylene Thiourea
Ethyl Methanesulfonate
Formaldehyde (Gas)*
Furan
Glasswool (Respirable Size)
Glycidol
Hexachlorobenzene
Hexachloroethane
Hexamethylphosphoramide
Hydrazine and Hydrazine Sulfate
Hydrazobenzene
Iron Dextran Complex
Isoprene
Kepone ®
Lead Acetate and Lead Phosphate
Lindane and Other
Hexachlorocyclohexane Isomers
2-Methylaziridine (Propylenimine)
4,4'-Methylenebis(2-chloroaniline)
4,4'-Methylenebis(*N,N*-dimethylbenzenamine)
4,4'-Methylenedianiline and Its
Dihydrochloride
Methyl Methanesulfonate
N-Methyl-*N*'-nitro-*N*-nitrosoguanidine
Metronidazole

Michler's Ketone
Mirex
Nickel and Certain Nickel Compounds
Nitrilotriacetic Acid
o-Nitroanisole
Nitroarenes
Nitrofen
Nitrogen Mustard Hydrochloride
2-Nitropropane
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine
N-Nitroso-N-ethylurea
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-
1-butanone (NNK)
N-Nitroso-N-methylurea
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosornicotine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Norethisterone
Ochratoxin A A
4,4'-Oxydianiline
Oxymetholone
Phenacetin
Phenazopyridine Hydrochloride
Phenolphthalein
Phenoxybenzamine Hydrochloride
Phenytoin
Polybrominated Biphenyls
Polychlorinated Biphenyls
Polycyclic Aromatic Hydrocarbons
Procarbazine Hydrochloride
Progesterone
1,3-Propane Sultone
β-Propiolactone
Propylene Oxide
Propylthiouracil
Reserpine
Safrole
Selenium Sulfide
Streptozotocin
Sulfallate
Tetrachloroethylene
Tetrafluoroethylene
Tetranitromethane
Thioacetamide
Thiourea
Toluene Diisocyanate

o-Toluidine and o-Toluidine

Hydrochloride

Toxaphene

Trichloroethylene

2,4,6-Trichlorophenol

1,2,3-Trichloropropane

Tris(2,3-dibromopropyl) Phosphate

Urethane

4-Vinyl-1-cyclohexene Diepoxide.

*** OSHA-regulated Carcinogens**

NOTE: The chemicals listed here were evaluated in 2000-2001 by the National Toxicology Program and published in the Ninth Annual Report on Cancer in May of 2000 (with amendments in 01/01). For a complete listing, see the report at <http://ntp-server.niehs.nih.gov/NewHomeRoc/AboutRoC.html>. To find out if the material you are working with is carcinogenic, look for specific warnings on the chemical label or ask your supervisor for the Material Safety Data Sheet (MSDS).

Information concerning all hazardous substances is available to you under the OSHA Hazard Communication Standard.

Reproductive Toxins:

There are numerous references on reproductive toxicology but, unfortunately, no scientific or government agency has established a definitive method for classifying potential human chemical reproductive toxins as they have done for carcinogens. It is, therefore, impossible to give an exhaustive list of all chemicals that should be considered reproductive toxins. The following list are examples of chemicals known or suspected to be human reproductive toxins. The list does not take into account the chemical form, concentration, toxicity, or length of exposure.

MUTAGENS

anesthetic gases benzene chloroprene

dibromo-3-chloropropane,1,2- dimethyl sulfoxide ethylene dibromide

lead and compounds some organic solvents toluene

vinyl chloride

TERATOGENS

aminopterin androgenic steroids anesthetic gases

antineoplastic agents antithyroid drugs arsenic and compounds

busulfan cadmium and compounds carbon disulfide

carbon monoxide chlorambucil chloroprene

coumarin anticoagulants cyclophosphamide DDT

diazepam diethylstilboestrol ethyl alcohol consumption

ethylene dibromide ethylene glycol ethers ethylene oxide

halothane lead and compounds lithium

lithium carbonate lithium citrate mercury and compounds

methimazole methylaminopterin nicotine

paramethadione penicillamine phenytoin

polybrominated biphenyls polychlorinated biphenyls retinoic acid, 1,3-cis-

tetracyclines thalidomide tobacco smoke(not passive)

