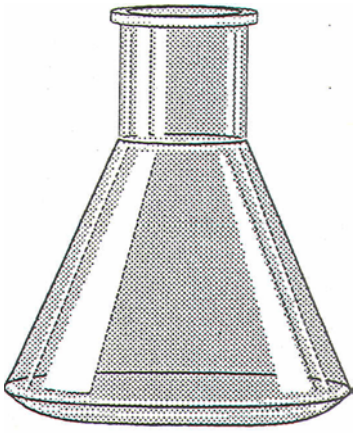
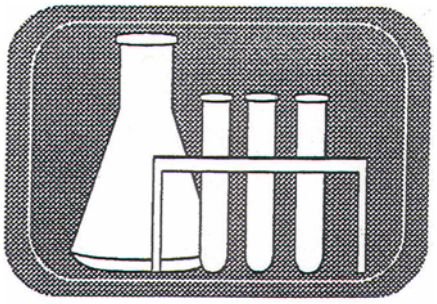
THE CITY UNIVERSITY OF NEW YORK
College of Staten Island

Chemical Hygiene Plan
and
Procedures Manual





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The College of Staten Island
The City University of New York

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1.0 Chemical Hygiene Responsibilities

1.1 Executive Responsibility

The President has ultimate administrative responsibility for Chemical Hygiene within the College, and provides, along with other College officers, continuing support for efforts to improve chemical laboratory safety and health.

The Provost and the Dean of Science and Technology supervise the Chemical Hygiene Officer and authorize the necessary steps to fulfill the objectives of the Chemical Hygiene Plan.

1.2 Chemical Hygiene Officer

The College's Chemical Hygiene Officer functions as specified in the OSHA Laboratory Standard. The Chemical Hygiene Officer coordinates all laboratory health and safety activities for the Lab Sciences building (6S).

The Chemical Hygiene Officer reports to the Director of Environmental Health and Safety and is authorized to shut down or suspend operations that do not conform to health and safety practices required by the Chemical Hygiene Plan. The Chemical Hygiene Officer will exercise his authority in order to minimize the short and long-term dangers to laboratory users, the community and the environment.

The major duties of the Chemical Hygiene Officer are to:

- Serve as chairperson of the Chemical Hygiene Committee and work with that committee to evaluate, implement, and update the Chemical Hygiene Plan.
- Provide technical expertise and administrative support to laboratory users in the area of laboratory safety and health, and to direct inquiries to the appropriate resources.
- Review specific research protocols and operating procedures, which are developed and enforced by principal investigators and laboratory personnel for the safe use, disposal, spill cleanup, and decontamination of hazardous chemicals.
- Coordinate the operation, acquisition and maintenance of safety equipment in chemical laboratories.
- Coordinate the routine inspection of chemical laboratories.
- Conduct, or coordinate, department-specific laboratory health and safety orientation sessions.
- Investigate all reports of hazardous laboratory incidents, spills and near misses, and recommend procedures to prevent repeat occurrences.
- Select a qualified waste disposal vendor to routinely remove chemical waste materials; and, coordinate waste pickups with faculty/staff representatives.

1.3 Chemical Hygiene Committee

The Chemical Hygiene Committee oversees and monitors the effectiveness of the Chemical Hygiene Plan, and revises and updates the plan annually, or as needed. The Committee consists of representatives of all departments in which laboratory work involves the use of hazardous or potentially hazardous substances. The committee will function in an advisory role; and, its authority will not conflict with or supersede current institutional policies. Committee members are chosen in the following manner:

- The Chemical Hygiene Officer (Chair)
- One member to be appointed by the Chairperson of each of the following departments: Applied Sciences, Biology Chemistry, Engineering Technology, Nursing.
- Up to three additional members, to be selected by the Administration to represent other relevant constituencies on campus.

The Committee meets as necessary. Members take minutes on a rotating basis. Minutes are to be maintained as an official record of chemical hygiene activities on campus and are available from the Chemical Hygiene Officer.

The duties of the Chemical Hygiene Committee members are to:

- Attend committee meetings.
- Periodically review and update the Chemical Hygiene Plan.
- Review academic and research protocols to ensure that proper controls are available to protect faculty members, staff and students.
- Participate in the laboratory inspection program with the Chemical Hygiene Officer.
- Bring unresolved departmental issues of safety and health to the attention of the committee.

1.4 Departmental Laboratory Safety Committee

The Departmental Laboratory Safety Committee (LSC) consists of a Faculty member chairperson respective to that department operating laboratories and other members of the department responsible for the operation of the laboratory areas. The LSC chair (in addition to the Dean and departmental chairperson) receives all in house laboratory inspection reports conducted by the EHS department and University Central Office. The Departmental LSC chair periodically holds meetings to review laboratory safety issues as well as discuss and set policy.

1.5 Departmental Chairperson

The department chairperson is responsible for chemical hygiene in his/her department. They are expected to know and understand the goals of the Chemical Hygiene Program. The duties of the chairperson are the following:

- Ensure the routine identification of expired and unusable chemical stores for disposal.

- Ensure cooperation in completion of annual (ongoing) computerized inventory of all chemicals in storage rooms and laboratories in their departments.
- Aid in periodic inspections of laboratories and maintain recordkeeping of completed inspection forms.
- Encourage staff to set high standards of health and safety by personal example, in order to instill in our students an attitude of mind which accepts good health and safety practice as normal.
- Arrange to notify EH&S regarding new research personnel and activities planned in near future.

1.6 Principal Investigators and Laboratory Supervisors

Principal investigators, faculty, and other laboratory supervisors have responsibility for chemical hygiene in the research or teaching laboratories in which they work. It is their duty to:

- Know and implement the guidelines and procedures of the Chemical Hygiene Plan.
- Write specific operating procedures for handling and disposing of extremely hazardous substances used in their laboratories and submit these procedures to the Chemical Hygiene Officer for review. (Policies do not have to be written for minimal risk chemicals).
- Train laboratory personnel in these operating procedures and ensure the use of proper control measures.
- Conduct routine inspections of laboratories with their laboratory workers.
- Ensure that the appropriate controls, including fume hoods and safety equipment are available and in good working order.
- Ensure that all incidents and near misses occurring in their laboratories are reported in writing to the Chemical Hygiene Officer using the Laboratory Incident Form (Appendix XII).
- Obtain a NYC Fire Department Certificate of Fitness for Supervising Chemical Laboratories. (The NYC Fire Department requires that each individual in charge of a laboratory obtain a Certificate of Fitness. The Laboratory Safety Office will provide assistance in obtaining a certificate).
- Ensure that every individual working in the laboratory in off-duty hours or on weekends does so under their supervision or has obtained his/her own Certificate of Fitness Supervising Chemical Laboratories from the NYC Fire Department.

1.7 Laboratory Employees, Users and Volunteers

Laboratory workers are those who, in the course of their work, are present in the laboratory on a regular or periodic basis. This may include laboratory technicians, instructors, researchers, secretaries, graduate assistants, student aides, part-time and temporary employees/collaborators. All employees, users and volunteers must:

- Follow procedures and guidelines outlined in the Chemical Hygiene Plan.
- Report any unsafe working conditions, faulty fume hoods, or emergency safety equipment to the laboratory supervisor and the Chemical Hygiene Officer.

2.0 Hazard Communication: Signs, Labels, and Material Safety Data Sheets

2.1 OSHA Hazard Communication Standard Requirements

The OSHA Hazard Communication Standard mandates that chemical manufacturers provide Material Safety Data Sheets and properly labeled containers for each chemical. These provide basic information about the safety and health hazards posed by a chemical, and precautions to take when using it.

2.2 Signage

The laboratory supervisor, in consultation with the Chemical Hygiene Officer will post a sign at the location where notices are normally posted to inform employees that they have the right to information from the College regarding toxic substances found in the workplace. The College will 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. In addition, during emergencies, the location of relevant safety information and emergency equipment must be clearly marked.

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 durable material and posted at eye level. The height of the letters in the word “laboratory” must be at least 1½ inches high; the words “potentially hazardous substances” must be at least 7/16 inches high.

2.2.2 No Smoking

A “No Smoking” sign is required to be posted both inside and at the entrance to storage areas and laboratories. This is in addition to the campus-wide “No Smoking” policy.

2.2.3 Emergency Equipment and Exit Identification

Large and conspicuous signs that indicate the location of each safety shower, eyewash station, fire extinguisher, and exit must be posted.

2.2.4 Emergency Telephone Numbers

Telephone numbers of emergency personnel such as public safety, facilities, supervisors, the Chemical Hygiene Officer must be posted next to the phone in each laboratory, storeroom/stockroom, and storage area. If there is no phone in the room, a sign should be posted indicating the location of the nearest phone (which should have pertinent telephone numbers posted next to it).

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
- Carcinogens
- Flammable gases
- Explosives
- Reproductive hazards
- Toxic gases (e.g. hydrogen cyanide)
- Radioactive materials
- Biohazardous materials
- Lasers

2.2.6 Flammable Liquid Storage Cabinets and Refrigerators

Flammable liquid storage cabinets must be used to isolate flammable liquids and should display the appropriate warning signs on the exterior; do not store other incompatible chemicals in the same cabinet (e.g. any oxidizer). Under no circumstances will a flammable liquid storage cabinet be used to store more than 60 gallons of flammable liquid. All refrigerators must be posted with the legend "Store No Flammables Flashing below 100ºF", in accordance with FDNY regulation, unless the refrigerator is manufactured as an "explosion-proof" or "non-sparking interior" device.

2.3 Labels

Any chemical container that is unlabeled is considered a waste and will be removed upon discovery. An interview with laboratory staff and testing methods will be conducted to determine the identity of the unidentified chemical, and proper disposal will follow.

2.3.1 Chemical Container Labels

Labels on chemical containers are mandatory. All chemical manufacturers and distributors are required under Federal statute to provide chemicals in properly labeled containers. The following information must appear on the label:

- Chemical name(s), concentration(s), and date(s)
- Hazard warning, indicating the most serious health and safety hazard(s) the chemical poses (e.g. corrosive, carcinogen, water reactive, flammable)
- Name, address and emergency telephone number of company

The OSHA Laboratory Standard requires that labels on all incoming containers be maintained and not defaced. The label on the container must not be defaced or removed until it is empty and rinsed. Portable containers filled from an original container must be labeled and bear the warnings found on the original label if used by more than one person, or used for more than one work day.

2.3.2 Inadequate Labeling

Any laboratory worker, finding inadequately labeled containers, must report them to the Laboratory Supervisor. Laboratory Supervisors will provide for correct labeling. Unlabeled, unidentifiable containers will be disposed in accordance with New York State Department of Environmental Conservation regulations, and the CSI Hazardous Waste Management Plan. Purchased chemical should be inspected upon arrival for proper labeling; improperly labeled material must be refused or returned to the manufacturer. Contact the Chemical Hygiene Officer with problems of incoming product labeling.

2.3.3 Damaged Containers

Workers charged with the receiving of chemical deliveries must examine them for possible breakage. Leaky or physically damaged cartons, or cartons that "rattle" (unless labeled "rattle o.k."), or emit an odor must be refused at the receiving point. If the breakage is noted after delivery, contact the shipper and the Chemical Hygiene Officer immediately. Do not attempt to move or disturb leaky or damaged chemical containers.

2.3.4 Newly Synthesized Chemicals

Laboratory Supervisors are responsible for ensuring that all newly synthesized materials are used exclusively within their laboratory and are properly labeled. Researchers should develop a preliminary Safety Data Sheet following Globally Harmonized System 16-section format at the earliest opportunity, and add to it as the properties of the product become known.

2.3.5 Safety Data Sheets

The sound management of chemicals should include systems through which chemical hazards are identified and communicated to all who are potentially exposed. On March 26, 2012, the Department of Labor adopted the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals—otherwise known as GHS. This change ensures that OSHA's current Hazard Communication Standard (HCS) is aligned with internationally-developed guidelines for the categorization and labeling of hazardous substances. Under the new GHS ruling, material safety data sheets (MSDS), will be referred to and called SDS (or Safety Data Sheets). The new standards affect any workplace that manufactures, uses, transports, or stores hazardous chemicals. One specific change in this ruling is to the ANSI Standardized MSDS format. The original 16-section MSDS format created by ANSI Z400.1 (2010 Rev.) will be replaced by the new specified 16-section format SDS under the GHS system for classification for hazardous chemicals. *The OSHA Laboratory Standard requires that Safety Data Sheets (SDS's) be collected and maintained for all chemicals used and stored in the laboratory and be accessible to employees in their work area.* For this reason, files of Safety Data Sheets should be maintained in laboratories. Exotic and uncommon chemical MSDS's, especially those which have highly reactive or toxic properties, should be kept in hard copy format to reduce access barriers and access time. Electronic formats are more suitable for routinely used chemicals and those low hazard chemicals which are used in large quantities. Regardless of how SDS's are retained, personnel working in the laboratory must know and have immediate access to the location of the binder/file where MSDS's are stored.

