ADVANCED SCIENCE RESEARCH CENTER CHEMICAL HYGIENE PLAN

Thomas Dickson

ASRC - CUNY GRADUATE CENTER

Table of Contents

Introduction

The following Chemical Hygiene Plan (CHP) has been developed for the Advanced Science Research Center (ASRC) in accordance with the requirements of the US Occupational Safety and Health Administration (OSHA) standard for "Occupational Exposures to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450). The plan is intended to assist those responsible for research-related activities in laboratories to safely store, use, and dispose of hazardous chemicals in accordance with OSHA and other applicable regulations. In addition to the OSHA Laboratory Standard, these regulations include the New York City Fire Department code and rule sections for Non-Production Chemical Laboratories, the Environmental Protection Agency (EPA) Hazardous Waste disposal requirements, and other applicable federal, state and local regulations. This plan is not intended to be a substitute for the actual regulations but rather as a set of policies and procedures to facilitate safety and compliance. Ensuring that these policies and procedures are put into practice is the responsibility of those in administrative positions as well as affected faculty, principal investigators, researchers, and technical staff. It is essential that all responsible individuals become familiar with this plan, attend training sessions, and seek additional advice when needed. Applicable sections of the CUNY's Laboratory Safety Manual should also be consulted (http://www2.cuny.edu/research/student-resources/laboratory-safety-manual/).

CONTACT CCNY PUBLIC SAFETY (212- 650- 7777) and 911 IN ANY EMERGENCY THAT REQUIRES IMMEDIATE POLICE, FIRE, OR MEDICAL RESPONSE

Emergency Numbers to report a Hazardous Material Spill:

During Business Hours (M-F 9am-5pm.);	917- 414-4608
Off-Hours - Contact CCNY Public Safety;	212- 650- 7777
First Aid/Medical Assistance	212- 650- 7777

1 Chemical Hygiene Responsibilities

The OSHA Laboratory Standard requires the designation of a Chemical Hygiene Officer to coordinate and provide technical guidance on the implementation of the Chemical Hygiene Plan. The Executive Director, along with other ASRC administrators, will provide continuing support for the institution's chemical hygiene plan. Area Directors, principal investigators, and other laboratory supervisors are responsible for laboratory safety and chemical hygiene within their respective areas. A self-inspection checklist (see Appendix K) can be used to periodically monitor compliance.

1.1. Chemical Hygiene Officer (CHO)

The Environmental Health and Safety Officer serves as the Chemical Hygiene Officer for the ASRC. He/she monitors mandated health and safety practices and makes appropriate recommendations to prevent injury and to minimize exposure to hazardous chemicals.

1.1.1 The major duties of the Chemical Hygiene Officer are:

- Coordinate compliance with regulatory mandates pertaining to laboratories and storage areas.
- Serve on the Environmental Health and Safety (EHS) Committee and work with administrators and other employees to develop and implement appropriate chemical hygiene and safety policies and practices.
- Provide technical expertise and administrative support to the laboratory community in areas of laboratory safety and health, and direct inquiries to appropriate resources.
- Conduct semiannual inspections of laboratories and storage areas. Perform walkthroughs with other members of the ASRC EHS Committee at least annually. Assist laboratory supervisors and principal investigators in conducting routine inspections of their areas.
- Write inspection reports and recommend follow-up activities.
- Monitor the proper operation of fume hoods, emergency safety showers and eyewashes in laboratories and storage areas.
- Coordinate laboratory health and safety training for lab staff and assist lab supervisors in developing and conducting lab specific training for their employees.
- Investigate laboratory safety incidents, hazardous material spills, and recommend procedures to prevent repeat occurrences.
- Act as liaison with regulatory agencies/departments. If necessary, bring unresolved and potentially serious health and safety problems to the ASRC administration's attention.
- Obtain and maintain records and make them available to employees, administrative personnel and regulatory agencies as required.
- Select qualified and licensed hazardous waste disposal vendors to routinely pick-up waste materials. Coordinate hazardous waste collection, storage, and removal with ASRC laboratory/facility representatives.

1.2. **Environmental Health and Safety (EHS) Committee**

1.2.1 The ASRC EHS Committee helps to implement and monitor the effectiveness of the Chemical Hygiene Plan and revises and updates it as necessary.

1.2.2. The committee consists of the EHS Officer, the Operations Director, the Facilities Director, and designees from each research/core area in which activities involve the use of hazardous materials. Campus Public Safety and Facilities representatives should attend meetings when their involvement is needed.

1.2.2. The duties of the EHS Committee are:

- Annually review and update the Chemical Hygiene Plan.
- Review safety protocols and determine if appropriate controls and equipment are available to protect employees.
- Review inspection reports and recommend action to correct conditions not in compliance with applicable regulations or generally accepted standard laboratory practices.
- Review plans for renovation or construction projects affecting safety or chemical hygiene of laboratories or storage areas. Make appropriate recommendations relative to health & safety.
- Offer advice and assistance on implementation issues and other problems as they may arise.
- Bring unresolved health & safety issues to the attention of the EHS/Chemical Hygiene Officer.

1.3. **Research Directors**

1.3.1 Each Director is responsible for chemical hygiene in his/her area and must know and understand the goals of the Chemical Hygiene Plan.

1.3.2 Duties of the Director

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

- The maintenance of a current inventory of all chemicals in storage rooms and laboratories in their respective areas, updated at least annually.
- The identification for disposal of all expired and unusable chemicals.
- The availability of SDS (safety data sheets) for all chemicals in their respective areas.
- The training of all laboratory staff and personnel.
- Ensure that the required personal protective equipment is available and properly used.

1.4. Faculty Members (Principal Investigators) and Laboratory Supervisors

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

1.4.1 Duties of Faculty Members (Principal Investigators) and Lab Supervisors:

- Know and implement the guidelines and procedures of the Chemical Hygiene Plan.
- Develop written safety procedures specifically applicable to their research areas. Train laboratory staff in these specific safety operating procedures and in the use of proper control measures. Maintain records related to training and Standard Operating Procedures (SOP's).
- Conduct routine inspections pertaining to safety and health.
- Supervise the laboratory to ensure that safe practices and engineering controls are properly utilized.
- Report all safety incidents to the EHS/Chemical Hygiene Officer and file a written Incident Report (See Appendix A: Safety Incident Report Form).
- Maintain a current inventory of chemicals with SDS for each one made available. The current system is Safety Stratus.
- Obtain and maintain a NYC Fire Department Certificate of Fitness for Supervising Chemical Laboratories (C-14).

The NYC Fire Department requires that each individual in charge of a chemical laboratory obtain a C-14 Certificate of Fitness. The EHS/Chemical Officer will provide assistance in this area.

The fact researchers work atypical hours at ASRC. Means a proper C14 holder may not always be always present while work occurs. Therefore, all researchers must get trained in the FDNY C14 regulations and apply for the C14 Certificate of Fitness to maintain compliance. The following are exceptions to this requirement:

1. **Visitors**
2. **Undergraduate students**
3. **Short term research**

*****In these cases, a C14 holding supervisor must be present in the laboratory. They cannot be in the lab without supervision.*****

1.5. Laboratory and Research Staff

Laboratory staff are individuals who, during their assignments, may routinely work with or around hazardous substances. These include laboratory technicians, researchers, graduate assistants, and part-time and temporary staff.

1.5.1 Duties of Lab and Research Staff:

- Follow safety rules/procedures and guidelines outlined in the Chemical Hygiene Plan, Safety Data Sheets, CUNY Laboratory Safety Manual, and other applicable safety documents.

- Report unsafe working conditions and practices, faulty fume hoods, faulty or outdated emergency safety equipment and other building deficiencies or incidents to the Laboratory Manager, Principal Investigator, Area Director, or EHS/Chemical Hygiene Officer.

- Attend all required health and safety training sessions.

- Confidentially notify supervisor of any pre-existing or new health condition (including pregnancy) which may be affected by working with hazardous substances in the laboratory.

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

2.1. OSHA Laboratory Standard Requirements

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

2.2. Signs

The New York State (NYS) Department of Labor (DOL) right–to-know and safety posters will be posted (where notices are normally posted) to inform employees that they have the right to information about toxic substances in the workplace. Hazard identification signs must also be affixed on/to entrance doors where materials that constitute an unusual or severe hazard are used or stored. This includes unstable, toxic, radioactive, carcinogenic, pathogenic, water reactive or cryogenic materials.

In addition, emergency contact information and emergency equipment must be clearly marked to facilitate ready access in case of an emergency.

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

2.2.1 Laboratory - Caution: Hazardous Materials

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

2.2.2 No Smoking

A “No Smoking" sign must be posted at the entrance to storage areas and laboratories.

2.2.3 Emergency Equipment and Exit Identification

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

2.2.4 Emergency Telephone Numbers

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

2.2.5 Special Hazards

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

- Water reactive chemicals
- Flammable or poisonous gases
- Radioactive materials

- Bio-hazardous materials
- Lasers
- Magnetic Field Producing Equipment

2.2.6 Flammable Storage Cabinets and Refrigerators

The local fire regulations require that the sign "Store no flammables flashing below 100°F" (37.8 degrees C) be posted on all non-explosion proof refrigerators and walk-in cold rooms.

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

2.3. **Labels**

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

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

The OSHA Laboratory Standard requires that labels on all incoming containers be maintained and not defaced. Do not deface or remove a label until all material originally contained has been used/discarded according to regulations and the container has been decontaminated. Portable containers used by more than one person or left overnight must be labeled with chemical name, manufacturer, and hazard warning (e.g., Acetone/Sigma/Flammable). Hazard information can be found on the original label or in the Safety Data Sheet.

2.3.1 Inspection of Container Labeling

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

All employees involved in unpacking chemicals are responsible for inspecting each container to ensure that it arrives properly labeled and that the original labels were not altered or removed. When there is a problem with an incoming product label, the EHS/Chemical Hygiene Officer must be contacted. Shipments of improperly labeled products are to be rejected.

2.3.2 Newly Synthesized Chemicals

Principal investigators (faculty members) in research laboratories are responsible for ensuring that newly synthesized chemicals are used only under appropriate conditions and are properly labeled (chemical name,

date of synthesis, expiration date (if any). If the hazards of a substance produced in the laboratory are unknown, it must be assumed to be hazardous, and the label must indicate that the potential hazards of that substance have not been tested and are unknown. The principal investigator should develop a preliminary Safety Data Sheet (following OSHA template in 29 CFR 1910.1200, Appendix D) at the earliest opportunity, and add to it, as more properties of the chemicals become known.

2.4. **Safety Data Sheets**

The OSHA Laboratory Standard requires that Safety Data Sheets (SDS) are collected and maintained for all chemicals used and stored. (See Appendix C for a description of what information is included in a SDS).

2.4.1 Availability of SDS

SDSs shall be made readily available to laboratory personnel either as hard copies (i.e., kept in a binder) and/or electronic file. In addition, access to safety information and links to SDSs for specific chemicals will also be available via the chemical inventory management software, where available.

2.4.2 Each laboratory shall have access to chemical inventory and SDS for each chemical currently used or stored at that specific location. The EHS/Chemical Hygiene Officer should be contacted if assistance is needed with SDS access.

2.4.3 The EHS/Chemical Hygiene Officer shall act as the designated inventory management software administrator for the ASRC, provide and manage user access to inventory database and safety information, and maintain an updated and location-specific master inventory of all chemical safety data sheets (SDS) for fire safety response planning purposes.

2.4.4 The current Chemical Inventory management system used at ASRC is the Safety Stratus Program. All laboratory users need to be familiar with its use to ensure access to Safety Data Sheets if hard copies are not readily available.

3 Chemical Inventory, Procurement and Receiving

3.1. Chemical Inventories

The EHS/Chemical Hygiene Officer shall assist in maintaining an inventory of all chemicals stored in the laboratories and chemical storage rooms. The EHS/Chemical Hygiene Officer will provide training on the current Safety Stratus Chemical Inventory Program. Each Research Director shall designate an individual to maintain his/her area's chemical inventory in the centralized inventory system. The inventory data shall consist of at least the following data:

- Chemical Name
- Chemical Abstract Service (CAS) registry number of the chemical
- Chemical manufacturer
- Amount of chemical (No of units and unit size)
- Date received (if applicable)
- Expiration date (if applicable)
- Storage location (room number)

3.1.1 Each laboratory's chemical inventory must be kept up to date. This inventory is needed to fulfill regulatory reporting requirements such as the annual NYC DEP Community Right to Know Tier 2 reports. The chemical inventory may also be needed when responding to an emergency such as a fire, flood, steam leak, etc.

3.1.2 Chemicals in storage must be evaluated for deterioration, containers, and label integrity, etc. at least every 6 months. Chemicals whose storage limits are about to expire must be marked for destruction or disposal or, if warranted, given a new expiration date. Particular attention must be paid to unstable chemicals such as peroxide formers. These must be dated when received and when opened, plus assigned an expiration date (See Appendix E).

3.1.3 No unstable reactive chemical whose shelf life has expired may be handled or moved by any laboratory employee taking inventory until the EHS/Chemical Hygiene Officer is contacted. It is better to be overcautious under these circumstances. Especially with peroxide formers and/or reactive chemicals.

3.2. Chemical Procurement

Prior to ordering any hazardous material, consideration must be given to the safety requirements for its use, storage, and disposal. Only Principal Investigators authorized by the EHS Office/Radiation Safety Officer (RSO) and on the ASRC Radioactive Materials License may order radioisotopes.