toluene trimethadione valproic acid

STERILITY/INFERTILITY

anesthetic gases cadmium carbon disulfide "s"

chloroprene DDT dibromo-3-chloropropane,1,2-

diethylstilboestrol ethyl alcohol consumption ethylene dibromide

ethylene glycol ethers kepone

lead and compounds mercury and compounds mirex

naphthyl methylcarbamate polychlorinated biphenyls (PCBs)

tobacco smoke (not passive) vinyl chloride

References

Shepard T.H., M.D.,1989. *Catalog of Teratogenic Agents, 6th edition*. The John Hopkins University Press, Baltimore.

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Plog, B.A. (ed), 1988. *Fundamentals of Industrial Hygiene, Third Edition*. National Safety Council.

U.S. Government Accounting Office, 1991. *Reproductive and Developmental Toxicants*. GAO/PEMD-92-3.

California, State of, 1993. *Chemicals Known to the State to Cause Cancer or Reproductive Toxicity*

Personal Protective Equipment

General Garments

- A fully fastened lab coat or disposable jumpsuit should be worn when handling chemical carcinogens (CC), reproductive toxins (RT) or acutely/extremely toxic (A/ET) materials. Shorts, short-sleeved shirts, sandals, and other clothing which does not protect the laboratory worker from accidental spills are not allowed in the laboratory.
- Long-sleeved clothing impermeable to the reagent in question must be worn whenever working in designated areas. Because decontamination of jewelry may be difficult, **jewelry must not be worn** when working in a designated area.
- Such clothing must not be worn outside the laboratory.
- Overtly contaminated clothing should immediately be removed, disposed of or decontaminated prior to laundering.
- Gloves must be worn during work with CC's, RT's, or A/ET's, and should be appropriate both for the chemical in use and to the chosen task (refer to manufacturers' selection charts, which are based upon permeability studies.)
- Disposable gloves should be discarded after each use and immediately after overt contact with a CC, RT, or A/ET. These and other disposable items should be treated as hazardous waste.

Eye/Face

- Goggles should be worn when pouring large quantities of liquid CC's, RT's or A/ET's.
- Face shields should be worn when not working in a hood that provides some splash protection. The shield provides protection for the eyes, face and neck.

Respiratory

- Respiratory protection from CC's, RT's, or A/ET's must be provided by fume hood exhaust in a designated area.
- If there is no fume hood available, there may be a need to participate in a respirator program. **Respirators are not to be used in any area without prior approval of the Chemical Hygiene Officer.** Respirator usage when handling CC's, RT's or A/ET's should be discouraged except in cases of emergency. Personnel likely to need respiratory protection must be trained according to the stringent requirements of the Occupational Safety and Health Administration (OSHA) standards for respiratory protection, 29CFR1910.134, and should consult the Chemical Hygiene Officer.

Safety Equipment

- Eyewash station provides gentle efficient cleansing for chemical splashes to the eyes.
- Chemical Safety showers are provided in the event of large chemical contamination.

Laboratory Work Practices

Good laboratory work practices can prevent unnecessary exposure to hazardous chemicals.

General

- There will be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics, or storage of utensils or food in laboratory areas where CC's, RT's or A/ET's are used or stored.
- There will be no mouth pipetting in laboratories; mechanical aids must always be used.
- To the degree possible, glass pipettes or other sharp objects likely to become contaminated should not be used with CC's, RT's, or A/ET's.
- All personnel should wash their hands immediately after working with CC's, RT's, or A/ET's as well as before leaving the laboratory area.
- Keep work area free of incompatible substances which may cause violent reactions with the material. Also, area should be neat to provide comfortable, safe movements.
- All employees should be aware of the location of all personal protective equipment including the eyewash station and chemical shower, and familiar with emergency procedures and numbers.

Specific to CC's, RT's, or A/ET's

- These substances must be used and stored only in areas of restricted access. Use of these materials must be in a **designated area**, which is defined as a hood, glove box, portion of a laboratory, or an entire laboratory designated as the only area where work can be done with these chemicals.

