CHEMICAL HYGIENE PLAN

Office of Environmental Health & Safety
Room 1219 Boylan Hall

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GLOSSARY

INTRODUCTION

Brooklyn College is responsible for implementing a Chemical Hygiene Plan in accordance with the Occupational Safety and Health Administration (OSHA) standard for "Occupational Exposures to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450). The following plan has been assembled by the Office of Environmental Health & Safety. The plan is intended to assist those responsible for teaching and research related activities in laboratories to safely store use and dispose of hazardous chemicals in accordance with applicable regulations. These regulations include the OSHA Laboratory Standard, the New York City Fire Department rules for Non-Production Chemical Laboratories, and other federal, state and local regulations. This plan is not intended to be a substitute for the actual regulations but rather as a set of policies and procedures to maximize safety and compliance. Placing these policies and procedures into practice is the responsibility of those in applicable administrative positions as well as all affected faculty, investigators and members of the technical staff. It is essential that all these individuals become familiar with this plan, attend training sessions, and seek additional advice when needed.

Emergency Numbers to report a Spill.

During Business Hours (9am - 5pm.)	5400
Off-Hours Call the Security Hotline	5444
Medical Assistance	5444

1. CHEMICAL HYGIENE RESPONSIBILITIES

The OSHA Laboratory Standard requires the designation of a Chemical Hygiene Officer to coordinate the implementation of the Chemical Hygiene Plan. It also recommends the appointment of a Chemical Hygiene Committee to monitor the effectiveness of the plan. The president of the College and members of the Executive Committee, along with other officers and administrators, provide continuing support for institutional chemical hygiene. Department chairpersons, principal investigators, faculty and other laboratory supervisors are responsible for laboratory safety and chemical hygiene within their respective areas.

1.1 Chemical Hygiene Officer (CHO).

The Hazardous Materials Manager serves as the Chemical Hygiene Officer for Brooklyn College. He/she monitors mandated health and safety practices and makes appropriate recommendations to prevent injury and to minimize exposure to hazardous chemicals. The Director of the Office of Environmental Health & Safety supervises the Chemical Hygiene Officer and authorizes him/her to take necessary steps to carry out the objectives of the Chemical Hygiene Plan.

1.1.1 The major duties of the Chemical Hygiene Officer are:

- Coordinate compliance with regulatory mandates pertaining to chemical laboratories or stockrooms.
- Serve on the Chemical Hygiene Committee and work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.
- Provide technical expertise and administrative support to the laboratory community in the area of laboratory safety and health, and direct inquiries to appropriate resources.
- Conduct inspections of laboratories and storage areas with other members of the Chemical Hygiene Committee and assist department personnel and principal investigators in conducting their routine inspections.
- Write inspection reports and recommend follow-up activities.
- Monitor the operation and maintenance of fume hoods, emergency safety showers, eyewashes, and fire extinguishers in all laboratories and stockrooms.
- Conduct or coordinate department-specific laboratory employee health and safety orientation sessions along with other department personnel and assist laboratory supervisors in developing and conducting hands-on sessions for employees.
- Investigate all reports of laboratory hazardous incidents, chemical spills, and recommend procedures to prevent repeat occurrences.
- Act as liaison between the department and the administration, and if necessary, bring unresolved and potentially serious health and safety problems to the administration's attention.

- Maintain records and make them available to employees, administrative personnel and regulatory agencies when required.
- Select a qualified and licensed waste disposal vendor to routinely pickup chemical waste materials. Coordinate hazardous waste collection, storage and removal with facility representatives.

1.2 Chemical Hygiene Committee

1.2.1 The Chemical Hygiene Committee oversees and monitors the effectiveness of the Chemical Hygiene Plan and revises and updates it when necessary.

1.2.2 The committee consists of the Environmental Health & Safety Officer, the Hazardous Materials Manager and the chairperson or his/her designee from each Science Department in which laboratory activities involve the use of chemicals or other potentially hazardous substances. Campus Security & Public Safety and Facilities Planning and Operations representatives will be requested to attend meetings when their involvement is needed.

1.2.3 ***The duties of the Chemical Hygiene Committee members are:***

- Periodically review and update the Chemical Hygiene Plan;
- Review academic research protocols and determine if appropriate controls and laboratory equipment are available to protect employees;
- Review inspection reports and recommend action to correct conditions not in compliance with applicable regulations or accepted prudent practices in laboratory health and safety.
- Review plans for renovation or construction projects affecting chemical laboratories or stockrooms. Make appropriate recommendations relative to health & safety.
- Offer advice and assistance on particular implementation issues and on other problems as they may arise.
- Bring unresolved department related health & safety issues to the attention of the Chemical Hygiene Committee.

1.3 Department Chairpersons

1.3.1 The Department Chairperson is responsible for chemical hygiene in his/her department and must know and understand the goals of the Chemical Hygiene Program.

1.3.2 Duties of the Chairperson

The duties of the Chairperson, or his/her designee, are to coordinate (with the assistance of the Chemical Hygiene Officer) the implementation of the following:

- The maintenance of a current inventory of all chemicals in storage rooms and laboratories in their respective department, updated at least annually.
- The identification for disposal of all expired and unusable chemicals.
- The maintenance of a MSDS (material safety data sheets) file for all chemicals in their respective department.

- The training of all laboratory employees who routinely come in contact with hazardous chemicals.
- Ensure that personal protective equipment required by employees and students is available and properly used.

1.4 Faculty Members and Laboratory Supervisors (Principal Investigators)

Principle investigators, faculty, and other laboratory supervisors are responsible for chemical hygiene in the research or teaching laboratories in which they work.

1.4.1 Responsibility of Faculty Members (Principal Investigators):

- Know and implement the guidelines and procedures of the Chemical Hygiene Plan.
- Develop written safety procedures applicable to their research and workers.
- Train laboratory personnel in these operating procedures and in the use of proper control measures.
- Conduct routine inspections with regard to safety and health.
- Supervise the laboratory to ensure that safe practices and engineering controls are properly utilized.
- Report all safety incidents to the Chemical Hygiene Officer and file a written Incident Report (See Appendix A: *Safety Incident Report Form*).
- Maintain a current inventory of chemicals.
- Obtain a NYC Fire Department Certificate of Fitness for Supervising Chemical Laboratories (C-14).

The NYC Fire Department requires that each individual in charge of a chemical laboratory obtain a C-14 Certificate of Fitness. The Office of Environmental Health & Safety will provide assistance in this area. See Appendix C "Storage of Hazardous Materials - Non-Production Chemical Laboratories."

1.5 Laboratory employees, users and volunteers

Laboratory employees are individuals who, in the course of their assignments may routinely work with or around hazardous chemical substances. These include laboratory technicians, instructors, researchers, graduate assistants, and part-time and temporary employees.

1.5.1 Duties of Employees, Users, Volunteers:

- Follow safety rules/procedures and guidelines outlined in the Chemical Hygiene Plan, Material Safety Data Sheets, CUNY Laboratory Safety Manual and other applicable documents.
- Report any unsafe working conditions, faulty fume hoods or emergency safety equipment and file incident reports with the laboratory supervisor, Department Chairperson, or Chemical Hygiene Officer.
- Attend required health and safety training sessions
- Notify supervisor of any pre-existing health condition that may be affected by working with the hazardous substances in the laboratory/area.

2. HAZARD COMMUNICATION: SIGNS, LABELS, AND MATERIAL SAFETY DATA SHEETS

2.1 OSHA Laboratory Standard Requirements

The OSHA Hazard Communication Standard mandates that chemical manufacturers provide a Material Safety Data Sheet (MSDS) and properly labeled container for each chemical. The labels and MSDS provide basic information about the safety and health hazards posed by a chemical and precautions to take when using it.

2.2 Signs

The employer must post a sign at the location where notices are normally posted to inform employees that they have the right to information from their employer regarding the toxic substances found in the workplace. The employer must provide information as to the hazards associated with materials or chemicals in the lab.

All laboratory employees, visitors and volunteers must be alerted to hazards that exist in an area they enter. The location of information and emergency equipment must be clearly marked to facilitate ready access in case of emergency.

The following is a list of the most important signs that must be posted.

2.2.1 Laboratory: Potentially Hazardous Substances

A sign with the above words in red on a white background must be posted on the door outside of each laboratory at the midpoint of the height of the door. It must be made of metal or other durable material and posted at eye level. The height of the letters in the word "Laboratory" must be at least 1 1/2 inches high; the words "potentially hazardous substances" must be at least 7/16 inches high.

2.2.2 No Smoking

A “No Smoking" sign must be posted at the entrance to storage areas and laboratories as well as on the inside of these spaces.

2.2.3 Emergency Equipment and Exit Identification

Signs indicating the location of each safety shower, eyewash station, fire extinguisher, and exit should be posted.

2.2.4 Emergency Telephone Numbers

Telephone numbers of emergency personnel, supervisors, and the Chemical Hygiene Officer must be posted in each laboratory, storeroom/ stockroom, and storage area.

2.2.5 Special Hazards

All laboratories in which the following materials are used or stored must post signs outside the laboratory and/or storage area indicating the presence of these hazards:

- Water reactive chemicals
- Flammable gases or explosives
- Radioactive materials
- Bio-hazardous materials
- Lasers

2.2.6 *Flammable Storage Cabinets and Refrigerators*

The local fire regulations require that the sign ***"Store no flammables flashing below 100°F"*** must be posted on all non-explosion proof refrigerators and walk-in cold rooms.

The Chemical Hygiene Officer will be responsible for ensuring that this standard operating procedure to post signs is followed in all laboratory and storage areas and that signs conform to local, federal and state regulations.

2.3 Labels

All chemical manufacturers are required under the Federal OSHA Hazard Communication Standard to provide distributors and consumers with properly labeled containers. Labels must include the following information:

- The common name of the chemical.
- Name, address, and emergency telephone number of company.
- A hazard warning indicating the most serious health or safety hazards the chemical poses (e.g., corrosive, carcinogen, water reactive, flammable).

The OSHA Laboratory Standard requires that labels on all incoming containers be maintained and not defaced. Never deface or remove a label from a container. Portable containers used by more than one person or left overnight must be labeled. This information can be found on the original label or on the Material Safety Data Sheet for the product.

2.3.1 Inspection of Container Labeling

The Chemical Hygiene Officer and departmental laboratory employees will assess adequacy of container labeling during routine inventory of chemicals or inspections of laboratories and storage areas. Containers without the minimum required information, unlabeled containers, or labels that are torn or illegible must be reported immediately to the Chemical Hygiene Officer. Unlabeled containers, if unidentifiable, will be disposed of according to Federal and New York State Department of Environmental Conservation regulations and this institution's hazardous waste disposal policy.

All employees involved in unpacking chemicals are responsible for inspecting each container to ensure that it arrives properly labeled. When there is a problem with an incoming product label, the Chemical Hygiene Officer should be contacted. Shipments of improperly labeled products should be rejected.

2.3.2 Newly Synthesized Chemicals

Principal investigators *(faculty members*) in research laboratories will be responsible for ensuring that newly synthesized chemicals are used only under appropriate conditions and are properly labeled. If the hazards of a substance produced in the laboratory are unknown, it must be assumed to be hazardous, and the label must indicate that the potential hazards of that substance have not been tested and are unknown. The principal investigator should develop a preliminary Material Safety Data Sheet at the earliest opportunity, and add to it, as properties of the chemicals become known.

2.4 Material Safety Data Sheets

The OSHA Laboratory Standard requires that Material Safety Data Sheets (MSDS) be collected and maintained for all chemicals used and stored.

2.4.1 Collection and Availability of MSDS

Material Safety Data Sheets must be collected and maintained to ensure that all laboratory personnel have access to them. ***The Office of Environmental Health & Safety will maintain a comprehensive file of Material Safety Data Sheets. These can be obtained from*** Room **252NE or 1219B Boylan** or by calling ext. 4268 or 5400.

2.4.2 Each research laboratory and chemical stockroom shall have access to Material Safety Data Sheets for the chemicals currently used or stored at that particular location. The Chemical Hygiene Officer will provide assistance in obtaining needed Material Safety Data Sheets.

2.4.3 The Chemical Hygiene Officer will also maintain reference materials and database of safety information for pertinent hazardous substances currently used in the college's laboratories. This information will be available for perusal upon request.

