

**Carnegie Mellon University Policy and Procedures on  
Occupational Exposure to  
Hazardous Chemicals in Laboratories  
29 CFR 1910.1450**

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This plan is available at on the [EHS website](#).

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# Carnegie Mellon University Policy and Procedures on Occupational Exposure to Hazardous Chemicals in Laboratories

## 29 CFR 1910.1450

### Introduction: Purpose and Policy

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***Purpose***

This is a statement of Environmental Health & Safety policy to establish the process for compliance with the Occupational Safety and Health Administration (OSHA) regulation “Occupational Exposure to Hazardous Chemicals in Laboratories.” The purpose of the process is to protect employees from the health hazards of hazardous chemicals in their laboratories and to keep chemical exposures below the OSHA Permissible Exposure Limit (PEL).

***Policy***

Carnegie Mellon University is dedicated to providing safe and healthy laboratory facilities for students and employees, and for complying with federal and state occupational health and safety standards. Laboratory administrators, managers, faculty, staff and students all share responsibility for minimizing their exposures to hazardous chemical substances. Lab workers must not be exposed to substances in excess of the permissible exposure limits (PEL) specified in OSHA rule 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances.

The standard applies where “laboratory use” of hazardous chemicals occurs. OSHA defines laboratory use as handling or use of chemicals on a “laboratory scale”. “Laboratory Scale” is when the work involves containers which can easily and safely be manipulated by one person, when multiple chemical procedures or chemical substances are used, and when protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposures to hazardous chemicals.

The Chemical Hygiene Plan (CHP) shall be reviewed and evaluated at least annually for its effectiveness, and updated as necessary. It shall be made available to all applicable employees and employee representatives. The CHP is currently located on the [EHS website](#).

Carnegie Mellon’s Chemical Hygiene Plan (CHP) includes: 1) periodic monitoring of the performance of ventilation systems, 2) periodic safety inspections of laboratories, 3) procedures that ensure that disposal of waste chemicals occurs at regular intervals, and 4) training opportunities for all laboratory workers. Implementation of these CHP procedures is a regular, continuing effort, endorsed by administration and faculty. All Carnegie Mellon University laboratory faculty and staff shall follow its recommendations.

### Responsibilities

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***Organizational Chart***

See University organizational charts available on the [Carnegie Mellon University’s Leadership website](#).

***Roles and Responsibilities***  
***Roles and Responsibilities***

**President**

- The president has ultimate authority for chemical safety at the university and shall, with other administrators, provide continuing support for the University’s Chemical Hygiene Plan (CHP).

**Administration**

- The provost, vice provosts, and deans shall require department heads to adhere to the CHP.

*Roles and Responsibilities*

- The provost shall provide administrative and financial support for lab safety issues.
- Department heads shall require laboratory managers, professors, researchers, and principal investigators to adhere to the CHP.

**Environmental Health & Safety**

- The Director of Environmental Health & Safety (EHS) is responsible for the training of EHS staff and providing appropriate facilities, suppliers, references, instruments, etc., to survey and evaluate safety systems and processes.
- The Director of EHS shall ensure the preparation, review, and distribution of the University's Laboratory Emergency Response Guide.
- EHS shall conduct periodic lab safety inspections.
- EHS shall conduct periodic inspections of exhaust hoods.
- EHS shall serve as an advisory source and create safety guidelines and programs.
- EHS shall maintain safety training records of appropriate faculty, staff, and students.

**Laboratory Safety Committee (LSC)**

- Advise EHS on safety standards and practices regarding the use of chemicals in laboratories.
- Establish laboratory safety program goals and acceptable performance levels.
- Determine the additional academic, research and administrative units to be represented on the LSC and recommend appropriate persons for appointment as these additional representatives.
- Perform annual assessments of the Chemical Hygiene Plan to ensure that it contains current and appropriate procedures, objectives and requirements.
- Determine where changes in university policies, guidelines and resources are needed to ensure the Chemical Hygiene Plan is implemented effectively.
- Aid in the resolution of issues involving application of safety rules/practices or engineering controls in Carnegie Mellon laboratories.
- Assist EHS in the arranging of training of appropriate faculty, staff and students within their department.
- Relay information between the LSC and the departments represented.

**Facilities Management & Campus Services**

- The Director of Facility Management & Campus Services shall ensure proper repair and maintenance of installed laboratory safety equipment a high priority.
- The Director of Facility Management & Campus Services is responsible for the prioritization and the performance of maintenance and repair of installed laboratory safety devices, for the training of service personnel, and for providing them with the necessary tools for installed safety system maintenance.
- Work orders to repair or renovate laboratory facilities may be initiated by principal investigators, laboratory instructors, or by FMS or EHS personnel.