Any procedure involving the use of a volatile CC, RT, or A/ET or one whose manipulation is likely to generate an aerosol (solid or liquid) must never be done on the open laboratory bench.

- A designated area must be clearly posted with signs warning that a specific, extremely hazardous material is in use and that only those trained to work with it are allowed to enter the area while procedures using it are being done. The boundaries of the designated area must be clearly defined.

Signage should read:

**CAUTION-POTENTIAL CANCER (REPRODUCTIVE) HAZARD
AUTHORIZED PERSONNEL ONLY**

Facilities or emergency personnel should be apprised of potential hazards in the laboratory before they enter the room. **Please note:** A designated area may be posted with a removable sign if work with extremely hazardous agents is not continuous in the laboratory.

- Vapors or aerosols of CC's, RT's, or A/ET's produced by analytical instruments should be captured at the site of production by local exhaust ventilation or be vented through a chemical fume hood.

Spill procedures must be developed and posted in the designated area. Staff should be familiar with and have available materials which will inactivate the extremely hazardous chemical.

- All surfaces on which CC's, RT's, or A/ET's are used or stored should be covered with an impervious material, e.g. stainless steel or plastic trays, or plastic-backed paper.
- The designated area must always be decontaminated when work is completed.
- Solid waste must be disposed of in hazardous chemical waste bags labeled with the name of the chemical used. Liquid wastes must be put into screw-top containers which are compatible with the chemical; the container must be labeled with the chemical name, and laboratory using it.
- Overtly contaminated analytical equipment should be labeled as such and should not be used until decontamination has been effected.
- Any equipment requiring maintenance or repair work should be decontaminated first.
- The smallest amount of chemical that is required by the procedure should be used or stored; purchase orders must not be based on financial savings. Whenever possible, the required material should be ordered in amounts equal to that required in a given procedure, so that no weighing is necessary.
- Environmental Services procedures should be limited to those which suppress aerosol formation, such as wet mops or special vacuum cleaners supplied with a high efficiency particulate air (HEPA) filter on the exhaust. Dry sweeping or dry mopping must not be done.
- All vacuum services, including water aspirators, should be protected with an absorbent or liquid trap and a HEPA filter to prevent entry of any CC into the system.
- If a volatile CC, RT, or A/ET is used, a separate vacuum pump, placed in a chemical fume hood, should be used.

Emergency Procedures for Contact with CC's, RT's, or A/ET's

Unfortunately, accidents happen even in the most controlled situation. If there is any contact with corrosive materials, the proper procedure is:

- Eye contact - use the eye wash station or any source of potable water; hold the eye lids open and flush with copious amounts of water for at least 15 minutes. Contact medical or emergency personnel in extreme cases. Always report incident to supervisor.
- Skin contact - use the Safety shower or submerge contaminated area with cool water for 15 minutes. If blister or reddening develops, do not scrub area, wash gently; seek medical attention. Report incident to supervisor.
- Clothing contact - remove contaminated clothing quickly and gently wash area with copious amounts of water. Contaminated clothing not removed may cause constant contact and more damage.
- Inhaled - quickly remove to fresh air and seek medical attention.
- Ingested - Contact Poison Center or, if MSDS available, look to see proper instructions on whether or not to induce vomiting. If not known, do not induce vomiting; call for emergency medical assistance.

Storage

- Chemicals should be stored in compatible containers. Glass containers are usually the container of choice. To be certain, use the original container in which the material was shipped.
- Chemicals should be stored away from incompatible chemicals. Refer to the MSDS for known incompatibles.
- Be sure all secondary containers are labeled with the correct chemical name, as well as the hazard category (CC, RT, or A/ET).
- Keep storage to a minimum by purchasing only those quantities required for one week's use.
- A current inventory, listing quantity on hand and storage location of each chemical should be maintained.

Transport

- Hazardous chemicals should be transported within the work place in compatible, sturdy outer containers. The inner container must be labeled properly.
- Contaminated materials to be transferred from work areas to disposal areas should be placed in a closed plastic bag or other impermeable primary container. This primary container should then be placed in a sturdy outer container which has been labeled with the name of the CC and the following:

CAUTION-POTENTIAL CANCER (REPRODUCTIVE) HAZARD

•When shipping outside of the work place, the chemical must be in a container suitable for shipping, the package must be clearly labeled as to the chemical's name and associated hazards and according to DOT specifications, as well as the name and phone number of whom to contact in case of an emergency. The outer package must contain some absorbent material in case of breakage.