3. CHEMICAL INVENTORY, PROCUREMENT AND RECEIVING

3.1 Chemical Inventories

Each Department shall maintain a comprehensive inventory of all chemicals purchased, transferred and disposed. *The Department Chairperson shall designate a suitably qualified individual to coordinate collection of inventories from individual laboratories. This inventory will be the department's inventory in the centralized inventorying system. The inventory data shall be comprised of at least the following data:*

- *Name of Chemical*
- *Chemical Abstract Service (CAS) registry number of the chemical*
- *Chemical supplier's name*
- *Department and division name*
- *Name of principal investigator (if applicable)*
- *Amount of chemical (No of units and unit size)*
- *Date received (if applicable)*
- *Expiration date (if applicable)*
- *Destination or location (room number where chemical is stored)*

3.1.1 Each Department chairperson must ensure that a departmental chemical inventory is updated at least annually and provided to the Chemical Hygiene Officer. This inventory will be used to fulfill reporting requirements of the EPA's Superfund Amendment and Reauthorization Act (SARA) of 1986. The inventory is also needed when responding to emergencies such as a ***fires, flood, steam leaks, etc***.

3.1.2 Chemicals in storage areas must be evaluated for deterioration, container and label integrity, and their age at least once each year. Chemicals whose storage limits have expired must be marked for destruction or disposal or, if warranted, given a new expiration date. Particular attention must be paid to unstable chemicals such as ethers and other peroxide forming materials.

3.1.3 No potentially explosive chemical whose shelf life has expired may be handled or moved by any laboratory employee taking inventory until the Chemical Hygiene Officer is contacted. It is better to be overcautious under these circumstances.

3.2 Chemical Procurement

Prior to ordering hazardous material, consideration must be given to the safety requirements for use, storage and disposal. Only those individuals authorized by the current Brooklyn College Radioactive Materials License may order radioisotopes. Unlicensed individuals can acquire material after authorization by the Radiation Safety Committee.

3.2.1 Procedures Required for Purchasing Chemicals

- Before Particularly Hazardous Substance are ordered, such as carcinogens, reproductive hazards, and acutely toxic substances, consideration must be given to the adequacy of facilities and equipment to safely handle its type and quantity. Consideration should also be given to whether a less hazardous material can be used.
- Check chemical purchases against the chemical inventory to reduce duplicate purchases and stock buildup. The Chemical Hygiene Officer will maintain a list of excess inventory that are available from other departments and CUNY Colleges.
- Efforts should be made to limit the purchase of chemicals to amounts needed. When large amounts are purchased, significant portions may remain unused and eventually require disposal. The lesser unit cost for bulk purchases is outweighed by the cost of additional storage and disposal of old unused materials.

3.3 Chemical Receiving

- Upon arrival at the College, Central Routing will send the unopened package to the department. Place the package in an appropriate location. Check the integrity of the package with adequate spill or decontaminating on hand.
- Forward a copy of the MSDS to the Chemical Hygiene Officer.
- Proper labels must be attached. Containers must be intact and in good condition
- Leaking containers must immediately be placed in an appropriate secondary container and treated as a chemical spill.
- Determine and assign expiration dates to each chemical container coming into the facility that contains any of the following:

  ⇒ *Picrates*
  ⇒ *Perchlorates*
  ⇒ *Peroxides*
  ⇒ *Peroxide forming materials**
  ⇒ *Polymerizers that react violently*
  ⇒ *Other materials known to deteriorate or become unstable or reactive over time*

  *See Appendix E

- Chemicals in the above categories should arrive with dates assigned. If there is no date, under no circumstances should the expiration date be later than one year after the date of acquisition.

- The chemical inventory must be kept current to reflect any incoming materials or outgoing materials from each laboratory or stockroom.

4. CHEMICAL STORAGE

Chemical storage areas in the academic laboratory setting include central stockrooms, storerooms, laboratory work areas, storage cabinets, cold rooms, refrigerators and freezers. There are established legal requirements as well as recommended practices for storing chemicals. Each laboratory and chemical storage area shall comply with regulatory requirements and safety guidelines summarized below.

4.1 General Storage of Laboratory Chemicals

General storage of chemicals is currently restricted to the following locations in the Ingersoll complex.

- Room 010 NE- Chemical Storage Vault.
- Room 0141N-Chemistry Stockroom
- Room 250 NE - General Chemistry Stockroom.
- Room 3307N- Organic Chemistry Stockroom
- Room 446NE-Physical/ Biochemistry Stockroom

4.2 Storage of Chemicals in Laboratories

NYC Fire Department regulations restrict the amount of flammables, oxidizing, and unstable reactives that can be stored in pre-existing laboratories (built prior to July 1, 2008) at any time as stipulated in the table below.

Lab Type	Fire Rating	Fire Protection	Flammable liquids	Flammable solids	Oxidizing Materials	Unstable Reactive
I	2 Hours	Sprinklers	30 gals	15 lb.	50 lb.	12 lb.
II	1 Hour	Sprinklers	25 gals	10 lb.	40 lb.	6 lb.
III	2 Hours	No Sprinklers	20 gals	6 lb.	30 lb.	3 lb.
IV	1 Hours	No Sprinklers	15 gals	3 lb.	20 lb.	2 lb.

4.3 General Requirements For Laboratory Storage

4.3.1 Every chemical must have an identifiable storage place and must be returned to that location after use.

4.3.2 A storage scheme must be developed in each chemical storage area to ensure the segregation of incompatibles. An effort must be made to isolate particularly flammable, reactive, and toxic materials. A storage scheme based solely on alphabetizing is prohibited.

4.3.3 The storage of working containers on bench tops and in fume hoods will be minimized in order to prevent the accidental spilling of chemicals and to reduce the risk of fire.

4.3.4 Compatible chemicals should be grouped by container size to make it easier to retrieve chemicals and to reduce the possibility of bottle breakage. Large containers should be stored on lower shelves. ***Chemicals must not be stored on the floor.***

4.3.5 Chemical storage in hoods should be kept to a minimum. Storing containers inside the hood interferes with airflow, reduces the workspace, and increases the risk of a spill, fire, or explosion. Where applicable, chemicals will be stored in safety cabinets.

4.3.6 Labels must be maintained on all stored materials. New labels must be applied to secondary containers used for transport.

4.3.7 Sensitive chemicals should be stored in amber bottles where required and must not be exposed to direct sunlight or heat.

4.3.8 Storage trays should be used to minimize the spread of a spill. ***The absence of storage trays in the teaching labs is a violation of regulations.***

4.3.9 Laboratory refrigerators must never be used to store food. Flammable liquids that are stored below ambient temperatures shall be stored only in explosion-proof refrigerators.

4.3.10 All chemical containers left out of storage areas should be checked at the end of each workday. Unneeded items must be returned to the appropriate chemical storage location(s).

4.3.11 Dates of initial opening must be assigned to all chemical containers in the following groups when they are initially opened by the first laboratory employee using them:

- ***Picrates***
- ***Perchlorates***
- ***Peroxides***
- ***Peroxide forming materials (aldehydes, ethers, and compounds containing benzylic hydrogen atoms, e.g., cumene isopropyl benzene and most alkenes, vinyl, and vinylidene compounds)***
- ***Polymerizers that react violently in polymerization or become hazardous after polymerization***
- ***Other materials known to deteriorate or become unstable or reactive over time***

4.3.12 Expiration dates must be assigned to all the above chemicals. When provided, the manufacturers' expiration date should be displayed. Peroxide forming materials must be tested routinely for peroxides. (See Appendix E for a listing of common peroxide-forming chemicals).

4.3.13 All laboratory personnel, upon notice of retirement, termination, transfer, or graduation, must, in conjunction with the laboratory supervisor and Chemical Hygiene Officer, arrange for the removal or safe storage of all hazardous materials remaining in their laboratory. *(See Appendix J: Policy and procedures for Laboratory Clean-out of hazardous materials).*

4.3.14 Appropriate spill-control, cleanup, and emergency equipment must be available wherever chemicals are *stored.*

4.4 Storage Requirement for Specific Hazard Classes of Chemicals

4.4.1 Flammable Liquids

- Flammable liquids purchased in large containers should be transferred into portable, approved safety cans for distribution to laboratories. Transfer drums should be grounded and bonded. Safety cans are available in a variety of sizes and materials and are designed to minimize the probability of ignition of flammable vapors and avoid accidental breakage.
- Small containers of flammable liquids in the laboratory should be stored in designated approved storage cabinets.

4.4.2 Flammable and Other Compressed Gases

- The names of compressed gases must be prominently posted.
- ***Storage of flammable gases in laboratories is not permitted, except for those being used. No more than twice the experiment's requirements should be present in the laboratory but at no point shall the total amount exceed the following table.***

Area of Laboratory	Up to 500 Sq. sq. ft	Per additional 100 Sq. Ft	Maximum per Laboratory. Unit.
Maximum Capacity	9.24 cu. ft.	1.54 cu. ft.	15.4 cu. ft.

- Flammable gas cylinders should be stored in a separate area from other types of compressed gases.
- Cylinders of incompatible gases must be segregated by distance.
- Cylinders must be grouped by the type of gas (e.g. toxic, corrosive, etc.)
- Empty cylinders should be separated from non-empty cylinders and labeled "empty" or "MT."
- All compressed gases must be stored away from direct or localized heat (including radiators, steam pipes, or boilers), in well-ventilated and dry areas and away from areas where heavy items may strike them (e.g., near elevators or service corridors).
- All compressed gases, including empty cylinders, must be secured in an upright position with chains, straps or special stands and must be capped when stored or moved.
- A gas cylinder hand truck must be available for transporting gas cylinders to and from storage areas.

4.4.3 Oxidizers

Oxidizers are any solid or liquid that readily yields oxygen or other oxidizing gas or that readily reacts to oxidize combustible materials. Strong oxidizers can present fire and explosion hazards on contact with organic compounds or other oxidizable materials. (See Appendix G)
Some examples are:

- Hydrogen peroxide (> 8%)
- Calcium hypochlorite
- Magnesium perchlorate
- Chromic acid
- Nitric acid
- Sodium peroxide
- Perchloric acid
- Silver nitrate
- Sodium chlorate

Some oxidizers (NFPA Class 4) can undergo explosive reactions when catalyzed or exposed to heat, shock, or friction and must be physically separated from other chemicals.

4.4.4 Storage considerations for oxidizers:

Oxidizers must be stored away from incompatible materials such as:

- Flammable and combustible materials
- Greases
- Paper trash bins
- Finely divided metals
- Organic liquids

Class 4 oxidizing agents must be stored and used in glass or other inert containers. Corks and rubber stoppers are prohibited.

Examples are:

- Ammonium perchlorate
- Ammonium permanganate
- Hydrogen peroxide (> 91% by weight)
- Perchloric acid solutions (> 72.5% by weight)
- Potassium superoxide

4.4.5 Inorganic acid storage

Nitric acid and perchloric acid should be stored in separate cabinets, or break-resistant containers, and placed in acid-resistant trays.

4.4.6 Unstable Reactives.

Restrict the amount of unstable reactive chemicals to that which is immediately required.

4.4.7 Peroxides.

Peroxides and chemicals that tend to form peroxides during storage conditions must be stored in airtight containers in a dark, cool, and dry place. *(Refer to Appendix E for list of chemicals, which will form peroxides on storage)*

4.4.7.1 Storage Temperature Considerations

To minimize the rate of decomposition, peroxides and peroxide-forming materials should be stored at the lowest possible temperature consistent with their solubility and freezing point. Liquid or solutions of peroxide should not be stored at or lower than the temperature at which the peroxide freezes or precipitates, because peroxides in these forms are extremely sensitive to shock and heat.

4.4.8 Highly Toxic/Particularly Hazardous Substances

These chemicals can cause either severe short-term health effects and/or severe long-term chronic health effects. These include “select carcinogens, toxins and substances which have a high degree of acute toxicity. (See Appendix B).

- These chemicals must be stored in unbreakable chemically resistant secondary containers to prevent breaks and spills.
- Adequate ventilation must be provided in storage areas especially for toxic substances that have a high vapor pressure.
- All dispensing of these materials must be conducted in a fume hood.

5. HANDLING CHEMICALS

5.1 Laboratory Hazard Evaluation

5.1.1 Assessment of Protocols and Experiments

- Laboratory personnel must be familiar with the potential hazards prior to beginning work and take appropriate safety precautions (i.e., local exhaust ventilation, protective equipment), to minimize exposure.
- A laboratory hazard evaluation must be performed before a new laboratory experiment is conducted. A hazard evaluation form must be completed for each new experiment involving particularly hazardous substances (See Appendix D: Hazard Evaluation form). This form must be used to make sure that the appropriate safety precautions are taken and to serve as a reference. Container labels and Material Safety Data Sheets, as well as other references, must be used to conduct the evaluation. The hazard evaluation also serves to prepare for a possible emergency response.
- Precautions to be taken when working with particularly hazardous substances are listed in Appendix B.