**Chemical Hygiene Officer (CHO)**

- Work with administrators, staff, and students to develop and implement chemical hygiene guidelines and programs.
- Prepare the CHP with annual review and revisions as needed.
- Make the CHP available via electronic means or, upon request, by hard copy.
- Provide technical assistance and consultation on laboratory safety issues.
- Provide for the disposal of hazardous waste.
- Assist Campus Design and Facility Development (CDFD) to incorporate safety in new construction and renovations.
- Remain current on regulatory issues.
- Direct periodic laboratory safety audits to determine regulatory compliance, and recommend corrective action.
- Provide training to laboratory workers concerning the provisions of the Chemical Hygiene Plan and hazardous waste disposal.
- Provide hazard awareness training to ancillary workers.

- Conduct exposure assessments as needed upon request or if an employee shows signs or symptoms associated with hazardous chemical exposure.
- Investigate reported workplace injuries of chemical exposures and incidents.
- Meet with LSC to form policies and plans, and update the LSC concerning changes to governmental safety regulations.

#### **Laboratory Managers /Principal Investigators (LM/PI)**

- Implement all provisions of the Chemical Hygiene Plan for laboratory facilities under their control.
- Keep up to date list of the personnel working in their laboratories within the University's BioRAFT system. Laboratory inspectors will confirm current lab worker lists during inspections, to confirm all applicable personnel are trained.
- Ensure that appropriate personal protective equipment is available and that it provides adequate protection.
- Notify EHS when the need to use respirators occurs.
- Ensure that facilities, equipment, and materials are adequate for intended use; e.g., corrosive chemicals are near a continuous-flow eyewash and emergency safety shower.
- Ensure preparation, maintenance and implementation of written standard operating procedures (SOP) regarding safety and health considerations for each hazardous procedure.
- Require laboratory workers to obtain specific permission for deviation(s) from an SOP.
- Complete laboratory safety training and ensure that laboratory workers have received basic lab safety training from EHS.
- Train laboratory workers regarding the specific work practices, and procedures according to the provisions of their laboratory's SOPs.
- Maintain a hazardous chemical inventory in the University's ChemTracker program, specify those chemicals that are particularly hazardous substances (PHS). Ensure the review of the inventory periodically.
- Ensure the performance of inspections for housekeeping and safety.
- Ensure that employees are familiar with electronic MSDS/SDS searches. Maintain hard copies of MSDS/SDS for PHSs and those chemicals not available electronically.
- Report to the Chemical Hygiene Officer (CHO) all workplace injuries, chemical exposures, incidents, or unsafe conditions.

#### **Individual Researchers and Laboratory Users**

- Complete Carnegie Mellon's hazard communication, laboratory safety, and hazardous waste training.
- Follow Standard Operating Procedures (SOP) and the requirements of the Chemical Hygiene Plan.
- Report all workplace injuries, chemical exposures, incidents, or unsafe conditions to their LM/PI as soon as possible.
- Assist with the maintenance of the inventory of all hazardous chemical substances, and identification of PHS on the inventory. Maintain PHS MSDS/SDSs for their laboratory.
- Contact LM/PI and/or the CHO when safety questions arise.
- Work with LM/PI to evaluate existing SOPs and develop new SOPs as needed. Review new procedures with LM/PI.

## **Employee Information and Training**

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### *Training*

The purpose of Laboratory Safety training is to provide employees with information about the physical and health hazards of the hazardous chemicals in their work area and of the methods and procedures employees should follow to protect themselves from these materials. It is a requirement of OSHA that all laboratory personnel who work with hazardous chemicals have this training. The training occurs at two levels:

- General chemical safety training is provided by EHS. The employee should receive this training within the first thirty days of a laboratory assignment.
- Laboratory-specific training is to be provided by the laboratory Principal Investigator or his or her designee. This training should be performed and documented before the employee is permitted to work unsupervised in the laboratory.

Refresher training in laboratory safety is to be performed every three years, through an on-line refresher training via BioRAFT, which is the university's training and inspection tool. Reading the EH&S Quarterly Newsletter is highly recommended to ensure lab workers stay current with any compliance or safety law changes between three year periods.

[Note that any personnel involved with the generation of hazardous waste must also attend Hazardous Waste Generator training, also offered by EHS concurrently with the Lab Safety Class, or on-line.]

### **1. General Chemical Safety Training**

EHS will provide training, Laboratory Safety and Hazardous Waste, to laboratory workers (e.g., faculty, principal investigators, supervisors, researchers, etc.) within 30 days of their initial assignment to the laboratory work area. Ensuring that each worker obtains the training will be the responsibility of department and laboratory supervisors.