Information

- Look at the MSDS
- Read label
- Ask supervisor
- Contact chemical manufacturer
- Contact the American Chemical Association

There are studies which have shown positive correlation between the exposure of workers to carcinogens and the subsequent development of cancer. These have usually involved relatively gross exposures of industrial workers to substances whose carcinogenicity was not recognized or fully appreciated at the time.

In contrast, research scientists and their assistants usually do not encounter such overt, flagrant exposure to carcinogens. Exposure in the research lab is more likely to involve relatively small amounts of carcinogen. This level of contamination is easily overlooked since the amount involved is invisible, odorless, tasteless and produces no acute effects in the exposed individual. Even when workers are aware of a contamination problem, there is no guarantee that they will take corrective action. Almost any protective measure is liable to make work harder or longer or more complicated. And, unless the risk to be avoided is both grave and obvious, most people prefer to believe that they are the lucky ones. Therefore, it is of great importance that personnel are not only aware of the recommended Safety protocols, but are also familiar with the risks involved with working with carcinogens and are motivated to follow safe work practices.

V. EMERGENCY PROCEDURES FOR CONTACT WITH CC's, RT's, or A/ET's

Unfortunately, accidents happen even in the most controlled situation. If there is any contact with corrosive materials, the proper procedure is:

1. Eye contact - use the eye wash station or any source of potable water; hold the eye lids open and flush with copious amounts of water for at least 15 minutes. Contact medical or emergency personnel in extreme cases. Always report incident to supervisor.
2. Skin contact - use the Safety shower or submerge contaminated area with cool water for 15 minutes. If blister or reddening develops, do not scrub area, wash gently; seek medical attention. Report incident to supervisor.
3. Clothing contact - remove contaminated clothing quickly and gently wash are with copious amounts of water. Contaminated clothing not removed may cause constant contact and more damage.
4. Inhaled - quickly remove to fresh air and seek medical attention.
5. Ingested - Contact Poison Center or, if MSDS available, look to see proper instructions on whether or not to induce vomiting. If not known, do not induce vomiting; call for emergency medical assistance.

VI. STORAGE:

1. Chemicals should be stored in compatible containers. Glass containers are usually the container of choice. To be certain, use the original container in which the material was shipped.
2. Chemicals should be stored away from incompatible chemicals. Refer to the MSDS for known incompatibles.
3. Be sure all secondary containers are labeled with the correct chemical name, as well as the hazard category (CC, RT, or A/ET).
4. Keep storage to a minimum by purchasing only those quantities required for one week's use.
5. A current inventory, listing quantity on hand and storage location of each chemical should be maintained.

VII. TRANSPORT:

1. Hazardous chemicals should be transported within the work place in compatible, sturdy outer containers. The inner container must be labeled properly.
2. Contaminated materials to be transferred from work areas to disposal areas should be placed in a closed plastic bag or other impermeable primary container. This primary container should then be placed in a sturdy outer container which has been labeled with the name of the CC and the following:

**CAUTION-POTENTIAL CANCER
(REPRODUCTIVE) HAZARD**

3. When shipping outside of the work place, the chemical must be in a container suitable for shipping, the package must be clearly labeled as to the chemical's name and associated hazards and according to DOT specifications, as well as the name and phone number of whom to contact in case of an emergency. The outer package must contain some absorbent material in case of breakage.

VIII. INFORMATION

To obtain information on the CC's, RT's or A/ET's you are working with:

1. Look at the MSDS,
2. Read label,
3. Ask supervisor,
4. Contact chemical manufacturer,
5. Contact the American Chemical Association

There are studies which have shown positive correlation between the exposure of workers to carcinogens and the subsequent development of cancer. These have usually involved relatively gross exposures of industrial workers to substances whose carcinogenicity was not recognized or fully appreciated at the time. In contrast, research scientists and their assistants usually do not encounter such overt, flagrant exposure to carcinogens. Exposure in the research lab is more likely to involve relatively small amounts of carcinogen. This level of contamination is easily overlooked since the amount involved is invisible, odorless, tasteless and produces no acute effects in the exposed individual. Even when workers are aware of a contamination problem, there is no guarantee that they will take corrective action. Almost any protective measure is liable to make work harder or longer or more complicated. And, unless the risk to be avoided is both grave and obvious, most people prefer to believe that they are the lucky ones. Therefore, it is of great importance that personnel are not only aware of the recommended Safety protocols, but are also familiar with the risks involved with working with carcinogens and are motivated to follow safe work practices.