3.2.1 Procedures Required for Purchasing Chemicals

- Before any Particularly Hazardous Substance is ordered (such as carcinogens, reproductive hazards, or acutely toxic substances), consideration must be given to the adequacy of facilities and availability of equipment to safely handle its type and quantity. Consideration should also be given to whether a less hazardous material can be used. (See Appendix B).

- Check chemical purchases against the chemical inventory to reduce duplicate purchases and stock buildup. Efforts should be made to limit the purchase of chemicals to the amount needed. When large amounts are purchased, significant portions may remain unused and eventually require disposal. The lesser unit cost for bulk purchases is outweighed by the cost of additional storage and disposal of unused materials. ASRC wants to prevent unwasted chemical waste and associated costs.

3.3. **Chemical Receiving**

- Upon arrival at the ASRC, the mailroom will send the unopened chemical container(s) to the laboratory/unit area. Recipient must check the integrity of the chemical containers before placing them in the appropriate storage location.

- Maintain a copy of the SDS.

- Hazard/safety labels must not be defaced. Containers must be kept in good condition.

- Leaking containers must immediately be placed in an appropriate secondary container and treated as a chemical spill (See Section 9).

- Peroxide-forming chemicals should arrive with expiration dates assigned. If there is no date, an expiration date should be assigned, no later than one year after the date of acquisition (See Appendix E).

- The EHS/Chemical Hygiene Officer and site-specific chemical inventory must be kept current with any incoming chemicals for each laboratory or stockroom. The use of the Safety Stratus program is key to compliance with this.

- While inventorying chemicals as they are received, it is optional for labs to barcode their chemicals. As it is prudent practice for managing chemicals throughout their use, the EHS Office maintains it us more important to have a proper up to date inventory.

4 Chemical Storage

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

4.1. General Storage of Laboratory Chemicals

General storage of chemicals is currently restricted to following locations:

- Chemical storage rooms, inside safety cabinets
- Designated storage cabinets in the laboratory

4.2. Storage of Chemicals in Laboratories

NYC Fire Department regulations restrict the amount of flammables, oxidizing, and unstable reactive chemicals that can be stored in laboratories at any time as per the table below. If your lab needs to go over these limits the Linear Equipment Chemical Storage rooms are the appropriate place for these chemicals.

Old Fire Code

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

New fire code

The modifications of the new fire code were primarily made to restrict the maximum allowable storage limitations for flammable and combustible liquids as permitted in NFPA 45. Following the new fire code, all non-production laboratories would be classified as Class “D” and Class “B” laboratories. For Class D laboratories, the new fire code keeps flammable and combustible liquid densities (in gallons per square foot) to a minimum while potentially allowing for up to 200 gallons of flammable and combustible liquids if certain requirements are met. For the Class B laboratories, the new fire code allows substantially increased flammable and combustible liquid densities (more gallons per square foot) but at the same time mirrors the maximum 30-gallon limit set forth in the old Rule.

Table I-2. Non-production Laboratory Classification in New Fire Code

Lab Class	Fire Rating	Fire Protection	Flammable & Combustible Liquid Density	Flammable & Combustible Liquid Limit
B	1 or 2 hours	Sprinklers	Up to 20 gal/100ft^2	Up to 30 gal
D	1 or 2 hours	Sprinklers	Up to 2 gal/100ft^2	Up to 200 gal

- ❖ Most of ASRC Labs are designated Class D Status and the max amount of flammables allowed is 75 gallons.
- ❖ The Chemical Storage rooms are the location where excess flammables must be stored and the max amount allowed is 300 gallons.

* In accordance with the new building code, laboratory units shall be provided throughout with an automatic sprinkler system.

Note: Educational and instructional labs and labs in health care occupancies shall comply with Class D requirement only.

FDNY permits issued for certain types of laboratory areas and storage rooms may also indicate the maximum quantity of certain type(s) of hazardous materials (e.g., flammable & combustible liquids) allowed in those locations. Consult with the EHS/Chemical Hygiene Officer about applicable storage limits for a particular area.

4.3. General Requirements for Laboratory Storage

4.3.1 Chemicals should have a designated storage location and be returned to that location after use.

4.3.2 A storage scheme must be developed in each laboratory and chemical storage area to insure the proper segregation of incompatible chemicals. Segregate and store chemicals according to hazard class and not based solely on alphabetizing. **See Appendix I for a partial list of Incompatible Chemicals. Specific incompatibilities of a particular chemical or compound are listed in the SDS.**

4.3.3 The storage of chemical containers on bench tops and in fume hoods must be minimized to prevent accidental spillage and reduce the risk of fire. Take what you need for the experiment and put the chemical container back in storage prior to initiating an experiment.

4.3.4 Compatible chemicals should also be grouped by container size to make it easier to retrieve chemicals and to reduce the possibility of bottle breakage. Large containers should be stored on lower shelves. Corrosives should not be stored above eye-level.

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

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

4.3.7 Reactive chemicals must be stored in accordance with the manufacturer's recommendations. Consult the SDS for information regarding appropriate storage.

4.3.8 Avoid storing chemicals on the floor. If necessary, use storage trays with retaining edges to minimize the spread of a spill. Hazardous waste must be stored in secondary containment (trays) at all times.

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

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

4.3.11 Date received and date of initial opening must be noted on the label affixed to each chemical container in the following groups when first opened by the laboratory employee using them:

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

4.3.12 Expiration dates must be assigned to the above chemicals. When provided, the manufacturers' expiration date should be displayed. Peroxide forming materials must be dated when received, dated when opened and tested routinely for peroxides with the test date noted**. See Appendix E for a listing of common peroxide-forming chemicals and applicable safety pre-cautions.**

4.3.13 All laboratory personnel, on notice of retirement, transfer, graduation, or departure must, in conjunction with the laboratory supervisor and EHS/Chemical Hygiene Officer, arrange for the removal or safe storage of all hazardous materials remaining in their laboratory. **See Appendix J: Procedure for Laboratory Clean-out of Hazardous Materials.**

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

4.4. Storage Requirement for Specific Hazard Classes of Chemicals

4.4.4 Flammable Liquids

- Flammable liquids should not be purchased in containers larger than 5 gal.
- Containers of flammable liquids in the laboratory must be stored in designated fire-retardant storage cabinets.

4.4.2 Flammable and Other Compressed Gases

- The names of compressed gases must be prominently posted.

- Use the smallest quantities possible.

- Storage of flammable gases in laboratories is not permitted, except for those gases being used. No more than what is minimally required should be present in the laboratory but at no point shall the total amount exceed the following:

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

Cylinders of incompatible gases must be segregated by distance. Oxygen cylinders must be stored at least 20 feet away from hydrogen or other flammable gases, or in a storage area separated by a firewall five feet high with a fire rating of half hour.

- Cylinders must be grouped by the type of gas (e.g., toxic, corrosive, flammable etc.)

- Empty cylinders should be separated from non-empty cylinders and labeled “empty”.

- All compressed gases must be stored away from direct or localized heat (including radiators, steam pipes, or boilers), in well-ventilated and dry areas and away from areas where heavy items may strike them (e.g., near elevators or service corridors).

- All compressed gases, including empty cylinders, must be secured in an upright position with chains, straps or special stands and must be capped when stored or moved.

- A gas cylinder hand truck must be available for transporting gas cylinders to and from storage areas. In addition, all cylinders must be properly capped and secured prior to transporting.

- Cylinders past their 10-year hydrostatic test date must be returned to the vendor or disposed of. The hydrostatic date is stamped onto the cylinder by the valve.

4.4.3 Oxidizers

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

Some examples are:

- Hydrogen peroxide (> 8%)

- Calcium hypochlorite

- Magnesium perchlorate

- Chromic acid

- Nitric acid

- Sodium peroxide
- Perchloric acid
- Silver nitrate
- Sodium chlorate

Some oxidizers (NFPA Class 4) can undergo explosive reactions when catalyzed or exposed to heat, shock, or friction, so must be physically separated from other chemicals. **See Appendix G: Oxidizers.**

4.4.4 Storage considerations for oxidizers:

Oxidizers must be stored away from incompatible materials such as:

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

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

Examples are:

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

4.4.5 Inorganic acid storage

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

4.4.6 Unstable Reactive Chemicals.

Restrict the amount of unstable reactive chemicals to only that which is immediately required. The NYC Fire Code Chapter 33 defines UNSTABLE (REACTIVE) MATERIAL as “A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose,

condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials."

4.4.7 Peroxides.

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

4.4.7.1 Storage Temperature Considerations

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

4.4.8 Highly Toxic/Particularly Hazardous Substances

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

- These chemicals must be stored in unbreakable chemically resistant secondary containers to prevent breaks and spills.

- Adequate ventilation must be provided in storage areas, especially for toxic substances that have a high vapor pressure.

- All dispensing of these materials must be conducted in a fume hood.

- Empty containers with leftover residue will be handled and disposed of as being full unless properly rinsed and the rinsed-out material is collected and properly labeled for disposal. If not just label the bottle properly and put it in satellite accumulation waste area for pickup.

5 Handling Chemicals

5.1. Laboratory Hazard Evaluation

5.1.1 Assessment of Protocols and Experiments

- All laboratories must complete a laboratory hazard assessment and submit it to the EHS Committee for review and approval. This information is required for the Emergency Response Plan and will remain on file for Emergency Response incidents.

- Laboratory personnel must be familiar with the potential hazards before beginning work and use appropriate safety precautions (i.e., local exhaust ventilation, protective equipment), to minimize exposure.

- A hazard evaluation must be performed before any new or materially altered laboratory experiment involving hazardous substances is conducted. A hazard evaluation form must be completed in each case. (See Appendix D: Chemical Risk Assessment Form). This form or similar one can be used to ensure that the appropriate safety precautions are taken. Container labels, Safety Data Sheets, and other chemical references should be used to conduct the evaluation. The hazard evaluation form will also serve as a reference and guide possible emergency responses.

- Precautions to be taken when working with particularly hazardous substances are listed in Appendix B.

5.2. Substitution as a Primary Method of Control

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

5.3. Reevaluation Prior to Modification of Procedures

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

- There will be unknown results.

- There is a significant change in procedure or test likely to alter the hazard. A significant change is defined as a 10% or greater increase or decrease in the amount of one or more chemicals used, the substitution or deletion of any of the chemicals in a procedure or a change in the conditions under which the procedure is conducted.

- Equipment normally used is not available, such as fume hoods, glove boxes or other local ventilation.

5.4. Reporting Laboratory Incidents and Unsafe Conditions

- Report all laboratory safety incidents to the Principal Investigator, Lab Manager, and Environmental Health & Safety Officer. Incident report forms are available from the Chemical Hygiene Officer. (See Appendix A).

- **Unusual or unexplainable chemical incidents must be discussed with others in the laboratory, to alert them about the potential risk of the procedure**.

- Report any unsafe conditions by contacting the Chemical Hygiene Officer in the Environmental Health & Safety Office so that the condition may be corrected as soon as possible.

- Unsafe conditions that must be reported include:

    1. Non-functioning hoods

    2. Unsafe storage conditions.

    3. Blocked emergency exits.

    4. Discharged fire extinguishers.

    5. Eyewash stations or safety showers that do not work.

    6. Absence of personal protective equipment (e.g. lab coats, goggles, gloves).

    7. Discharged fire extinguishers or ones that failed an inspection.

5.5. **Personal Hygiene**

- Never store food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operations.

- Do not eat, drink, smoke, chew gum, or apply cosmetics in laboratory areas where chemicals or other hazardous materials (e.g., radioactive, or bio-hazardous materials) are present.

- Never pipette by mouth. Always use a pipette bulb or other mechanical pipette-filling device.

- Wash areas of exposed skin before leaving the laboratory. (e.g., hands)

5.6. **Wearing Appropriate Personal Apparel**

Confine long hair and loose clothing. Lab personnel must always wear appropriate closed-toed shoes (preferably non-absorbent fabric) in the laboratory; do not wear:

- Sandals

- Flip flops

- Perforated shoes

- Clogs, crocks, etc

Short skirts or shorts must not be worn while performing laboratory work. Wear a lab coat and long-legged clothing. Do not wear clothing that could become a trip hazard or interfere with laboratory work. Do not wear jewelry that interferes with gloves, other protective clothing, and could come into contact with electrical sources, or react with chemicals.

5.7. **Proper Equipment Use**

- Use equipment only for its intended purpose.
- Inspect all equipment and lab apparatus for damage before use.
- Never use damaged equipment such as cracked glassware or equipment with frayed electrical wiring. Take it out of service. (Lock out tagout).
- Shield or wrap Dewar flasks and other evacuated glassware to contain chemicals and glass fragments should an explosion or implosion occur.

5.8. **Personal Protective Equipment and Fume Hoods**

- Select appropriate equipment based on the evaluation of chemical and procedural hazards **(See Appendix D: Risk Assessment)**.
- Inspect all protective equipment (safety glasses or goggles, gloves, etc.) for damage before use. Do not use damaged protective equipment.
- All personnel and students working in locations where chemicals are stored or handled must always wear laboratory coats and safety glasses while working. Visitors are not permitted in any chemical laboratories without laboratory coats and safety glasses.
- Laboratory coats are not permitted in office areas.
- Wear appropriate gloves when there is potential for skin contact with hazardous chemicals. When ordering gloves, consult chemical permeation and resistance charts. Consult chemical SDS for additional cautions when selecting appropriate gloves for use.
- Contaminated laboratory gloves used for chemical handling should not be worn outside of the laboratory. Gloves should not be in contact with any door handles.
- Use additional personal protective equipment when necessary (e.g., chemical splash goggles, face-shield, apron, etc.) based on hazard assessment.
- Check fume hood airflow monitor and integrity of the enclosure before use to ensure adequate functioning. See the alarm on the front.
- When working with particularly hazardous substances follow recommended special precautions **(See Appendix B)**.