The training will include the following topics:

- This Chemical Hygiene Plan and its content.
- The contents of the [OSHA standard \(29CFR1910.1450\)](#) and its appendices.
- The availability of the Chemical Hygiene Plan.
- Location of reference material on the hazards (including Material Safety Data Sheet/Safety Data Sheets), safe handling, storage, and disposal of hazardous chemicals found in the laboratory.
- Methods and observations that may be used to detect the presence or release of hazardous chemicals.
- Protective measures an employee or student can take to prevent or reduce exposure to a hazardous chemical.
- Emergency response procedures.

Training documentation, including attendees, dates and subjects addressed, shall be maintained by EHS.

The Chemistry Department offers two courses which satisfy the requirements of the Laboratory Safety and Hazardous Waste training. They are 09-221, Laboratory I: Introduction to Chemical Analysis, and 09-202, Undergraduate Seminar II.

### **2. Laboratory Specific Training**

Laboratory supervisors will ensure that training is provided to laboratory personnel for the procedures/experiments they are performing. This training should be provided before laboratory work begins for the employee. It should include specifics of the hazardous materials to be used and the specific safe work practices for each.

### **3. Stockroom/Storeroom Training**

Training for stockroom/storeroom personnel shall be addressed under the Carnegie Mellon University Hazard Communication Program.

## Information

### Material Safety Data Sheet/Safety Data Sheets (MSDS/SDS)

Material Safety Data Sheet/Safety Data Sheets (MSDS/SDSs) are critical elements to a chemical safety program. All laboratory employees should be able to read and understand the relevant MSDS/SDS and also know where they can be obtained. The program [MSDSonline](#) is available from the EHS web page and within BioRAFT ChemTracker, it is accessible to all Carnegie Mellon staff, faculty and students. This program provides easy access to millions of MSDS/SDS. Chemical manufacturers and distributors are also a good source for SDS. MSDS/SDSs not available at the following link, or by internet search, employees should contact EHS.

A current MSDS/SDS for each chemical must be available for review in the work/storage area. This may be through the use of a paper copy or as accessible from the internet. Instructions for accessing items from the webpage are provided in the EHS webpage instructions.

Due to changes in the OSHA Hazard Communication Standard in 2012, Material Safety Data Sheets are now referred to as Safety Data Sheets (SDS.) SDSs may have a different format and rating system. Always use the most current version, or recent year, in the GHS SDS format.

### General Information

Assistance will be provided by EHS to any department, PI or employee requesting guidance or training to satisfy implementation of this policy.

### Global Harmonization System

The Global Harmonization System (GHS) is used to identify and evaluate chemical hazards. Through a series of pictograms, and a number rating, GHS provides a quick reference for evaluating the hazard(s) of a chemical. The hazard categories are numbered from 1 to 5. The LOWER the number, the GREATER the severity of the hazard. So, category 1 hazards are the most dangerous. The pictograms are as follows:



### Explosive

- Explosives
- Self-reactive substances
- Organic peroxides





**Flammable**

- Flammable gases, aerosols, liquids, and solids
- Pyrophoric liquids or solids
- Self-heating substances
- Self-reactive substances
- Substances that emit a flammable gas upon contact with water
- Organic peroxides



**Corrosive**

- Skin corrosion/burns
- Eye damage
- Corrosive to metals



**Oxidizer**

- Oxidizing gases, liquids, and solids



#### **Compressed gas**

- Gases under pressure



#### **Irritant**

- Irritant (skin and eye)
- Skin sensitizer
- Acute toxins
- Narcotic effects
- Respiratory tract irritants
- Hazardous to ozone layer (non-mandatory)



#### **Toxic Substance**

- Acutely toxic substances that may be fatal or toxic if inhaled, ingested, or absorbed through the skin



#### **Environmental Hazard (non-mandatory)**

- Acute aquatic toxins
- Chronic aquatic toxins



#### **Health Hazard**

- Respiratory sensitizers, Aspiration toxins
- Carcinogens, Mutagens, Reproductive toxins
- Target organ toxins, single exposure or repeated exposure

## **Control Measures**

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### ***Engineering Controls***

The best way to prevent exposure to airborne hazards is to prevent their release into the working atmosphere by use of hoods, gloveboxes, and other ventilation devices. Operations such as running reactions, heating or evaporating solvents, and transfer of chemicals from one container to another should be performed in a hood, or glovebox, when there is reasonable potential for hazardous material exposure.