2.3.6 Collection, Distribution, and Retention of MSDS's

Safety Data Sheets may be received from the manufacturer directly at the laboratory that ordered and received the chemical either in hardcopy format with the chemical or separately by mail or electronic format. It is the laboratory's responsibility to ensure that current SDS's are kept on file and are accessible.

Any SDS's received by the Office of Environmental Health and Safety are archived electronically and sent to the receiving laboratory. Electronic archives are available to PI's and laboratory staff upon request.

A hardcopy file of SDS's is maintained in binders at the Campus Security Office (2A-109). To obtain a Material Safety Data Sheet in an emergency situation, contact Security at extension 2116.

3.0 Chemical Inventory, Procurement and Receiving

3.1 Chemical Inventory

The Chemical Hygiene Officer maintains an inventory of hazardous chemicals used on campus. Purchases of chemicals which dramatically change the inventory of a laboratory, either due to quantity or hazard class, must be reported to EHS prior to procurement.

A separately kept inventory, reflecting on-hand quantities of chemicals, should be maintained for each work area. This will assist in avoiding duplicative purchases, and excessive inventory.

It is recommended that the date of receipt and date of opening of each container be written on the label to allow for rotation of stock. See section 4.9.

3.2 Chemical Procurement

Before purchasing reagents, check with EHS or colleagues for the chemical which may be surplus to their work. Before ordering an extremely hazardous substance, such as a known carcinogen, reproductive hazard or acutely toxic substance, consider the adequacy of available facilities to safely handle its type and quantity. If a less hazardous alternative is available, it should be given consideration as a substitute. Certain substances are regulated by individual statute and require monitoring, and other safeguards. Please consult with the Chemical Hygiene Officer before purchasing or using materials having substance-specific requirements.

Substance-specific work standards have been established for the following materials:

- Butyl lithium reagents
- Cyanogens bromide
- Carbon tetrachloride
- Ethidium bromide
- ethylene oxide
- formaldehyde
- Osmium tetroxide
- Sodium azide
- Sodium cyanide
- Vinyl chloride

Efforts should be made to limit purchases of all chemical reagent to the amount needed. When large quantities of chemicals are purchased it is frequently a false economy because significant portions may go unused, require storage, and eventually become expensive disposal. Before purchasing, check with EHS for surplus chemicals which will be immediately available at no cost.

3.3 Chemical Receiving

Workers charged with the receiving of chemical deliveries must examine them for possible breakage. See section 2.3.3
Appropriate spill control materials, cleanup and emergency equipment must be available wherever chemicals are received or stored.

4.0 Chemical Storage

4.1 Storage Limits

The nature of laboratory work requires quantities of chemicals to be on hand for easy access. It is incumbent upon laboratory workers; however, minimize the quantities of chemicals stored on bench tops, in hoods or other exposed areas. Under no circumstances shall the total quantities of hazardous chemicals stored in a laboratory unit exceed those permitted by New York City Fire regulations pre 2009 code (see table below).

Lab Type	Fire Rating	Fire Protection	Flammable Liquids	Flammable Solids	Oxidizing Materials	Unstable Reactives
I	2 hour	Sprinklers	25 gallon	15 pound	50 pound	12 pound
II	1 hour	Sprinklers	15 gallon	10 pound	40 pound	6 pound
III	2 hour	No sprinklers	20 gallon	6 pound	30 pound	3 pound
IV	1 hour	no sprinklers	15 gallon	3 pound	20 pound	2 pound

Laboratory units will be covered under the new 2009 NYC fire code if their total square footage for the laboratory unit exceeds 1250 square feet. In this case all things remain the same except for storage maxima. For example under the new code the maximum for flammable liquids will be 2 gallons for each 100 square feet and provided that at least 50% of the stock is stored in NFPA rated flammable storage cabinets.

4.2 General Requirements

Chemicals shall be stored according to SDS recommendations

4.2.1 Re-shelving

Every chemical must have an identifiable storage space and must be returned to that space after use. Do not store chemicals on the floor.

4.2.2 Storage Patterns

A storage scheme must be developed for each area where chemicals are stored to provide for segregation of incompatibles. A storage pattern based solely on alphabetizing is prohibited. Examples of suggested storage schemes for organic and inorganic compounds follow.

SUGGESTED SHELF STORAGE PATTERN

SULFUR, PHOSPHORUS ARSENIC, PHOSPHORUS PENTOXIDE	ARSENATES, CYANIDES, CYANATES (Store away from any water)	**ACIDS CABINET** ACIDS, except NITRIC
HALIDES, SULFATES, SULFITES, THIOSULFATES, PHOSPHATES, HALOGENS, ACETATES	SULFIDES, SELENIDES, PHOSPHIDES, CARBIDES, NITRIDES	
AMIDES, NITRATES (Not AMMONIUM NITRATE) NITRITES, AZIDES (Store ammonium nitrate away from all other substances – ISOLATE IT!)	BORATES, CHROMATES, MANGANATES, PERMANGANATES	
METALS & HYDRIDES (Store away from any water. Store flammable solids in flammables cabinet)	CHLORATES, PERCHLORATES, CHLORITES, PEROXIDES, HYPOCHLORITES HYDROGEN PERODIDE	
HYDROXIDES, OXIDES, SILICATES, CARBONATES, CARBON	MISCELLANEOUS	

Store Nitric Acid away from other acids unless your acid cabinet provides a separate compartment for Nitric Acid.

Store Perchloric Acid away from other acids unless your acid cabinet provides for a separate compartment for Perchloric Acid

Storage Scheme 1

SUGGESTED SHELF STORAGE PATTERN

ALCOHOLS, GLYCOLS, AMINES, AMIDES, IMINES, INIDES (Store flammables in a dedicated cabinet)	PHENOL, CRESOLS	**POISONS CABINET** SEVERE POISONS **POISON**
HYDROCARBONS, ESTERS, ALDEHYDES (Store flammables in a dedicated cabinet)	PEROXIDES, AZIDES HYDROPEROXIDES	**FLAMMABLES CABINET** ALCOHOLS, GLYCOLS, ETC. ETHERS, KETONES, ETC. **FLAMMABLES**
ETHERS, KETONES, KETENES, HALOGENATED HYDROCARBONS, ETHYLENE OXIDE (Store flammables in a dedicated cabinet)	ACIDS, ANHYDRIDES, PERACIDS (Store certain organic acids in acid cabinet)	
EPOXY COMPOUNDS, ISOCYANATES	MISCELLANEOUS	
SULFIDES, POLYSULFIDES, ETC.	MISCELLANEOUS	

Adapted from material developed by Flynn Scientific, Inc. (Flynn Chemical Catalogue Reference Manual)

Storage Scheme 2

4.3 Bench top Clutter

The storage of working containers on bench tops should be minimized to reduce severity of reactions due to spillage or breakage.

4.4 Storage in Fume Hoods

Chemical storage in hoods should be kept at a minimum. Clutter in fume hoods interferes with airflow, reduces work space, increases risk of fire and undesirable reactions and may lead to hazardous materials spill. See section 7.1 for specifics on fume hood use.

4.5 Labeling

All chemical containers must be properly labeled. Secondary containers must be labeled if they are used by more than one person, or if they will be used for more than one work day. See Section 2.3

4.6 Storage Conditions

Chemicals in storage should be kept away from excessive heat and light.

4.7 Secondary Containment

Storage trays or other devices should be used to minimize and contain the extent of a possible spill or leak. Tray construction materials should be appropriate to the chemicals stored.

4.8 Laboratory Refrigerators

Laboratory refrigerators must never be used to store food, beverages or condiments. See Section 2.2.6

4.9 Rotation of Inventory

Chemical containers should be marked with the dates of receipt and when initially opened by a laboratory worker to assist in rotation of stock. Older bottles should be used first. Chemicals in the following categories shall be dated when received, when first opened, and have expiration dates assigned and a program of inspection, testing, or maintenance established, where appropriate:

- picrates and picric acid
- perchlorates
- peroxides and peroxidizable materials (certain aldehydes, ether, most alkenes, vinyl and vinylidene compounds) (see section 5.4)
- compounds that react violently in polymerization, or become hazardous after polymerization
- Pyrophoric compounds and water reactive compounds
- any other materials known to deteriorate or become off-specification, unstable, or reactive, over time

4.10 Laboratory Closure

All laboratory personnel, upon notice of retirement, termination, transfer or graduation must consult with the department chair or his/her designee, and the Chemical Hygiene Officer to arrange for the removal, safe storage or transfer of custody of all hazardous materials in their laboratories.

4.11 Spill Control

Appropriate spill control, cleanup and emergency equipment must be available wherever hazardous chemicals are stored. See Section 16 for generic spill response procedures.

5.0 Storage Requirement for Specific Hazard Classes of Chemicals.

5.1 Flammable Liquids

Flammable liquids are to be stored in containers approved for storage of flammable liquids. When storage is in glass or plastic containers, then containers must be in flammable liquid storage cabinets. Cabinets may be of metal or NFPA approved wood construction. Measures must be taken to segregate flammable liquids oxidizers, as well as sources of ignition and excessive heat. Care must also be taken to segregate flammable liquids from acids, alkalis, toxics, and other potentially incompatible material. See section 4.1 for laboratory unit flammable liquid storage limits and section 4.2.2 for storage patterns.

5.2 Compressed Gases

Please see section 9 for compressed gas storage information.

5.3 Oxidizers

Oxidizers are substances that readily react to oxidize combustible materials. Strong oxidizers present a risk of fire or explosion upon contact with organic compounds or other oxidizable materials. Examples are:

- Hydrogen peroxide (>8% solution)
- Calcium hypochlorite
- Magnesium perchlorate
- Potassium Permanganate
- Chromic acid
- Nitric acid
- Sodium peroxide
- Silver nitrate

Oxidizers must be stored away from incompatible materials, such as:

- Greases
- Paper trash bins
- Finely divided metals
- All other flammable or combustible materials

Nitric acid, sulfuric acid and perchloric acid should be stored separately, and on acid resistant trays for secondary containment.
Some oxidizers are capable of explosive reactions when catalyzed or exposed to heat, shock or friction. They must be physically isolated. Some examples:

- Ammonium perchlorate
- Ammonium permanganate
- Hydrogen peroxide
- Perchloric acid (>72.5% by wt)
- Potassium peroxide

Strong oxidizers should be used in glass, or other inert containers. Corks or rubber stoppers should not be used.

5.4 Peroxides and Peroxide-forming Chemicals.

Due to these special handling requirements, users must have the appropriate laboratory equipment, information, knowledge and training to use these compounds safely. These substances should be stored in airtight containers in a dark, cool, and dry location, protected from physical damage and ignition sources. To minimize the rate of decomposition, store peroxides at the lowest possible temperature consistent with their solubility and freezing point. Solutions of peroxides should not be stored at or below temperatures at which the peroxide freezes or precipitates; peroxides in this form are extremely shock sensitive. A warning label should be affixed to all peroxide forming materials to indicate the date of receipt and the date the container was first opened. Ethers and other peroxide forming compounds must be tested regularly after opening for the presence of peroxides. Test dates must be recorded on the container. Containers showing a positive test (<5mg/L) must be disposed according to CSI hazardous waste procedures. The Chemical Hygiene Officer will provide test methods, if needed. A table of peroxide forming chemicals along with testing schedule appears in Appendix II.

5.5 Toxic Chemicals.

Toxic chemicals can cause either severe short-term health effects (acute), and/or severe long-term health effects (chronic). The methods of handling and storage must be selected after careful consideration of the type of toxicity that will be encountered. Toxic materials can include corrosives, dehydrating agents, carcinogens, allergic sensitizers, and reproductive toxins. They include chemicals known to affect the nervous system, liver, kidneys, or the respiratory system. In general, the following rules should be observed, in addition to those deemed necessary for the particular substances' characteristics:

- Store chemicals in their original container, within an unbreakable, chemically resistant secondary container.
- Adequate ventilation must be provided in storage areas. This is especially important for those toxic chemicals having a high vapor pressure.
- Work with these materials must be conducted in a working chemical fume hood.
- Provisions for personal protective equipment, first aid, antidotes, spill control procedures, and waste destruction/removal method must all be developed before commencing work with toxic materials.