5.2 Substitution as a Primary Method of Control

As part of the hazard evaluation, laboratory personnel should always consider substituting with less hazardous and toxic substances. Only chemicals for which appropriate exposure controls are present may be used.

5.3 Reevaluation Prior to Modification of Procedures

Graduate students and technicians should obtain prior approval from their respective Principal Investigators and Coordinators before initiating new steps or procedures. A re-evaluation should be completed whenever one or more of the following applies:

- There will be unknown results.
- There is a significant change in procedure or test likely to alter the hazard. A significant change is defined as a 10% or greater increase or decrease in the amount of one or more chemicals used, a substitution or deletion of any of the chemicals in a procedure or a change in the conditions under which the procedure is conducted.
- Equipment normally used is not available, such as fume hoods or other local ventilation.

5.4 Reporting Laboratory Incidents and Unsafe Conditions

- Report all laboratory safety incidents to the Department Chairperson and Office of Environmental Health & Safety**. Incident report forms are available from the Chemical Hygiene Officer. (See Appendix A).**

- **Unusual or unexplainable chemical incidents should be discussed with others in the laboratory, to caution them as to the risk of the procedure.**
- **Report any unsafe conditions by contacting the Chemical Hygiene Officer or the Office of Environmental Health & Safety so that the condition may be corrected as soon as possible.**
- ***Unsafe conditions that must be reported include:***

    1. Non-functioning hoods.
    2. Unsafe storage conditions.
    3. Blocked emergency exits.
    4. Discharged fire extinguishers.
    5. Eyewash stations or safety showers that do not work.
    6. Absence of personal protective equipment (e.g. goggles, gloves).

5.5 Personal Hygiene

- Never store food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operations.
- Do not eat, drink, smoke, chew gum, or apply cosmetics in laboratory areas where chemicals or other hazardous materials (e.g., Radioactive or Bio-hazardous materials) are present.
- Never pipette by mouth. Always use a pipette bulb or other mechanical pipette-filling device.
- Wash areas of exposed skin before leaving the laboratory.

5.6 Wearing Appropriate Personal Apparel

Confine long hair and loose clothing. Wear appropriate shoes at all times in the laboratory; do not wear:

- Sandals
- Flip flops
- Perforated shoes
- Cloth Sneakers

Short-sleeved T-shirts, short skirts, or shorts should not be worn while performing laboratory work. Wear long-sleeved and long-legged clothing. Do not wear jewelry that interferes with gloves and other protective clothing or that could come into contact with electrical sources or react with chemicals.

5.7 Proper Equipment Use

- Use equipment only for its intended purpose.
- Inspect equipment or lab apparatus for damage before use.
- Never use damaged equipment such as cracked glassware or equipment with frayed electrical wiring.

- Shield or wrap Dewar flasks and other evacuated glassware to contain chemicals and glass fragments should an explosion or implosion occur.

5.8 Personal Protective Equipment and Fume Hoods

- Select appropriate equipment based on the evaluation of chemical and procedural hazards.
- Inspect all protective equipment (glasses, goggles, gloves) for damage before use. Do not use damaged protective equipment.
- All personnel, students, and any visitors in locations where chemicals are stored or handled must wear protective goggles at all times. Students are not permitted to work in any Chemistry Laboratories without Eye Protection.
- Wear appropriate gloves when there is potential for skin contact with toxic chemicals. When ordering gloves, consult chemical permeation and resistance charts.
- Use additional personal protective equipment when necessary.
- Check fume hoods before use to ensure adequate functioning.
- When working with particularly hazardous substances follow appropriate special precautions in *Appendix B.*

5.9 Transport of Chemicals

The following guidelines must be followed when transporting all chemicals within facilities, from building to building, and on public streets.

- Laboratory employees transporting chemicals must wear gloves, splash goggles and an apron in the event that containers break and chemicals are splashed.
- Compressed gas cylinders must be transported with gas cylinder hand trucks only with the cylinder strapped in place. Cylinders should NEVER be rolled or dragged. Keep the cylinder capped until it is used.
- Use freight elevators when available. If necessary, passenger elevators should be occupied only by those who are handling the chemicals, preferably during low-use time periods.
- Wheeled carts used to transport chemicals should be stable and move smoothly over uneven surfaces without tipping or stopping suddenly, and should have lipped surfaces that would contain the chemicals if the containers break.
- Hand-carried chemicals should be placed in secondary container or acid-carrying bucket to protect against breakage.

5.10 Housekeeping

- Keep all work areas (including work benches and floors) clean, dry, and uncluttered.
- Access to emergency equipment, utility controls, showers, eyewash stations, and laboratory exits must not be blocked.

5.11 Toxic Discharges and Waste Disposal

- Deposit chemical waste in their appropriate, labeled receptacles and follow all other disposal procedures described in section on waste handling. *Any questions with respect to disposal of specific chemicals should be directed to the Chemical Hygiene Officer at ext. 4268.*
- Be particularly cautious about releasing hazardous substances into designated "cold" or "warm" rooms, since these facilities have recirculated atmospheres.
- Minimize the release of toxic vapors into the laboratory by venting apparatus such as vacuum pumps and distillation columns into local exhaust devices. When especially toxic or corrosive vapors are involved, they should pass through scrubbers prior to being discharged from the local exhaust system.
- Broken glassware or empty bottles should be cleaned of chemicals and placed in a separate cardboard container for disposal. The container should be clearly labeled "GLASS" or "BROKEN GLASS".

If you are using a rotary evaporator with the vacuum attached, it is always prudent to use an appropriate device to trap any vapors.

5.12 Biohazardous or Infectious Material

Persons working with infectious agents or potentially infectious material must be aware of the potential hazards and must be trained and proficient in the practices and techniques required for handling such material safely. The person in charge of the laboratory is responsible for providing or arranging for appropriate training of personnel.

The handling of potentially infectious material requires strict adherence to good laboratory practices and standard microbiological techniques. When these are not sufficient to control the hazard associated with a particular agent, the use of appropriate safety equipment and additional control measures may be needed. The Hazardous Materials Manager is available for consultation on such issues. For proper treatment and disposal of bio-hazardous waste see S*ection 10.10.*

5.13 Working Alone

It is required that a person holding a C-14 Certificate of Fitness, issued by the City of New York Fire Department (FDNY), be present in all laboratories when chemicals are in use. (See Appendix C for a copy of the FDNY regulation).
In undergraduate teaching laboratories, an Instructor holding a C-14 Certificate must be present in the laboratory at all times when undergraduate students are conducting experiments. Also, Undergraduate Students are not permitted to work in Research Laboratories without the physical presence of a person holding a C-14 Certificate.
It is recommended that all personnel working alone during off-hours contact Security to make them aware of their presence in the facility.

6. CONTROLS

Appropriate controls will be provided where they are needed to protect students, faculty and staff. The OSHA Laboratory Standard requires that "fume hoods and other protective equipment function properly and [that] specific measures [be] taken to ensure proper and adequate performance of such equipment". Additional employee control measures may also be required when working with particularly hazardous substances. (*See Appendix B*).

Controls shall include the following:

1. Functional general ventilation systems and fume hoods that meet the requirements for procedures performed.
2. Appropriate personal protective equipment (PPE) (*See section 7*).
3. Sufficient and accessible emergency safety facilities and equipment, such as eyewashes, deluge showers, fire extinguishers, etc.

Requirements with respect to general and local exhaust ventilation criteria for their use are described below.

6.1 Ventilation Systems

6.1.1 General Ventilation

- The general ventilation system in laboratories must be well maintained and the quantity and quality of airflow monitored at least annually.
- ***Storage areas used for flammables must have six air changes per hour. Air supplied in all active laboratories and chemical storage areas should be 100% fresh air.***
- ***Air removed from the laboratories through vents and ducts by general ventilation should be vented to the outside, not into the general facility circulation. Intake vents for the system should be far enough removed from the system's discharge port to prevent cross contamination.***
- ***A slightly negative pressure should be maintained in laboratories and Chemical Storage areas to prevent air flowing from the laboratory into adjacent areas.***
- ***General ventilation will not be relied upon to protect employees from toxic exposures. Fume hoods and other local exhaust system devices must be used.***
- ***These recommendations must be taken into account in new designs and redesigns of ventilation systems for laboratory use.***

6.2 Fume Hoods

Fume hoods minimize personal risk of exposure to toxic and hazardous materials by isolating activities from the general laboratory environment. The chemical vapors, fumes, and mists are captured at their source, preventing them from entering the general

laboratory environment. Their use is encouraged whenever possible and mandated for certain substances and procedures, as outlined below.

6.3 When Hoods will be used

- The toxicity of the substance used must be considered. Hoods must always be used when working with a known or suspected carcinogen, reproductive hazard, sensitizer, or acutely toxic chemical.
- Flammable and reactive substances should be handled in a fume hood.
- Running new reactions that may be unpredictable or old reactions that may have a history of being less than fully reliable should be conducted in a hood.
- The quantity should also be considered. Hoods should always be used when handling large quantities of chemicals (over 500 milliliters of liquid or over 30 grams of a solid).

6.4 Required Work Practices with Fume Hoods

- All laboratory employees must check the functioning of fume hoods before use and employ work practices that optimize the protection afforded by fume hoods.
- Immediately report non-functioning fume hoods to the laboratory supervisor or contact the Chemical Hygiene Officer.
- Do not block vents in the hood with stored chemicals or equipment. Doing so interferes with the proper airflow.
- Hoods must not be used to dispose of or store hazardous chemicals. Hoods used for operations involving highly toxic vapors or dust may need to be fitted with condensers, traps, or scrubbers, to contain and collect them and prevent them from being released into the environment.
- Hoods should be closed when not in use. Keep the sash down as far as possible during use to improve the overall performance of the hood. If chemicals remain in the hood after use, they should be capped and placed in the rear of the hood.
- Reduce turbulence near and in the hood by closing nearby doors and windows when possible, opening and closing the sash slowly and smoothly, and by avoiding rapid movements inside the hood.
- Keep equipment at least 6 inches inside the hood face. Connect electrical equipment to outlets outside the hood. This way, in the event of an emergency, one can disconnect equipment without creating a spark inside the hood. Be cautious of tripping hazards with electrical cords.
- Wash the hood work platform as often as necessary to maintain a clean, dry surface.
- An independent duct must serve fume hoods in which perchloric acid, strong oxidizing agents, or highly reactive chemicals are used. Crystals can form inside the ductwork due to condensation, which can lead to explosions when performing maintenance work on the ventilation system. If you are unsure of whether this is the case when using these materials, DO NOT GO FORWARD WITH YOUR WORK. CONTACT THE CHEMICAL HYGIENE OFFICER at ext. ***4268***.

6.5 Fume Hood Performance Requirements

- The fume hoods in the laboratories must be maintained at an average face velocity of 100 feet per minute (fpm) with no point falling below 75 fpm.
- Common ventilation ducts may be used only for fume hoods located in the same laboratory unit (defined as an enclosed fire-rated space that may contain more than one separate laboratory work area).
- Hoods in different laboratory units should not have combined ducts, and these ducts should lead to a point where laboratory contaminants can be released safely into the atmosphere.

6.6 Situations in which Laboratory Work Should Not Proceed

- When fume hoods are not operating, they should not be used.
- Where there is reason to believe that laboratory employees would be overexposed to hazardous chemicals due to the failure of appropriate controls, activities should cease until an alternative solution is found or the problem is resolved.

6.7 New Construction or Renovation Work

Laboratory areas to be renovated in pre-1980 buildings must be inspected for the presence of asbestos. If asbestos is going to be disturbed, proper procedures must be taken for its safe containment or removal prior to the commencement of renovation activities.

All renovation and construction work in or around the laboratories should be coordinated with Department representatives and the Office of Environmental Health & Safety.

7. PERSONAL PROTECTIVE EQUIPMENT

The need for and selection of personal protective equipment must be based on a hazard determination and assessment in accordance with 29 CFR 1910 Subpart I. Special consideration must be given to proper selection and use. All equipment must meet applicable standards. The choice of equipment must be reviewed with the Chemical Hygiene Officer prior to final selection. All respiratory protective equipment must be selected, distributed and used in accordance with OSHA requirements (*29 CFR 1910.134*).

7.1 Eye Protection

All laboratory personnel must wear proper eye protection, which meets applicable ANSI Z 87.1 performance requirements and is appropriate for the particular hazard (e.g., chemical splashes and/or impact hazard). Persons who wear prescription lenses while engaged in operations that involve eye hazards must wear eye protective devices designed to be worn over the prescription eyewear or wear protective devices fitted with the prescription lenses. It should be recognized that dusty or and/or chemical environments may represent an additional hazard to contact lens wearers.