### ***Engineering Controls***

#### **1. General Laboratory Ventilation**

General ventilation must not be relied on to control chemical vapors, gases, and mists

#### **2. Fume Hoods**

Use the fume hood for operations that might result in the release of hazardous chemical vapors, gases, mists, or dusts.

Confirm adequate hood performance before use; typically, it is best to maintain the hood sash at a working height of approximately 18 inches; keep materials stored in hoods to a minimum and do not allow them to block air flow.

In the event of ventilation hood failure, stop all experiments within the hood (if possible), lower the sash completely, and notify EHS. If there is a possibility of the release of a significant health hazard, campus police must be contacted and the building should be evacuated

Laboratory hoods shall be provided according to the following specifications:

- Where applicable, the hood shall have a working sash.
- When the hood sash is open approximately eighteen inches, an average face velocity of 80-150 fpm at the hood face shall be provided.
- The hood enclosure should be fire- and chemical-resistant.
- In new construction, consideration shall be given to locating the hood such that ambient air currents do not unacceptably reduce the containment efficiency of the hood.
- In new construction the hood shall be designed to produce laminar airflow.
- The hood shall have only modifications approved by EHS. Any modification must not detract from the hood performance.
- In new construction, the room in which the hood is located shall have a source of sufficient make-up air to replace the air that is exhausted out.
- All fume hoods shall have a monitoring device to measure airflow, or at a minimum have a low flow alarm.
- The fume hood should be appropriate for the material used within (i.e., perchloric acid usage.)
- Airflow shall be such that contaminants within do not escape the fume hood, as shown by a smoke tube test.

Face velocity and airflow monitors will be evaluated by EHS upon installation of laboratory hoods. Each laboratory hood at Carnegie Mellon University is re-checked periodically for usage and performance. Where performance parameters fall outside specifications, work orders are initiated to repair the hoods. When appropriate, a notice is placed on the hood indicating that it is not to be used until its performance is within the specified performance parameters.

Non-venting hoods (e.g., laminar flow hoods with in-room venting) shall be clearly labeled as such. Ductless fume hoods should be reviewed and approved by EHS.

Laboratory hoods are not to be modified without the involvement of the Chemical Hygiene Officer. Changes in airflow quantity and airflow patterns can significantly affect laboratory exposure potential, and the Chemical Hygiene Officer will ensure that modifications will not degrade the safety of the laboratory environment. Prior to putting modified hoods into service, airflow testing will be conducted by EHS specialists to ensure that airflow specifications have been met.

### **3. Other Local Ventilation Devices**

Exhaust air from glove boxes and isolation rooms should release into the hood exhaust system.

### **4. Special Ventilation Areas**

Procedures involving radioactive aerosols, powders or gaseous products, or procedures that could produce volatile radioactive effluents shall be conducted in an approved hood, glove box or other suitable closed system. Such fume hoods shall be designed with smooth, non-porous materials and possess adequate lighting to facilitate work within. The hoods shall have a minimum face velocity of 100 ft/min. Contact the Radiation Safety Office for further information on hoods for radioactive materials.

### ***Personal Protective Equipment***

Each laboratory should have access to protective apparel and equipment appropriate for the hazards present. Appropriate protective apparel and equipment should be determined by the laboratory PI or lab supervisor, in consultation with EHS. The PI or Lab Supervisor must assure that all persons, including visitors, wear appropriate eye protection where chemicals or hazardous materials are stored or used.

## 1. Respiratory Protection

Engineering controls should maintain all contaminant levels below the PEL or other applicable standard. When efficient engineering controls are not possible, suitable respiratory protection should be provided. Respirator use *must* be approved by EHS and *must* follow the Carnegie Mellon Respiratory Protection Program. Refer to the [Carnegie Mellon University Respiratory Protection Program](#) for further details.

## 2. Protective Clothing

Protective clothing such as chemically-resistant gloves, lab coats, aprons, or suits should be used when working with hazardous materials. Wear a lab coat or an apron specific for the hazards of the procedures performed in the laboratory. This includes, but is not limited to, using flame resistant clothing for use with pyrophorics, acid resistant protection when working with acids (especially HF), and protective items when working with hot or cold materials. The Principal Investigator or Laboratory Instructor is responsible for determining the protective clothing needed. The Chemical Hygiene Officer may be consulted as a resource for clothing selection.

Protective clothing should be inspected prior to each use. Laboratory coats should be laundered as needed. Care should be taken to avoid producing further contamination when having the lab coats laundered. Consult the EHS web page for further details on lab coat laundering options.

Wear appropriate gloves when the potential for contact with hazardous materials exists. Disposable gloves should not be reused and should NOT be washed or rinsed before disposal. Reusable gloves should be washed or cleaned before removal to prevent contamination. Always inspect all gloves before each use. Gloves should not be worn outside of the laboratory.