6.0 Waste Management

Many laboratories generate chemical wastes that pose human and environmental hazards. These hazardous wastes are regulated by federal, state and local law. There are also separate regulations that provide for the proper disposal of radioactive, non-radioactive solid waste, biological and non-hazardous chemical wastes. This section will only address chemical and non-radioactive solid wastes.

6.1 Chemical Waste

See Appendix IX for detailed Standard Operating Procedure for the Handling of Chemical Waste.

6.1.1 What is Chemical Waste?

All chemical reagents, products and reaction mixtures are to be discarded as chemical waste unless it is determined in writing by the Chemical Hygiene Officer that an alternate means of disposal is acceptable. Chemical wastes of different composition should not be mixed. Only dilute common acids and bases may be disposed in a sink, and only in small quantities accompanied by copious amounts of running water. No liquids of any type are to be disposed in waste baskets or dumpsters.

6.1.2 Containers

Waste chemicals should be packaged in securely capped bottles or containers which are chemically compatible with the contents. All old labels should be removed/defaced and replaced with a “Hazardous Waste” label which is available from the Chemical Hygiene Officer.

6.1.3 Waste Determinations

Waste Determinations are performed by the Chemical Hygiene Officer and will determine how each waste stream is handled. Waste may either be Hazardous or non-Hazardous Waste, depending on the characteristics of the waste material. See the CSI-EHS Hazardous Waste Management Plan if the Chemical Hygiene Officer has determined that your waste stream is a hazardous waste. Be sure that the Chemical Hygiene Officer has performed a waste determination for each waste stream the laboratory produces and the laboratory retains a file copy. In addition, the Department Office and the Office of Environmental Health and Safety will also retain a copy for faculty and staff review.

6.2 Non-radioactive Solid Waste

It should be recognized that not all materials used in and discarded from laboratories are hazardous wastes. The following listing of typical non-hazardous wastes adapted from *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, can be used as a guide in determining which materials do not require handling as USEPA RCRA hazardous waste.

Typical Non-hazardous Non-RCRA Laboratory Wastes

A. *Organic Chemicals*
- Sugars and sugar alcohols
- Starch
- Naturally occurring α-amino acids and salts
- Citric acid and its Na, K, Mg, Ca, NH_4 salts
- Lactic acid and its Na, K, Mg, Ca, NH_4 salts.

B. *Inorganic Chemicals*
- Sulfates: Na, K, Mg, Ca, Sr, NH_4
- Phosphates: Na, K, Mg, Ca, Sr, NH_4
- Carbonates: Na, K, Mg, Ca, Sr, NH_4
- Oxides: B, Mg, Ca, Sr, Al, Si, Ti, Mn, Fe, Co, Cu, Zn
- Chlorides: Na, K, Mg
- Fluorides: Ca
- Borates: Na, K, Mg, Ca

C. *Laboratory Materials Not Contaminated with Hazardous Substances*
- Chromatographic adsorbent
- Glassware (except pipettes, syringes and broken glass)
- Filter paper
- Filter aids
- Rubber and plastic protective clothing and tubing

Please note that any sharp materials, such as scalpels, needles, razor blades, broken glass and slides or any medical glassware, used or unused, must be collected in special “sharps containers” and disposed as biological waste. Refer questions on this matter to the Chemical Hygiene Officer.
See Appendix X for detailed Standard Operating Procedure for the Handling of Biological/Regulated Medical Waste

6.3 Empty Reagent Bottles

Empty bottles must be drained, and once rendered RCRA empty (containing less than 1% of the original contents) can be evaporated to dryness or internally rinsed three times with water, and labels removed (except for inventory barcodes), covered, or defaced. Inventory barcode labels should be left un-obscured so that empty containers can be removed from the inventory database. Empties should then be boxed for transport, and the Chemical Hygiene Officer contacted. Empties can also be used for waste containers provided that stock labels are removed, covered, or defaced maintained inventory barcodes are intact.

7.0 Laboratory Ventilation

The laboratory ventilation system must be used properly to adequately protect laboratory workers from airborne contaminants.

7.1 Fume Hood Use

Fume hood are designed to contain contaminants as they are generated and remove them before they enter the breathing zone of the worker or other occupants of the area. Fume hoods are not capable of efficiently removing contaminants generated outside the hood cabinet.

The following work practices are generally required; however, more stringent practices may be necessary under certain circumstances. Please consult with the Chemical Hygiene Officer, before using extremely hazardous substances or if unusual demands will be placed on your fume hood.

- Conduct all operations that may generate air contaminants or noxious odors inside a hood. Activities involving the heating of flammable materials must also be performed in a hood. Perchloric acid digestions must be performed in a hood specially designed for that purpose. Contac the Chemical Hygiene Officer if you use Perchloric acid.
- Do not use an improperly operating fume hood. Check the electronic hood airflow monitor before using the hood. If the flow should be interrupted during hood use, close the sash and sash panels completely, and contact Buildings and Grounds (x-3210) and the Chemical Hygiene Officer (x-4300)
- Keep all apparatus at least 6 inches back from the face of the hood.
- Do not put your head in the hood when contaminants are being generated.
- Do not use the hood as a waste disposal mechanism for volatile materials.
- Do not store chemicals or apparatus in the hood. Store hazardous chemicals in proper containers, in approved safety cabinets.
- Keep the hood sash closed as much as possible. Do not perform chemical operations in the hood with sash fully opened or with sash panels removed. Do not mute or disable the flow monitor alarm, or attempt to modify the fume hood or its performance. All modifications of fume hood specifications must be approved by Campus Planning. See the Office of Environmental Health and Safety for information.
- Keep the hood clean, and uncluttered. Baffle slots must be free of obstruction by apparatus or containers. Do not allow debris, such as paper to be drawn into the exhaust. If a problem occurs, contact Buildings and Grounds and the Chemical Hygiene Officer.
- Minimize foot traffic past the face of the hood and keep laboratory doors closed to reduce turbulence in or near the hood. In order to maintain negative air pressure in laboratories, doors must **not** be chocked open.
- Do not place electrical power strips, or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.
- Use an appropriate barricade, or splash shield, if there is a chance of explosion or eruption. See the Chemical Hygiene Officer for information and advice.

7.2 Maintenance of Laboratory Ventilation System

The fume hood maintenance program is comprised of the following elements, and is performed by the College of Staten Island Buildings and Grounds Engineering Staff:

- Check bearings for overheating (grease as required)
- Check belts for wear and proper tension
- Check fan for accumulation of debris
- Check for proper direction of rotation
- Check motors for proper electrical and mechanical operation
- Check ductwork for blockage, intact joints, corrosion, dents or holes.

7.3 Fume Hood Recertification

Fume hood performance recertification shall be performed annually by the Chemical Hygiene Officer. It consists of the following:

- Measure uniformity rate of flow at face of hood
- Inspect operation of sash, and any mechanical malfunction, or evidence of tampering

8.0 Personal Protective Equipment and Clothing

It is the responsibility of Laboratory Supervisors and Principal Investigators to require the use of proper personal protective equipment in their laboratories. The Chemical Hygiene Officer will render assistance in the selection of equipment appropriate to specific tasks.

8.1 Eye Protection

All safety eyewear must meet the criteria of the current American National Standards Institute (ANSI) Standard Z87.1 and must be worn at all times in designated laboratories. Eye protection should be selected to match the type of hazard you will be likely to encounter (i.e. chemical splash, UV radiation, etc.). Goggles used for laser protection must be specific to the wavelength of the laser. The Chemical Hygiene Officer can assist in the risk assessment selecting adequate eye protection.

It is strongly recommended that *contact lenses not be worn in laboratories* where chemicals are used. *If contact lenses are worn*, the laboratory instructor or supervisor must be informed that this is the case. This information must be available for any first aid provider providing assistance to the contact lens wearer. Wearers of contact lenses must remove them immediately if redness of the eye, blurry vision, or eye pain occurs.

8.2 Gloves

Proper gloves must be selected and used when handling the following materials to protect your skin from hazardous exposures:

- Chemicals (corrosive, toxic or of unknown toxicity)
- Rough or sharp objects
- Very hot objects
- Very cold objects

WARNING: Do NOT wear gloves when operating machinery.

8.3 Glove Selection and Use

Glove selection is based on a risk assessment of the characteristics of the materials being handled and the hazards associated with the operation being performed. All glove materials are permeable and degrade. Latex rubber gloves offer minimal protection against chemical exposure, and are usually not recommended for use in the chemical laboratory. Check a glove selection guide for the brand(s) of gloves used in your lab. Each manufacturer's guide is specific to the manufacturer's formulations. If the characteristics you require are not met, check a different selection guide. You may contact Chemical Hygiene Officer for assistance in performing a risk assessment.

- Rings should not be worn under gloves as they increase the risk of breakthrough.
- Do not reuse gloves if they have become contaminated and cannot be decontaminated.
- Replace gloves often, based on their permeability and degradation characteristics.
- Chemical protective gloves should be washed before removing them.
- Cuffs should be turned up on gloves to stop liquids from running onto forearms when hands are raised.
- Prevent spreading contamination by removing gloves before leaving the work area or prior to touching uncontaminated objects, such as telephones, pens, and doorknobs.
- Consider double gloving technique when contaminated gloves are an issue. This will offer additional protection and prevent contamination when removing the outer pair.
- Wear leather gloves when handling broken glassware, inserting glass tubing through rubber stoppers, handling cylinders, or when chemical protection is not required.
- Wear insulated gloves (such as Kevlar® or Nomex®) for operations requiring thermal protection. Do not use asbestos fiber gloves for hot objects. Call the Chemical Hygiene Officer for proper disposal of asbestos gloves.
- Wear loose fitting gloves made of impervious material for protection while handling cryogenic liquids. Absorbent gloves can freeze to your hands; loose fitting gloves are easily thrown off should liquid enter them.

8.4 Clothing

The proper apparel for laboratory workers is determined by the nature of laboratory operations to be performed. The minimum, however, should be a laboratory coast worn over street clothes. Lab coats should be laundered regularly and when contaminated, they should be supplemented as needed with aprons, boots or shoe covers, or gauntlets. The wearing of shorts, open-toed shoes or sandals/flip flops is strongly discouraged in the laboratory.

9.0 Compressed Gas Cylinders

9.1 Definition

This section outlines procedures for the safe handling of compressed gas cylinders. Gas cylinders are constructed with varying features, in a variety of sizes and shapes, depending on delivery requirements and nature of contents. For purposes of this chapter, all portable metal vessels used to contain gases at pressures above atmospheric are included. There are physical, fire, chemical and health hazards associated with gas cylinder use. Please consult with the Chemical Hygiene Officer regarding your specific usage.

9.2 Identification

The contents of a cylinder of compressed gas must always be clearly identified. Never accept a cylinder that is not legibly labeled. Do not depend on color coding to identify cylinder contents. The following information should appear on the cylinder:

- Identification must be stenciled, stamped or provided on an adhesive label. (Do all forms of identification agree?)
- The distributor or manufacturer's name and address must be clearly identified.
- The Department of Transportation (DOT) 'diamond" label must complement the content label.

If the labeling does not meet these criteria, do not accept the cylinder from the supplier.

9.3 Storage and Handling

The following requirements must be met when storing and transporting cylinders.

- Compressed gas cylinders must be secured in an upright position with chains, straps or special floor stands. They must never be fastened to electrical conduit, or any movable furniture or cart. Cylinder hand trucks may be used in lieu of chains, etc., if the cylinder use is temporary (i.e. less than 24 hours).
- Cylinders must be capped when stored and moved. Caps must be straight and snug. Cylinder hand trucks with chain, belt, or securing strap **must** be used to transport cylinders larger than a lecture bottle.
- Cylinders of flammable gases should be stored separately from all other types of compressed gases. Flammable gas cylinders are permitted in the laboratory only when they are connected to an instrument in an ongoing operation, such as Atomic Absorption Spectroscopy. One back-up cylinder, of equal volume, is permitted. Under no circumstances will flammable gases be stored or used below grade (i.e. in cellars), or in quantities exceeding the following table:

Area of laboratory in square feet	Up to 500 sq. ft.	Per additional 100 sq. ft.	Maximum per laboratory unit
Maximum capacity	9.24 cu. ft. capacity	1.54 cu.ft. capacity	15.4 cu. ft. capacity

Note: Capacity is "water weight", not compressed gas capacity. 1K size (or 1A, Matheson) = 1.54 cu ft. water weight capacity.