5.9. **Transport of Chemicals**

The following guidelines must be followed when transporting hazardous materials within the facility:

- Secondary containment must be used to prevent breakage, spill, or exposure to hazardous material during transport. When transportation by gloved hand is not feasible, a sturdy lab cart with sides must be used or a special chemical tote.

- Compressed gas cylinders must be transported with gas cylinder hand trucks only with the cylinder strapped in place. Cylinders should NEVER be rolled or dragged. Keep the cylinder capped until it is used.

- Use Linear-Equipment Room (LER) corridors and freight elevator must be used whenever possible transporting chemicals. If a passenger elevator must be used, it should only be used by those personnel who are handling the chemicals during low-use time periods if possible. If that is not possible, transport personnel must not allow others on the passenger elevator during transport. Stairwells are not to be used for the transport of chemicals or potentially hazardous materials.

- Wheeled carts used to transport chemicals must be sturdy and secondary containment should be used. Carts with sides and spill prevention are preferred.

- Do not transport chemicals via the stairs.

5.10. **Housekeeping**

- Keep all work areas (including work benches and floors) clean, dry, and uncluttered at all times.

- Excess garbage, cardboard and debris/combustible must not accumulate in the laboratory. They should be removed as soon as possible.

- All spills must be immediately addressed.

- Access to emergency equipment, utility controls, showers, eyewash stations, and laboratory exits must never be blocked.

5.11. **Toxic Discharges and Waste Disposal**

- Deposit chemical waste in their appropriate, labeled receptacles and follow all other disposal procedures described in Section 10 and Appendix H. Any questions with respect to disposal of specific chemicals should be directed to the EHS/Chemical Hygiene Officer.

- Be particularly cautious about releasing hazardous substances into designated “cold” or “warm” rooms since these facilities have recirculated atmospheres (breathing air).

- Minimize the release of toxic vapors into the laboratory by venting apparatus such as vacuum pumps and distillation columns into local exhaust devices. When toxic or corrosive vapors are involved, they should pass through scrubbers prior to discharge from the local exhaust system.

- Broken glassware or empty bottles must be cleaned of chemicals and placed in a separate cardboard container for disposal. The container should be clearly labeled “GLASS” or “BROKEN GLASS”.

- Empty bottles that are rinsed 3X and properly defaced can be picked up when hazardous waste is picked up.

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

5.12. Biohazardous or Infectious Material

Persons working with infectious agents or potentially infectious material must remain vigilant to potential hazards and be trained and proficient in the practices and techniques required for handling such material safely. The person in charge of the laboratory is responsible for providing or arranging appropriate training of personnel (The ASRC Biosafety Plan should be consulted for additional information).

The handling of potentially infectious material always requires strict adherence to good laboratory practices and standard microbiological techniques. If those are not sufficient to control the hazard associated with a particular agent, the use of specialized safety equipment and additional control measures may be required. The EHS/Chemical Hygiene Officer should be consulted on such issues. For proper treatment and disposal of bio-hazardous waste see Section 10.10.

Furthermore, the Biosafety Officer and Institutional Biosafety Committee should be consulted prior to any new biological or infectious material be ordered for use. A review may be required per the CDC and NIH.

5.13. Working Alone

Working alone with particularly hazardous substances (see Appendix B) in the laboratory is not permitted. Another person must always be present. Whether work can be safely conducted alone can be evaluated using the Chemical Risk Assessment (see Appendix D), Lab Hazard Assessment and Hazard evaluations.

A person holding a C-14 Certificate of Fitness, issued by the City of New York Fire Department (FDNY), must always be present in laboratories when chemicals are being handled. Contact the EHS/Chemical Hygiene Officer for assistance.

5.14. Undergraduate Student

Undergraduate students cannot work with hazardous materials in the laboratory without direct supervision. An exception may be made by the PI, if on his/her recommendation, the student obtains the C-14 certificate of fitness from the FDNY by passing the C-14 exam.

5.15. High School Student/Minors

High School students are not permitted to work in a laboratory at any time without direct supervision. Minors under 18 years of age need to have parental consent. In addition, they are not permitted to work with radioactive materials, biosafety level (BSL) 2 biohazards, or any other particularly hazardous substances (See Appendix B).

6 Controls

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

Hierarchy of Controls includes the following:

- Hazard Elimination or Substitution – eliminates exposure before it occurs. If an alternative/safer solution or product can be used.
- Engineering Controls – functional ventilation system, fume hoods, etc., that meet the requirements for procedures performed.
- Administrative Controls – work practices, SOPs, training, prior-authorization, and supervision.
- Appropriate Personal Protective Equipment (PPE) (See section 7).
- Sufficient and accessible emergency safety facilities and equipment, such as eyewashes, deluge showers, fire extinguishers, etc.

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

6.1. **Ventilation Systems**

6.1.1 General Ventilation

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

6.2. **Fume Hoods**

Fume hoods minimize personal risk of exposure to toxic and hazardous materials by isolating activities from the general laboratory environment. The chemical vapors, fumes, and mists are captured at their source, preventing them from entering the general laboratory environment. Their use is encouraged whenever possible and mandated for particularly hazardous substances and procedures, as outlined below.

6.3. **When Hoods Will Be Used**

- The toxicity of the substance used must be considered. Hoods must always be used when working with a known or suspected carcinogen, reproductive hazard, sensitizer, or acutely toxic chemical.

- Flammable and reactive substances should be handled in a fume hood.

- Running new reactions that may be unpredictable or old reactions that may have a history of being less than fully reliable should be conducted in a hood.

- The quantity should also be considered. Hoods should always be used when handling large quantities of chemicals (e.g., over 500 milliliters of liquid or over 30 grams of a solid).

6.4. **Required Work Practices with Fume Hoods**

- Check the fume-hood airflow monitor before use. If in alarm, do not use and notify the EHS Director or Facilities Director.

- Immediately report non-functioning fume hoods to the laboratory supervisor or contact the Chemical Hygiene Officer.

- Do not block vents in the hood with stored chemicals or equipment. Doing so interferes with the proper airflow.

- Paper, paper towels, or tissues should never be kept in a fume hood. If required, they should be used and immediately removed after use.

- Hoods must not be used to dispose of or store hazardous chemicals. Hoods used for operations involving highly toxic vapors or dust may need to be fitted with condensers, traps, or scrubbers, to contain or collect them and prevent their release into the environment.

- Hood sash should be closed when hood not in use. Keep the sash down as far as possible during use to improve the overall performance of the hood. If some chemical containers must remain in the hood, they must be kept closed.

- Reduce air turbulence near and in the hood by closing nearby doors and windows when applicable, opening and closing the sash slowly, and by avoiding rapid movements.

- Keep equipment at least six inches inside the hood face. Connect electrical equipment to outlets outside the hood. In the event of an emergency, disconnect equipment without creating a spark inside the hood. Be cautious of tripping hazards with electrical cords.

- Wash the hood work platform as often as necessary to maintain a clean, dry surface.

- A special fume hood may be needed for perchloric acid, or highly reactive chemicals. If you need to use any of these materials, contact the Chemical Hygiene Officer at ext. X3351.

6.5. **Fume Hood Performance Requirements**

- The fume hoods in the laboratories must be maintained at an average face velocity of 80-120 feet per minute (fpm).

- Common ventilation ducts must not be used for radioisotope hoods. Only designated labs and hoods may be used. In addition, they must have appropriate Hazcom signage.

- Hood exhaust ducts must lead to a safe point of discharge (i.e., roof stacks) to prevent contaminants from being reintroduced back into the facility.

6.6. **Situations in which Hazardous Laboratory Work Should Not Proceed**

- When fume hoods are not operating properly.

- Where there is reason to believe that laboratory employees would be overexposed to hazardous chemicals due to the failure of appropriate controls, HAZARDOUS activities should cease until an alternative solution is found or the problem is resolved.

6.7. **New Construction or Renovation Work**

All renovation and construction work in or around the laboratories must be coordinated with the Facilities Director. Research activities involving hazardous materials may need to be restricted during time of renovation and/or construction. All hazardous materials should be stored correctly prior to any renovation and/or construction work. The EHS/Chemical Hygiene Officer should also be included if work involves the generation or use of hazardous materials, and/or facilities staff will be working in an area housing hazardous material.

7 Personal Protective Equipment

The selection and use of personal protective equipment must be based on a hazard assessment conducted in accordance with 29 CFR 1910 Subpart I, meet applicable safety standards, and be reviewed with the EHS/Chemical Hygiene Officer prior to final selection. All respiratory protective equipment must be selected, distributed and used in accordance with OSHA requirements (29 CFR 1910.134).

7.1. **Eye Protection**

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

7.1.1 Safety Shields/ Face Shields

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

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

7.2. **Guidelines to be observed when using gloves**

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

7.2.1 Lab personnel must inspect gloves before each use. When removing gloves, grab the cuff of the left glove with the right hand and remove that glove. While holding the left glove in the right hand, grab the cuff and invert the right glove over the removed glove and dispose of both in trash bin or appropriate hazardous waste disposal container.

7.2.1 Glove materials vary in the way they resist degradation and permeation. Prior to use, lab personnel must consult the glove manufacturer's permeation and resistance charts (available from the manufacturer) to make sure that the glove is made of the proper material for the chemicals being used. No glove totally resists degradation and permeation over time, so must be replaced periodically. Disposable nitrile gloves are adequate for incidental contact only. Thicker, longer cuff gloves need to be used when dispensing/handling highly corrosive or toxic chemicals.

7.3. **Protective clothing**

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

- **Lab coats**

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

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

- Ability to resist fire, heat and the chemicals used.
- Impermeability, when needed.
- Comfort, permitting execution of tasks when worn.
- Ease of cleaning (unless disposable)
- Ability to remove it during an emergency or chemical splash.

7.4. Respiratory Protection Program

29 CFR 1910.134

Any researcher, student or user who requires the use of a respirator, must consult with the EHS Officer prior to using the respirator and commencing work.

Proper training, medical evaluation and fit test are required before use.

7.5. Availability and Inspection of Personal Protective Equipment

Each laboratory must have posted signs indicating the minimum required personal protective equipment. All essential safety equipment must be made available to employees. The Chemical Hygiene Officer will periodically review the effectiveness of safety equipment. Personal protective equipment should be evaluated under real or simulated conditions to ensure that it meets both safety and performance standards. For example, chemical splash goggles may meet ANSI standards but could fog up rapidly or fit uncomfortably. Situations like this will make compliance and use difficult. The effectiveness of the equipment should be reviewed periodically, and improvements made where possible.

8 Maintenance and Inspection Program

The EHS/Chemical Hygiene Officer will inspect on an annual basis the facilities; fume hoods, emergency equipment including eyewash stations and lab safety showers, storage areas, and prep rooms.
Areas in which particularly hazardous chemicals and/or procedures are used may require more frequent inspections.

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

8.1. **General ventilation system**

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

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

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

8.2. **Local Exhaust Systems: Fume Hoods Maintenance**

8.2.1 General Maintenance and Major Repairs

The Facilities Department will schedule general maintenance and repairs as necessary. Arrangements will be made with the Facilities Director, Research Director (or his/her designee) and Environmental Health and Safety Office to notify affected laboratory faculty and staff in advance not to use hoods during scheduled repair times. As necessary, notices will also be posted on the hoods in the laboratory informing everyone of pending maintenance and repairs.

8.2.2 Minor or Emergency Repairs

Facilities Maintenance will consult with the Facilities Director to schedule any emergency repairs. The Director will notify affected laboratory faculty and staff not to use a particular hood or other safety equipment during this time. Notices may be posted at the laboratory location(s) affected by repairs.

The Environmental Health & Safety Office must be informed of scheduled repairs so that safety checks can be made. On completion of repairs, the Environmental Health & Safety Office will check the hoods or other safety equipment to ensure proper functioning.

8.2.3 Cleaning

The cleaning of the interior surfaces of the hood and sash glass is the responsibility of the users in each hood location. Fume hood manufacturer’s recommendations should be consulted. The Chemical Hygiene Officer should be consulted if assistance is needed.

8.3. Emergency Eyewash and Deluge Showers

The performance of emergency eyewash and deluge showers will be evaluated during annual facility inspections. Needed maintenance or repair requests must be forwarded to the Facilities Director.

8.4. Fire extinguishers

CCNY Public Safety will have all building and laboratory fire extinguishers inspected and maintained (i.e., checked monthly, inspected annually) to ensure that they are properly functional in the event of a fire. Faulty extinguishers will be immediately replaced once appropriate parties are notified.

8.5. Report Malfunctioning Equipment

Laboratory personnel having any indication of improperly functioning fume hoods or safety equipment must alert the EHS/Chemical Hygiene Officer and forward a maintenance work request form to Facilities Director detailing the problem and location of the fume hood or equipment.

8.6. Chemical Hygiene Inspections

The EHS/Chemical Hygiene Officer will conduct periodic inspections (as often as necessary and at least annually) of laboratories and safety equipment to ensure its proper functioning. The chemical inventory and basic laboratory operations conducted will also be reviewed as part of the inspection process.

8.7. Laboratory Inspections

Semi - Annual laboratory inspections will include the following:

1. Fume Hood Performance.

- Measure the average rate of airflow at the face of the hood as well as the uniformity of air delivery into the hood by making a series of face velocity measurements with appropriate instrument.
- Average velocity shall be 80-120 feet per minute.
- Use smoke tubes to observe airflow interferences affecting the fume hood's operation.