APPENDIX R**STANDARD OPERATING PROCEDURES FOR WORKING WITH: UNKNOWN MATERIALS****I. DEFINITION:**

Any material that is not labeled or whose label is illegible **MUST** be considered unknown. Since the properties of the compounds are not known, they must not be used in any procedure. These materials should be labeled as UNKNOWN HAZARDOUS WASTE and disposed of as hazardous waste.

II. PERSONAL PROTECTIVE EQUIPMENT (PPE):

PPE should be used when preparing the unknown chemical for disposal.

A. GENERAL GARMENTS

1. Laboratory coats - fastened lab coats should be worn to protect from accidental skin absorption and contaminating clothing.
2. Gloves - use a heavy glove with a broad spectrum of chemical usage, e.g., neoprene.

B. EYE/FACE:

1. Goggles should be worn in case of accidental breakage.
2. Prescription glasses with face shield can also be worn for protection.

C. RESPIRATORY:

If the unknown chemical is fuming or releases noxious vapors store in a fume hood until disposal.

D. SAFETY EQUIPMENT:

1. Located in the hallway of every lab floor, eyewash station provides gentle efficient cleansing for chemical splashes to the eyes.
2. Located in the hallway of every lab floor, chemical Safety showers are provided in the event of large chemical contamination.
3. Located at the exit to every lab, fire extinguishers and fire blankets in case of fire or explosions.

IV. LABORATORY WORK PRACTICES:

NEVER WORK WITH A CHEMICAL THAT IS NOT POSITIVELY IDENTIFIED. Since the properties as well as the material itself is unknown, the addition of any substance may cause a potentially dangerous reaction.

1. All employees should be aware of the location of all personal protective equipment including the eyewash station, chemical shower and fire extinguisher; and familiar with emergency procedures and numbers.
2. All personnel should wash their hands immediately after working with chemicals as well as before leaving the laboratory area. This will prevent any injury resulting from residual chemical, as well as prevent contamination to other areas in and out of the work area.

V. EMERGENCY PROCEDURES IN CASE OF CONTACT WITH CHEMICALS:

1. Eye contact - use the eye wash station located in the hallway of every lab floor or any source of potable water; hold the eye lids open and flush with copious amounts of water for at least 15 minutes. Contact medical or emergency personnel in extreme cases.
2. Always report incidents to supervisor and Employee Health Services.
3. Skin contact - use the Safety shower located in the hallway of every lab floor or submerge contaminated area with cool water for 15 minutes. Report incident to supervisor and Employee Health Services
4. Clothing contact - remove contaminated clothing quickly and gently wash area with copious amounts of water. Contaminated clothing not removed may cause constant contact and more damage.
5. Inhaled - quickly remove to fresh air and seek medical attention.
6. Ingested - call POISON CONTROL CENTER _____.

VI. STORAGE: DO NOT STORE UNKNOWN CHEMICALS FOR PROLONGED PERIODS OF TIME. THESE MATERIALS SHOULD BE DISPOSED OF AS SOON AS POSSIBLE TO PREVENT CONTACT WITH INCOMPATIBLE SOURCE, SPILLAGE AND EXPOSURE.**VII. TRANSPORT: UNKNOWN MATERIALS SHOULD ONLY BE TRANSPORTED TO A SAFE AREA WHILE AWAITING DISPOSAL.**

1. Wear personal protective clothing
2. Transport in sturdy container with general absorbent material
3. Keep away from all chemicals and other possible incompatible sources e.g. heat, water
4. Keep the chemical in its original container to prevent possibility of incompatible container
5. Handle with extreme care in case the material is shock sensitive