- All cylinders should be kept away from heat sources, in well ventilated areas, and away from high traffic areas.
- Never transport Oxygen and flammable gas together
- Empty cylinders should be tagged or marked in chalk (“empty” or “MT”) and stored separately from full cylinders. Empty cylinders must be secured same as full cylinders, stored in designated areas at all times, and shall be returned to their supplier as soon as possible.
- Cylinders must be segregated according to compatibility as any other chemical. Different gases must be separated by distance.
- Keep caps on cylinders when they are not in use.
- Do not store cylinders where they may become electrically energized.

9.4 Hazardous Properties of Compressed Gases

9.4.1 Health Hazards

The health hazards presented by gases are categorized as simple asphyxiants, chemical asphyxiants, corrosives and toxic gases. Specific gases may possess one or more of these hazardous properties. Be aware of the reported characteristic odors, symptoms or signs of exposure and treatment of the toxic gases in your laboratory. Discuss these matters with the Chemical Hygiene Officer before using such gases.

- Simple asphyxiants are physiologically inert, such as argon and nitrogen. They can displace oxygen in the ambient atmosphere causing unconsciousness and ultimately, death. Do not use or store any compressed gases in unventilated areas.
- Chemical asphyxiants, such as carbon monoxide or hydrogen cyanide, through direct chemical action, prevent uptake of or interfere with the body’s ability to transport oxygen. Exposure to chemical asphyxiants must be avoided by the use of properly operating laboratory fume hoods, and maintaining properly leak-tested systems.
- Corrosive gases such as chlorine cause visible destruction, or irreversible damage to human lungs, eyes or other tissue, and materials such as metals. Exposure may cause damage to the respiratory system, or at any other point of contact.
- Toxic gases, such as phosgene or vinyl chloride, may be of acute or chronic nature. Exposure to acutely toxic gases is capable of causing immediate poisoning after short exposure to relatively low concentrations. Chronic exposure, that is, repeated or long term exposure, can cause serious damage by either accumulating the contaminant, or accumulating physiological damage. Exposure can occur through inhalation, skin contact, or ingestion. Avoid routine exposures to all laboratory gases.
- Respiratory protective devices, such as respirators, offer either little or no protection against exposure to laboratory gases, and are strongly discouraged. Voluntary use may be allowed in certain circumstances with the written permission of the Chemical Hygiene Officer (OSHA appendix D).

9.4.2 Flammability Hazards

Fire prevention methods used with compressed gases should be based on leak prevention, ample dilution or ventilation, and removing sources of ignition. Flammable gases must be stored, transported and used separately from oxidizers. Air and oxygen must be purged (with inert gas) from systems before using flammable gases. Electrically ground flammable gas cylinders to prevent accumulation of static charge.

Two common flammable gases, acetylene and hydrogen, have notable characteristics.

- Acetylene, a highly thermodynamically unstable compound, has an exceptionally wide flammable range (4%-75%) in air. It should never be pressurized outside the cylinder as explosive decomposition may occur.
- Hydrogen burns with an almost invisible flame. It sometimes will unexpectedly ignite when a cylinder is rapidly vented. This is probably due to static discharge. Due to hydrogen's low viscosity, piped systems must be regularly leak tested.

Flammable gases have a left-hand threaded regulator fitting to prevent improper connection. Do not use adapters to defeat this important safety feature.

9.4.3 Oxygen and Other Oxidizers

In addition to isolation from flammable gases, oxygen and other oxidizers such as chlorine and nitrous oxide, must be kept and used separately from hydrocarbons, such as solvents, organic greases and oils. Cylinders and equipment must not be handled with oily gloves or hands. Regulators and fittings must be manufactured, cleaned and labeled as "suitable for oxygen service".

Liquid oxygen must not be stored on asphalt or wood. If you plan to use liquid oxygen, consult with the Chemical Hygiene Officer before ordering the material.

If you will be using oxygen in combination with a flammable gas, a Fire Department Certificate of Fitness for welding operations is required. See the Chemical Hygiene Officer for study materials, and to arrange a test date.

9.4.4 Corrosive Gases

Corrosive gases present added problems of selecting appropriate valving, regulating and gasketing materials. Gas suppliers' catalogues are probably the best source of guidance in materials selection. When using corrosive gases, the following precautions should be followed:

- Use traps on delivery systems to minimize reverse flow to prevent cylinder and regulator corrosion.
- Moisture must be excluded from any system containing corrosive compressed gases.
- Equipment in corrosive gas service must be checked weekly for corrosion, and corrective action taken immediately. Equipment in the general area, especially

safety equipment, such as showers, eyewash stations and fire extinguishers, should also be checked for corrosion which would interfere with their function.

- Never use the regulator as an On-Off control. Always close the cylinder valve, and bleed the regulator to atmospheric pressure. Purge regulators and cap openings with dry nitrogen or dry air before storage.
- Operate the cylinder valve at least once a day in which the cylinder is in use to break up corrosion products which may have formed.
- Purchase cylinders in a size that will assure rapid consumption. Do not overstock.

9.4.5 General Precautions for Compressed Gas Usage

Observe the following precautions when using gas cylinders:

- Always use the proper Compressed Gas Association (CGA) coded fittings and valves.
- Do not tamper with safety equipment on compressed gas cylinders or systems.
- Use only soapy water to leak test systems.
- When working with oxidizers or highly toxic gases, leak test the system with inert gas before use.
- Keep cylinder valve accessible at all times while cylinder is in use.
- Before installing a regulator, inspect the regulator seat for foreign material. Check to see if a washer is required.
- Never oil regulators or valves.
- Always order returnable cylinders, regardless of type. Cylinder disposal is both difficult and expensive.

9.4.6 Installing a Regulator

Use the following procedure to install a gas cylinder regulator:

- Inspect cylinder valve outlet for damage and corrosion. Threads should appear smooth and no dents or gouges present.
- Replace worn or missing gaskets.
- Inspect regulator inlet and cylinder valve outlet for dirt and foreign matter. Remove contaminant with a clean, dry cloth, except in the case of oxygen, chlorine, and other oxidizing gases. In this case, return regulator, cylinder, etc., to manufacturer for proper cleaning. The presence of organic contamination in a pressurized oxidizer system can cause explosion. Special cleaning procedures must be employed.
- Make sure the regulator properly matches the cylinder valve outlet's CGA fitting. Adapters are not allowed under CSI policy.
- Tighten the regulator inlet connection with a flat-faced wrench, being cautious not to force or over tighten the threads. Observe the right-handed, or left-handed character of the threads and the presence of a gasket if required.

10.0 Cryogenic Materials

The extreme cold that is associated with cryogenic materials is the same property that makes them particularly hazardous to use. The cold temperatures (-60 degrees C to -270

degrees C) can damage living tissue on contact and embrittle structural materials.

10.1 Storage and Handling of Cryogens

- Cryogenic liquids that are liquefied under pressure must be kept in specially designed, high-pressure vessels that contain fittings to relieve pressure. Ice formation occurs when in contact with moist air, and can plug pressure release devices thus posing an explosion hazard. For this reason, store vessels in a dry place and periodically check for ice formation.
- Cryogenic liquids can present fire and explosion hazards. Liquid nitrogen can condense air to form oxygen-enriched liquid air. If flammable material is present, ignition or detonation can occur. This effect can occur when liquid nitrogen is used to cool a cold trap. If the coolant is still in contact with the trap after venting to the atmosphere, liquid air can condense and react violently with trapped organics in the trap.
- Store and work with cryogenics in a well-ventilated area. These materials can cause asphyxiation due to oxygen displacement. When working with large amounts of cryogenics, it is crucial to have oxygen sensor in the lab.
- Safety glasses and face shields should be used. The handling of cryogenic liquids requires the use of dry potholders or loose-fitting gloves (e.g., welding gloves). Exposed components at cryogenic temperatures can freeze skin to cold pipes or metal parts. Gloves need to be loose fitting so they can be thrown off readily if cryogen is spilled into them. This assures that the cryogen will not be trapped against the skin. Small spills of liquid nitrogen on the skin will evaporate without damage unless the liquid is trapped against the skin.
- Cushion glassware such as Dewar (vacuum) flasks in a protective covering or wrap with tape to prevent injury that may be caused by flying glass in the event of implosion or explosion.
- Transport fragile cryogenic containers with caution, using a hand truck or dolly.
- Cryogenic liquids can splash and boil when in contact with warm objects.

11.0 Personal Hygiene

11.1 General Work Practices

Safe laboratory work practices include the following:

- Confine long hair, loose clothing and jewelry in the laboratory.
- Never use mouth suction to pipette chemicals or start a siphon. Use a mechanical pipetter or an aspirator to provide vacuum.
- Avoid unnecessary or routine exposures to gases, vapors, and aerosols (dusts and mists). Use appropriate ventilation such as fume hood, or biological safety cabinet whenever inhalation exposure is likely. Respirators should only be used when engineering methods of exposure control are not available, or impractical. Contact EHS Office for assistance in selecting respiratory protection.
- Wash hands thoroughly with soap and water before leaving the laboratory area, even if you have been wearing gloves. Do not use solvents for washing skin.
- To prevent contamination, do not wear protective equipment such as gloves and

aprons outside the laboratory. Remove gloves before using the telephone, handling doorknobs, elevator buttons etc.

- Clean up work area at the end of the day and/or at the completion of a task. This is especially important when hazardous materials have been used.
- Never store food or beverages in refrigerators, glassware or utensils that are also used for laboratory operations.
- Do not eat, drink, smoke, chew gum, or apply cosmetics where chemicals or other hazardous materials (e.g. radioactive, or biohazard) are present, or used.
- Do not use deionized water for drinking purposes.

12.0 Housekeeping

12.1 General Work Practices

- All work areas must be kept clean and free from broken glass, leftover chemicals, papers and other obstructions. Cleanup must follow the completion of any process, any spill or at the end of each day. Spilled chemicals must be disposed using established procedures.
- Chemicals that are no longer needed should not be allowed to accumulate in the laboratory. Arrange for the redistribution of unneeded, but still useful chemicals through the Chemical Hygiene Officer to minimize waste (and disposal costs).
- Floors must be cleaned regularly and kept free of hazards and obstructions. Pick up spilled ice, glass beads, glass tubing, stoppers and other small items, as well as spilled liquids.
- Never use floors, stairways, hallways or service corridors as storage areas. Blocking doors or passages is unsafe and considered a violation of the fire code.
- Keep drawers, cabinet and entrance doors closed.

13.0 Safe Work Practices

13.1 Personal Conduct

- During off-hours, i.e. weekends, holidays, late night, no one is to work alone in laboratories where potential biological, chemical or physical hazards exist.
- No horseplay will be tolerated in laboratories or adjoining areas. This includes any improper activity that might create or constitute a hazard to anyone, such as fighting, practical jokes, unnecessary running or jumping, or similar distracting behavior.
- Chemicals are to be used in designated laboratories only. None are to be removed for unauthorized experiments, on or off campus.
- Transporting of open containers of chemicals through corridors, in elevators, or other public areas is prohibited. Laboratory carts, rubber bottle carriers or original shipping cartons must be used when transporting chemicals.

13.2 General Equipment Setup

- Before setup, make sure all work surfaces are clean and neat, and your apparatus

is clean.
- While working, keep larger pieces of equipment toward the rear of work area.
- Keep the floor free of apparatus, chemical containers and equipment at all times.
- Use supports under glassware and use cushioned clamps.
- If there is a danger of release of hazardous materials into the environment, design into your experiment or process appropriate containment, neutralization and/or conversion of these materials.
- Make sure that there are no ignition sources in the vicinity and that equipment and materials are properly bonded and grounded when using flammable liquids or gases. Do not heat flammable liquids over an open flame or electric hot plate. Use a heating mantle or steam bath; perform this operation in an operating fume hood.
- Keep the table top clean and uncluttered, and return stock containers to their proper storage locations to avoid "chain-reactions" in the work areas, should a mishap occur.

13.3 Selecting and Handling Glassware

- Wash glassware individually to prevent damage by bumping pieces together. Do not accumulate glassware in piles while awaiting washing.
- Carefully inspect glassware before use. Damaged items must be discarded or repaired.
- Make sure the type of glass, and the type, shape, and size of the glassware is appropriate to the process involved. Never use filter flasks or glass bottles for heating. When heating is required, round bottom flasks are preferred; Erlenmeyer flasks are suitable for only moderate heating.
- Always protect your hands when inserting thermometers or glass tubing into rubber or cork stoppers, placing rubber tubing on glass hose connections, or inserting pipettes into mechanical pipetters. This will prevent accidental injury from items breaking under strain.
- Handle vacuum jacketed glass apparatus, such as glass Dewar flasks, with extreme care to prevent implosions. Dewar flasks must be shielded or taped.
- Only glassware designed for vacuum must be used for that purpose.
- Allow at least 20% free space in your containers.