2. Safety inspection

- Inspect and test emergency equipment including eyewash stations and safety showers.
- Look for and correct blocked emergency exits.
- Check fire extinguishers to make sure they are properly charged.
- Check availability and appropriateness of spill-control and other emergency equipment.
- Inspect protective equipment for integrity as well as appropriateness

.

- Observe general housekeeping conditions and systems used to communicate hazards (e.g., signs and labels).

- Inspect chemical storage areas for proper segregation of chemical classes and container integrity.

- Review hazardous waste disposal practices.

- Unannounced inspections can occur at any time from any regulatory agency.

8.8. **Inspection Reports**

The EHS/Chemical Hygiene Officer will report and prioritize any problems encountered during inspections. The results of the inspections and recommended remedial action will be discussed with the laboratory supervisor and principal investigators. Serious and potentially serious laboratory safety and/or health issues will be brought to the attention of the appropriate ASRC Initiative Director, as well as ASRC safety committee, if necessary, along with recommended steps and a time frame for correction.

9 Guidelines for Chemical Spills, Fire, and Related Emergencies

Each research area must anticipate the types of emergencies that may arise in their respective laboratories and establish steps to be taken if those emergencies occur. Any laboratory handling hazardous substances (carcinogens, reproductive hazards, acutely toxic chemicals or sensitizers) must consider spill control protocols involving these specific materials **(see Appendix B).** All laboratory employees must be familiar with the steps to take in the event of an emergency. The following procedure can be used as a general guide for spill containment. Safety Data Sheets and other references shall be consulted for more specific information. In the event of a chemical spill, release, injury, illness, or medical emergency, an incident report must be prepared **(see appendix A)** by either the person involved or his/her supervisor or co-worker witnessing the incident. A copy of the incident report must be sent to the EHS/Chemical Hygiene Officer.

9.1. Standard Operating Procedures

The Chemical Hygiene Plans include specific elements and measures to ensure employee protection in the laboratory. In addition, the risk assessment from (Appendix D). One such element is the establishment of Standard Operating Procedures (SOPs) "relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals."

SOPs can be stand-alone documents or be supplemental information included as part of research notebooks, experiment documentation, or research proposals. The requirement for SOPs is to ensure that a process is in place to document and addresses relevant health and safety issues as part of every experiment.

At a minimum, SOPs should address the following topics:

- Chemicals involved and their hazards
- Special hazards and circumstances
- Engineering controls (such as fume hoods)
- Required PPE
- Spill response measures
- Waste disposal procedures
- Decontamination procedures
- Description of how to perform the experiment or operation

While the OSHA Laboratory Standard specifies the requirement for SOPs for work involving hazardous chemicals, laboratories should also develop SOPs for work involving any piece of equipment or operation that may pose any physical hazards. This includes safe use and considerations of LASERs, cryogenic liquids and fill procedures and high voltage equipment as well as connecting regulators to gas cylinders and cylinder change outs.

SOPs do not have to be lengthy, and it is perfectly acceptable to point laboratory personnel to other sources of information. Examples include: "To use this piece of equipment, see page 4 in the operator's manual (located in file cabinet #4)" or "The chemical and physical hazards of this chemical can be found in the SDS located in the SDS binder. Read the SDS before using this chemical."

It is the responsibility of the P.I. and laboratory supervisor to ensure that written SOPs are developed for work involving the use of hazardous chemicals in laboratories under their supervision and that PPE and engineering controls are adequate to prevent exposure. In addition, P.I.s and 24 29 CFR 1910.1450€(3)(i) https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106 laboratory supervisors must ensure that personnel working in laboratories under their supervision have been trained to use these SOPs. See Appendix D for additional information and templates. Your EHS Office can also assist laboratories with developing SOPs.

**The use of biological or radiological materials requires separate protocols and SOP's, which will depend on the quantity, extent, and severity of the potential hazards. The Biosafety Plan and the Radiation Safety Plan outline procedures for handling spills involving these materials.

**The use of lasers requires separate protocols and will be found in the Laser Safety Plan.

9.2. **Chemical Spills**

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

Laboratory personnel witnessing a chemical spill or emergency **must not** take it upon themselves to clean up a chemical spill, put out a fire, or administer medical assistance if they:

- Are not familiar with the relevant emergency or spill control protocol
- Don't know which chemicals are involved or their potential hazards
- Don't have the proper personal protective equipment
- Don't think they can handle it

DO NOT contact the custodial staff to respond to chemical spills! Custodial staff are neither trained nor equipped to cleanup laboratory chemical spills. If immediate assistance is needed, contact the EHS/ Chemical Hygiene Officer. Outside of normal operating hours, or if EHS/Chemical Hygiene Officer is unavailable, report the spill to CCNY Public Safety.

Tom Dickson (917)-414-4608

Public Safety (212)-650-7777

Action to be taken for hazardous spills:

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

- If a flammable liquid is spilled, shut down nearby electrical equipment and extinguish flames if possible, without endangering your safety.
- Clear the laboratory of all personnel.
- Close any door to adjacent rooms, if possible.
- Exit immediately, closing the door, restrict others from entering.

- Immediately contact the EHS/Chemical Hygiene Officer (917)-414-4608. During off hours, call the CCNY Public Safety Emergency Hotline at 212-650-7777.

Give the following information:

- Name of person calling and phone number
- Type of spill and approximate quantity.
- Location (building, floor and room number).

9.3. **Personal Chemical Contamination and Medical Emergencies**

Laboratory personnel involved in and affected by a chemical spill, release, or other safety injury should seek medical attention by immediately contacting the CCNY Public Safety Emergency Hotline at 212-650-7777. All safety incidents must be reported to the EHS/Chemical Hygiene Officer and an incident report prepared as soon as possible. Always get the SDS ready.

9.3.1 Chemical eye splashes:

Immediately rinse the affected eye or eyes at the eyewash station for at least 15 minutes while holding eyelids open to ensure proper irrigation. Call for medical assistance as soon as possible.

9.3.2 Contamination of large areas of the body:

Immediately remove contaminated clothing while using the emergency safety shower. Wash contaminated areas with mild soap and water. Do not use neutralizing agents or salves.

9.3.4 Ingestion of chemicals:

Seek medical attention by calling the CCNY Public Safety Emergency Hotline at 212-650-7777 and provide pertinent information. If necessary, contact the NYC Poison Control Center at 1-800-222-1222 or 212-POISONS (212-764-7667).

9.3.4 Development of signs or symptoms of chemical exposure

If a laboratory employee develops dizziness, nausea, light-headedness (dyspnea), a burning sensation in the eyes, nose, or throat, or other signs and symptoms of chemical exposure, they must leave the area immediately and get fresh air. Contact your laboratory supervisor and/or the EHS/Chemical Hygiene Officer. During off-hours, or for medical assistance, contact the CCNY Public Safety Emergency Hotline at 212-650-7777.

9.3.5 Thermal and chemical burns

For minor burns, flush the area with cold water. For more serious burns, call the CCNY Public Safety Emergency Hotline (212-650-7777) and seek immediate medical attention.

9.3.6 Gashes, cuts, and heavy bleeding

Apply compression to the wound to slow bleeding. Seek medical assistance by contacting the CCNY Public Safety Emergency Hotline (212-650-7777).

9.3.7 Fire and Fire-Related Incidents

All employees must respond to alarms of fire or emergency evacuation. All laboratory employees are required to participate in fire drills and other exercises to prepare for these events. CCNY Public Safety coordinates emergency evacuations and fire drills.

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

9.4. **Basic Steps to Take in the Event of a Fire**

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

- Alert personnel in the immediate vicinity of a fire or emergency.
- Confine the fire or emergency.
- Evacuate the building.
- Summon aid.

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

9.5. **Determining When to Attempt to Put Out a Fire**

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

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

.

- The fire extinguisher is the right type for the chemical involved.
- A move toward the fire extinguisher will not trap you in the room if fire spreads.

9.5.1 Circumstances under which an attempt should NOT be made include:

- The fire has spread to a secondary location (other than the site where it began).
- You don't know how to use a fire extinguisher

- A move to get the fire extinguisher could trap you in the room if the fire spreads
- The fire is very close to other chemicals.
- The fire extinguisher is the wrong type (e.g., carbon dioxide extinguisher for a lithium aluminum hydride fire).

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

9.6. **Using the Fire Extinguisher**

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

PASS METHOD

1. Pull the pin out on the extinguisher handle.
2. Aim the extinguisher hose at the base of the fire.
3. Squeeze the nozzle to release extinguishing material.
4. Sweep: Use a back and forth sweeping motion. If after a few minutes the intensity or size of the fire has not diminished, GET OUT and close the door behind you. Larger or rapidly growing fires MUST BE LEFT FORTHE FIRE DEPARTMENT!

If Clothing is on Fire:

If your clothes are on fire, STOP, DROP, AND ROLL. Your body weight will smother the fire. DO NOT RUN! Running simply fuels the flames. Use the safety shower if it is not far away.

If you witness a person on fire, make sure he/she Stops, Drops, and Rolls. Have someone else pull the fire alarm to contact the fire department and emergency services. DO NOT WRAP A PERSON IN A VERTICAL POSITION IN A BLANKET TO SMOTHER THE FLAMES. This could worsen the situation.

10 Waste Management and Disposal

The ASRC utilizes approved hazardous waste removal contractors to dispose of all hazardous waste from the facility. The EHS/Chemical Hygiene Officer makes the arrangements for collection and disposal. To do this in a legal, safe and efficient manner, all laboratories generating hazardous waste must follow applicable regulatory requirements. This section, as well as Appendix H: Chemical Waste Management, Appendix J: Laboratory Clean-Outs, posted instructions and other EHS guidance documents must be adhered to. When in doubt about the proper disposal of chemicals or other waste material, or if there are any questions about which regulatory requirements apply, please consult with the EHS/Chemical Hygiene Officer.

Do not pour large quantities of acids or bases down the drain. Small amounts of weak acids or alkalis used in the normal course of laboratory experiments may be disposed of by first properly diluting or neutralizing the substance, then slowly flushing down the laboratory drain with large quantities of water.

Spent solvents must be collected as hazardous waste in a suitable container for removal when full. It is important not to mix non-compatible substances in the same container. See Appendix H. Some solvents (ethers and secondary alcohol) form unstable peroxides on standing. Some reactions can form explosions directly (e.g., Acetone and Chloroform in the presence of a base). Direct any questions to the EHS/Chemical Hygiene Officer. **Again, see Appendix H: Hazardous Waste Management, for more detailed information.**

10.1. Non-Hazardous Wastes

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

Organic Chemicals

Acetates: Ca, Na, NH 4 and K Amino Acids and their Salts

Citric Acid and salts of Na, K, Mg, Ca, and NH4 Lactic

Acid and salts of Na, K, Mg, Ca and NH4 Sugars

Inorganic Chemicals

Bicarbonates**:** Na, K Borates: Na, K, Mg, and Ca

Bromides: Na, K, Mg, and Ca

Chlorides: Na, K, Mg, and Ca

Fluorides: Ca

Iodides: Na, K,

Oxides: Na, K, Mg, Ca, B, Al, Si,

Fe Phosphates: Na, K, Mg, Ca, and NH4

Silicates: Na, K, Mg, and Ca

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

10.2. **Collection of Hazardous Waste**

- Collect, identify and tag/label all hazardous waste. The waste is stored in the satellite accumulation area located within the lab. Hazardous waste labels are available from the EHS/Chemical Hygiene Officer. Please pay careful attention to segregate and properly label waste since waste collection and disposal personnel depend on this information for their safety and to make decisions about handling, storage, and proper disposal. Unlabeled materials/unknowns require costly analysis prior to disposal, so must be prevented as much as possible.

- Segregate waste using appropriate containers or bottles closest in size to the amount of waste generated.

- The presence of any radioactivity must be indicated on the waste labels. The Radioactive material is collected separately from other waste. Infectious/medical waste also must be disposed according to applicable regulations through the EHS Office.

- Do not discard any hazardous waste (chemical, radioactive or infectious) into receptacles routinely removed by custodial service, (e.g. waste baskets, cartons, etc.). Contact EHS for assistance.

- Never add heated solutions into the waste containers.

10.3. **Disposal of Acids and Bases**

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

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

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

10.5. **Flammable Liquids**

Flammable liquids for disposal are to be stored in a suitable container properly labeled for collection. Please contact the EHS/Chemical Hygiene Officer when these containers are ready for disposal from the lab area.

10.6. **Chlorinated/Halogenated Solvents**

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

10.7. **Reactive Chemicals.**

Reactive chemicals are substances that, under certain ambient or induced conditions, can violently react by spontaneously generating of large quantities of heat, light and gases. Segregate into tightly sealed

containers. Please notify the EHS/Chemical Hygiene Officer when there are reactive chemicals for disposal such as sodium, potassium, phosphorus, or metal hydrides.

10.8. **Ethidium Bromide and the like**

Notify the EHS/Chemical Hygiene Officer when you have unbleached Ethidium Bromide, Streptozocin, or similar materials for disposal.

10.9. **Empty Chemical Containers**

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

Containers that contained or have residues of acutely toxic must be treated as Hazardous waste unless the container is properly rinsed and the resulting rinse material is collected separately as hazardous waste.