## 3. Eye Protection

Eye protection is mandatory for all entries into a work area within a laboratory where hazardous chemicals are used. The Principal Investigator or Laboratory Instructor will determine the level of eye protection required. All eye protection used should meet the ANSI Z87.1 requirement. For additional information about selecting proper eye protection please contact EHS.

### *Standard Operating Procedures*

Standard Operating Procedures prepared by the laboratory should be made available to all applicable laboratory personnel and to EHS and/or auditors.

### *Administrative Controls*

#### **Chemical Inventory**

All locations where chemicals are stored and/or used must have an accurate inventory of the chemicals, maintained currently in the University's designated program within BioRAFT, known as *ChemTracker*.

#### **Housekeeping, Maintenance, and Inspections**

##### Inspections

EHS performs laboratory safety inspections annually to ensure that adequate safety equipment is available and functioning, personal protection is available, chemicals are properly used and stored, MSDS/SDSs are readily accessible, and good housekeeping is being practiced. Inspections may be performed more frequently as deemed necessary by EHS. Follow-up inspections will be performed as necessary, to confirm completion of corrective actions. The results of these inspections can be viewed online by the Principal

Investigator as well as the Co-investigators or Compliance Liaison(s) for the lab through the EHS system, [BioRAFT](#),

**Internal** housekeeping and chemical hygiene inspections are recommended and should be conducted by the principal investigator, laboratory instructor, or appointed representative at least quarterly. Internal inspections can be conducted using the “Self-Inspections” function in BioRAFT. Please refer to the link above.

#### Repair

Facilities Management & Campus Services (FMCS) Service Response should be contacted if safety equipment is malfunctioning. Malfunctioning fume hoods should be marked “Do Not Use” if they are to be repaired. If the fume hood is not to be repaired, it should be labeled “Out of Service”. To re-start an “Out of Service” fume hood, contact EHS. Malfunctioning eyewashes and safety showers should be marked “Do Not Use”.

#### Maintenance

Laboratory personnel should inspect eyewashes monthly, by operating them until the water runs clear, and to ensure outlets have sufficient and even supply. FMCS coordinates annual testing of safety showers.

#### Personal housekeeping

Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation and at the end of each day. Stairways and halls should not be used for storage. Access to exits, emergency equipment, and utility controls must never be blocked.

### **Usage of laboratories**

#### *Administrative Controls*

Work conducted in Carnegie Mellon laboratories is for research or instructional purposes. Work is laboratory scale in nature, and activities are conducted within the physical limitations of the laboratory facilities and safety equipment, especially local exhaust systems. EHS shall be informed by the Lab Manager or Principal Investigator should chemical usage fall outside of typical laboratory scale operations.

### **Working alone**

If possible, avoid working alone in a laboratory. The definition of “working alone” is only one person in a lab or contiguous space who is working with hazardous materials, hazardous procedures or hazardous equipment. If necessary, working alone in a laboratory requires the lab worker and Principal Investigator review, complete, sign, and submit upload to BioRAFT or submit to EHS the [Working Alone in Research Laboratories, Shops, Studios and Work Areas form](#). When filling out the form, careful consideration should be given to the hazards and potential hazards of the materials present in the laboratory and of the work being performed. Advance planning should be made in these cases to address emergency response procedures and including consideration of when to inform outside parties of the employee’s work plan and schedule. The work alone form offers suggestions to assist in this advance planning. All Permission to Work Alone forms should be uploaded to the lab members BioRAFT documents. EHS can be asked to review forms, and will review forms during inspections. Some work scenarios do not allow working alone and require the buddy system, such as: working with pyrophoric materials, acutely toxic materials, and highly hazardous equipment. NOTE: Schools, Departments, and Principal Investigators may set a higher level of safety regarding working alone.

### **Special Medical Conditions**

Lab workers should contact their supervisor, PI and/or EHS if they have any of the following:

- A medical condition that may be affected by their laboratory work
- A medical condition that may affect the laboratory's general safety environment or ability to participate in and obey the university's emergency response plans.

### **Other University Safety Programs**

Laboratory personnel who work with biological agents and radiation sources or radiation producing devices, are subject to the requirements of the University's Biological Safety and Radiation Safety Programs, respectively. Further information on each is available on the [EHS website](#).

## **Chemical Usage Procedures**

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### ***Minimizing Chemical Exposures***

It is prudent to minimize all chemical exposures by any route, and to observe good laboratory practice by using an exhaust hood, wearing eye and hand protection, and a laboratory coat or apron. The cardinal rule for safety in working with hazardous substances is that all work with these materials in a laboratory should be performed in such a way that they do not enter the body by any mode, including inhalation, injection, absorption or ingestion. Quantities of vapors or dust should be prevented from entering the general laboratory atmosphere. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals have been adopted in addition to specific guidelines. These general hazards for handling chemicals in the laboratory may be classified broadly as physical or chemical.