13.4 Using Heat or Flame

- When possible, use controlled electrical heaters or steam instead of gas burners. Do not use open flame or electric hotplates to heat flammables.
- When using a gas burner, protect glassware with ceramic centered wire gauze.
- If stirring is not used, place inert boiling stones in the liquid prior to heating. Do not use boiling stones in vacuum operations.

14.0 Inspections

It is the responsibility of all laboratory workers to inspect their work area for safety and health hazards on a continuous basis. Conditions to look for include (but are not limited to) slip and fall hazards, blocked exits and safety equipment, expended fire extinguishers,

inoperable fume hoods, and improper storage of incompatible chemicals. Report all unsafe conditions that are not immediately correctable to the Laboratory Supervisor, and the Chemical Hygiene Officer.

Laboratory Supervisors are required to routinely inspect laboratory areas, under their charge, for unsafe conditions. It is recommended that inspections be performed monthly, but shall not be performed less frequently than every 90 days. Laboratory inspections forms are available from the Chemical Hygiene Officer. A sample form appears in Appendix VII and may be copied as needed. Space is provided on the form for additional items specific to your laboratory. Laboratory Supervisors may delegate responsibility for inspection to a senior laboratory worker, but the form must be signed by the Supervisor upon completion. A file of completed inspection forms must be kept, and be stored in an accessible place in the laboratory.

The Chemical Hygiene Officer is responsible for coordinating the inspection of laboratories, in association with Laboratory Supervisor. He/She is responsible for reviewing the self-evaluation forms to assure the quality of the inspection program.

It is the responsibility of Principle Investigators and individual laboratory users to test eyewash stations in laboratories under their auspices on a monthly basis. Occupants of laboratories equipped with eyewashes are required to flush them for several minutes each month. Malfunctioning units must be reported to Buildings and Grounds and the Chemical Hygiene Officer immediately. EHS tests emergency showers in all public area at least annually.

15.0 Equipment Safety

- Electrical and mechanical equipment in the laboratory must be kept in proper working condition. Any signs of damage and excessive wear must be repaired according to the manufacturer or reasonable and customary practices. Do not modify any equipment in such a way as to remove or override any safety devices or systems.
- Do not string extension cords around the laboratory; keep cords off the floor in high traffic areas. Replace frayed electrical cords immediately.

16.0 Spill Procedures

FOR SPILLS GREATER THAN 1 LITER, CALL PUBLIC SAFETY (X-2111) THEY WILL CONTACT THE OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY (X-4300)

BEFORE PROCEEDING READ THESE INSTRUCTIONS CAREFULLY.
REFER TO THEM AGAIN, AS NEEDED, DURING THE CLEAN UP.

- If the materials have contacted eyes or skin, immediately wash using the nearest available eyewash or shower. Discard any contaminated clothing.
- Notify personnel in the immediate area to evacuate.
- Call the Office of Public Safety (x2111)
- If possible notify the Office of Environmental Health and Safety (x4300).
- Custodial Personnel are not trained to clean chemical spills.
- Spill clean-up materials are to be used by personnel competent in their use, and only for a minor spill. If you are not confident, or are unaware of the degree of risk **DO NOT** attempt a cleanup. Wait for the Chemical Hygiene Officer to respond before proceeding. Don protective coverall, gloves and goggles.
- If the spill is a solid (not water-reactive):
    a) Cover with wet paper towels. Do not dry sweep.
    b) For flammables – remove ignition sources.
    c) Ventilate area of spill.
    d) Carefully scoop materials to plastic bag.
    e) Wipe area with wet paper towels again.
    f) Neutralize as appropriate to the spilled material.
    g) Dispose of residue according to college disposal procedure.
- If the spill is a liquid (>1L):
    a) Evacuate personnel from the area of the spilled material. For volatile liquids, allow the area of the spill to ventilate. If the spill occurs in a fume hood, this is achieved by closing the hood sash. If volatile material is spilled in a laboratory, close all doors to corridors and adjacent spaces. In any other indoor area, isolate the spill by closing doors to adjacent areas. Close all exterior doors. Do not attempt to open windows, modify HVAC system, or take other extreme measures.
    b) For flammables spills – remove ignition sources if possible. Flames-extinguish all flames that might be in use by shutting gas supply. Electrical-Do not directly unplug electrical equipment as it can cause a spark, rather use the emergency electrical shut off located at the entrance of each laboratory. If not equipped with shut off consider using the power button on the electrical appliance.
    c) If you have the appropriate training, proceed as follows: Surround area with absorbent material (Lite-Dri, spill pillows, soda ash, sand, etc.) as appropriate. Note: Lite-Dri is not for use on strong acid or caustic materials; spill pillows are not for use on hydrofluoric acid spills.
    d) Carefully spread additional absorbent material onto chemical. Avoid splashing. Allow sufficient time for absorption.
    e) Carefully scoop bulk material into a plastic bag or other appropriate container.
    f) Dispose of residue according to college disposal procedure.

17.0 Laboratory Safety Information Resources

17.1 Literature

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18.0 Other Information Sources

CHEMTREC (Chemical Transportation Emergency Center)
Non-emergency: 800-262-8200 Emergency: 800 424-3900

National Institute for Occupational Safety and Health (NIOSH)
Workplace Hazards Hotline: 800 356-4674

U.S.E.P.A. Hazardous Waste Hotline: 800 424-9346

Appendix I – Glossary

Certificate of Fitness. A certificate issued by the Fire Department certifying that the person to whom it is issued has passed an examination or fulfilled educational and experience requirements to perform such tasks as are covered by the fire code.
Combustible Material. Combustible materials are those capable of igniting and burning. These materials have Tagliabue closed cup flash point above 100°F. Wood, paper and oil are good examples of such materials.
Explosive Material. Any Class A, B or C explosive as classified by the US Department of Transportation or the Fire Department of the City of New York.
Flammable gas. A gas which forms an explosive mixture with air. Utility gas piped to a laboratory is not considered a flammable gas for regulatory purposes by the Fire Department of the City of New York.
Flammable liquid. Any compound or mixture which emits a flammable vapor at temperatures below 100°F. That is, having a Tagliabue closed cup flash point less than 100°F.
Flammable solid. A solid substance, other than an explosive, which may cause fire through friction, absorption of moisture, spontaneously, or as a result of retained heat in a chemical reaction. (Examples: white phosphorous, metallic alkali metals, nitrocellulose).
Global Harmony System (GHS).
Hazard Communication Standard (HCS). A U.S. Dept. of Labor Occupational Safety and Health Standard available at 29CFR1910.1200 that protects employees from chemical and other recognized hazards in the workplace.
Laboratory. As defined by the Fire Department, a building, space, equipment or operation wherein testing, research or experimental work is conducted, and shall include laboratories used for instructional purposes.
Lethal Dose (LD50). Is the lethal dose that would cause death in 50% of a given pool.
Risk Assessment. The process by which activities are analyzed quantifying the probability of a harmful effect to individuals and worst case scenarios from said activities in an effort to plan and protect against such events.
Safety Data Sheet (SDS). Is a 16-section document focusing on the hazards of working with the material in an occupational setting.
Unstable (reactive) chemical. As defined by the New York City Fire Department, a substance, other than an explosive, which will vigorously 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: organic peroxides, nitromethane, and ammonium nitrate).

Appendix II – Peroxide-Forming Chemicals

The chemicals listed below can form explosive peroxide crystals on exposure to air, and therefore require special handling procedures after the container is opened. Some of the chemicals form peroxides that are violently explosive in concentrated solution or as solids, and therefore should never be evaporated to dryness. Others are polymerizable unsaturated compounds and can initiate an explosive chain reaction. The list is not complete, please consult chemical SDS.

A. Severe Peroxide Hazard with Exposure to Air (consume or discard within 3 months from opening)

Diisopropyl ether (isopropyl ether)
Vinylidene chloride (1, 1-dichloroethylene)
Sodium amide (sodamida)
Divinylacetylene (DVA)
Potassium metal*
Potassium amide

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)
Cumene (isopropylbenzene
Cyclohexene
Cyclopentene
Decalin (decahydronaphthalene)
Diacetylene (butadiene)
Dicyclopentadiene
Diethyl ether (ether)
Diethylene glycol dimethyl ether (diglyme)
Dioxane
Ethylene glycol dimethyl ether (glyme)
Ethylene glycol ether acetates
Ethylene glycol monoethers (cellosolves)
Furan
Methylacetylene
Methylcyclopentane
Methyl isobutyl ketone
Tetrahydrofuran (THF)
Tetralin (tetrahydronaphthalene)
Vinyl ethers
*Never attempt to scrape or cut the crusty material which forms on potassium metal.

Appendix III – Poisonous Gases

The gases on this list are either on the US Department of Transportation's Category 1 list, or the Linde Specialty Gases Company's Group 6 – Very Poisonous list. These chemicals are highly toxic gases at ambient temperature and pressure. They have an extremely high potential for causing significant harm if not adequately controlled.

Name	Formula
Arsine	AsH_3
Boron trichloride	BCl_3
Chlorine pentafluoride	ClF_5
Chlorine trifluoride	ClF_3
Cyanogen	NCCN
Cyanogen chloride	ClCN
Diborane	B_2H_6
Dinitrogen tetroxide	N_2O_4
Fluorine	F_2
Germane	GeH_4
Hydrogen selenide	H_2Se
Nitric oxide	NO
Nitrogen dioxide	NO_2
Nitrogen trioxide	NO_3
Nitrosyl chloride	NOCl
Oxygen difluoride	OF_2
Phosgene	Cl_2CO
Phosphine	PH_3
Phosphorus pentafluoride	PCl_5
Selenium hexafluoride	SeF_6
Stibine	SbH_3
Sulfur tetrafluoride	SF_4
Tellurium Hexafluoride	TeF_6
Tetraethyldithiopyrophosphate	$(C_2H_5O)_2P(S)\ (OC_2H_5)_2$
Tetraethylpyrophospate	$(C_2H_5)_4P_2O_7$

Before purchasing a gas on this list, please consider alternatives to its use, and discuss your plan with the Chemical Hygiene Officer.

Appendix IV – Shock Sensitive Chemicals

Classes of chemicals listed below may explode when subjected to shock or friction. Users must have appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

- *Acetylenic compounds*, especially ployacetylenes, haloacetylenes, and heavy metal salts of acetylenes (copper, silver, and mercury salts are particularly sensitive)
- *Acyl* nitrates
- *Alkyl nitrates*, particularly polyol nitrates such as nitrocellulose and nitroglycerine
- *Alkyl* and *acyl* nitrites
- *Alkyl* perchlorates
- *Amminemetal oxosalts*: metal compounds with coordinated ammonia, hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate, or other oxidizing group
- *Azides*, including metal, nonmetal, and organic azides
- *Chlorite salts* of metals, such as silver chlorite ($AgClO_2$) and mercuric chlorite ($Hg(ClO_2)_2$)
- *Diazo compounds* such as diazomethane (CH_2N_2)
- *Diazonium salts*, when dry
- *Fulminates*, such as mercury fulminate ($Hg(CNO)_2$)
- *Hydrogen peroxide* becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals.
- *N-Halogen compounds* such as difluoroamino compounds and halogen azides
- *N-Nitro compounds* such as N-nitromethylamine, nitrourea, nitroguanidine, and nitric amide
- *Oxo salts of nitrogenous bases*: perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.

- *Perchlorate salts* (which can form when perchloric acid mists dry in fume hoods or associated duct work. Most metal, nonmetal, and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials. See Note 1 below.)
- *Peroxides and hydroperoxides*, organic
- *Peroxides* (solid) that crystallize from or are left from evaporation of peroxidizable solvents (see Appendix II)
- *Peroxides*, transition-metal salts
- *Picrates*, especially salts of transition and heavy metals, such as nickel, lead, mercury, copper, and zinc
- *Polynitroalkyl compounds* such as tetranitromethane and dinitroacetonitrile
- *Polynitroaromatic compounds* especially polynitrohydrocarbons, phenols, and amines (e.g., dinitrotoluene, trinitrotoluene, and picric acid)

Note 1: Perchloric acid must be used only in specially-designed perchloric acid fume hood that have built-in wash down systems to remove shock-sensitive deposits. Before purchase, laboratory supervisors must arrange for use of an approved perchloric acid hood.