10.10. **Storage, Treatment and Disposal of Bio-hazardous Waste**

Bio-hazardous or regulated medical waste generated during experiments must be placed in covered, labeled, leak-proof containers or in labeled red bags within a secondary labeled container. Care must be taken to place all syringe needles, scalpel blades, and other discarded sharps in puncture-proof, labeled containers. (See the ASRC Biosafety Plan for additional information). The "sharps” containers are available from the EHS Office. Contact the EHS/Chemical Hygiene Officer for disposal of all sharps containers, bio-hazardous waste, and if hazardous chemicals or radioactive materials are also present. Bio-hazardous material, which has been properly decontaminated by autoclaving or chemical disinfectant, may be able to be disposed of in the sewer system or in regular trash. If disposing of decontaminated material in regular trash, do not use red plastic bags and remove any biohazard label. Before disposal, consult the EHS/Chemical Hygiene Officer to determine whether this is appropriate.

11 Medical Consultations and Exams

The ASRC will provide employees who work with hazardous chemicals an opportunity to receive a medical consultation if an employee:

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

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

All medical consultations and examinations will be:

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

11.1. **Information to be provided to the physician:**

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

11.2. **Employee medical reports**

The EHS Officer and Human Resource Manager will obtain a written opinion from the examining physician. The written opinion should include:

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

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

12 Employee Information and Training Programs

12.1. Training

All laboratory employees (faculty, lab technicians, graduate assistants and other personnel who come in contact with hazardous chemicals in the laboratory environment) must complete laboratory safety chemical hygiene training. The training will be coordinated by the EHS/Chemical Hygiene Officer and will cover requirements under the OSHA Laboratory Standard, safe-operating procedures for working with hazardous chemicals, etc. Additional training will be provided as required or deemed necessary.

12.2. Training Program Elements

12.2.1 Training sessions

The EHS/Chemical Hygiene Officer will provide training for new staff and conduct periodic lab safety/chemical hygiene training sessions for all personnel on a regular basis.

Times and locations for these sessions will be coordinated with each research/area director or his/her designee. All laboratory personnel must attend this session. The EHS Office will report attendance to laboratory/area supervisors.

Training sessions will cover the following topics:

- Requirements of the OSHA Laboratory Standard and how the ASRC will meet its responsibilities.
- Chemical Hygiene Plan.
- Labels, placards, signage, Safety Data Sheets, and other pertinent laboratory health and safety information

.

- Chemical hazards (flammables, reactive, carcinogens, corrosives, etc.). General operating procedures for the safe handling of hazardous materials, including emergency spill response.
- OSHA permissible exposure limits and other recommended levels (National Institutes for Occupational Safety and Health, American Conference of Governmental Industrial Hygienists, etc.).
- Signs and symptoms of exposure to hazardous chemicals and availability of medical assistance, consultations, and exams.
- Use of fume hoods, emergency, and personal protective equipment. Protocol for dealing with faulty hoods and equipment and lack of proper safety equipment.
- Special operating procedures to be used for particularly hazardous substances.
- How to conduct a laboratory hazard assessment
- How to identify and manage hazardous wastes.
- Emergency response, reporting emergencies and incidents.

12.2.2 Hands-on Instruction

All laboratory supervisors or principal investigators must provide lab-specific information and hands-on instruction, with assistance from the EHS Officer if needed, to ensure that all personnel working with hazardous materials in the laboratory understand.

- Lab-specific hazards involved and necessary safety precautions and SOPs.
- Proper use of laboratory equipment.

13 Recordkeeping

The EHS/Chemical Hygiene Officer will maintain records of laboratory training sessions, inspections, hazardous waste manifests, SDS data, etc. in a central location. These records will be maintained for the specified period of time required by applicable regulations. Principal investigators and laboratory supervisors must maintain required safety records (as outlined in Section 1.4 and other sections of this Chemical Hygiene Plan) and make these available to the EHS/Chemical Hygiene Officer upon request.

Appendix A: Laboratory Incident Report Form

Name: **Title:**	**Department:** **Building / Room:**
Date/Time of incident:	**Phone #:**
	E-Mail:
Witness(es):	
Description of incident: Include the use of personal protective equipment, chemical hood or other environmental control, safety equipment (attach additional pages if necessary).	
Did the incident result in an injury? Yes ☐ No ☐ **Description of injury:**	
Public Safety notified: Yes ☐ No ☐ **Date: Time:**	
Environmental Health and Safety (EH&S) notified: Yes ☐ No ☐ **Name of EH&S staff person notified:** **Title:** **Date: Time:**	
Emergency response information (include EH&S, fire, police, ambulance response present at the scene):	
Name of Supervisor:	**Report prepared by:** **Date:**

Appendix B: Working with Particularly Hazardous Substances

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

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

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

Safety Data Sheets must be consulted for specific information. T echnical assistance can be obtained from the EHS/Chemical Hygiene Officer.

Safe Work Practices with Particularly Hazardous Substances

- Maintain an accurate and up-to-date inventory record of these substances, including the amounts used and stored in the laboratory.
- In the event that toxicologically significant quantities of a particularly hazardous substance are used on a routine or frequent basis, contact the EHS/Chemical Hygiene Officer to determine if exposure monitoring, medical surveillance etc. is warranted.
- Particularly hazardous substances must be handled inside a chemical fume hood. They must also be kept in a secondary container to help prevent breaks and spills.
- A suitable label must be attached to all storage containers to alert others of the hazard and (if required) the need for special precautions. For example: "Warning - Cancer Hazard" or "Highly Toxic".
- Access to the designated laboratory work areas must be controlled. Appropriate signs that warn of the hazards and indicate the precautions or approvals for entry must also be used.
- Additional containment devices (such as shielding or protective filters) may be needed to safely handle, store or protect equipment when using these chemicals.
- In addition to the use of the proper gloves, lab coat, eye/face protection, other protective apparel or equipment may be needed. Examples could include: impervious gowns or aprons, gauntlets or other specialized protective equipment.
- Work surfaces must be protected from contamination through the use of disposable, absorbent, plastic- backed paper. Replace contaminated paper as necessary and handle as hazardous waste.
- Specialized waste disposal may be needed. Contact the EHS/Chemical Hygiene Officer for assistance.
- On completion of work and before leaving the laboratory, remove all protective apparel and thoroughly wash hands.
- A specific written safety procedure must be developed prior to beginning work. This safety procedure must include: (1) a description of the hazardous chemical(s) used, including the

potential physical and health effects; (2) a step-by-step review of the work to be performed **(See Appendix D: Chemical Risk Assessment Form).**

- The proposed activities are to be conducted by trained personnel in accordance with the developed safety procedure and other applicable safety precautions.

Appendix C: Hazard Communication: Safety Data Sheets

The OSHA Hazard Communication Standard (29 CFR 1910.1200(g)), revised in 2012, requires that the chemical manufacturer, distributor, or importer provide Safety Data Sheets (SDSs) (formerly MSDSs or Material Safety Data Sheets) for each hazardous chemical to downstream users to communicate information on these hazards. The information contained in the SDS is largely the same as the MSDS, except now the data must be presented in a consistent, user-friendly, 16-section format.

The SDS includes information such as the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical. The information contained in the SDS must be in English (although it may be in other languages as well). In addition, OSHA requires that SDS preparers provide specific minimum information as detailed in Appendix D of 29 CFR 1910.1200. The SDS may also include additional information.

Sections 1 through 8 contain general information about the chemical, identification, hazards, composition, safe handling practices, and emergency control measures (e.g., firefighting). This information should be helpful to those that need to get the information quickly. Sections 9 through 11 and 16 contain other technical and scientific information, such as physical and chemical properties, stability and reactivity information, toxicological information, exposure control information, and other information including the date of preparation or last revision. The SDS must also state that no applicable information was found when the preparer does not find relevant information for any required element.

The SDS must also contain Sections 12 through 15, to be consistent with the UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

A description of the 16 sections of the SDS, and their contents, is presented below:

Section 1: Identification

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known.
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number.
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier).

Section 2: Hazard(s) Identification

This section identifies the hazards of the chemical listed on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid).
- Signal word.
- Hazard statement(s).
- Pictograms (the pictograms or hazard symbols may be presented as graphical reproductions of the symbols in black and white or be a description of the name of the symbol (e.g., skull and crossbones, flame).
- Precautionary statement(s).

- Description of any hazards not otherwise classified.
- For a mixture that contains an ingredient(s) with unknown toxicity, a statement describing how much (percentage) of the mixture consists of ingredient(s) with unknown acute toxicity. Please note that this is a total percentage of the mixture and is not tied to the individual ingredient(s).

Section 3: Composition/Information on Ingredients

This section identifies the ingredient(s) contained in the product indicated on the SDS, including impurities and stabilizing additives. This section includes information on substances, mixtures, and any chemical where a trade secret is claimed. The required information consists of:

Substances

- Chemical name.
- Common name and synonyms.
- Chemical Abstracts Service (CAS) number and other unique identifiers.
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical.

Mixtures

- Same information as is required for substances.
- The chemical name and concentration (i.e., exact percentage) of all ingredients which are classified as health hazards and are:
    - Present above their cut-off/concentration limits or
    - Present a health risk below the cut-off/concentration limits.
- The concentration (exact percentages) of each ingredient must be specified, except that concentration ranges may be used in the following situations:
    - A trade secret claim is made,
    - There is batch-to-batch variation, or
    - The SDS is used for a group of substantially similar mixtures.

Chemicals where a trade secret is claimed

- A statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.

Section 4: First-Aid Measures

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions by relevant routes of exposure (inhalation, skin and eye contact, and ingestion).
- Description of the most important symptoms or effects, and any symptoms that are acute or delayed.
- Recommendations for immediate medical care and special treatment needed, when necessary.

Section 5: Fire-Fighting Measures

This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:

- Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation.
- Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns.

- Recommendations on special protective equipment or precautions for firefighters.

Section 6: Accidental Release Measures

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations that distinguish between responses for large and small spills where spill volume will have a significant impact on the magnitude of hazard. The required information may consist of recommendations for:

- Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing.
- Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
- Methods and materials used for containment (e.g., covering the drains and capping procedures).
- Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning or vacuuming; adsorbent materials; and/or equipment required for containment/clean up)

Section 7: Handling and Storage

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:

- Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited).
- Recommendations on the conditions for safe storage, including any incompatibilities and advice on specific storage requirements (e.g., ventilation).

Section 8: Exposure Controls/Personal Protection

This section indicates the exposure limits, engineering controls, and personal protective measures that should be used to minimize worker exposure. The required information consists of:

- OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.
- Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system).
- Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate types of eye, face, skin or respiratory protection needed based on hazards and potential exposure).
- Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material).

Section 9: Physical and Chemical Properties

This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.)
- Upper/lower flammability or explosive limits
- Odor

- Vapor pressure
- Odor threshold
- Vapor density
- pH
- Relative density
- Melting point/freezing point
- Solubility(ies)
- Initial boiling point and boiling range
- Flash point
- Evaporation rate
- Flammability (solid, gas)
- Partition coefficient: n-octanol/water
- Auto-ignition temperature
- Decomposition temperature; and
- Viscosity.

The SDS may not contain every item on the above list because information may not be relevant or available. When this occurs, a notation to that effect must be made for that chemical property. Manufacturers may also add other relevant properties, such as the dust deflagration index for combustible dust -used to evaluate a dust's explosive potential.

Section 10: Stability and Reactivity

This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:

Reactivity

- Description of the specific test data for the chemical(s). This data can be for a class or family of the chemical if such data adequately represent the anticipated hazard of the chemical(s).

Chemical stability

- Indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage or being handled.
- Description of any stabilizers that may be needed to maintain chemical stability.
- Statement of any safety issues that may arise should the product change in physical appearance.

Other

- Indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, release excess pressure or heat, or create other hazardous conditions. Also, a description of the conditions under which hazardous reactions may occur.
- List of all conditions that should be avoided (e.g., static discharge, shock, vibrations, or environmental conditions that may lead to hazardous conditions).
- List of all classes of incompatible materials (e.g., classes of chemicals or specific substances) with which the chemical could react to produce a hazardous situation.
- List of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating. (Hazardous combustion products should also be included in Section 5 (Fire-Fighting Measures) of the SDS.)

Section 11: Toxicological Information

This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
- Description of the delayed, immediate, or chronic effects from short- and long-term exposure.
- The numerical measures of toxicity [e.g., acute toxicity estimates such as the LD50 (median lethal dose) –the estimated amount (of a substance) expected to kill 50% of test animals in a single dose].
- Description of the symptoms. This description includes the symptoms associated with exposure to the chemical and should list symptoms from the lowest to the most severe exposure.
- Indication of whether the chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions) or found to be a potential carcinogen by OSHA

Section 12: Ecological Information (non-mandatory)

This section provides information to evaluate the environmental impact of the chemical(s) if released to the environment. The information may include:

- Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available (e.g., acute or chronic aquatic toxicity data for fish, algae, crustaceans, and other plants; toxicity data on birds, bees, plants).
- whether there is a potential for the chemical to persist and degrade in the environment either through biodegradation or other processes, such as oxidation or hydrolysis.
- Results of tests of bioaccumulation potential, making reference to the octanol-water partition coefficient (Kow) and the bioconcentration factor (BCF), where available.
- The potential for a substance to move from the soil to the groundwater (indicate results from adsorption studies or leaching studies).
- Other adverse effects (e.g., environmental fate, ozone layer depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential).