Instructors are not to allow students in the laboratory without proper eye protection.

7.1.1 *Safety Shields/ Face Shields*

Face shields should be used when face protection from flying particles and harmful liquids is needed in addition to eye protection.

Safety shields should be used on or near equipment when there is a potential for explosion or splash hazards. Fixed shields will be used whenever possible, recognizing that their weight and resistance provide superior protection. Portable shields may be used when the hazard is limited to small splashes, heat or fire. Where combustion is possible, the shield must be made of non-flammable or heat resistant material.

7.2 Guidelines to be observed when using gloves

Gloves should be worn whenever there is a chance for hand contact with chemicals. Gloves must be worn if the chemicals involved are easily absorbed through the skin and/or are acute or chronic toxins.

7.2.1 Lab personnel must inspect gloves prior to each use. When removing gloves, grab the base of the left glove with the right hand and remove that glove. While holding the left glove in the right hand, invert the right glove over the removed glove and dispose of them properly.

7.2.2 The glove materials vary in the way they resist being degraded and permeated. Prior to use, lab personnel will consult the glove manufacturer's permeation and

resistance charts (available from the manufacturer) to make sure that the glove is made of the proper material for the chemicals being used. No glove totally resists degradation and permeation over time and must be replaced periodically.

7.3 Protective clothing

The choice of protective clothing depends on the degree of protection required. Appropriate protective clothing is required whenever a potential exists for chemical splashes, fire, extreme heat or cold, excessive moisture, and radiation. Protective clothing required may include one or more of the following depending on the hazards anticipated:

- ***Lab coats***
- ***Boots***
- ***Lab aprons***
- ***Shoe covers***
- ***Gauntlets***
- ***Jump suits/coveralls***

Laboratory personnel must consider the following characteristics in protective clothing selection and purchase:

- **Ability to resist fire, heat and the chemicals used**
- **Impermeability, when needed**
- **Comfort, permitting easy execution of tasks when worn**
- **Ease of cleaning (unless disposable)**
- **Ability to be removed during an emergency or chemical splash (e.g., snap fasteners rather than buttons)**

7.4 Availability and Inspection of Personal Protective Equipment

Each science department will maintain a list of personal protective equipment required for teaching and research laboratories. The checklist will be used to ensure that all necessary equipment is made available to employees. The Chemical Hygiene Officer will review safety equipment periodically. Personal protective equipment should be evaluated under real or simulated conditions to ensure that it meets both safety and performance standards. For example, chemical splash goggles may meet ANSI standards but fog up rapidly or fit uncomfortably. Situations like this will make compliance difficult. The effectiveness of the equipment should be reviewed periodically and improvements made where possible.

8. MAINTENANCE AND INSPECTION PROGRAM

Brooklyn College Facilities Planning and Operations is responsible for the installation and maintenance of emergency safety equipment.

The Chemical Hygiene Officer will conduct annual inspections of facilities; fume hoods, and emergency equipment such as eyewash stations, safety showers, and fire extinguishers in laboratories, storage areas, and preparation rooms.

Areas in which particularly hazardous chemicals and/or procedures are used may require more frequent inspections.

Between maintenance and inspection intervals, laboratory faculty/principal investigators or laboratory supervisors must report improperly functioning fume hoods, ventilation systems, safety showers/eyewash stations, and other safety equipment to the Chemical Hygiene Officer and forward a "Maintenance Request" to Facilities.

8.1 General ventilation system

The general ventilation system serving the laboratories must be designed and maintained in good working order to ensure that the required amount of outside air and air changes per hour are provided.

Centralized heating, ventilation, and air-conditioning (HVAC) maintenance will include the following:

- Filters are inspected and changed periodically.
- Drip pans are cleaned regularly to prevent mold or bacterial growth.

8.2 Local Exhaust Systems: Fume hoods Maintenance

8.2.1 General Maintenance and Major Repairs

The Department Of Facilities Planning & Operations will schedule general maintenance and repairs when classes are not in session (i.e., between semesters, spring break, etc.). Arrangements will be made with the department chairperson (or his/her designee) and Environmental Health and Safety to notify laboratory faculty and staff in advance not to use hoods during scheduled repair times. Notices will be posted throughout the department informing everyone of pending maintenance and repairs.

8.2.2 Minor or Emergency Repairs

Facilities Maintenance will consult with the department for the best time to perform the emergency repair. The department will notify faculty and staff not to use the hoods during this time. Notices will be posted on those hoods or laboratory doors affected by repairs.

In all instances the Office of Environmental Health & Safety will be informed of scheduled repairs so that safety checks can be made. On completion of all repairs the Environmental Health & Safety Office will check that the hoods are functioning properly.

8.2.3 Cleaning

The cleaning of the interior surfaces of the hood and sash glass will be the responsibility of the users in that hood location.

8.3 Emergency Eyewash and Deluge Showers

The performance of emergency eyewash and deluge showers will be evaluated during annual facility inspections. *Any needed maintenance or repairs will be forwarded to Facilities.*

8.4 Fire extinguishers

All Laboratory fire extinguishers will be inspected during annual inspections. Facilities will install or replace them as needed. Facilities will be responsible for having hallway and stairwell extinguishers inspected and maintained to ensure that they are properly charged in the event of a fire.

8.5 Mechanisms to Report Malfunctioning Equipment

Departmental personnel and laboratory employees having any indication of improper functioning of fume hoods or safety equipment will alert the Chemical Hygiene Officer and forward a maintenance request form to Facilities indicating the problem and the location of the fume hood or equipment.

8.6 Chemical Hygiene Inspections

The Chemical Hygiene Officer will conduct annual inspections of laboratories and safety equipment to ensure its proper functioning. The chemical inventory and basic operations conducted in the laboratory will be reviewed as part of the inspection process.

8.7 Laboratory Inspections

Annual laboratory inspections will include the following:

1. Fume Hood Performance.
    - Measure the rate of flow at the face of the hood as well as the uniformity of air delivery to the hood by making a series of face velocity measurements using appropriate instruments.
    - The average velocity shall not be less than 100 feet per minute and not below 75 feet per minute at any point.
    - Use smoke tubes to observe airflow interferences affecting the fume hood's operation.
2. Safety inspection
    - Inspect and test emergency equipment including eyewash stations and safety showers. The Department of Facilities will assist in the testing of the safety showers.
    - Look for and correct blocked emergency exits.
    - Check fire extinguishers to make sure they are properly charged.
    - Check availability and appropriateness of spill-control and other emergency equipment.
    - Inspect protective equipment for integrity as well as appropriateness.
    - Observe general housekeeping conditions and systems used to communicate hazards (e.g., signs and labels).
    - Inspect chemical storage areas for proper segregation of chemical classes and container integrity.
    - Review hazardous waste disposal practices.

8.8 Inspection Reports

The Chemical Hygiene Officer will report and prioritize any problems encountered during inspections. The results of the inspections and recommended remedial action will be discussed with the department chairperson, committee, laboratory supervisors or principal investigators as necessary. All serious and potentially serious laboratory safety and/or health problems will be brought to the attention of the appropriate department and a schedule of steps and a time frame for correcting them will be established.

9. GUIDELINES FOR CHEMICAL SPILLS, FIRE, AND RELATED EMERGENCIES

Each science department must consider the types of emergencies that may arise in their respective division's laboratories and the series of steps to be taken in the event that these emergencies occur. Any laboratory handling particularly hazardous substances (including carcinogens, potential carcinogens, reproductive hazards, acutely toxic chemicals or sensitizers) must consider spill control protocols involving these specific materials (see Appendix B). All laboratory employees must be aware of the steps to take in the event of an emergency. The following procedure can be used as a general guide for spill containment. Material Safety Data Sheets and other references should be consulted for more specific information. In the event of any chemical spill, release, injury, illness, or medical emergency, an incident report must be prepared (see appendix A) and signed by either the person involved or his/her supervisor or co-worker witnessing the incident. A copy of the incident report must be sent to the Office Of Environmental Health & Safety in Room 1219B Boylan.

9.1 Standard Operating Procedures

The use of biological and radiological materials may require distinct protocols, depending on their quantity and the extent and severity of their hazards. The Radiation Safety Plan outlines procedures for handling radioactive spills.

9.2 Chemical Spills

Most spills in the laboratory involve comparatively small quantities of chemicals that can readily be neutralized and cleaned up by laboratory personnel. Laboratory employees involved in the cleanup of chemical spills must wear personal protective equipment that will prevent contact with toxic chemicals. The Chemical Hygiene Officer should be contacted immediately if assistance is needed to cleanup a spill or to arrange for the disposal of the chemicals. The Chemical Hygiene Officer will maintain a supply of spill containment equipment for emergency response purposes. Each research laboratory and stock room must have an adequate supply of suitable neutralizing or absorbent material spill kit for the hazardous chemicals in that area.

Laboratory employees witnessing chemical spills or emergencies must not take it upon themselves to clean up a chemical spill, put out a fire, or administer medical assistance
If they:

- ***Are not familiar with emergency or spill control protocol***
- ***Don't know what chemicals are involved or what the potential hazards are***
- ***Don't have the proper protection***
- ***Don't think they can handle it***

DO NOT contact the custodial staff to respond to chemical spills! Custodial staff are neither trained nor equipped to cleanup laboratory chemical spills.

9.3 Action to be taken for hazardous spills

If there is a spill of such magnitude and/or potential hazard that additional assistance is required, take the following measures at once:

- If a flammable liquid is spilled, shut down all electrical equipment and extinguish all flames.
- Clear the laboratory of all personnel.
- Close any door to adjacent rooms, if possible.
- Exit immediately, closing the door, restrict others from entering.
- Immediately contact the Chemical Hygiene Officer at Ext. 5400 or 4268. During off hours, call the Security Office Emergency Hotline at 5444.

Give the Following information:

- **Name Of Person Calling and Phone Number**
- **Type of Spill and Approximate Quantity.**
- **Location (Building, Floor and Room Number).**

9.4 Personal Chemical Contamination and Medical Emergencies

In case of injuries, immediately contact the Emergency Hotline at 5444. All incidents must be reported to the Chemical Hygiene Officer and an incident report prepared as soon as possible.

- Laboratory employees involved in and affected by a chemical spill, release, or other incident are entitled to a medical consultation by a qualified physician.

9.4.1 **Chemical eye splashes**:

Immediately rinse the affected eye or eyes at the eyewash station for at least 15 minutes while holding the eyelids open to ensure proper irrigation. Get medical assistance whether or not symptoms persist.

9.4.2 Contamination of large areas of the body:

Immediately remove contaminated clothing while using the safety shower for at least 15 minutes. Wash contaminated areas with a mild soap and water. **Do not use neutralizing agents or salves.**

9.4.3 Ingestion of chemicals:

Seek medical attention by calling the Emergency Hotline at 5444 and provide pertinent information. If necessary, contact NYC Poison Control. Phone (212) 340-4494 or (212) 764 7667.

9.4.4 Development of signs or symptoms of chemical exposure:

In the event that a laboratory employee develops dizziness, nausea, light-headedness (dyspnea), a burning sensation in the eyes, nose, or throat, or other signs and symptoms of chemical exposure, they must leave the area immediately and get fresh air. Contact your laboratory

supervisor and/or the Chemical Hygiene Officer at 5400/4268. During off-hours, or for medical assistance, contact Emergency Hotline at 5444.

9.4.5 Thermal and chemical burns

Where appropriate, flush area with cold water. For extreme burns, call the Emergency Hotline (5444).

9.4.6 Gashes, cuts, and heavy bleeding

Seek medical assistance from the nearest person trained in first aid. Contact the Emergency Hotline (5444). Apply compression to the wound to slow bleeding.

9.4.7 Fire and Fire-Related Incidents

All employees must respond to alarms of fire or emergency evacuation. All laboratory employees are required to participate in fire drills and other exercises to prepare for these events. The Office of Security and Public Safety coordinates emergency evacuation and fire drills ***(See Brooklyn College Fire Safety Plan).***

9.4.8 Incident follow-up

After each incident, designated department personnel will ensure that all emergency equipment, supplies, and materials are replenished. Environmental Health & Safety will conduct a follow-up inspection and review of necessary corrective action.

9.5 Basic steps to take in the event of a fire

The order of these steps may vary depending upon the situation.

- **A**lert personnel in the immediate vicinity of a fire or emergency.
- **C**onfine the fire or emergency.
- **E**vacuate the building.
- **S**ummon aid.

If there is time and it is safe, shut off all power and close the door of the room where the fire is. If you are working and you hear a fire alarm, immediately leave the building by taking the nearest stairwell. ALWAYS USE THE STAIRS. NEVER TAKE THE ELEVATOR UNLESS OTHERWISE INSTRUCTED.