Appendix V – Pyrophoric Chemicals

The classes of chemicals listed below will readily oxidize and ignite spontaneously in air. Users must have the appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

Name	Formula (example)
Grignard reagents	RMgX
Metal alkyls and aryls	RLi, RNa, R_3Al, R_2Zn
Metal carbonyls	Ni $(CO)_4$, Fe $(CO)_5$, $Co_2(CO)_8$
Alkali metals	Na, K
Metal powders	Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn, Zn, Zr
Metal hydrides	NaH, $LiAlH_4$
Nonmetal hydrides	B_2H_6, PH_3, AsH_3
Nonmetal alkyls	R_3B, R_3P, R_3As
Phosphorus (white)	P

Appendix VI – Chemical Incompatibilities

This list is, by necessity, incomplete. It is suggested you consult the appropriate Material Safety Data Sheets or *Bretherick's Handbook of Reactive Chemical Hazards* for more complete information.

Acetylene and monosubstituted acetylene	Halogens, group IB & IIB metals and salts
Alkali metals (Na, K, etc.)	Carbon tetrachloride, Carbon dioxide, water
Ammonia & Ammonium hydroxide	Halogens & halogenating agents Silver, mercury (e.g. manometers)
Carbon, activated	Oxidizing agents
Hydrogen peroxide	Metals & salts
Nitric acid	Metals Sulfuric acid Sulfides, nitrites & other reducing agents Chromic acid & chromates Permanganates
Mercury & amalgams	Ammonia & Ammonium Hydroxide Nitric acid Acetylene Sodium azide
Oxalic acid	Silver, mercury
Phosphorus (yellow)	Oxidizing agents Strong bases
Phosphorus pentoxide	Water Halogenating agents
Sulfuric acid	Metals Chlorates & perchlorates Permanganates Nitric acid

Appendix VII – Laboratory Inspection Form

College of Staten island Laboratory Inspection Form

Date: Inspector:

Department: Bldg & Room Type

During Inspection: Occupied Unoccupied Lab Equipment Room Other

FDNY Operating Permit # Expiration Date:

C of F Y N Cert # Exp. Date: C of F Holder

Signs & Labels

Signs & Labels	Yes	No	N/A
Laboratory potentially hazardous substances FDNY			
Laser signage where needed			
Laboratory / no smoking, eating, drinking			
All Chemical containers labeled (primary and secondary)			
Appropriate signage on chemical storage areas (acids, oxidizers, etc.)			
Appropriate signage posted (flammable gas, water reactive, etc.)			
Non flammable refrigerators "store no flammables flashing below 100 F°"			
Emergency Contact numbers are posted			

Engineering Controls

Engineering Controls	Yes	No	N/A
Fume Hoods clear of excess storage			
Visual indicator of air flow (face velocity, monitor, gauge, Kim wipe)			
Total number of fume hoods ______ Commisioning tag present ______			
Face velocity ______ Date last tested ______			
Procedures conducted at least 6" inside the hood			
Large pieces of equipment raised to allow air flow			
Baffles and slots are clear and move when window position is changed			
Hood interior and exterior have not been modified by lab personnel			
Sash windows closed to smallest possible opening, intact and slide easily			
Total number of Biological Safety Cabinets ____ Certified within last year ______			
Hazardous chemicals used in non-ducted BSC			
Lab doors are kept close			

	Yes	No	N/A
Machine guarding			

Safety & Housekeeping

Safety & Housekeeping	Yes	No	N/A
Means of Egress unobstructed (free of slipping/ tripping hazard)			
Exits are clearly marked/ egress map			
Aisle space is free and unobstructed			
Secondary egress for spaces greater than 500 sq. ft.			
Sharps disposal in puncture-proof containers (disposed of when full)			
Hand washing facilities available (soap, paper towels, working sink)			
Food/drink consumed in lab			
CSI Chemical Hygiene Plan available			
Access to MSDS is readily available			
Proper attire in lab (no shorts, sandals, exposed skn) Appropriate PPE available/used			
Spill Kit available, accessible and marked			
Suitable eye wash station present and acessible where needed			
Eye wash station regularly tested. Date last tested ______			
Safety showers accessible/labeled and tested ______			
No storage within 18" of sprinklers			

Compressed Gas

Compressed Gas	Yes	No	N/A
Compressed gas cylinders secured/upright			
Compressed gas connections are in good condition and leak free			
Compressed gas cylinders are properly labeled			
Cylinder Hydrostatically tested within last 10 years			

Electrical Safety

Electrical Safety	Yes	No	N/A
Electrical cords in good condition			
Surge protector in use where more than one plug is used			
GFCI receptacles where needed (fume hood, sink, etc.)			
Grounded plug unaltered			
No extension cord as permanent wiring			
Instrinsically safe electrical equipment used in potentially explosive atmospheres			
Service panels unobstructed			

Chemical Storage	Yes	No	N/A
Chemical storage areas neat and clean			
All chemical are kept away from sink and drains			
Segregation of incompatible hazard classes			
Oxidizing acids segregated from contact with all other chemicals, metal surfaces, wood.			
Metal shelves protected from contact with acids and other corrosive materials			
Water reactive materials protected from contact with water			
Cold rooms free of flammables			
Non explosion proof, non flammable storage refrigerators free of flammables			
Glass bottles stored in cabinets or shelves			
Chemical containers intact and free of signs of deterioration			
Chemical container immediately recapped after use			
Flammable gases present only where ongoing procedure requires their use			
Flammable gases segregated from oxidizing gases by at least 25 feet			
Chemicals are stored on floor			
Chemical stock kept at necessary minimum			

Fire Safety

# of fire extinguishers _____ Date(s) last inspected _____			
Fire extinguishers mounted and accessible			
Flammable storage within allowable limit (FDNY)			
Peroxidable chemicals labeled with opening date/tested periodically			
Peroxidables disposed or tested by expiration date (1 year from open date)			
Fire extinguishers hydrostatically tested within last 5 years			

Hazardous Waste

Satellite Accumalation Area is established with signage			
Secondary containment used where needed			
All hazardous waste containers labeled with the words "Hazardous Waste"			
All containers legibly labeled with the full chemical or trade name (no abbreviations/formulas)			
Waste containers are in good condition			
All hazardous waste is segregated/ Secondary containment used where needed			
Efforts made to minimize hazardous waste. Waste removed regularly			

Training Requirements

Level A:	Level B:
Hazardous Waste Management (HWM)	Bloodborne Pathogens
Laboratory Safety (LS)	Radioation Safety (RS)

Personnel in Lab and Training Required	Yes	No	N/A

General comments (make note of general safety issues. Unique hazards i.e. lasers, radiation may require specific precautions)

March 2019

Appendix VIII – Standard Operating Procedures

Standard Operating Procedures must be developed for those operations, peculiar to your laboratory, which contain a component of risk to health, safety and or the environment. The Laboratory Supervisor or Principal Investigator is responsible for developing, with the assistance of the Chemical Hygiene Officer, a set of Standard Operating Procedures to be inserted at this point.

Appendix IX – Standard Operating Procedure for Chemical Waste Management

Note: this appendix is an adaptation form the college's Hazardous Waste Management Plan meant to be a quick reference for laboratory users See: CSI Hazardous Waste Management Plan for the full plan.

Containers

- Containers used for the collection of hazardous chemical wastes must be compatible with the substances they contain. Glass and plastic are appropriate for most laboratory waste. Compatibility of caps and cap-liners with the contents must also be considered. In order to minimize probability of incidents, only screw-on caps must be used.
- When reagent bottles, etc. are reused to store chemical waste, the original label must be removed or covered with a new label to avoid confusion as to the contents.
- Do not use containers previously used for consumer products, such as beverage and soap bottles, or food containers for chemical waste.

Labeling

- When a used or unused chemical has become a waste, it must be placed in a container which is labeled with the words "Hazardous Waste". If the material is to be reused, it must be labeled as such (e.g. "used alcohol for cleaning"), not "Hazardous Waste" or other types of waste.
- Preprinted "Hazardous Waste" labels are available from the Chemical Hygiene Officer.
- Labels must be clearly written, in English, avoiding abbreviations and structural formulae. Date the label with the first date material is added to it ("Start date").

Container Management

- Hazardous waste containers must be kept securely closed except when material is being added or removed. They must be in good condition, and not be corroded, leaking or covered with residue.
- When a container is kept next to a sink or drain, it must be stored in a secondary container (such as a deep tray, basin or tub).
- Containers of chemical waste must be segregated from other containers of incompatible chemical wastes.
- Arrange removal of containers immediately after they become full. No one is to remove waste chemicals from the laboratory other than the Chemical Hygiene Officer or his designee.

Defining Hazardous Chemical Wastes

- Wastes are considered hazardous waste if they appear on one of the lists published in the EPA regulation or if they meet one or more of the following criteria:
- Toxicity – EPA D list
- Ignitability – Flashpoint of less than 140° F
- Corrosivity – 2> pH >12
- Reactivity – Water reactive, cyanides, sulfides, etc.
- Chemicals, for which there is no immediate use, or have missing, obliterated or

corroded labels are considered to be “Inherently Waste-like.” Stored chemicals should be inspected regularly to determine if they will be used in the future. Unwanted or unusable chemicals should be declared as waste and sent for disposal, to avoid serious regulatory consequences.

EPA RCRA D-List

Maximum Concentration of Contaminants for the Toxicity Characteristic

HW #	Contaminant	CAS #	Regulatory level mg/L
D004	Arsenic	7441-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	200.0
D024	m-Cresol	108-39-4	200.0
D025	p-Cresol	106-44-5	200.0
D026	Cresol		200.0
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichlorobenzene	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	0.13
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	0.13
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200
D036	Nitrobenzene	98-95-3	2.0
D037	Pentachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	5.0
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0

D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400.0
D042	2,4,6-Trichlorophenol	88-06-2	2.0
D017	2,4,5-TP	93-72-1	1.0
D043	Vinyl Chloride	75-01-4	0.2

- Some materials which do not fit the traditional vision of Chemical Waste must be treated as such. Electronic devices (computers, CRT's, printed circuit boards), lamps (fluorescent, high intensity discharge, sodium or mercury vapor), thermometers, thermostats and batteries (wet and dry cell) all have special disposal requirements.
- Typical non-hazardous wastes are listed in the following table:

A. *Organic Chemicals*

Starch and sugars
Naturally occurring α-amino acids and salts
Citric acid and its Na, K, Mg, Ca, NH4 salts
Lactic acid and its Na, K, Mg, Ca, NH4 salts

B. *Inorganic Chemicals*

Sulfates: Na, K, Mg, Ca, Sr, , NH4
Phosphates: Na, K, Mg, Ca, Sr, NH4
Carbonates: Na, K, Ms, Ca, Sr, , NH4
Oxides: B, Mg, Ca, Sr, Al, Si, Ti, Mn, Fe, Co, Cu, Zn
Chlorides: Na, K, Mg
Fluorides: Ca
Borates: Na, K, Mg, Ca

C. *Laboratory Materials Not Contaminated with Hazardous Substances*

Chromatographic adsorbent
Filter paper and filter aids
Rubber and plastic protective clothing

Drain Disposal

Drain disposal of certain chemicals is permitted. Dilute, common mineral acids and dilute, common alkalies are permitted as long as solution is 5<pH<9. Only small quantities should be released into the drain and accompanied by copious amounts of running water.
Drain disposal of picric, perchloric or hydrofluoric acids and their salts are prohibited. See the Chemical Hygiene Officer for these.

- 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 waste baskets or dumpsters.

Other Laboratory Wastes

- Waste originating in Biological or Clinical Laboratories may fit the criteria for

"Regulated Medical Waste" as defined by state and local statute. Please see separate instructions for Biological/Regulated Medical Waste (appendix X).

- Sharps such as scalpels, razor blades, needles or broken glass, or any medical glassware, used or unused, must be collected in special "sharps containers" and disposed as biological waste.
- Empty bottles must be drained, internally rinsed three times with water or other appropriate solvent, and labels removed. They should then be boxed and labeled for transport, and disposal arranged with the Chemical Hygiene Officer.
- Disposal of radioactive materials must be in accord with the most recent Nuclear Regulatory Commission and N.Y. C. Department of Health guidelines. Disposal arrangements are to be made in advance of the ordering of material, in consultation with the Chemical Hygiene Officer and the Radiation Safety Officer.

Appendix X – Standard Operating Procedure for Biological Waste / Regulated Medical Waste

Note: this appendix is an adaptation form the college's Regulated Medical Waste Management Plan meant to be a quick reference for laboratory users See: CSI Regulated Medical Waste Management Plan for the full plan.