Section 13: Disposal Considerations (non-mandatory)

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices. To minimize exposure, this section should cross-reference Section 8 (Exposure Controls/Personal Protection) of the SDS. The information may include:

- Description of appropriate disposal containers to use.
- Recommendations of appropriate disposal methods to employ.
- Description of the physical and chemical properties that may affect disposal activities.
- Language discouraging sewage disposal.
- Any special precautions for landfills or incineration activities

Section 14: Transport Information (non-mandatory)

This section states guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:

- UN number (i.e., four-figure identification number of the substance).
- UN proper shipping name.
- Transport hazard class(es).
- Packing group number, if applicable, based on the degree of hazard.
- Environmental hazards (e.g., identify if it is a marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code)).
- Guidance on transport in bulk (according to Annex II of MARPOL 73/78 and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code (IBC Code)).
- Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises (indicate when information is not available).

Section 15: Regulatory Information (non-mandatory)

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include:

- Any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations)

Section 16: Other Information

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here.

Employer Responsibilities

Employers must ensure that the SDSs are readily accessible to employees for all hazardous chemicals in their workplace. This may be done in many ways. For example, employers may keep the SDSs in a binder or on computers as long as the employees have immediate access to the information without leaving their work area when needed and a back-up is available for rapid access to the SDS in the case of a power outage or other emergency. Furthermore, employers may want to designate a person(s) responsible for obtaining and maintaining the SDSs. If the employer does not have an SDS, the EHS/Chemical Hygiene Officer or other designated person(s) must contact the manufacturer to obtain one.

Appendix D: Chemical Risk Assessment Form

CHEMICAL SAFETY
RISK ASSESSMENT FORM

Before completing this form, please consult the ASRC Chemical Hygiene plan, applicable Safety Data Sheets (SDSs), as well as the University Lab Safety manual and other applicable available guidance, in order to ensure the form is completed properly.

This form **MUST BE COMPLETED** prior to the commencement of any work involving hazardous substances so that a suitable and sufficient assessment of any potential health risks can be made.

Individuals working under this risk assessment have responsibility to ensure they are aware of the hazards associated with the work activities they are undertaking and that they follow the control measures stipulated to safeguard the health and safety of themselves and others.

SECTION 1

1.1 OPERATION / ACTIVITY			*Complete the relevant details of the activity being assessed.*
Title:			
Location(s) of work		**Ref. No.**	
Brief description:			

1.2 PERSON REVIEWING THIS ASSESSMENT			
Name:		**Position:**	
Department:		**Signature:**	

1.3 PERSON CONDUCTING THIS ASSESSMENT			
Name:		**Position:**	
Date risk assessment undertaken:		**Signature:**	

1.4 ASSESSMENT REVIEW HISTORY

This assessment should be reviewed immediately if there is any reason to suppose that the original assessment is no longer valid. Otherwise, the assessment should be reviewed annually. The responsible person must ensure that this risk assessment remains updated.

REVIEW HISTORY				
	Review 1	**Review 2**	**Review 3**	**Review 4**
Due date				
Date conducted				
Conducted by				

SECTION 2

2.1: SUMMARY CLASSIFICATION OF HAZARDOUS SUBSTANCES

Substances can be regarded as hazardous not just in the form in which they occur in the work activity but also in by-products and as intermediate substances in process and waste residues.

CHEMICAL	 Very Toxic ☐	 Toxic ☐	 Corrosive ☐	 Irritant ☐	 Mutagen ☐
	 Reproductive Toxin ☐	 Flammable ☐	 Oxidizer ☐	 Explosive ☐	 Carcinogen ☐
	 Respiratory Sensitizer ☐	 Environmental Hazard ☐	 Skin Sensitizer ☐	Biosafety Level (BSL) Group 1 ☐ 2 ☐	

2.2: HAZARDS

List all the details of the hazardous substance(s) used in the appropriate columns. Name of the substance including the chemical name where known. Quantity used in the process. Form of substance in use (e.g. liquid, powder, dust etc.). The nature of the hazard should state whether the substance is very toxic, toxic, corrosive, harmful or irritant etc. For biological substances this should include the Biosafety Level (BSL). If the substance has a Permissible Exposure Limit (PEL) or Recommended Exposure Limit (REL) it should be entered here. State whether a Safety Data Sheet (SDS) is available for the substance.

Substance	Quantity To be used	Form of Substance	Nature of Hazard or Biological Hazard Grouping	Exposure Limit (ppm or mg/m^3) 15 min or 8 hr.	SDS Available?
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐
				Yes ☐ No ☐	Yes ☐ No ☐

Note: *Please copy this page if additional substances need to be listed in this assessment*

2.3: ROUTE(S) BY WHICH THE SUBSTANCES ARE HAZARDOUS

Complete all boxes that may apply

Inhalation	Direct contact: skin, eyes	Skin absorption	Injection (via sharps)	Ingestion
☐	☐	☐	☐	☐

2.4: PROCESS FACTORS INFLUENCING THE RISK OF EXPOSURE

☐ Weighing ☐ Pipetting ☐ Filtering ☐ Shaking / Mixing ☐ Centrifugation

☐ Use of sharps ☐ Elevated temperatures ☐ High pressure ☐ Sonication

☐ Other (specify):

2.5: COMMENTS ON THE HAZARDS ASSOCIATED WITH THE SUBSTANCES

List any known or suspected health hazards associated with potential exposures to the substances used or generated in the operation or activity.

SECTION 3.0

3.0: IDENTIFICATION OF THOSE AT RISK OF EXPOSURE

Identify all categories of individuals who may be affected either directly or indirectly through the work activity.

☐ Dept. Staff ☐ Graduate Students ☐ Undergraduate Students

☐ Cleaning staff ☐ Visitors ☐ Contractors ☐ Other: please specify- _____

SECTION 4.0

List the control measures taken to reduce risks. Can any substances be eliminated, or substituted with a less hazardous one? Are engineering controls (such as enclosure,
local exhaust ventilation, etc.) or PPE available? Do not forget that controls include safe working procedures, information, instruction, training and supervision.

4.1: CONTROL MEASURES – ELIMINATION / SUBSITUTION

Can any of the hazardous substances identified or the procedures required for this activity be eliminated or substituted with a less hazardous substance or procedure (e.g. by changing from a fine powder to a liquid form of the chemical)? ***If so, give details below:*** Yes ☐ No ☐

4.2: CONTROL MEASURES – ENGINEERING & DESIGN

☐ Work can be carried out on the open bench without the use of control measures.

☐ Local Exhaust Ventilation - Fume Hood (FH) FH No. Location:

☐ Local Exhaust Ventilation (Other Partial Enclosure) Specify:

☐ Local Exhaust Ventilation (Full Enclosure) Specify:

☐ Biological Safety Cabinet Class: Cabinet No. Location:

☐ Biosafety Level (BSL):

☐ Laminar Flow Cabinet Specify:

☐ Other: please specify –

4.3: ADMINISTRATIVE CONTROLS (*e.g., Risk Assessments, SOPs, Signage).*

4.4: INSTRUCTION AND TRAINING

4.5: SUPERVISION AND WORKING ALONE

Working Alone is defined as whether the work can be safely conducted individually or whether a buddy or helper is required to be present

☐ The reviewer will approve straightforward routine work in progress.

☐ The reviewer will specifically approve the safe system of work.

☐ The reviewer will provide personal supervision to control the work.

Is working alone permitted for this activity? Yes ☐ No ☐

4.6: CONTROL MEASURES – PERSONAL PROTECTIVE EQUIPMENT			
Eyes / Face	☐ Safety Glasses	☐ Goggles	☐ Face shield
Hand	☐ Gloves	***(specify)***:	
Respiratory	☐ Disposable respirator Type ☐ Powered hood Type	☐ Full-face respirator Type ☐ Breathing apparatus Type	☐ Reusable half-face respirator Type ☐ Other ***(specify)***:
Clothing	☐ Coverall Specify: Other ☐ ***(specify)***	☐ Laboratory coat Specify:	☐ Apron / Gown Specify:

4.7: MONITORING AND HEALTH SURVIELLANCE

If monitoring or health surveillance is required for any of the hazardous substances relating to this assessment specify how this will be carried out.

Will monitoring for airborne contaminants be required? ***If "yes", give details below:***	Yes ☐	No ☐
Will health surveillance for workers be required? ***If "yes", give details below:***	Yes ☐	No ☐

SECTION 5.0: RISK EVALUATION RATING

Use the information above, and the guidance from the Hazard Identification and Risk Assessment section, taking into account the control measures in operation, decide the applicable SEVERITY and LIKELIHOOD, and ESTIMATE the risk rating

SEVERITY	LIKELIHOOD	RATING
1. *Negligible injury or illness.* 2. *Minor injury or illness.* 3. *Moderate injury or illness.* 4. *Major injury or illness.* 5. *Extreme loss, fatality, disaster.*	1. *Very Unlikely - Rarely happens* 2. *Unlikely to occur.* 3. *Possibly can occur.* 4. *Likely to occur.* 5. *Very Likely to occur.*	Rating = Severity x Likelihood

SECTION 6.0: STORAGE, TRANSPORT, HANDLING AND USE

Highlight any special circumstances relating to the safe method of storing, handling and using the substances. If there are any special requirements highlight them here.

SECTION 7.0: WASTE DISPOSAL ROUTES

State how the substances or any excess or waste will be disposed of. If there are any special requirements due to the nature of the material, or if it should be treated as Hazardous Waste (HW), identify what procedures will be used for safe disposal.

- ☐ In-house to regular trash collection (if determined to be non-hazardous and safe)
- ☐ In-house to drain (if determined to be non-hazardous and safe)
- ☐ Project specific solid chemical waste (disposed via special arrangement with EH&S Office)
- ☐ Project specific liquid chemical waste (disposed via special arrangement with EH&S Office)
- ☐ Communal lab solvent waste (disposed via regular pick-up by EH&S Office)
- ☐ Biological Waste (disposed via EH&S Office)
- ☐ Other: please specify

SECTION 8.0: SPILLAGE / EMERGENCY PROCEDURES

Identify any specific instructions or requirements in the event of a spillage or emergency.

- ☐ Written emergency instructions will be provided to workers and others who might be affected.
  Specify:
- ☐ First Aid Provisions (for example, eye wash station, body shower, antidote, etc.)
  Specify:
- ☐ Specific Spill Procedures (such as neutralization, absorption, disinfection, etc.)
  Specify:
- ☐ Other ***Specify:***

SECTION 9.0: SUMMARY OF ASSESSMENT RECOMMENDATIONS

Complete this section after the assessment. Include brief details of the assessment findings. Include details on control measures and other relevant details.

SECTION 10.0: STANDARD OPERATING PROCEDURE (SOP)

Specify if a SOP is required for the work activity and if so complete or attach the details of this.

Is a standard operating procedure deemed necessary for this work?	Yes ☐	No ☐

If yes, please give details:

Appendix E: Peroxide-Forming Chemicals

Peroxide-forming chemicals must be used and stored in accordance with manufacturer's recommendations. If you suspect that peroxides are present, do NOT open the container. These peroxides can be shock and/or friction sensitive, especially when dry. Segregate other chemicals away from the suspect peroxide-containing chemical(s) and notify the EHS/Chemical Hygiene Officer.

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

LIST A
Severe Peroxide Hazard on Storage with Exposure to Air:

Discard within 3 months

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

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

Discard or test for peroxides after 6 months

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

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

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

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

- Styrene
- Vinylpyridine

b. **Normal Gases; Discard after 12 months**
- Butadiene[c]
- Tetrafluoroethylene (TFE) [c]
- Vinyl chloride
- Vinylacetylene (MVA) [c]

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

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

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

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

OSHA® FactSheet

Laboratory Safety OSHA Laboratory Standard

OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories standard **(29 CFR 1910.1450), referred to as the Laboratory standard, covers laboratories where chemical manipulation generally involves small amounts of a limited variety of chemicals. This standard applies to all hazardous chemicals meeting the definition of "laboratory use" and having the potential for worker exposure.**

Hazardous chemicals present physical and/or health threats to workers in clinical, industrial, and academic laboratories. Hazardous laboratory chemicals include cancer-causing agents (carcinogens), toxins that may affect the liver, kidney, or nervous system, irritants, corrosives, and sensitizers, as well as agents that act on the blood system or damage the lungs, skin, eyes, or mucous membranes. OSHA rules limit all industry exposures to approximately 400 substances.

Elements of the Laboratory Standard

This standard applies to employers engaged in laboratory use of hazardous chemicals.[1]

- "Laboratory" means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.
- "Laboratory use of hazardous chemicals" means handling or use of such chemicals in which all of the following conditions are met:
  - Chemical manipulations are carried out on a "laboratory scale" (i.e., work with substances in which the containers used for reactions, transfers, and other handling of substances is designed to be easily handled by one person);
  - Multiple chemical procedures or chemicals are used;
  - The procedures involved are not part of a production process, nor do they in any way simulate a production process; and
- "Protective laboratory practices and equipment" are available and in common use to minimize the potential for worker exposure to hazardous chemicals.
- Any hazardous chemical use which does not meet this definition is regulated under other standards. This includes other hazardous chemical use within a laboratory. For instance:
  - Chemicals used in building maintenance of a laboratory are not covered under the Laboratory standard.
  - The production of a chemical for commercial sale, even in small quantities, is not covered by the Laboratory standard.
  - Quality control testing of a product is not covered under the Laboratory standard.
- If the Laboratory standard applies, employers must develop a Chemical Hygiene Plan (CHP). A CHP is the laboratory's program which ad- dresses all aspects of the Laboratory standard.
  - The employer is required to develop and carry out the provisions of a written CHP.
  - A CHP must address virtually every aspect of the procurement, storage, handling, and disposal of chemicals in use in a facility.
- Primary elements of a CHP include the following:
  - Minimizing exposure to chemicals by establishing standard operating procedures, requirements for personal protective equipment, engineering controls (e.g., chemical fume hoods, air handlers, etc.) and waste disposal procedures.
  - For some chemicals, the work environment must be monitored for levels that require action or medical attention.
  - Procedures to obtain free medical care for work-related exposures must be stated.