Physical hazards include those of fire, explosion or electric shock. Other physical hazards arise from high or low pressure, such as cylinders of compressed gases and experimental vessels, cryogenic equipment, furnaces, refrigerators and glass apparatus.

Chemical hazards are associated with their health effects and may be sub-classified as acute or chronic. Acute hazards are those capable of producing prompt effects (such as burns, inflammation, or damage to eyes, lungs, or nervous system). Some chemicals are extremely dangerous in this respect and a small amount can cause death or severe injury very quickly. Other toxicological effects of chemicals may be delayed or develop only after exposure over long periods of time and are referred to as chronic hazards. (See: "Particularly Hazardous Substances," Page 17.) Do not smell or taste chemicals. Vent apparatus that may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust ventilation systems. Inspect gloves and test glove boxes before use. Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained re-circulated atmospheres.

### ***Understanding Chemical Hazards***

#### **Avoid Underestimation of Risk**

Under some circumstances, all chemicals can be hazardous. Even for substances of no known significant hazard, exposure should be minimized; for work with substances that present special hazards, special precautions should be taken. One should assume that any mixture would be more hazardous than its most hazardous component. Especially in the research laboratory where new preparations are constantly being developed, it is wise to maintain at least the same level of safe practice in the disposal of chemical waste and residues as in the actual preparative procedure. All substances of unknown hazard must be considered hazardous until proven otherwise.

### ***Routes of Chemical Entry***

Hazardous chemicals may enter the body in a number of different ways; all should be considered in identifying protective practices:

- Through inhalation of vapors, dust or fumes,
- Through skin or eye contact or absorption,
- Through the mouth or other mucous membranes, or
- Through a cut, puncture or other opening in the skin.

### ***Environmental Monitoring and Surveillance***

All environmental monitoring and surveillance will be performed by or overseen by EHS. All concerns of overexposure should be addressed to EHS.

**Routine sampling** will occur when initial monitoring results are at or above any applicable exposure limit or action level.

NIOSH or OSHA validated sampling methods, or equivalent methods, will be used to perform air sampling:

- Appropriate quality assurance will be used for all sampling and monitoring.
- Laboratory analysis shall be performed by an AIHA accredited laboratory where applicable

**Non-routine Sampling** is conducted for short-term operations or other reasons such as those listed below:

- A single step operation where verification of process controls is desired.
- Requests by the principal investigator, laboratory instructor, or laboratory worker.
- Laboratory accidents involving release of air contaminants.

#### **Observe the PELs, TLVs**

The permissible exposure limits (PEL) of OSHA and the threshold limit values (TLV) of the American Conference of Governmental Industrial Hygienists (ACGIH) should not be exceeded. This may be achieved by a combination of experimental design and engineering controls. In general, use of a hood is recommended when working with a volatile substance. These exposure limits may be found on a chemical's Material Safety Data Sheet/Safety Data Sheet.

#### **Environmental Monitoring and Surveillance**

- Air sampling may be performed for any chemical process where laboratory hood/filtered glove box or comparable exposure control device is not used to contain the contaminant.
- Air sampling will be performed where respiratory protection is required.
- Air sampling will be performed upon the request of the Principal Investigator, Laboratory Instructor, or laboratory worker.
- Air sampling will be performed in any situation where there is reason to believe a PEL or similar exposure standard has been exceeded.
- Air sampling specifications, including frequency and test method will be determined by the Chemical Hygiene Officer, in consultation with lab and EHS personnel.
- Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories, but may be appropriate when testing or redesigning hoods or other ventilation devices, or when a highly toxic substance is used regularly (e.g., 3 times/week). All monitoring results shall be prominently posted and/or provided to applicable employees within 10 days of receipt.

#### **OSHA Recognized Carcinogen List**

Working with an OSHA Recognized Carcinogen may require personal sampling, or at a minimum review by EHS for exposure control planning. The current list of OSHA Recognized Carcinogens is as follows:

- asbestos



- 4-Nitrobiphenyl
- alpha-Naphthylamine
- Methyl chloromethyl ether
- 3,3'-Dichlorobenzidine (and its salts)
- bis-Chloromethyl ether
- beta-Naphthylamine
- Benzidine
- 4-Aminodiphenyl
- Ethyleneimine
- beta-Propiolactone
- 2-Acetylamino fluorene
- 4-Dimethylaminoazobenzene
- N-Nitrosodimethylamine
- Vinyl chloride
- Inorganic arsenic
- Cadmium
- Benzene
- Coke oven emissions
- 1,2-dibromo-3-chloropropane
- Acrylonitrile
- Ethylene oxide
- Formaldehyde
- Methylenedianiline
- 1,3-Butadiene
- Methylene Chloride

Workers should contact EHS for a review and potential exposure monitoring.