A host of regulations govern the handling of wastes originating in biological and clinical laboratories. It is the policy of the College to abide by the letter and spirit of these regulations to assure the safety and health of members of the College and local communities. Laboratory supervisors and workers are responsible for seeing that wastes originating in their laboratories are properly identified and disposed of legally. Under these regulations, the following are considered to be "Regulated Medical Waste":

- Cultures and stocks of infectious agents
- Human pathological wastes
- Waste human blood
- Animal parts and carcasses
- Used and unused laboratory sharps, including hypodermic needles, syringes, pasteur pipettes, broken glassware, scalpel blades, blood vials, test tubes, pins
- Dialysis wastes
- Laboratory wastes which may have been in contact with infectious agents

If you are a generator of material that may be characterized as Regulated Medical Waste, or if you have any question as to whether a material is considered Regulated Medical Waste, you must contact the Chemical Hygiene Officer (x3928). He will answer questions and provide you with instructions for preparing the waste for removal by the College's contractor. Mrs. Lynn McCarthy (x3957) will arrange for appropriate packaging materials for members of the Biology department. Under no circumstances are Regulated Medical Wastes to be included with ordinary trash or left in unsupervised storage rooms, public areas, loading docks, etc.

Handling Methods / Packaging Requirements for Biological Waste

Regulated Medical Waste (Biological waste) is to be segregated from other waste streams at its point or origin. Malodorous or putrescible waste must be refrigerated until arrangements for removal are made. The following **must never** be included with Regulated Medical Waste:

- Radioactive waste
- Hazardous chemical waste (i.e. toxic, corrosive, flammable, reactive or explosive)

All Regulated Medical Waste, except sharps, must be placed in a minimum of one 3 mil thick red polyethylene bag, sealed by tying or taping, and placed upright in a red plastic bag-lined carton or drum, labeled for the purpose. Containers must not have full vials or free liquids. The carton or drum must be sealed securely to avoid spillage or leaking of vapors.

Liquids, including body fluids, in many instances may be legally discharged into the public sewer system. Please contact the Chemical Hygiene Officer (x3928), in advance, to determine if this is the case. If the fluid cannot be discharged into the sewer system, it must be placed in a container with sufficient absorbent material to prevent leakage. Laboratory sharps must be stored in a puncture-proof container located in each laboratory. When full, contact the Chemical Hygiene Officer (x3928) for removal and replacement containers.

Appendix XI – Laboratory Biosafety Level Criteria

The following is extracted from Biosafety in Microbiological and Biomedical Laboratories, HHS Publication No. (CDC) 93-8395, U.S. Department of Health and Human Services, Public Health Services, Centers for Disease Control and Prevention and National Institutes of Health, 3rd Edition March 1993:

The essential elements of the four biosafety levels for activities involving infectious microorganisms and laboratory animals are summarized in Tables 1 and 2 (at the end of this appendix). The levels are designated in ascending order, by degree of protection provided to personnel, the environment, and the community.

Biosafety Level 1

BIOSAFETY LEVEL 1 is suitable for work involving well-characterized agents not known to cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment. The laboratory is not necessarily separated from the general traffic patterns in the building. Work is generally conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required nor generally used. Laboratory personnel have specific training in the procedures conducted in the laboratory personnel have specific training in the procedures conducted in the laboratory and are supervised by a scientist with general training in microbiology or a related science.

The following standard and special practices, safety equipment and facilities apply to agents assigned to Biosafety Level 1:

A. Standard Microbiological Practices

1 Access to the laboratory is limited or restricted at the discretion of the laboratory director when experiments or work with cultures and specimens are in progress.
2 Persons wash their hands after they handle viable materials and animals, after they handle viable materials and animals, after removing gloves, and before leaving the laboratory.
3 Eating, drinking, smoking, handling contact lenses, and applying cosmetics are not permitted in the work areas where there is reasonable likelihood of exposure to potentially infectious materials. Persons who wear contact lenses in laboratories should also wear goggles or a face shield. Food is stored outside the work area in cabinets or refrigerators designated and used for this purpose only.
4 Mouth pipetting is prohibited; mechanical pipetting devices are used.
5 All procedures are performed carefully to minimize the creation of splashes or aerosols.
6 Work surfaces are decontaminated at least once a day and after any spill of viable material.
7 All cultures, stocks and other regulated wastes are decontaminated before disposal by an approved decontamination method, such as autoclaving. Materials to be decontaminated outside of the immediate laboratory are to be placed in a durable, leak-proof container and closed for transport from the laboratory. Materials to be decontaminated at off-site from the laboratory are packaged in accordance with

applicable local, state, and federal regulations, before removal from the facility.
8 An insect and rodent control program is in effect.

B. Special Practices: None

C. Safety Equipment (Primary Barriers)

1 Special containment devices or equipment such as biological safety cabinet are generally not required for manipulations of agents assigned to Biosafety Level 1.
2 It is recommended that laboratory coasts, gowns, or uniforms be worn to prevent contamination or soiling of street clothes.
3 Gloves should be worn if the skin on the hands is broken or if a rash exists.
4 Protective eyewear should be worn for anticipated splashes of microorganisms or other hazardous materials to the face.

D. Laboratory Facilities (Secondary Barriers)

1 Each laboratory contains a sink for hand washing.
2 The laboratory is designed so that it can be easily cleaned. Rugs in laboratories are not appropriate, and should not be used because proper decontamination following a spill is extremely difficult to achieve.
3 Bench tops are impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
4 Laboratory furniture is sturdy. Spaces between benches, cabinets, and equipment are accessible for cleaning.
5 If the laboratory has windows that open, they are fitted with fly screens.

Biosafety Level 2

BIOSAFETY LEVEL 2 is similar to Level 1 and is suitable for working involving agents of moderate potential hazard to personnel and the environment. It differs in the (1) laboratory personnel have specific training in handling pathogenic agents and are directed by competent scientists, (2) access to the laboratory is limited when work is being conducted, (3) extreme precautions are taken with contaminated sharp items, and (4) certain procedures in which infectious aerosols or splashes may be created are conducted in biological safety cabinets or other physical containment equipment.

The following standard and special practices, safety equipment, and facilities apply to agents assigned to Biosafety Level 2:

A. Standard Microbiological Practices

1 Access to the laboratory is limited or restricted at the discretion of the laboratory director when experiments are in progress.
2 Persons wash their hands after they handle viable materials and animals, after removing gloves, and before leaving the laboratory.

3 Eating, drinking, smoking, handling contact lenses, and applying cosmetics are not permitted in the work areas. Persons who wear contact lenses in laboratories should also wear goggles or a face shield. Food is stored outside the work area in cabinets or refrigerators designated for this purpose only.
4 Mouth pipetting is prohibited; mechanical pipetting devices are used.
5 All procedures are performed carefully to minimize the creation of splashes or aerosols.
6 Work surfaces are decontaminated at least once a day and after any spill of viable material.
7 All cultures, stocks, and other regulated wastes are decontaminated before disposal by an approved decontamination method, such as autoclaving. Materials to be decontaminated outside of the immediate laboratory are to be placed in a durable, leak proof container and closed for transport from the laboratory. Materials to be decontaminated at off-site from the laboratory are packaged in accordance with applicable local, state, and federal regulations, before removal from the facility.
8 An insect and rodent control program is in effect.

B. Special Practices

1 Access to the laboratory is limited or restricted by the laboratory director when work with infectious agents is in progress. In general, persons who are at increased risk of acquiring infection or for whom infection may be unusually hazardous are not allowed in the laboratory or animal rooms. For example, persons who are immune-compromised or immunosuppressed may be at risk of acquiring infections. The laboratory director has the final responsibility for assessing each circumstance and determining who may enter or work in the laboratory.
2 The laboratory director establishes policies and procedures whereby only persons who have been advised of the potential hazard and meet specific entry requirements (e.g. immunization) enter the laboratory or animal rooms.
3 When the infectious agent(s) in use in the laboratory require special provisions for entry (e.g. immunization), a hazard warning sign incorporating the universal biohazard symbol is posted on the access door to the laboratory work area. The hazard warning sign identifies the infectious agent, lists the name and telephone number of the laboratory director or other responsible person(s), and indicates the special requirement(s) for entering the laboratory.
4 Laboratory personnel receive appropriate immunizations or tests for the agents handled or potentially present in the laboratory (e.g., hepatitis B vaccine or TB skin testing).
5 When appropriate, considering the agent(s) handled, baseline serum samples for laboratory and other at-risk personnel are collected and stored. Additional serum specimens may be collected periodically, depending on the agents handled or the function of the facility.
6 A biosafety manual is prepared or adopted. Personnel are advised of special hazards and are required to read and to follow instructions on practices and procedures.
7 Laboratory personnel receive appropriate training on the potential hazards

associated with the work involved, the necessary precautions to prevent exposures, and the exposure evaluation procedures. Personnel receive annual updates, or additional training as necessary for procedural or policy changes.

8 A high degree of precaution must always be taken with any contaminated sharp items, including needles and syringes, slides, pipettes, capillary tubes, and scalpels. Needles and syringes or other sharp instruments should be restricted in the laboratory for use only when there is no alternative, such as parenteral injection, phlebotomy, or aspiration of fluids from laboratory animals and diaphragm bottles. Plastic ware should be substituted for glassware whenever possible.

   A. Only needle-locking syringes or disposable syringe-needle units (i.e., needle is integral to the syringe) are used for injection or aspiration of infectious materials. Used disposable needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal; rather, they must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal. Non-disposable sharps must be placed in a hard-walled container for transport to a processing area for decontamination, preferable by autoclaving.
   B. Syringes which re-sheathe the needle, needle-less systems, and other safe devices should be used when appropriate.
   C. Broken glassware must not be handled directly by hand, but must be removed by mechanical means such as a brush and dustpan, tong, or forceps. Containers of contaminated needles, sharp equipment, and broken glass are decontaminated before disposal, according to any local, state, or federal regulations.

9 Cultures, tissues, or specimens of body fluids are placed in a container that prevents leakage during collection, handling, processing storage, transport, or shipping.

10 Laboratory equipment and work surfaces should be decontaminated with an appropriate disinfectant on a routine basis, after work with infectious materials is finished, and especially after overt spills, splashes, or other contamination by infectious materials. Contaminated equipment must be decontaminated according to any local, state, or federal regulations before it is sent for repair or maintenance or packaged for transport in accordance with applicable local, state, or federal regulations, before removal from the facility.

11 Spills and accidents which result in overt exposures to infectious materials are immediately reported to the laboratory director. Medical evaluation, surveillance, and treatment are provided as appropriate and written records are maintained.

12 Animals not involved in the work being performed are not permitted in the lab.

C. Safety Equipment (Primary Barriers)

   1 Properly maintained biological safety cabinets, preferably Class II, or other appropriate personal protective equipment or physical containment devices are used whenever:

      A. Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include centrifuging, grinding, blending,

vigorous shaking or mixing, sonic disruption, opening containers of infectious materials whose internal pressure may be different from ambient pressure, inoculating animals intra-nasally, and harvesting infected tissues from animals or eggs.

B. High concentrations or large volumes of infectious agents are used. Such materials may be centrifuged in the open laboratory if sealed rotor heads or centrifuge safety cups are used, and if these rotors or safety cups are opened only in a biological safety cabinet.

2 Face protection (goggles, mask, face shield or other splatter guards) is used for anticipated splashes or sprays of infectious or other hazardous materials to the face, when the microorganisms must be manipulated outside the BCS.

3 Protective laboratory coats, gown, smocks, or uniforms designated for lab use are worn while in the laboratory. This protective clothing is removed and left in the laboratory before leaving for non-laboratory areas (e.g. cafeteria, library, administrative offices, restrooms). All protective clothing is either disposed of in the laboratory or laundered by the institution; it should never be taken home by personnel.

4 Gloves are worn when handling infected animals and when hands may contact infectious materials, contaminated surfaces or equipment. Wearing two pairs of gloves may be appropriate; if a spill or splatter occurs, the hand will be protected after the contaminated gloved is removed. Gloves are disposed of when contaminated, remove when work with infectious materials is completed, and are not worn outside the laboratory. Disposable gloves are not washed or reused.

D. Laboratory Facilities (Secondary Barriers)

1. Each laboratory contains a sink for hand washing.
2. The laboratory is designed so that it can be easily cleaned. Rugs in laboratories are not appropriate, and should not be used because proper decontamination following a spill is extremely difficult to achieve.
3. Bench tops are impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
4. Laboratory furniture is sturdy, and spaces between benches, cabinets, and equipment are accessible for cleaning.
5. If the laboratory has windows that open, they are fitted with fly screens.
6. A method for decontamination of infectious or regulated laboratory wastes is available (e.g., autoclave, chemical disinfection, incinerator, or other approved decontamination system).
7. An eyewash facility is available.