- The means to administer the plan must be specified.
- Responsible persons must be designated for procurement and handling of Material Safety Data Sheets, organizing training sessions, monitoring employee work practices, and annual revision of the CHP.

[1] **Note:** The scope of the Formaldehyde standard (29 CFR 1910.1048) is not affected in most cases by the Laboratory standard. The Laboratory standard specifically does not apply to formaldehyde use in histology, pathology, and human or animal anatomy laboratories; however, if formaldehyde is used in other types of laboratories which are covered by the Laboratory standard, the employer must comply with 29 CFR 1910.1450.

Additional Information

The following OSHA Interpretations of the Laboratory standard provide additional information:

- Labeling Requirements under the HAZCOM and Laboratory standards; use of safe needle devices. (2001, January 11). Available at: www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=23781. Also, for labeling information, refer to the Laboratory Safety Quickcard.
- Coverage of various types of laboratories by the Laboratory standard. (1991, February 8). Available at: www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETA-TIONS&pid=20190.
- The Laboratory standard does not apply to a pharmacy operation mixing cytotoxic drugs. (1990, June 22). Available at: www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20025.

OSHA's Safety and Health Topics Page entitled "Laboratories", provides more detailed information about the Laboratory standard and is available at: www.osha.gov/SLTC/laboratories/index.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request.

.

OSHA
FS-3464
8/2011
DSG

Appendix G: Oxidizers

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

Additional safety information should be obtained from the SDSs and other reference material before proceeding with work involving these compounds, especially those classified as Class 3 and 4 oxidizers.

TABLE 2 - Classification System for Oxidizing Materials

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

Table 3 – Oxidizing Materials (as classified by the NFPA)

Class 1	lithium peroxide sodium aluminum nitrate persulfate magnesium potassium dichromate nitrate strontium ammonium persulfate chlorate magnesium potassium nitrate perchlorate strontium barium chlorate nitrate magnesium potassium persulfate peroxide strontium barium nitrate peroxide nickel nitrate silver nitrate zinc chlorate barium peroxide nitric acid (<70% conc.) sodium carbonate peroxide zinc peroxide calcium chlorate perchloric acid (<60% conc.) sodium dichloro-s-triazinetrione calcium nitrate sodium dichromate calcium peroxide sodium nitrate cupric nitrate sodium nitrite hydrogen peroxide (8-27.5%) sodium perborate lead nitrate sodium perborate tetrahydrate lithium hypochlorite sodium perchlorate monohydrate
Class 2	calcium hypochlorite (<50% wgt) potassium permanganate chromium trioxide (chromic acid) sodium chlorite (<40% wgt.) halane sodium peroxide hydrogen peroxide (27.5-52% conc.) sodium permanganate nitric acid (>70% conc.) trichloro-s-triazinetrione
Class 3	ammonium dichromate potassium chlorate hydrogen peroxide (52-91% conc.) potassium dichloroisocyanurate calcium hypochlorite (>50% wgt.) sodium chlorate perchloric acid (60-72.5% conc.) sodium chlorite (>40% wgt.) potassium bromate sodium dichloro-s-triazinetrione

Class 4	ammonium perchlorate ammonium permanganate guanidine nitrate hydrogen peroxide (>91% conc.) perchloric acid (>72.5%) potassium superoxide

Appendix H: Hazardous Waste Management

Hazardous chemical waste includes but is not limited to, waste from laboratory processes, chemicals which are no longer needed, out of date chemicals, etc. All hazardous chemical waste must be reported to the EHS Officer to ensure proper handling and disposal. The chemical waste management plan includes:

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

Defining Hazardous Chemical Wastes

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

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

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

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

Containers

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

Labeling

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

Container Management

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

Drain Disposal

- Limited drain disposal of certain chemicals may be permitted. Dilute, common mineral acids and dilute, common alkali solutions are permitted, but only in small quantities, and accompanied by copious amounts of running water. Drain disposal of picric, perchloric or hydrofluoric acids and their salts is prohibited.
- Flammable materials are prohibited from sinks and drains. This includes alcohols, acetone, ethers and glacial acetic acid. Miscibility with water is NO justification for drain disposal. No liquids of any type may be disposed in wastebaskets or dumpsters.

The EHS/Chemical Hygiene Officer must be notified to arrange periodic pickups as necessary. The containers must clearly indicate the chemical name(s) and approximate % concentrations if waste is part of a mixture. Please contact the EHS /Chemical Hygiene Officer for assistance with chemical waste disposal.

Other Laboratory Wastes

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

Appendix I: Incompatible Chemicals

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

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

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

Appendix J: Laboratory Clean-Out of Hazardous Materials

This procedure is designed to ensure that hazardous materials are disposed of properly when faculty, staff, postdoctoral associates, or graduate students transfer to a different laboratory or leave the ASRC. This will reduce the number of unwanted and unknown hazardous materials in laboratories, reduce waste disposal costs, and provide laboratory personnel with a healthful, safe, and clean place to work. This policy specifies responsibilities of both the individual and department, as well as the procedures that must be followed for the proper disposal of hazardous materials.

Each faculty member assigned to a laboratory is responsible for the proper use and disposal of all hazardous materials in his/her assigned laboratory space. When faculty member or personnel under his/her supervision transfers to a new laboratory or leaves, that individual must follow proper "clean-out" procedures. Each unit manager will be responsible for implementing and enforcing clean-out procedures, then inspecting facilities for hazardous materials after laboratory clean-out procedures are completed. EHS/Chemical Hygiene Officer will review checkout procedures and provide information on hazardous materials, proper disposal procedures, and regulations governing disposal of hazardous materials.

Any problems resulting from improper management of hazardous materials at clean-out will be addressed by the laboratory director or manager, EHS, and (if applicable) the Chair of the ASRC safety committee.

Procedures:

1. Remove and properly dispose of all hazardous materials from the laboratory and also from any shared storage units such as refrigerators, cold rooms, stock rooms, and waste collection areas. *A suggested Laboratory Checkout List is attached.*
2. Clean and decontaminate all laboratory equipment, fume hoods, benchtops, cabinets, floors, and shelves. Submit hazardous waste removal request to Environmental Health & Safety.
3. If laboratory equipment is to be discarded, be aware that hazardous materials (e.g., batteries, capacitors, transformers, mercury switches, mercury thermometers, oil, radioactive sources, and CFCs from refrigerators, etc.) may be in equipment and must be removed before disposal. Contact EH&S for assistance.
4. The laboratory supervisor shall inspect the facilities and ensure that graduate students, postdocs, and employees under his/her supervision have completed the proper disposal procedures and fulfilled their responsibilities for cleanup.
5. Request that EH&S inspect the facilities to determine that the laboratory has been properly cleaned and decontaminated.

SAMPLE LABORATORY CHECKOUT LIST

1. **Name:_____ Room#: _____**

2. **Chemicals**

   A. Inventory and label all chemicals and chemical waste in the laboratory.
   B. All areas of the laboratory must be inspected including refrigerators, acid and flammable storage cabinets, shelves,
   and drawers

3. **Hazardous Waste Disposal**

   A. Properly cap and label all hazardous material containers.
   B. Characterize any "unknown" chemicals as completely as possible.
   C. Transfer chemicals in good condition to another researcher or to area
   D. Contact Office of Environmental Health and Safety (EHS) for waste removal.

4.

   A. Return to distributor/supplier
   B. Report lecture size cylinders to EH&S

5. **Controlled Substances**

   A. Inventory all controlled substances and notify EHS for disposal.

6. **Biological Materials**

   A. Inventory and label all materials
   B. Transfer usable materials to another researcher
   C. Decontaminate equipment as necessary
   D. Contact EHS for Biomedical / Infectious removal

7. **Radioactive Materials**

   A. Send inventory of all reusable material to EHS
   B. Return film badge (if one has been issued)
   C. Contact EHS/Radiation Safety Officer for checkout / decontamination

8. **Defective Equipment/Laboratory Repairs**

   A. Report to principal investigator, lab manager, or EHS for repair or

9. A. Inspect Fire extinguishers monthly.

_____ _____

Signature Date

cc: Environmental Health & Safety

Appendix K: Lab Safety Inspection Checklist

ADVANCED SCIENCE RESEARCH CENTER
THE GRADUATE CENTER
CITY UNIVERSITY OF NEW YORK
Environmental Health & Safety

Lab Safety Inspection Checklist

In Compliance? OK	NO	N/A		Notes/ Date Corrected
4. Electrical Safety, Moving Parts, and Energy Sources				
☐	☐	☐	A. Extension cords are not used as permanent wiring.	
☐	☐	☐	B. Extension cords are not "daisy-chained" to reach a distant outlet.	
☐	☐	☐	C. Outlets, wiring, and electrical cords are in good condition and not exposed wires.	
☐	☐	☐	D. All power strips and outlets near sources of water are protected by a GFCI.	
☐	☐	☐	E. Electrical outlets are not overloaded. No splitters used to allow more plugs into an outlet.	
☐	☐	☐	F. Heavy duty power cords (not cheap household types) are used for lab equipment.	
☐	☐	☐	G. Machines with moving parts or accessible energy sources (e.g. UV) have guards or interlocks.	
☐	☐	☐	H. Equipment with broken doors, interlocks, frayed wires, etc. is labeled as "out of service".	
5. Compressed Gas Cylinders ☐ **N/A** No gas cylinders in room				
☐	☐	☐	A. Gas cylinders are clearly labeled identifying their contents.	
☐	☐	☐	B. Cylinders are secured to a fixed counter or wall with straps or chains.	
☐	☐	☐	C. When gases are not 'in use', regulators are removed and replaced with cylinder caps.	
☐	☐	☐	D. Flammable gases are stored ≥ 20 ft from oxygen gas/sparks sources (or 1 hr fire wall).	
6. Fume Hoods and Biosafety Cabinets ☐ **N/A** No hoods/glove boxes				
☐	☐	☐	A. Fume hoods are functioning and the air flow monitors are working properly.	
☐	☐	☐	B. Fume hoods are not excessively cluttered and there is room to work.	
☐	☐	☐	C. Good fume hood use: Chemicals/Equipment don't block the baffle slots in the back.	
☐	☐	☐	D. Good fume hood use: Chemicals used 6" behind sash face, air foil in front is not blocked.	
☐	☐	☐	E. Good fume hood use: Large equipment elevated to allow air flow.	
☐	☐	☐	F. Biosafety cabinets and fume hoods have been tested within the last 12 months.	
7. Chemical Storage ☐ **N/A** ≤ 1L Stored in room				
☐	☐	☐	A. Chemical containers are stored by hazard class* using separate cabinets or tray to catch leaks and prevent incompatible liquids from causing unwanted reactions.	
☐	☐	☐	B. All chemical containers such as bottles, cans, beakers, and flasks have a legible label or tag stating the contents.	
☐	☐	☐	C. Cabinets containing hazardous materials are labeled with the chemical hazard class(es)*.	
☐	☐	☐	D. Unstable chemicals are dated when received and opened and discarded when expired.	
☐	☐	☐	E. All containers are stored upright and secure. Containers not at edge of counter.	
☐	☐	☐	F. Containers are capped or closed when material is not being added or removed.	
☐	☐	☐	G. Solvents and other hazardous liquids are stored off the floor and not in aisles.	
☐	☐	☐	H. 5 gal cans are stored inside flammable storage cabinets or chemical storage room.	
☐	☐	☐	I. Bulging, damaged containers and those with obvious chemical reactions removed.	

*HAZARD CLASSES: acids, bases, flammables, oxidizers, etc.

ADVANCED SCIENCE RESEARCH CENTER
THE GRADUATE CENTER
CITY UNIVERSITY OF NEW YORK
Environmental Health & Safety

Lab Safety Inspection Checklist

In Compliance? OK	NO	N/A		Notes/ Date Corrected
8. Flammable Materials ☐ N/A ≤ 1L Stored in room				
☐	☐	☐	A. Flammable liquids are stored in flammable storage cabinets—w/self-closing doors.	
☐	☐	☐	B. Ethyl ether and tetrahydrofuran dated & not stored past expiration date.	
☐	☐	☐	C. Flammable liquids and gases are stored away from open flames, spark sources, strong oxidizers, or oxygen cylinders.	
☐	☐	☐	D. Flammables that require refrigeration are only stored in refrigerators marked as "Explosion-Proof."	
☐	☐	☐	E. Halogenated solvents that are not flammable (i.e., chloroform) are not stored in cabinets labeled "Flammable Storage." They are stored with other organics.	
9. Hazardous Waste (Chemical) ☐ N/A				
☐	☐	☐	A. Containers with any chemical waste in it have a completed hazardous waste ID tag or label.	
☐	☐	☐	B. Waste ID labels correctly identify the contents and are legible.	
☐	☐	☐	C. Liquid hazardous waste containers are stored in secondary containment to collect spills.	
☐	☐	☐	D. Incompatible waste types are separated by secondary containers and labeled.	
☐	☐	☐	E. Used batteries, UV, halogen, and fluorescent lamps are stored in dated containers labeled "Universal Waste".	
☐	☐	☐	F. Hazardous waste is clearly segregated from in use or stored chemicals.	
☐	☐	☐	G. Waste containers are closed, except when waste is being added. (*Funnels are not caps. Closed top funnels and drilled caps for tubing are okay).*	

Other Issues or Notes: _____

Name of person performing self-inspection _____ *print name* **Date** _____

Signature of Person Responsible for Room _____ *signature* **Date** _____

LABORATORY HAZARD ASSESSMENT TOOL

Thomas Dickson – Director of Environmental Health and Occupational Safety
tdickson@gc.cuny.edu Phone (212)-413-3351

This form must be completed by the PI, Lab Supervisor, (*most experienced*) or their designee to conduct a laboratory hazard assessment specific to activities in their laboratories. The laboratory hazard assessment identifies hazards to employees and specifies personal protective equipment (PPE) to protect employees during work activities. The PI assessment must verify that it is complete and that training has been conducted.