***Chemical  
Hazard Types***

**Corrosive agents**

Corrosive agents shall always be handled using proper personal protective equipment appropriate for the type of material, the quantity being used and the potential exposure route. This may include gloves, lab coat or protective apron, goggles or face shields. Volatile corrosives shall be used in a fume hood when there is any potential for inhalation exposure. Be aware that many corrosive materials (i.e., hydrofluoric acid, phenol) exhibit additional hazards that must be addressed when they are used in the laboratory.

**Handling flammable materials**

Do not use an open flame to heat a flammable liquid or to carry out a distillation under reduced pressure. Use an open flame only when necessary, and extinguish it when it is no longer needed. Before lighting a flame, remove all flammable materials from the immediate area. Check all containers of flammable materials in the area to ensure that they are tightly closed. Store flammable materials properly. When volatile flammable materials may be present, use only non-sparking electrical equipment.

**Performing activities with explosion potential**

Safety shielding shall be used for any operation having the potential for explosion:

- When a reaction is attempted for the first time, small quantities of reactants should be used to minimize hazards.
- When a familiar reaction is carried out on a larger than usual scale (i.e., 5-10 times more material).

- When operations are carried out under non-ambient conditions.

Shields must be placed so that all personal in the area are protected from hazard. Also, be sure to inspect equipment and pressure/vacuum connections prior to starting the procedure.

#### **Fire and explosion hazards.**

In the event of a small-scale fire (sized less than a square foot) the room fire extinguisher can be used to extinguish the fire, provided the extinguisher is appropriate for the type of fire. All fires shall be reported to Campus Police at 412-268-2323 (re: Clery Act). Lab workers should be familiar with the location of the closest fire extinguisher and fire alarm pull stations. It is recommended that lab workers complete [Fire Extinguisher Training](#).

All building occupants MUST evacuate when building alarms are sounded. Individuals may be fined by the City of Pittsburgh for non-compliance with evacuation requirements.

In the event of an explosion of any size or type, contact University Police at 412-268-2323.

### ***Labeling***

#### **Signs and Labels**

All Carnegie Mellon University personnel who work with chemicals must be familiar with conventions used for hazard communication via signs and labels. This information is provided in EHS Laboratory Safety training, which is available both on-line, and in-class through BioRAFT.

Labels on incoming containers of hazardous chemicals are not to be removed or defaced until product is emptied from the container. In March of 2012, OSHA revised the Hazard Communication Standard which addresses the format of chemical container labels. This system of label requirements, and is designed to meet the Globally Harmonized System used throughout much of the world. Information on this system, and changes is available from EHS through written documents and on the [EHS web site](#).

Secondary use containers (containers used for dispensing from bulk containers or containers of “made-up” chemical mixtures) should be labeled with the identity of the contents of the container, as a minimum. It is recommended that secondary use containers also be labeled with the substance name, type of hazard, name of laboratory worker who prepared the container, and date of preparation. Customized secondary-use container labels are available from EHS.

Laboratories shall prominently post:

1. Emergency telephone numbers.
2. Location signs for safety showers, eye washes, fire extinguishers, spill response kits, and first aid equipment.
3. Warning signs at areas or equipment where special or unusual hazards exist.  
(Contact EHS for assistance in obtaining appropriate signage)

EHS prepares and posts laboratory door safety signs outside each laboratory. Contact EHS if the information on your door sign changes or needs to be updated.

### ***Procurement and Storage of Chemicals***

#### **Procurement of Chemicals:**

No container shall be accepted without an adequate identifying label. Delivery should be refused for leaking containers. Persons who receive hazardous chemical shipments must take [DOT Hazardous Materials Receiving on-line training](#). This training outlines further requirements for hazardous chemical receipt.

In order to minimize the presence of hazardous materials at the university, chemicals should be ordered in the smallest quantity needed to conduct the work. For situations where you are in need of a chemical material for a single test or a preliminary evaluation of an experiment, consider contacting EHS to see if the material is present already on campus. Another chemical owner may be willing to let you use some of his or her stock, in such limited situations. All of these transfers MUST be performed from PI to PI.

EHS shall be contacted in advance of any acquisition of chemicals that will not be purchased but are to be transferred to the Carnegie Mellon University from another university or organization.