9.6 Determining when to attempt to put out a fire

Judgment must be used to determine whether to attempt to put out a fire yourself. The following circumstances must be considered prior to an attempt is made:

- The fire is small.
- Chemical(s) and or processes involved are not potentially explosive.
- Fire is isolated (away from other chemicals).
- You have received training and know how to use a fire extinguisher.
- The fire extinguisher is the right type for the chemical involved (e.g. dry chemical type).

- A move toward the fire extinguisher does not trap you in the room in the event that the fire spreads.

9.6.1 Circumstances under which an attempt should not be made include:

- The fire has spread to a secondary source (other than the site where it began).
- You don't know how to use a fire extinguisher
- A move to get the fire extinguisher could trap you in the room if the fire spreads
- The fire is very close to other chemicals.
- The fire extinguisher is the wrong type (e.g., carbon dioxide extinguisher for a lithium aluminum hydride fire).

A watch glass may be used to extinguish a fire limited to a beaker or other small container. NEVER PLACE A WATCH GLASS ONTO A BEAKER DIRECTLY WITH YOUR BARE HANDS. The watch glass must be handled with tongs or other tools.

9.7 Using the fire extinguisher

If the use of a fire extinguisher is necessary, the following four steps should be taken:

1. Pull the pin out on the extinguisher handle.
2. Aim the extinguisher hose at the base of the fire.
3. Squeeze the nozzle to release extinguishing material.

Sweep: Use a back and forth sweeping motion. If after a few minutes the intensity or size of the fire has not diminished, GET OUT and close the door behind you. Larger or rapidly growing fires MUST BE LEFT UP TO THE FIRE DEPARTMENT!

When a Person and/or Their Clothing is on Fire

If you are on fire, STOP, DROP, AND ROLL. Your body weight will smother the fire. DO NOT RUN! Running simply fuels the flames. Use the safety shower if it is not far away.
If you witness a person on fire, make sure he/she Stops, Drops, and Rolls. Have someone else pull the fire alarm to contact the fire department and emergency services. DO NOT WRAP A PERSON IN A VERTICAL POSITION IN A BLANKET TO SMOTHER THE FLAMES. This could worsen the situation.

10. WASTE MANAGEMENT AND DISPOSAL

Brooklyn College utilizes approved hazardous waste removal contractors to dispose of all hazardous waste from the campus. The Environmental Health & Safety office makes the arrangements for collection and disposal. In order to do this in a legal, safe and efficient manner, all laboratories generating hazardous waste must follow all applicable regulatory requirements. This procedure, as well as Appendix H "Chemical Waste Management", Appendix J " Laboratory Clean-Outs", posted instructions and other EHS guidance documents must be adhered to. When in doubt about the proper disposal of chemicals or other waste material, or if there are any questions regarding regulatory requirements, please consult with the Hazardous Materials Manager at Ext. 4268.

Do not pour large quantities of acids or bases down the drain. Small amounts of acids or alkalis used in the normal course of laboratory experiments can be disposed of by properly diluting or neutralizing and slowly flushing them down the laboratory drain with large quantities of water.

Spent solvents must be collected in a suitable container for removal when full. When feasible, distilling and reusing solvents is one method of minimizing amounts of solvent waste. It is important not to mix non-compatible substances in the same container. Some solvents (ethers and secondary alcohol) form unstable peroxides on standing. Some reactions can form explosions directly (e.g., Acetone and Chloroform in the presence of a base). Direct any questions to the Hazardous Materials Manager. Also, please see Appendix H for more detailed information.

10.1 Non-Hazardous Wastes.

The following non-hazardous compounds can be disposed in small quantities without special handling:

Organic Chemicals.

Acetates: Ca, Na, NH_4 and K
Amino Acids And their Salts
Citric Acid and salts of Na, K, Mg, Ca, and NH_4
Lactic Acid and salts of Na, K, Mg, Ca and NH_4
Sugars

Inorganic Chemicals

Bicarbonates: Na, K
Borates: Na, K, Mg, and Ca
Bromides: Na, K, Mg, and Ca
Chlorides: Na, K, Mg, and Ca
Fluorides: Ca
Iodides: Na, K,
Oxides: Na, K, Mg, Ca, B, Al, Si, and Fe

Phosphates: Na, K, Mg, Ca, and NH4
Silicates: Na, K, Mg, and Ca
Sulfates: Na, K, Mg, Ca, and NH4

10.2 Collection of Hazardous Waste

- Collect, identify and tag all hazardous waste. Hazardous waste labels are available from the Chemical Hygiene Officer at ext. 4268. Please pay careful attention to accurately segregate and label waste since the college's safety personnel depend on this information for their safety and for making decisions regarding handling, storage, and proper disposal. Unlabeled materials require analysis prior to disposal and must be prevented as much as possible.
- Segregate waste using containers or bottles closest in size to the amount of waste generated.
- The presence of any radioactivity must be indicated on the waste labels. The radioactive material is collected separately from other waste. Infectious / medical waste must also be disposed according to applicable regulations through the Office of Environmental Health & Safety.
- Do not discard <u>any</u> hazardous waste (chemical, radioactive or infectious) into receptacles that are routinely removed by custodial service, (e.g. waste baskets, cartons, etc.). Contact EHS.
- IT IS IMPERATIVE THAT YOU NEVER ADD ANY HEATED SOLUTIONS TO THE WASTE CONTAINERS.

10.3 Disposal of Acids and Bases

10.3.1 Small quantities of diluted acids and bases can safely be flushed down the sink followed by large quantities of water. Acids such as chromic acid used for cleaning cannot be disposed of down the sink and must be collected in a suitable container.

10.4 Aqueous Corrosives (e.g., "Chromerge")

Collect in a suitable container. Please label with the materials added to the container.

10.5 Flammable Liquids

Flammable liquids for disposal are to be stored in a suitable container properly labeled for collection. Please contact the Hazardous Materials Manager when these containers are ready for disposal from the lab area.

10.6 *Chlorinated Solvents*

Chlorinated materials are to be collected in a separate labeled container. The containers must indicate the name and the amount of each solvent type added to the bottle. Chlorinated solvents include but are not limited to methylene chloride, chloroform, etc. Chlorinated solvents will sometimes corrode metallic containers. A glass container is the best choice for storing.

10.7 Reactive Chemicals.

Reactive chemicals are substances that, under certain ambient or induced conditions, can enter into a violent reaction with spontaneous generation of large quantities of heat, light and gases. Segregate into tightly sealed containers. Please notify the Hazardous Materials Manager (4268) when there are reactive chemicals such as sodium, potassium, phosphorus, or metal hydrides for disposal.

10.8 Ethidium Bromide

Notify the Hazardous Materials Manager when you have unbleached Ethidium Bromide, Streptozocin, or similar materials for disposal.

10.9 Empty Chemical Containers

Empty containers from the laboratory must be washed and triple rinsed. After the container is cleaned, deface labels, and place empty glass bottles in a suitable cardboard box labeled “Glass” and dispose as regular trash.

10.10 Storage, Treatment and Disposal of Bio-hazardous Waste

Bio-hazardous or regulated medical waste generated during experiments must be placed in covered, labeled, leak-proof containers or in labeled red bags within a secondary labeled container. Care must be taken to place all needles, syringes, scalpel blades, and other discarded sharps in puncture-proof, labeled containers. These "sharps” containers are available from Environmental Health and Safety. Contact the Hazardous Materials Manager (4268) for disposal of all sharps containers and bio-hazardous waste. If hazardous chemicals or radioactive materials are also present, please consult EH&S. Bio-hazardous material, which has been properly decontaminated by autoclaving or chemical disinfectant, may be able to be disposed of in the sewer system or in regular trash. If disposing of decontaminated material in regular trash, **do not use red plastic bags and remove any biohazard label**. Consult with EHS to determine whether this is appropriate.

11. MEDICAL CONSULTATIONS AND EXAMS

Brooklyn College is required to provide employees who work with hazardous chemicals an opportunity to receive a medical consultation whenever employee:

- Develops signs and symptoms of exposure associated with chemicals he/she is using, or may be in contact with, in the laboratory.
- Is exposed to OSHA regulated substances above the Permissible Exposure Levels (PEL).
- Is present in the event of a chemical spill, leak, explosion, or other situation that exposes him/her to a hazardous chemical.

The purpose of the consultation is to determine whether the employee will need a medical examination.

- All medical consultations and examinations must be:

1. Performed by or under the supervision of a qualified physician.
2. Performed at a reasonable time and place for the employee.

11.1 Information to be provided to the physician:

1. The generic and trade names of hazardous chemical(s) and or chemical compound(s) to which the employee was exposed along with copies of Material Safety Data Sheets.
2. Conditions under which the exposure occurred.
3. Signs or symptoms of exposure experienced by the employee during, soon after, and within 72 hours after the incident. Everyone in the proximity of the exposure should be interviewed to determine if others experienced similar symptoms.

11.2 Employee medical reports

The Brooklyn College Office of Human Resource Services will obtain a written opinion from the examining physician. The written opinion must include:

- Recommendations for medical follow-up
- The results of medical examinations and tests
- Any medical condition the employee has that places him/her at risk as a result of future exposures to the hazardous chemical(s).
- A statement confirming that the employee has been advised of the results of the examinations and tests, including any medical conditions relevant to the occupational or chemical exposures.

The written opinion must not reveal any specific findings or diagnoses unrelated to the occupational exposure.

12. EMPLOYEE INFORMATION AND TRAINING PROGRAMS

12.1 Training

All laboratory employees of Brooklyn College (including faculty, lab technicians, graduate assistants and other employees who come in contact with hazardous chemicals in the laboratory environment) must attend chemical hygiene training. The training will be coordinated by the EHS Office and will cover rights and responsibilities under the OSHA Laboratory Standard, safe-operating procedures for working with hazardous chemicals, etc. Additional training will also be provided as required or deemed necessary.

12.2 Training Program Elements

12.2.1 Training sessions

The EHS office will conduct chemical hygiene training sessions. Specific focus of training will be developed in conjunction with departmental representatives. Training sessions will be conducted in groups of approximately 35 people to optimize opportunity for participation.

Times and locations for these sessions will be coordinated with each department chairperson or his/her designee. All laboratory employees must attend this session. EHS will coordinate attendance through designated department personnel.

The training sessions will cover the following topics:

- Contents of the OSHA Laboratory Standard and its appendices and how the institution has responded to meet its responsibilities.
- College's Chemical Hygiene Plan.
- Labels, Placards, Signage, Material Safety Data Sheets, and additional laboratory health and safety information.
- Physical and health hazards of chemical classes (flammables, reactives, carcinogens, corrosives, etc.). General operating procedures for the safe handling of hazardous materials, including emergency spill response.
- OSHA permissible exposure limits and other recommended limits (National Institutes for Occupational Safety and Health, American Conference of Governmental Industrial Hygienists, etc.).
- Signs and symptoms of exposure to hazardous chemicals and availability of medical consultations and exams.
- Use of fume hoods, emergency, and personal protective equipment. Protocol for dealing with faulty hoods and equipment and lack of proper safety equipment.
- Special operating procedures to be used for particularly hazardous substances.

- How to conduct a hazard evaluation of lab operations.
- How to identify and manage hazardous wastes.
- Filing incident report forms.

12.2.2 Hands-on Instruction

All laboratory supervisors are required to provide lab-specific information and hands-on instruction, with assistance from the EHS Office if needed, to ensure that all employees and students working with hazardous substances in the laboratory understand:

- Hazards involved and necessary safety precautions
- Proper use of fume hoods and/or other protective equipment.
- Use of emergency showers and eyewash stations.
- Waste collection and disposal procedures.
- Location and use of spill-control equipment.
- Emergency protocol and telephone numbers.

13. RECORDKEEPING

The Office of Environmental Health & Safety will maintain records of all laboratory training sessions, inspections, hazardous waste manifests, etc. The Chemical Hygiene Officer, in conjunction with appropriate departmental administrative personnel, will assure that at least one copy of all required records is maintained in a single, central location. These records will be maintained at a minimum for the specified period of time required by applicable regulations. Also, laboratory supervisors must maintain required safety records (as outlined in Section 1.4 as well as other sections of the Chemical Hygiene Plan) and make these available to the Office of Environmental Health and Safety upon request.

Appendix A

LABORATORY INCIDENT REPORT

Brooklyn College Office of Environmental Health and Safety

Use to report any breakage, spill, cut, abrasion, fall, fire, explosion or any other incident, no matter how minor.

Date___/___/___ Dept._____

Name_____ Phone # (….-…..-…….)