Vertebrate Animal Biosafety Level Criteria

If experimental animals are used, institutional management must provide facilities and staff and establish practices which reasonably assure appropriate levels of environmental quality, safety, and care. Laboratory animal facilities in many ways are extension of the laboratory. As a general principle, the biosafety level (facilities, practices, and operational requirements) recommended for working with infectious

agents *in vivo* and *in vitro* are comparable. It is good to remember, however, that the animal room is not the laboratory and can present some unique problems. In the laboratory, hazardous conditions are caused by personnel or the equipment that is being used. In the animal room the activities of the animals themselves can introduce new hazards. Animals may produce aerosols, and they may also infect and traumatize animal handlers by biting and scratching.

These recommendations presuppose that laboratory animal facilities, operational practices, and quality of animal care meet applicable standards and regulations and that appropriate species have been selected for animal experiments (e.g., Guide for the Care and Use of Laboratory Animals, HEW Publication No. (NIH) 86-23, Rev. 1985, and Laboratory Animal Welfare Regulations – 9 CFR, Subchapter A, Parts 1,2 and 3).

Ideally, facilities for laboratory animals used for studies of infectious or noninfectious disease should be physically separate from other activities such as animal production and quarantine, clinical laboratories, and especially from facilities that provide patient care. Animal facilities should be designed and constructed to facilitate cleaning and housekeeping. Traffic flow that will minimize the risk of cross contamination should be considered in the plans. A “clean/dirty hall” layout is useful in achieving this. Floor drains should be installed in animal facilities only on the basis of clearly defined needs. If floor drains are installed, the drain trap should always contain water or a suitable disinfectant.

These recommendations describe four combinations of practices, safety equipment, and facilities for experiments on animals infected with agents which produce, or may produce, human infection. These four combinations provide increasing levels of protection to personnel and to the environment, and are recommended as minimal standards for activities involving infected laboratory animals. These four combinations, designated Animal Biosafety Levels (ABSL) 1-4, described animal facilities and practices applicable to work on animals infected with agents assigned to corresponding Biosafety Levels 1-4.

Facility standards and practices for invertebrate vectors and hosts are not specifically addressed in standards written for commonly used laboratory animals. The Subcommittee on Arborvirus Laboratory Safety of the American Committee on Arthropod-Borne Viruses serves as a useful reference in the design and operation of facilities using arthropods.

Animal Biosafety Level 1 (ABSL-1)

A. Standard Practices

1. Access to the animal facility is limited or restricted at the discretion of the laboratory or animal facility director.
2. Personnel wash their hands after handling cultures and animals, after removing gloves, and before leaving the animal facility.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human use are not permitted in animal rooms. Persons who wear contact lenses in animal rooms should also wear goggles or a face shield.
4. All procedures are carefully performed to minimize the creation of aerosols.
5. Work surfaces are decontaminated after use or after any spill of viable materials.
6. Doors to animal rooms open inward, are self-closing and are kept closed when experimental animals are present.
7. All wastes from the animal room are appropriately decontaminated, preferably by autoclaving, before disposal. Infected animal carcasses are incinerated after being transported from the animal room in leak proof, covered containers.
8. An insect and rodent control program is in effect.

B. Special Practices

1. The laboratory or animal facility director limits access to the animal room to personnel who have been advised of the potential hazard and who need to enter the room for program or service purposed when work is in progress. In general, persons who may be at increased risk of acquiring infection, or for whom infection might be unusually hazardous, are not allowed in the animal room.
2. The laboratory or animal facility director establishes policies and procedures whereby only persons who have been advised of the potential hazard and meet any specific requirements (e.g., immunization) may enter the animal room.
3. Bedding materials from animal cages are removed in such a manner as to minimize the creation of aerosols, and are disposed of in compliance with applicable institutional or local requirements.

4. Cages are washed manually or in a cage washer. Temperature of final rinse water in a mechanical washer should be 180 degrees F.
5. The wearing of laboratory coats, gown, or uniforms in the animal facility is recommended. It is further recommended that laboratory coats worn in the animal facility not be worn in other areas.
6. A biosafety manual is prepared or adopted. Personnel are advised of special hazards, are required to read and to follow instructions on practices and procedures.

C. Safety Equipment (Primary Barriers)

Special containment equipment is not required for animals infected with agents assigned to Biosafety Level 1.

D. Animal Facilities (Secondary Barriers)

1. The animal facility is designed and constructed to facilitate cleaning and housekeeping.
2. A hand washing sink is available in the animal facility.
3. If the animal facility has windows that open, they are fitted with fly screens.
4. Exhaust air is discharged to the outside without being recirculated to other rooms, and it is recommended, but not required, that the direction of airflow in the animal facility is inward.

TABLE 1 Summary of Recommended Biosafety Levels for Infectious Agents

Biosafety Level	Agents	Practices	Safety Equipment (Primary Barriers)	Facilities (Secondary Barriers)
1	Not known to cause disease in healthy adults.	Standard Microbiological Practices	None Required.	Open bench top sink required.
2	Associated with human disease, hazard = auto-inoculation, ingestion, mucous membrane exposure.	BSL-1 practice plus: Limited access; Biohazard warning signs; "Sharps" precautions; Biosafety manual defining any needed waste decontamination or medical surveillance policies.	Primary barriers= Class I or II BSCs or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials; PPEs: laboratory coats; gloves; face protection as needed.	BDL – 1 plus: Autoclave available.
3	Indigenous or exotic agents with potential for aerosol transmission; disease may have serious or lethal consequences.	BSL-2 practice plus: Controlled access; Decontamination of all waste; Decontamination of lab clothing before laundering; Baseline serum.	Primary barriers= Class I or II BCs or other physical containment devices used for all manipulations of agents; PPEs: protective lab clothing; gloves; respiratory protection as needed.	BSL-2 plus: Physical separation from access corridors; Self-closing, double-door access; Exhausted air not recirculated; Negative airflow into laboratory.
4	Dangerous/exotic agents which pose high risk of life-threatening disease, aerosol-transmitted lab infections; or related agents with unknown risk of transmission.	BSL-3 practices plus: Clothing change before entering; Shower on exit; All material decontaminated on exit from facility.	All procedures conducted in Class III BSCs or Class I or II BSCs in combination with full body, air-supplied, positive pressure personnel suit.	BSL-3 plus: Separate building or isolated zone; Dedicated supply/exhaust, vacuum, and decon systems;

Biosafety Level	Agents	Practices	Safety Equipment (Primary Barriers)	Facilities (Secondary Barriers)
1	Not known to cause disease in healthy human adults	Standard animal care and management practices, including appropriate medical surveillance programs.	As required for normal care of each species.	Standard animal facility: Non recirculation of exhaust air; directional air flow recommended.
2	Associated with human disease. Hazard: percutaneous exposure, ingestion, mucous membrane exposure.	ABSL-1 practices plus: limited access; biohazard warning signs; sharps precautions; biosafety manual; decontamination of all infectious wastes and of animal cages prior to washing.	ABSL-1 equipment plus primary barriers: containment equipment appropriate for animal species; PPEs: laboratory coasts, gloves, face and respiratory protection as needed.	ABSL-1 facility plus: autoclave available; hand washing sink available in the animal room.
3	Indigenous or exotic agents with potential for aerosol transmission; disease may have serious health effects.	ABSL-2 practices plus: controlled access; decontamination of clothing before laundering; cages decontaminated before bedding removed; disinfectant foot bath as needed.	ABSL-2 equipment plus: containment equipment for housing animals and cage dumping activities; Class I or II BSCs available for manipulative procedures (inoculation, necropsy) that may create infectious aerosols. PPEs: appropriate respiratory protection.	ABSL-3 facility plus: separate building or isolated zone; dedicated supply/exhaust, vacuum and decontamination systems; other requirements outlined in the text.
4	Dangerous/exotic agents which pose high risk of life threatening disease; aerosol transmission, or related agents with unknown risk of transmission.	ABSL-3 practices plus: entrance through change room where personal clothing is removed and laboratory clothing is put on; shower on exiting; all wastes are decontaminated before removal from the facility.	ABSL-3 equipment plus: maximum containment equipment (i.e., Class III BSC or partial containment equipment in combination with full body, air-supplied positive-pressure personnel suit) used for all procedures and activities.	ABSL-3 facility plus: separate building or isolated zone; dedicated supply/exhaust, vacuum and decontamination systems; other requirements outlined in the text.

Appendix XII – Unattended Operations

Whenever it is necessary to have unattended operations occurring in a lab, it is important to ensure that safeguards are put into place in the event of an emergency. Laboratory personnel are strongly encouraged to adhere to the following guidelines when it is necessary to carry out unattended operations. The guidelines were taken from Appendix A of OSHA standard 29 CFR1910.1450 and/or *Prudent Practices in the Laboratory.*

For unattended operations involving highly hazardous materials, a light should be left on and an appropriate warning/explanation sign should be placed on the laboratory door or in a conspicuous place that could be easily seen without putting someone else in danger in the event of an emergency. The warning sign should list the following information:

- The nature of the experiment in progress.
- The chemicals in use.
- Hazards present (electrical, heat, or explosion.)
- The name of the person conducting the experiment and a contact number as well as a secondary name and contact number (most likely the P.I.).

When setting up an experiment that will be left unattended, try to anticipate potential incidents that could occur if something went wrong. For example:

- Use secondary containment such as trays to contain any spills that may occur.
- Use safety shields and keep the hood sash low to contain chemicals and glass in case an explosion occurs.
- Remove any chemicals or equipment that are not necessary for the experiment or items that could potentially react with the chemicals or other materials being used in the experiment.
- Whenever possible, use automatic shutoff devices to prevent accidents such as loss of cooling water shutoff or over-temperature shut off.
- Use emergency power outlets for those pieces of equipment that could be negatively affected in the event that utilities are interrupted.
- Equipment should always be inspected to ensure that it is in proper working order prior to leaving an experiment unattended.

It is the responsibility of P.I.s and laboratory supervisors to ensure that procedures for unattended operations are developed and followed by personnel working in laboratories under their supervision. The P.I. should be aware at all times of all work being performed in his/her respective laboratory.

Appendix XIII – Laboratory Incident Report Form

LABORATORY INCIDENT REPORT

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

Date___/___/___ Dept._____

Name_____ Phone # (….-…..-…….)

Note: **Return after completion To Room …….**
Copies of this form may be obtained from Office of Environmental Health & Safety

Date, Time and Place of incident
_____

Name of Injured person
_____

1. Summary of Incident and aid rendered
_____
_____
_____
_____
_____
_____
_____
_____

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

3. What was the first indication you had an incident/near miss?

_____
_____
_____
_____

4. What did you observe? How did you respond?

_____
_____
_____
_____
_____
_____
_____

5. Was the proper equipment available/functional to respond to this incident (e.g. Eye wash station/shower, fire extinguisher, spill response equipment, first aid kit)?

_____
_____
_____
_____

6. Were Emergency Contact phone numbers posted?

_____

7.Comments_____
_____
_____

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

_____
_____

Signature_____

Appendix XIV – Food Consumption and Cosmetics Use in Laboratories

Chemical exposure can occur through ingestion of food or drink contaminated with chemicals. This type of contamination can occur when food or drinks are brought into a lab or when food or drinks are stored in refrigerators, freezers, or cabinets with chemicals. When this occurs, it is possible for the food or drink to absorb chemical vapors and thus lead to a chemical exposure when the food or drink is consumed. Eating or drinking in areas exposed to toxic materials is prohibited by the OSHA Sanitation Standard, 29 CFR 1910.141(g)(2).

A similar principle of potential chemical exposure holds true with regard to the application of cosmetics (make-up, hand lotion, etc.) in a laboratory setting. Cosmetics have the ability of absorbing chemical vapors, dusts, and mists from the air and when applied to the skin can result in skin exposure to chemicals.

To prevent exposure to hazardous chemicals through ingestion, do not eat, drink, chew gum, or apply cosmetics in areas where hazardous chemicals are used. Wash your hands thoroughly after using any chemicals or other laboratory materials, even if you were wearing gloves, and especially before eating or drinking.

To help promote awareness, refrigerators, freezers, microwave ovens, and food processors should be properly labeled. For example, refrigerators for the storage of food should be labeled, “Food Only, No Chemical” or “No Chemicals or Samples.” Refrigerators used for the storage of chemicals should be labeled “Chemicals Only, No Food.”

Keep in mind that some chemical exposure can result in immediate effects (acute exposure) while other effects may not be evident for some time despite repeated exposure (chronic exposure). Consuming food or drink or applying cosmetics in the lab can result in both types of exposure.