This assessment consists of four sections and serves as a step in satisfying PPE requirements.

Section 1: Lab Information
Section 2: Laboratory Hazard Assessment
Section 3: Conduct PPE Training
Section 4: Verification of PPE Training

EH&S personnel are available at your request to assist with completing this form or with reviewing it after you have completed it. EH&S may also be consulted by calling the numbers listed above.

Section 1: Lab Information

Department	
Lab location(s) with building & room number(s)	
Principal Investigator	
Laboratory Safety Coordinator	
Name & title of person conducting assessment	
Phone number	
Email address	
Date assessment completed	
Signature	

Section 2: Laboratory Hazard Assessment

In this section, you will:

- Conduct a hazard assessment of the laboratory to identify activities when PPE is needed to protect the lab staff from exposure to hazards.
- Certify the hazard assessment for the laboratory by signing in Section 1.

The following checklists are an overview of common lab activities and associated potential hazards and applicable PPE. Check each box that describes activities performed by lab personnel.

Chemical Hazards				
Are the following activities performed in the lab?				
Yes	**No**	**Activity**	**Potential Hazard**	**Applicable PPE**
☐	☐	Working with small volumes (<4 liters) of corrosive liquids.	Eye or skin damage.	Safety glasses or goggles. Light chemical-resistant gloves. Lab coat.
☐	☐	Working with large volumes (>4 liters) of corrosive liquids, small to large volumes of acutely toxic corrosives, or work which creates a splash hazard.superscript.[1]	Poisoning; increased potential for eye and skin damage.	Safety goggles. Heavy chemical-resistant gloves. Lab coat and chemical-resistant apron.
☐	☐	Working with small volumes (<4 liters) of organic solvents or flammable organic compounds.	Skin or eye damage, potential poisoning through skin contact.	Safety glasses or goggles. Light chemical-resistant gloves. Lab coat.
☐	☐	Working with large volumes (>4 liters) of organic solvents, small to large volumes of very dangerous solvents, or work which creates a splash hazard.[1]	Major skin or eye damage, potential poisoning through skin contact. Fire.	Safety goggles. Heavy chemical-resistant gloves. Flame-resistant lab coat (e.g. Nomex).
☐	☐	Working with toxic or hazardous chemicals (solid, liquid, or gas).[1,2]	Skin or eye damage, potential poisoning through skin contact.	Safety glasses (goggles for large quantities). Light chemical-resistant gloves. Lab coat.
☐	☐	Working with acutely toxic or hazardous chemicals (solid, liquid, or gas).[1, 2, 3]	Increased potential for eye or skin damage; increased potential poisoning through skin contact.	Safety goggles. Heavy chemical- resistant gloves. Lab coat.
☐	☐	Working with an apparatus wit contents under pressure c vacuum.	Eye or skin damage.	Safety glasses or goggles; face shield for high risk activities. Chemical-resistant

				gloves. Lab coat, chemical-resistant apron for high risk activities.
☐	☐	Working with air or water reactive chemicals.	Severe skin and eye damage. Fire.	Work in inert atmosphere, when possible. Safety glasses or goggles. Chemical-resistant gloves. Lab coat, flame resistant lab coat for high risk activities (e.g. Nomex). Chemical-resistant apron for high risk activities.
☐	☐	Working with potentially explosive chemicals.	Splash, detonation, flying debris, skin and eye damage. Fire.	Safety glasses face shield, and blast shield. Heavy gloves. Flame-resistant lab coat (e.g. Nomex).
☐	☐	Working with low and high temperatures.	Burns; splashes. Fire.	Safety glasses. Lab coat. Thermal insulated gloves, when needed.
☐	☐	Minor chemical spill cleanup.	Skin or eye damage, respiratory damage.	Safety glasses or goggles. Chemical-resistant gloves. Lab coat. Chemical-resistant apron and boot/shoe covers for high risk activities. Respirator as needed. Consider keeping Silver Shield gloves in the lab spill kit.
☐	☐	Reactive Materials		

Biological Hazards

Are the following activities performed in the lab?

Yes	No	Activity	Potential Hazard	Applicable PPE
☐	☐	Working with human blood, body fluids, tissues, or blood borne pathogens (BBP). [5]	Exposure to infectious material.	Safety goggles with face shield or facemask plus goggles, latex or nitrile gloves, lab coat or gown.
☐	☐	Working with preserved animal and/or human specimens.	Exposure to infectious material or preservatives.	Safety glasses or goggles, protective gloves such as light latex or nitrile for unpreserved specimens (select protective glove for preserved specimens according to preservative used), lab coat or gown.
☐	☐	Working with radioactive human blood, body fluids, or blood borne pathogens (BBP).	Cell damage, potential spread of radioactive contaminants, or potential BBP exposure.	Safety glasses (goggles for splash hazard), light latex or nitrile gloves, lab coat or gown.
☐	☐	Working with agents or recombinant DNA classified as Biosafety Level 1 (BSL-1).	Eye or skin irritation.	Safety glasses or goggles for protection from splash or other eye hazard, light latex

				or nitrile gloves for broken skin or skin rash, lab coat or gown.
☐	☐	Manipulation of cell lines, viruses, bacteria, or other organisms classified as Biosafety Level 2 (BSL-2). [5]	Exposure to infectious material, particularly through broken skin or mucous membranes.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves, lab coat or gown.
☐	☐	Manipulation of infectious materials classified as Biosafety Level 2 facility with BSL-3 practices (BSL-2+). [5]	Exposure to infectious materials with high risk of exposure by contact or mucous membranes.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves (double), lab coat or disposable gown (preferred), surgical mask.
☐	☐	Manipulation of infectious materials classified as Biosafety Level 3 (BLS-3).	Exposure to infectious materials with high risk of exposure, particularly through the inhalation route.	Safety glasses or goggles for protection from splash or other eye hazard, light latex or nitrile gloves (double), full disposable gown or Tyvek suite (preferred), respirator, shoe cover or dedicated shoe.
☐	☐	Working with live animals (Animal Biosafety Level 1, ABL-1).	Animal bites, allergies.	Safety glasses or goggles for protection from splash or other eye hazard, light latex, nitrile or vinyl gloves for broken skin or skin rash, lab coat or gown. Consider need for wire mesh glove.
☐	☐	Working with live animals (Animal Biosafety Level 2, ABL-2). [5]	Animal bites, exposure to infectious material, allergies.	Safety glasses or goggles for protection from splash or other eye hazard, light latex, nitrile or vinyl gloves, lab gown, hair cover, shoe covers, surgical mask. Consider need for wire mesh glove.

Radiological Hazards

Are the following activities performed in the lab?

Yes	No	Activity	Potential Hazard	Applicable PPE
☐	☐	Working with solid radioactive materials or waste.	Cell damage, potential spread of radioactive materials.	Safety glasses, impermeable gloves, lab coat.
☐	☐	Working with radioactive materials in hazardous chemicals (corrosives, flammables, liquids, powders, etc.).	Cell damage or spread of contamination plus hazards for the specific chemical.	Safety glasses (or goggles for splash hazard), light chemical-resistant gloves, lab coat. Note: Select glove for

				the applicable chemical hazards above.
☐	☐	Working with ultraviolet radiation.	Conjunctivitis, corneal damage, skin redness.	
☐	☐	Working with infrared emitting equipment (e.g. glass blowing).	Cataracts, burns to cornea.	UV face shield and goggles, lab coat.
☐	☐	Working with X-Rays		Appropriate shaded goggles, lab coat.

Laser Hazards

Are the following activities performed in the lab?

Yes	No	Activity	Potential Hazard	Applicable PPE
		Open Beam		
☐	☐	Performing alignment, trouble-shooting or maintenance that requires working with an open beam and/or defeating the interlock(s) on any Class 3 or Class 4 laser system.	Eye damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters.
☐	☐	Viewing a Class 3R laser beam with magnifying optics (including eyeglasses).	Eye damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters.
☐	☐	Working with a Class 3B laser open beam system with the potential for producing direct or specular reflections.	Eye damage, skin damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters, appropriate skin protection.
☐	☐	Working with a Class 4 laser open beam system with the potential for producing direct, specular, or diffuse reflections.	Eye damage, skin damage.	Appropriately shaded goggles/glasses with optical density based on individual beam parameters, appropriate skin protection.
		Non Beam		
☐	☐	Handling dye laser materials, such as powdered dyes, chemicals, and solvents.	Cancer, explosion, fire.	Gloves, safety glasses, flame resistant lab coat or coveralls.
☐	☐	Maintaining and repairing power sources for large Class 3B and Class 4 laser systems.	Electrocution, explosion, fire.	Electrical isolation mat, flame- resistant lab coat or coveralls.

Physical Hazards

Are the following activities performed in the lab?				
Yes	No	**Activity**	Potential Hazard	**Applicable PPE**
☐	☐	Working with cryogenic liquids.	Major skin, tissue, or eye damage.	Safety glasses or goggles for large volumes, impermeable insulated gloves, lab coat.
☐	☐	Removing freezer vials from liquid nitrogen	Vials may explode upon rapid warming. Cuts to face/neck and frostbite to hands.	Face shield, impermeable insulated gloves, lab coat.
☐	☐	Working with very cold equipment or dry ice.	Frostbite, hypothermia.	Safety glasses, insulated gloves (possibly warm clothing), lab coat.
☐	☐	Working with hot liquids, equipment, open flames (autoclave, Bunsen burner, water bath, oil bath).	Burns resulting in skin or eye damage.	Safety glasses or goggles for large volumes, insulated gloves (impermeable insulated gloves for liquids, steam), lab coat.
☐	☐	Glassware washing.	Lacerations.	Heavy rubber gloves, lab coat.
☐	☐	Working with loud equipment, noises, sounds, alarms, etc.	Potential ear damage and hearing loss.	Earplugs or ear muffs as necessary.
☐	☐	Working with a centrifuge.	Imbalanced rotor can lead to broken vials, cuts, exposure.	Safety glasses or goggles, lab coat, latex, vinyl, or nitrile gloves.
☐	☐	Working with a sonicator.	Ear damage, exposure.	Safety glasses or goggles, lab coat, latex, vinyl, or nitrile gloves.
☐	☐	Working with sharps.	Cuts, exposure.	Safety glasses or goggles, lab coat, latex, vinyl, or nitrile gloves.

Nanomaterial Hazard

Is the following activity performed in the lab?				
Yes	No	**Activity**	Potential Hazard	**Applicable PPE**
☐	☐	Working with engineered nanomaterials. 8	Inhalation, exposure, dermal exposure.	Goggles, gloves, lab coat.

1. Use a chemical fume hood or other engineering control whenever possible. In addition to engineering controls and PPE, consider personal clothing that provides adequate skin coverage.
2. Consult MSDS.
3. Chemical-resistant gloves are to be selected based on the specific chemical(s) used.
4. Use a Biosafety cabinet to minimize exposure
5. Appropriate skin protection can include lab coat, gloves, sun block, barrier cream.
6. Working with dry engineered nanomaterials (e.g. synthesizing, storage) should be separately evaluated for respiratory protectio

Section 3: Conduct PPE Training

PPE training consists of **site-specific training** conducted by the lab PI. Verification is required to document that training has been conducted (see the following page).

Step 1

1. The PI, lab manager, or their designee reviews the **completed** *Hazard Assessment Tool* (this document) with the employee. It describes the tasks in the lab when employees need PPE to protect themselves from exposure to hazards. In this step, the hazard assessment is used as a training tool.
2. While discussing lab activities and the associated hazards with lab staff, the supervisor will address how their lab obtains PPE, what types of PPE are used in the lab and for which tasks, where and how the PPE is stored and maintained, how to properly use the PPE, and discuss any limitations of the PPE. The supervisor should also discuss general PPE safety practices, including not wearing PPE outside of lab hazard areas (e.g. hallways and eating areas).

Step 2

When the supervisor believes the employee has demonstrated understanding, the employee(s) and the supervisor then sign the following *Verification of PPE Training* form (next page) to document that PPE training has been conducted. A copy of this signed form is to be maintained in the Lab Safety Manual.

Step 3

Repeat or conduct a refresher training whenever the hazard assessment is updated (at least annually).

Section **4: Verification of PPE Training**

The following employees of _____(laboratory) have reviewed the online presentation *PPE Use for Research Laboratories* and have received the following training:

1. When PPE is necessary.
2. What PPE is required.
3. How to properly don, doff, adjust, and wear PPE.
4. The limitations of PPE.
5. The proper care, maintenance, useful life, and disposal of PPE.

Employee Name	**FNDY COF Number**	**Employee Signature**

As a part of this training, employees were informed of the personal protective equipment selected by this facility for their use. By my signature and those of the employees listed above, we certify that each employee has demonstrated his/her understanding of this training.

~~(Signature of Principal Investigator)~~ ~~(Date)~~