Note : **Return after completion To Room 252NE or 1219B**.
Copies of this form may be obtained from Office of Environmental Health & Safety 1219B Boylan.

Date and time of incident _____

Name of Injured person _____

Place of Incident _____

Summary of Incident

_____
_____
_____
_____
_____
_____
___

Aid Rendered

_____
_____
_____
_____

Was the Incident related to an Experiment? Yes ___/No___.
If So What Experiment?._____
_____
_____

What Was The First indication you had of the incident?

OVER

_____
_____
_____

What did you observe?

_____
_____
_____
_____
___

What did you do?

_____
_____
_____

Was the proper equipment available to respond to this incident (e.g. fire extinguisher, Spill equipment, first aid kit)?

_____
_____
_____

Were Emergency Telephone numbers Posted?. _____

Were Eye Wash stations operating properly?. _____Yes_____No

Comments_____
_____
_____
_

What Else did you see or hear that you think is important?

Signature_____

OVER

APPENDIX B

Precautions to be Taken When Working With Particularly Hazardous Substances

These substances include 'select' carcinogens, reproductive toxins as well as chemicals that have a high degree of acute toxicity. Examples include the following:

- Chemical(s) which can cause severe acute or chronic health effects upon exposure by any route.
- Highly unstable compounds or compounds that, if combined with other compounds in the procedure, can explode.
- Compounds that may undergo chemical or physical changes during routine use, and generate by-products that may overcome standard control measures or penetrate available personal protective equipment to cause severe acute or lethal injuries.
- Specific hazardous substances and operations that have been determined to require prior approval above the level of the laboratory principal investigator.

The principal investigator or laboratory supervisor is responsible for ensuring that appropriate additional precautions are taken when working with such hazardous substances.

Materials Safety Data Sheets must be consulted for specific information. Also, technical assistance can be obtained from the EHS Office (ext. 4268/5400).

Safe Work Practices With Particularly Hazardous Substances

- Maintain an accurate inventory record of these substances and the amounts used and stored in the laboratory.
- In the event that toxicologically significant quantities of a particularly hazardous substance are used on a routine or frequent basis, contact the EHS Office at ext. 5400 to determine if exposure monitoring, medical surveillance etc. may be warranted.
- Particularly hazardous substances must be handled inside a chemical fumehood. They must also be kept in a secondary container to help prevent breaks and spills.
- A suitable label must be attached to all storage containers to alert others of the chemical contained therein and (if required) the need for special precautions. For example: "Warning- - Cancer Hazard" or "Highly Toxic".
- Access to the designated laboratory work areas must be controlled. Appropriate signs that warn of the hazards and indicate the precautions or approvals for entry must also be used.
- Additional containment devices (such as shielding or protective filters) may be needed to safely handle, store or protect equipment when using these chemicals.
- In addition to the use of the proper gloves, eye/face protection, other protective apparel or equipment may be needed. Examples could include: lab coats, impervious gowns, aprons, gauntlets or other specialized protective equipment.

- Work surfaces must be protected from contamination through the use of disposable, absorbent, plastic backed paper. Replace contaminated paper as necessary and handle as hazardous waste.
- Specialized waste disposal may be needed. Contact the EHS Office at ext. 5400 for assistance.
- On completion of work and before leaving the laboratory, remove all protective apparel and thoroughly wash hands, forearms, face, and neck.
- A specific written safety procedure must be developed prior to beginning work. This safety procedure must include: (1) a description of the hazardous chemical(s) used, including the potential physical and health effects, (2) a step-by-step review of the work to be performed (See Appendix D: Hazard evaluation form).
- The proposed activities are to be conducted by specifically trained personnel in accordance with the developed safety procedure and other applicable safety precautions.

Appendix C

RULES OF THE
FIRE DEPARTMENT
OF THE CITY OF NEW YORK
**(TITLE 3 OF THE RULES OF
THE CITY OF NEW YORK)**

Chapter 48

§ 4827-01 Storage of Hazardous Materials in Pre-Existing Facilities

Scope. This section consolidates the New York City Fire Prevention Code and former Fire Department *rules* in effect on June 30, 2008, that are applicable to the design and installation of *hazardous material* installations in *pre-existing facilities*.

General Provisions. *Pre-existing facilities* with *hazardous material* installations the design and installation of which would not be allowed or approved under the Fire Code, but which, pursuant to FC102.3 and R102-01, may be continued with respect to such *hazardous material* installations under the applicable laws, rules and regulations in effect prior to the Fire Code, and shall continue to comply with the provisions of such laws, rules and regulations, including former Administrative Code §§27-4234, 27-4236, 27-4237, 27-4238, 27-4240, 27-4241, 27-4242 and 27-4246, and former Fire Department *rules* 3 RCNY §§10-01, 15-05 and 34-01, as applicable, until such time as such *facilities* may be required to comply with the Fire Code and the *rules* with respect to their design and installation.

Non-Production Chemical Laboratories
(1) Former Fire Department Rule 3 RCNY §10-01
§10-01 Storage and Use of Chemicals, Acids and Gases in College, University, Hospital, Research and Commercial Laboratories

(a) Definitions.
* * *
Laboratory. Laboratory means a generic term denoting a building, space, equipment or operation, wherein testing, research or experimental work is conducted and shall include laboratories used for instructional purposes.
Laboratory Building. Laboratory building means a structure consisting wholly or principally of one or more laboratory units.
Laboratory Unit. Laboratory unit means an enclosed, fire rated space used for testing, research, experimental or educational purposes. Laboratory units may or may not include offices, laboratories, and other contiguous rooms maintained for, or used by, laboratory personnel, and corridors within the units. It may contain one or more separate laboratory

work areas.

Laboratory Work Area. Laboratory work area means a room or space within a laboratory unit for testing, analysis, research, instruction, or similar activities which involve the use of chemicals or gases. A work area may or may not be enclosed.

Exception: This section shall not apply to physical, electronic, instrument or similar laboratories which use small quantities (less than 32 oz. flammable liquids, 0.5 lb. oxidizing materials, and 0.15 cu.ft. water container capacity of flammable gases) for incidental purposes such as cleaning, maintenance or repair and these substances are not used directly in experimental chemical research work.

* * *

Storage Cabinet. Storage cabinet means a cabinet for the storage of not more than 60 gallons of flammable liquid which is designed and constructed in accordance with "OSHA General Industry Standards-Flammable and Combustible Liquids".

Storage Room. Storage room means a room where chemicals or gases regulated by this directive are stored and not otherwise used or reacted.

Unstable (Reactive) Chemical. Unstable (reactive) chemical means a substance, other than one classified as an explosive or blasting agent, which will vigorously and energetically react, is potentially explosive, will polymerize or decompose instantaneously, undergo uncontrollable auto-reaction or can be exploded by heat, shock, pressure or combinations thereof. Examples are: organic peroxides, nitromethane, and ammonium nitrate.

* * *

(d) **Storage.**

(1) Storage of chemicals for use in individual laboratory units shall be in accordance with Table I below. Any amounts in addition to the maxima set forth in Table I below shall be at the discretion of the Commissioner and shall be in storage cabinets.

(2) Determination of the fire rating of laboratory unit enclosures shall be in accordance with the criteria of the Building Code, except that, in partitions not required to have a fire rating under the provisions of that Code, fire dampers shall not be required to be installed in existing ducts penetrating existing laboratory partitions.

(3) Storage of volatile flammable oils shall be in accordance with Table I of this section.

Table I
Maximum Laboratory Unit Storage Limits

Lab Type	Fire Rating	Fire Protection	Flammable Liquids and	Flammable Solids	Oxidizing Materials	Unstable Reactive
I	2 Hours	Sprinklers	30 gals	15 lbs	50 lbs	12 lbs
II	1 Hour	Sprinklers	25 gals	10 lbs	40 lbs	6 lbs
III	2 Hours	No Sprinklers	20 gals	6 lbs	30 lbs	3 lbs
IV	1 Hour	No Sprinklers	15 gals	3 lbs	20 lbs	2lbs

(5) Storage and use of flammable gases within laboratory units shall be in accordance with Table II below, except that no storage of flammable gases shall be allowed in any

laboratory unit where there is not an on-going operation requiring their use. On-going operations shall allow storage of flammable gases sufficient to meet the operating requirements of the equipment in that laboratory unit plus an equal reserve.

Table II
Storage of Flammable Gases

Area of Laboratory in square feet**	Up to 500 sq. ft.	per additional 100 sq. ft.	Maximum per Laboratory Unit
Maximum Capacity	9.24	1.54	15.4

** Water container capacity

Storage rooms shall be of a minimum 2 hour rated construction and shall be provided with:

(i) a constant mechanical exhaust system to the exterior capable of providing at least six changes of air per hour;

(ii) a sill at the doorway (except that no sill shall be required at doorways of flammable gas storage rooms);

(iii) a sprinkler system providing at least one head per 90 sq. ft.

* * *

(13) All fixed electrical equipment within cold rooms where flammable liquids or flammable gases are used shall be explosion proof in accordance with subdivision (f)(3) of this section. Cold rooms shall not be used for storage of principal stock of flammable gases or flammable liquids.

(e) Signs and warning placards.

(1) A sign prohibiting smoking shall be conspicuously posted at the exterior of entrances to storage and laboratory areas and within such areas.

(2) Signs with RED letters of minimum size two inches high by three-eighths inch stroke on a contrasting background shall be posted at entrances to areas:

(i) Where materials which react with water are stored or used.

(ii) Where flammable gases or explosives are stored or used.

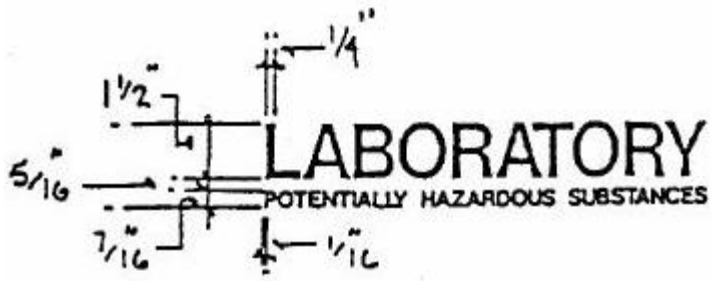
(3) Warning placards in conformance with Federal, State and Local regulations shall be posted at entrances to areas:

(i) Where radioactive material is stored or used;

(ii) Where biohazardous material is stored or used;

(iii) Where poisonous gases are stored or used.

(4) The outside of each chemical laboratory unit door shall have a sign, as detailed below, or metal or other durable material, with RED letters on a white background which shall be located in the area of the mid-point of the height of the door.



Fire prevention and protection.

(1) In laboratories and storage rooms which are sprinkled, the protection area per sprinkler head shall not exceed 90 sq. ft., except that the protection area per sprinkler head shall not exceed 100 sq. ft. where the system is hydraulically designed.

(2) In existing buildings, water supply to sprinkler systems may be taken off existing standpipes provided that the system is hydraulically designed.

(3) All electrical equipment in all flammable liquid and all flammable gas storage rooms shall conform with the requirements of the New York City Electrical Code set forth in §27-3198(4), Administrative Code, irrespective of whether such room would be classified as a Class I Location by §27-3197(1) of such code.

(4) Laboratory units and laboratory work areas shall be considered as unclassified electrically with respect to §27-3197 of the Administrative Code.

(5) Fume hoods shall be provided and utilized in conformance with these requirements and those of such other agencies as have jurisdiction over operations and special storage conditions which give off noxious odors or flammable or poisonous vapors, or radioactive materials.

(6) Fume hoods shall be so vented that a minimum average face velocity of 100 feet per minute, with minimum face velocity at any point not less than 75 feet per minute, is provided.

(7) Fume hoods shall be located away from doors, windows that may be opened, principal traffic lanes or room air outlets or returns which may cause drafts sufficient to interfere with exhaust operations of fume hoods.

(8) Every fume hood used for handling perchloric acids, strong oxidizing agents or highly reactive chemicals shall be served by an independent duct.

(9) Common ducts may be permitted for fume hoods in the same laboratory unit. Hoods in different laboratory units shall not have their ducts combined. Hoods in common ducts must be so arranged or equipped that exhaust from one duct cannot be forced out through any other hood served by the common duct.

(10) Exhaust ducts shall have the minimum number of turns, bends or obstructions as is practical, and shall have adequate air movement in the duct for the number of hoods vented by that duct and sufficient to prevent any back up into the hood.

(11) Washdown provisions shall be provided for hoods and ducts in which perchloric acid is heated above ambient temperature and in which vapors are not trapped or scrubbed before entering the hood exhaust system.

(12) Exhaust fans for ducts shall, wherever possible, be located outside the building and as close as possible to the terminal so that negative pressure is maintained in ducts within the building.

(13) A system of explosion hazard control consisting of explosion prevention, explosion

suppression, explosion venting, area ventilation, extinguishment system(s), barrier protection, separation and isolation, remove controlled apparatus or any combination thereof, shall be provided in laboratories or storage rooms where any of the following conditions occur:

(i) Storage of materials which in themselves are readily capable of detonation or of an explosive decomposition or explosive reaction at normal ambient temperature and pressure.

(ii) Use of materials which explode, violently decompose or produce rapid increases in pressure and temperature upon:
(A) Vacuum distillation;
(B) Being subjected to slight or moderate shock;
(C) Exposure to ultraviolet or visible light;
(D) Exposure to pressure or more than one atmosphere;
(E) Exposure to temperature in excess of 122(degrees)F. or 50(degrees)C.;
(F) Exposure to air;
(G) Increase in the concentration above which the substance is not longer stable;
(H) Standing (i.e. spontaneously).

(iii) Highly exothermic reactions which also involve rapid increases in pressure, such as certain polymerizations, oxidations, nitrations, peroxidations, hydrations, or organometallic reactions.

(iv) Use or formation of materials whose chemical structure or functional group indicate potential hazard, but whose properties have not been established. Examples would be triple bonds, epoxy radicals, nitro and [nitroso] nitrous compounds, and peroxides.

(14) The commissioner shall evaluate the method of explosion hazard control, on an individual basis, considering in each instance the following criteria:
(i) The nature and quantity of the constituent material(s);
(ii) The nature of the process;
(iii) The potential energy release;
(iv) Isolation of the equipment;
(v) The particular physical location and exposures.

SECTION FC 2706
NON-PRODUCTION CHEMICAL LABORATORIES

2706.1 Scope. This section shall govern the storage, handling and use of laboratory chemicals in a non-production laboratory and accessory storage of laboratory chemicals in a storage room. The design and construction of non-production laboratories and accessory storage rooms for laboratory chemicals shall comply with the requirements of the construction codes, including the Building Code and the Mechanical Code.

2706.2 General. Laboratory chemicals within a laboratory unit shall be stored, handled and used in accordance with this section and, except as otherwise provided in this section, NFPA 45 laboratory unit fire hazard class D requirements.

2706.3 Permits. Permits shall be required as set forth in Section 105.6.

2706.4 Supervision. Non-production laboratory operations requiring a permit shall be under the personal supervision of a certificate of fitness holder. At least one certificate of fitness holder shall be present on each floor of the laboratory unit on which laboratory operations are being conducted while the laboratory is in operation. Additional certificate of fitness holders shall be provided as the commissioner may require as a condition of the permit. Accessory laboratory chemical storage rooms shall be under the general supervision of a certificate of fitness holder.

2706.5 Prohibitions. It shall be unlawful in any non-production laboratory or any accessory storage of laboratory chemicals in a storage room to:

1. Store, handle or use any explosive.
2. Store, handle or use any unclassified detonable organic peroxide, detonable pyrophoric material, detonable unstable (reactive) material or detonable water-reactive material.
3. Store, handle or use any Class 4 unstable (reactive) material. 375
4. Store, handle or use any Class 4 oxidizing material.
5. Store, handle or use below grade any flammable gas.
6. Use an open flame for heating or distilling any flammable solid, flammable liquid or flammable gas.

Appendix D

Hazard Evaluation Form
Office of Environmental Health and Safety

Date_____ **Lab/Room**_____ **Phone**_____

Name_____ **Dept.**_____

Experiment/Procedure_____

Hazardous Chemicals or By-Products **Hazard Classes**

Step 1

_____

_____ _____
_____ _____
_____ _____

Safety Precautions:_____

Step 2

_____

_____ _____
_____ _____
_____ _____

Safety Precautions:_____

Step 3

_____

_____ _____
_____ _____
_____ _____

Safety Precautions:_____

Step 4

_____

_____ _____
_____ _____
_____ _____

_____

Hazard Classes:

Flammable (liquid, solid, gas)
Corrosive
Carcinogen or Potential Carcinogen
Reproductive Toxin
Sensitizer (allergen)
Explosive
Air/Water Reactive
Peroxide Former
Strong Oxidizer

Appendix E COMMON PEROXIDE-FORMING CHEMICALS

Peroxide-forming chemicals must be used and stored in accordance with manufacturer's recommendations. If you suspect that peroxides are present do NOT open the container. These peroxides can be shock and/or friction sensitive especially when dry. Segregate other chemicals away from the suspect peroxide-containing chemical(s) and contact the Environmental Health and Safety (EHS) office at Ext. 5400 or 4268.

The following is a selection of chemical substances which can form Peroxide:

LIST A

Severe Peroxide Hazard on Storage with Exposure to Air

Discard within 3 months

- Diisopropyl ether (Isopropyl ether)
- Divinyl ether (DVA)[a]
- Potassium metal
- Potassium amide
- Sodium amide (Sodamide)
- Vinylidene chloride (1.1-1.1-dichloroethylene[a])

LIST B

Peroxide Hazard on Concentration; Do Not Distill or Evaporate Without First Testing for the Presence of Peroxides

Discard or test for peroxides after 6 months

- Acetaldehyde diethyl acetal (Acetal)
- Cyclopentene
- Methylacetylene
- Cyclohexene
- Decahydronapthalene (Decalin)
- Diacetylene (Butadiene)
- Dicyclopentadiene
- Diethyl ether (Ether)
- Diethylene glycol dimethyl ether (Diglyme)
- Dioxane
- Ethylene glycol ether acetates
- Ethylene glycol monoethers (Cellosolves)
- Furan
- Ethylene glycol dimethyl ether (Glyme)
- Isopropylbenzene (Cumene)
- Methylcyclopentane
- Methyl isobutyl ketone
- Styrene
- Tetrahydrofuran (THF)
- Tetrahydronaphthalene (Tetralin)
- Vinyl ethers

LIST C

Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides[a]

a. Normal Liquids; Discard or test for peroxides after 6 months[b]

- 2-Chloro-1,3-butadiene (Chloroprene)[c]
- Styrene
- Vinyl acetate
- Vinylpyridine

b. Normal Gases; Discard after 12 months

- Butadiene[c]
- Tetrafluoroethylene (TFE)[c]
- Vinylacetylene (MVA)[c]
- Vinyl chloride

(a)Polymerizable monomers should be stored with a polymerization inhibitor from which the monomer can separate by distillation just before use.

(b)Although common acrylic monomers such as acrylonitrile, acrylic acid, ethyl acrylate, and methyl methacrylate can form peroxides, they have not been reported to develop hazardous level in normal use and storage.

(c)The hazard from peroxides in these compounds is substantially greater when they are stored in the liquid phase, and if so stored without an inhibitor they should be considered as in LIST A.

(d)Although air will not enter a gas cylinder in which gases are stored under pressure, these gases are sometimes transferred from the original cylinder to another in the laboratory, and It is difficult to be sure that there is no residual air in the receiving cylinder. An inhibitor should be put into any such secondary cylinder before one of these gases is transferred into it; the supplier can suggest inhibitors to be used. The hazard posed by these gases is much greater if there is a liquid phase in such a secondary container. Under conditions that create a liquid phase these should be discarded within 12 months.

Appendix F:

§ 1910.1450 Occupational exposure to hazardous chemicals in laboratories.

(a) *Scope and application.* (1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(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:

(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.

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

(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.

(3) This section shall not apply to:

(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 Z, even if such use occurs in a laboratory.

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

(A) 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

(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 indvidual 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 °F (37.8 °C), but below 200 °F (93.3 °C), except any mixture having components with flashpoints of 200 °F (93.3 °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 °F (21.1 °C); or

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 °F (54.4 °C) regardless of the pressure at 70 °F (21.1 °C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 °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.

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 °F (37.8 °C), except any mixture having components with flashpoints of 100 °F (37.8 °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°F (37.8°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 Flash Point 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°F (37.8°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 moveable 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

(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/m^3;

(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.

(d) *Employee exposure determination-* (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).

(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.

(3) *Termination of monitoring.* Monitoring may be terminated in accordance with the relevant standard.

(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.)

(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:

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

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

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

(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:

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

(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;

(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;

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

(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;

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

(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

(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:

(A) Establishment of a designated area;

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

(C) Procedures for safe removal of contaminated waste; and

(D) Decontamination procedures.

(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.* (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.

(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.

(3) *Information.* Employees shall be informed of:

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

(ii) The location and availability of the employer's Chemical Hygiene Plan;

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

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

(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.

(4) *Training.* (i) Employee training shall include:

(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.);

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

(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.

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

(g) *Medical consultation and medical examinations.* (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:

(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.

(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.

(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.

(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.

(3) *Information provided to the physician.* The employer shall provide the following information to the physician:

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

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

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

(4) *Physician's written opinion.* (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:

(A) Any recommendation for further medical follow-up;

(B) The results of the medical examination and any associated tests;

(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 chemical found in the workplace; and

(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.

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

(h) *Hazard identification.* (1) With respect to labels and material safety data sheets:

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

(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.

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

(i) 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.

(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.

(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.* (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.

(2) The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.20.

(k) *Dates*-(1) *Effective date.* This section shall become effective May 1, 1990.

(2) *Start-up dates.* (i) Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.

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

(l) *Appendices.* The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[55 FR 3327, Jan. 31, 1990, 55 FR 7967, Mar. 6, 1990, 55 FR 12111, Mar. 30, 1990]

§1910.1450, App. A

Appendix A to §1910.1450-KNational Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)

Appendix G

OXIDIZERS

The following is a National Fire Protection Association (NFPA) list of oxidizers. The primary hazard associated with this class of compounds lies in their ability to act as an oxygen source, and thus to readily stimulate the combustion of organic materials.

Additional Safety information should be obtained from MSDS's and other reference material before proceeding with work involving these compounds, especially those classified as Class 3 and 4 oxidizers.

TABLE 2 - Classification System for Oxidizing Materials	
Class Rating	**Hazard Description**
Class 1	An oxidizing material whose primary hazard is that it may increase the burning rate of combustible material with which it comes in contact.
Class 2	An oxidizing material that will moderately increase the burning rate or which may cause spontaneous ignition of combustible material with which it comes in contact.
Class 3	An oxidizing material that will cause a severe increase in the burning rate of combustible material with which it comes in contact or which will undergo vigorous self-sustained decomposition when catalyzed or exposed to heat.
Class 4	An oxidizing material that can undergo an **explosive reaction** when catalyzed or exposed to heat, shock or friction.

Table 3 – Oxidizing Materials (as classified by the NFPA)	
Class 1	aluminum nitrate potassium dichromate ammonium persulfate potassium nitrate barium chlorate potassium persulfate barium nitrate silver nitrate barium peroxide sodium carbonate peroxide calcium chlorate sodium dichloro-s-triazinetrione calcium nitrate sodium dichromate calcium peroxide sodium nitrate

	cupric nitrate sodium nitrite hydrogen peroxide (8-27.5%) sodium perborate lead nitrate sodium perborate tetrahydrate lithium hypochlorite sodium perchlorate monohydrate lithium peroxide sodium persulfate magnesium nitrate strontium chlorate magnesium perchlorate strontium nitrate magnesium peroxide strontium peroxide nickel nitrate zinc chlorate nitric acid (<70% conc.) zinc peroxide perchloric acid (<60% concen.)
Class 2	calcium hypochlorite (<50% wgt) potassium permanganate chromium trioxide (chromic acid) sodium chlorite (<40% wgt.) halane sodium peroxide hydrogen peroxide (27.5-52% conc.) sodium permanganate nitric acid (>70% conc.) trichloro-s-triazinetrione
Class 3	ammonium dichromate potassium chlorate hydrogen peroxide (52-91% conc.) potassium dichloroisocyanurate calcium hypochlorite (>50% wgt.) sodium chlorate perchloric acid (60-72.5% conc.) sodium chlorite (>40% wgt.) potassium bromate sodium dichloro-s-triazinetrione
Class 4	ammonium perchlorate ammonium permanganate guanidine nitrate hydrogen peroxide (>91% conc.) perchloric acid (>72.5%) potassium superoxide

Appendix H

Chemical Waste Management

Hazardous chemical waste includes but is not limited to, out of date chemicals, waste from laboratory processes, as well as waste from maintenance and construction activities. All hazardous chemical waste must be reported to the Office of Environmental Health & Safety to ensure proper handling and disposal. The chemical waste management plan includes:

- Identification of waste
- Waste collection and pickup
- Proper disposal according to federal, state, and local regulations

Defining Hazardous Chemical Wastes

- Chemical wastes are considered hazardous waste if they appear on one of the lists published in the US EPA regulations or if they meet one or more of the following defined characteristics:
  Toxicity, Ignitability, Corrosivity, Reactivity

(Please see 40CFR Part 261for definitions of listed and characteristic hazardous chemical waste).

- Chemicals, which are no longer used or have missing, obliterated or corroded labels, are considered to be "inherently waste like." Stored chemicals should be inventoried and inspected regularly. Unwanted or unusable chemicals should be removed and sent for disposal.
- Typical non-hazardous wastes include starches, sugars, naturally occurring amino acids and salts, etc.

The following procedures must be used when accumulating hazardous chemical waste:

Containers

- Containers used to collect chemical wastes must be compatible with the substance they contain. Glass or nalgene jars are appropriate for most laboratory waste.
- Containers reused for waste must have the original label defaced to avoid confusion regarding container contents.
- Do not use soda bottles, food containers, or other containers that could be confused with consumer products for chemical wastes.

Labeling

- Important! Used chemical substances designated as “hazardous waste” must be labeled with, or placed in, a container featuring the words “Hazardous Waste”.
- Preprinted “Hazardous Waste” labels containing required EPA/state information are recommended. These can be obtained from the Environmental Health and Safety (EHS) Office by calling ext. 4268.
- Chemicals that are to be reused for another purpose (e.g., as in using alcohol for cleaning) should be clearly labeled to avoid confusion with true “hazardous waste”, i.e., that which is intended for disposal.
- Labels must be clearly written, in English, avoiding abbreviations and structural formulas.

Container Management

- Hazardous waste containers must be stored in designated Satellite Accumulation Areas and kept closed unless waste is being added. Containers must be kept in good condition and must not be corroded, leaking, or encrusted with residue.
- Containers stored adjacent to sinks and drains should be stored in secondary containment such as a tray, basin, or tub.
- Waste must be segregated from other incompatible waste.
- When containers become full, arrange for removal with EHS Office within 3 days.

Drain Disposal

- Drain disposal of certain chemicals is permitted. Dilute, common mineral acids and dilute, common alkalies are permitted, but only in small quantities, and accompanied by copious amounts of running water. Drain disposal of picric, perchloric or hydrofluoric acids and their salts are prohibited.
- Flammable materials are prohibited from sinks and drains. This includes alcohols, acetone, ethers and glacial acetic acid. Miscibility with water is not justification for drain disposal. No liquids of any type are to be disposed in wastebaskets or dumpsters.

The Office of Environmental Health & Safety will arrange for quarterly pickup or sooner if conditions demand it. The container must clearly indicate the name(s) and approximate quantity of the particular chemical in the waste mixture. Please contact the office of Environmental Health & Safety to arrange for assistance with chemical waste disposal.

Other Laboratory Wastes

- Waste originating in Biological or Clinical laboratories may fit the criteria of "Regulated Medical Waste" as defined by state and local statute. RMW must be collected in labeled containers and disposed thru the EHS Office.
- Sharps such as scalpels, razor blades or syringes, used or unused, must be collected in special "sharps containers" and also disposed as Regulate Medical Waste. Contact EHS to obtain empty sharp containers.
- Empty bottles must be drained, internally rinsed three times with water or other appropriate solvent, and labels removed or defaced. They should then be boxed and labeled "glass" and disposed as regular trash.
- Disposal of radioactive materials must be in accord with Nuclear Regulatory Commission and N.Y.C. Department of Health regulations. Disposal arrangements are to be made in advance of the ordering of material, in consultation with the Radiation Safety Officer.
- Fluorescent lamps, mercury-containing devices (e.g. thermometers, thermostats, sphygmomanometers) and batteries (wet and dry cell) also cannot be discarded as regular trash and have special disposal requirements as Universal Waste. Contact the EHS Office to arrange for disposal of these wastes.
- Used electronic devices (computers, CRT's, printed circuit boards) must be disposed thru the Office of Property Management for recycling.

To dispose of chemical waste, or unwanted and unusable chemicals as hazardous waste, please contact the Hazardous Materials Manager at ext. 4268. A waste management and disposal policy (See Chapter 10), a laboratory closeout policy (App. J), and other chemical hygiene procedures have been developed to facilitate regulatory compliance. These are part of the written Chemical Hygiene Plan. If you have not received a copy, or if you need assistance, please contact The EHS office at ext. 5400 or 4268.

Appendix I

Incompatible Chemicals

The following list is to be used only as a guide. Specific Incompatibilities are listed in the material Safety Data Sheet.

CHEMICAL	INCOMPATIBLE WITH
Acetic Acid	Chromic Acid, nitric Acid, Hydroxyl Compounds, ethylene Glycol, Perchloric Acid, peroxides, Permanganates
Acetylene	Chlorine, Bromine Copper, Fluorine, Silver, mercury
Acetone	Concentrated Nitric and Sulfuric acid mixtures
Alkali and Alkaline Earth metals(such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens.
Ammonia(anhydrous	Mercury, Chlorine, Calcium hypochlorite, iodine, bromine, hydrofluoric acid(anhydrous)
Ammonium Nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic combustible materials
Arsenical Materials	Any reducing Agents
Azides	Acids
Bromine	Se Chlorine
Calcium Oxide	Water
Carbon (activated)	Calcium Hypochlorite, all oxidizing agents
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials.
Aniline	Nitric Acid, hydrogen Peroxide
Chromic acid and Chromium trioxide	Acetic acid, Naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, Acetylene, butadiene, Butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine.
Copper	Acetylene, hydrogen peroxide
Cumene Hydroperoxide	Acids(organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	All other chemicals
Hydrocarbons	Fluorine, Chlorine, bromine, Chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid(anhydrous)	Ammonia aqueous or anhydrous
Hydrogen sulfide	Fuming Nitric acid, oxidizing gases
Hypochlorites	Acids, Activated Carbon
Iodine	Acetylene, Ammonia, hydrogen

Appendix I continued .....

Incompatible Chemicals

CHEMICAL	INCOMPATIBLE WITH
Mercury	Acetylene, Fulminic Acid, ammonia
Nitrates	Acids
Nitric acid(concentrated)	Acetic acid, aniline,chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids and gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, Mercury
Oxygen	Oils, grease, hydrogen; Flammable liquids, solids and gases
Perchloric acid	Acetic Anhydride, bismuth and its alloys, alcohols, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorous (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium Chlorate	Sulfuric and other acids
Potassium perchlorate	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene Glycol, benzaldehyde, Sulfuric acid
Selenides	Reducing Agents
Silver	Acetylene, Oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium Nitrite	Ammonium Nitrate and other ammonium salts
Sodium Peroxide	Ethyl and Methyl Alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium Chlorate, potassium perchlorate, potassium permanganate,(similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing Agents

Appendix J

POLICY AND PROCEDURES FOR LABORATORY CLEAN-OUT OF HAZARDOUS MATERIALS

Hazardous Materials Manager/Chemical Hygiene Officer

May 1996
Revised July 2004

Policy

A policy is established for the "Laboratory Clean-out of Hazardous Materials" to assure that hazardous materials are disposed of properly when faculty, staff, postdoctoral associate, or graduate student transfers to a different laboratory or leaves the Campus. This policy will reduce the number of unwanted and unknown hazardous materials in laboratories, reduce waste disposal costs, and provide laboratory personnel with a healthful, safe, and clean place to work. This policy specifies responsibilities of the individual and department and the procedures that must be followed for the proper disposal of hazardous materials.

The faculty member assigned to a laboratory is responsible for the proper use and disposal of all hazardous materials in his/her assigned laboratory space. When a faculty member or personnel under his/her supervision transfers to a new laboratory or leaves, He/she must follow proper "clean-out" procedures. Each department will be responsible for implementing and enforcing checkout procedures and inspecting facilities for hazardous materials when laboratory close out procedures have been completed. Environmental Health and Safety (EH&S) will review checkout procedures, providing information on hazardous materials, proper disposal procedures, and regulations governing disposal of hazardous materials.

Any problems resulting from improper management of hazardous materials at close-out will be addressed by the department head/chairperson, appropriate dean, Environmental Health & Safety and the chairperson of the appropriate safety committee. EH&S will not be responsible for any additional cleanup costs, regulatory action or fines resulting from non-compliance with this policy.

Procedures:

1. Remove and properly dispose of all hazardous materials from the main laboratory and also from any shared storage units such as refrigerators, cold rooms, stock rooms, and waste collection areas. *A suggested Laboratory Checkout List is attached.*

2. Clean and decontaminate all laboratory equipment, fume hoods, benchtops, cabinets, floors, and shelves. Submit hazardous waste removal request to Environmental Health & Safety.

3. If laboratory equipment is to be discarded, beware that hazardous materials (e.g., batteries, capacitors, transformers, mercury switches, mercury thermometers, oil, asbestos linings, radioactive sources, and CFCs from refrigerators, etc.) may be in equipment and must be removed before disposal. Contact EH&S for assistance.

4. Dispose of equipment (not containing hazardous materials), in accordance with the Property Management / Internal Inventory Control Office procedures.

5. The supervising faculty member of the laboratory shall inspect the facilities and notify the department head/chairperson that graduate students, postdoctoral associates, and employees under his/her supervision have completed the proper disposal procedures and fulfilled his/her responsibilities for cleanup.

6. In the absence of a supervising faculty member, the department head/chairperson shall appoint a faculty member to inspect the facilities or request that EH&S inspect the facilities to determine if the laboratory has been properly cleaned and decontaminated.

7. In instance where a laboratory has been abandoned or is being turned over to the administration, the chairperson or head of the department shall inform the Office of Environmental Health & Safety in writing at least six weeks before the room is to be reassigned.

SAMPLE LABORATORY CHECKOUT LIST

Each faculty member, graduate, postdoctoral, and undergraduate student shall have this form signed by the faculty member and department head before leaving the department.

1. Name: _____ Building: _____ Room: _____

2. Chemicals

1. Inventory and label all chemicals and chemical waste in the laboratory.

All areas of the laboratory should be inspected including refrigerators, acid and flammable storage cabinets, shelves, and drawers

3. Hazardous Waste Disposal

1. Properly cap and label all hazardous material containers.
2. Characterize all "Unknown" chemicals as completely as possible.
3. Transfer chemicals in good condition to another researcher or to department's stockroom.
4. Contact Office of Environmental Health and Safety (EHS) for waste removal.

4. Compressed Gas Cylinders

1. Return to distributor/supplier
2. Report lecture size cylinders to EH&S

5. Controlled Substances

Inventory all controlled substances and notify EH&S for disposal.

6. Biological Materials

1. Inventory and label all materials
2. Transfer usable materials to another researcher
3. Decontaminate equipment as necessary
4. Contact EHS for Biomedical / Infectious removal

7. Radiological Material

1. Send inventory of all reusable material to Office Of Environmental Health & Safety
2. Return film badge (if one has been issued)
3. Contact EH&S / Radiation Safety for checkout / decontamination procedures

8. Defective Equipment/Laboratory Repairs

1. Report to principal investigator, department head for repair or replacement.

_____ _____

Faculty Member / Department Head Date

(signature)

cc: Environmental Health & Safety

Appendix K

Policy for the purchase of Lecture bottles.

This policy applies to all College personnel purchasing or using the category of small cylinders of compressed gas or liquids under pressure called “lecture bottles.”

Purpose

To eliminate the generation of lecture bottles of unknown contents and those with known contents which cannot be economically disposed.

Policy

Researchers should comply with the following:

- Do not buy lecture bottles from suppliers who are not willing to accept back cylinders that still have contents.
- If this is not possible, plan to use all the bottle contents or develop procedures to destroy any hazardous constituents remaining.
- Comply with all safety recommendations from the supplier of the lecture bottle and supplier of the regulator or manual control.
- Insure that any fixtures attached to the lecture bottle comply with the manufacturer’s recommendations.
- Insure that purging procedures are complied with, where applicable.
- When the lecture bottle is empty, mark it as such with an indelible marker.
- If it contained a poison gas or liquid, contact EH&S as soon as it is empty for disposal instructions. Some bottles are still hazardous when “empty.”
- When use is finished, contact EH&S for disposition instructions, if needed. DO NOT store unneeded lecture bottles of hazardous gases for some possible future use.

Reason

Disposal of hazardous lecture bottles is one of the most difficult, expensive waste management operations. Few suppliers are willing to take back their cylinders. Lecture bottles with unknown contents can cost thousands of dollars to dispose. Old bottles can also pose a significant hazard, both to lab personnel and others. Small leaks in storage can damage nearby equipment.