Note: University Procurement Services places restrictions on how hazardous chemicals may be purchased. Use of a Purchase Order, or the HAZMAT P-Card, is the preferred method. Some materials are prohibited from purchase using a purchasing card. [Contact EHS](#), or [Procurement](#) if there are any questions.

#### **Stockrooms/Storerooms:**

Hazardous substances in storage should be segregated by hazard categories, following manufacturer recommendations. Containers of Particularly Hazardous Substance (PHS) materials should be placed in secondary containers. Stored chemicals shall be examined periodically (at least annually) for replacement, deterioration, and container integrity.

Stockrooms and storerooms should not be used as preparation or repackaging areas.

#### **Laboratory Storage:**

Storage in laboratories will be performed as follows:

- Chemicals will be stored so incompatible chemicals are separated. Compatibility information is available on the chemical's Material Safety Data Sheet/Safety Data Sheet.
- A UL (Underwriters Laboratory) Functional Safety Listed flammable storage cabinet must be used to store flammables when there are more than five gallons total present in the lab.
- A corrosive storage cabinet is strongly recommended for storage of acids and bases. Corrosive materials should only be stored in cabinets approved by the manufacturer for this use.
- Acetic acid should be treated as a flammable rather than a corrosive.
- Refrigerators used for storage of flammable liquids should be either flammable or explosion proof.
- New construction should follow NFPA 45 for guidelines on flammable and combustible liquid storage.
- Chemical storage in hoods and on bench tops should be minimized.

### ***Transport & Shipment of Chemicals***

#### **Chemical Transport**

The following safety precautions should be taken for chemical transport:

- Chemicals should be transported in safety containers, or on a wheeled cart with a design capable of containing leakage or spillage and negotiating uneven surfaces (e.g. expansion joints or floor drains) without tipping the chemical container or cart.
- Chemicals should be transported on freight rather than passenger elevators where possible.
- Chemical containers should be sealed during transport.
- Cylinders should be strapped to a hand truck specifically designed for that purpose and cylinder cover caps should be in place.
- Transportation of hazardous materials on any public road, aircraft, railway or navigable waters should NEVER be performed except under the oversight of EHS. This transportation is highly regulated and the University MUST ensure that all regulations are followed for such moves. The regulations include personal or commercial transportation by any vehicle, including cars, trucks, trains, buses, watercraft, vans or aircraft.

Additionally, persons offering hazardous materials for shipment, for example by FedEx or similar carrier, MUST arrange for this shipment through EHS. Visit the [EHS web page](#) to request shipment advice and guidance, or to learn more about the requirements.

### **Chemical Segregation**

Refer to the Material Safety Data Sheet/Safety Data Sheets of each hazardous material to identify any incompatible material. Incompatible materials may NEVER be stored together. Common storage incompatibilities are as follows:

1. Flammable materials must be separated from oxidizers (this includes gases as well as liquids)
2. Acids and bases must be separated in storage
3. Corrosives away from acutely toxic materials

### **General Laboratory Rules**

The following rules should be followed for all laboratory work with chemicals and hazardous materials:

- Know the safety rules and procedures that apply to the work that is being done. Determine the potential hazards and appropriate safety precautions before beginning any new operation.
- Know the location of and how to use the emergency equipment in your area, as well as how to obtain additional help in an emergency, and be familiar with emergency procedures.
- Be alert to unsafe conditions and actions and call attention to them so that corrections can be made as soon as possible. Someone else's accident can be as dangerous to you as any you might have.
- Use equipment only for its designed purpose.
- Use only those chemicals for which the quality of the engineering controls and protective equipment is appropriate for safe handling.
- Eating, drinking, smoking, gum chewing, or application of cosmetics are never permitted in areas where laboratory chemicals are present. Laboratory workers should be sure to wash their hands before eating, drinking, smoking, etc. outside the laboratory environment. Personnel must adopt safe practices by eating or drinking outside of laboratory areas, and only after washing their hands.
- Storage of food and beverages is not allowed in refrigerators, cold rooms or ice chests that contain any hazardous chemical, radioactive, or infectious materials. Storage of food and beverages is prohibited except in designated break areas away from laboratories.
- Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur.
- Leave all protective equipment in the lab when exiting including lab coats and protective gloves. Wash areas of exposed skin well before leaving the laboratory.
- Avoid practical jokes or other behavior that might confuse, startle, or distract other workers.
- All new procedures should be evaluated for potential hazards associated with the work. The following resources are available for this evaluation.
  - Contact Environmental Health and Safety.
  - Review the MSDS/SDSs for the materials in question.
- NEVER use mouth suction for pipetting or starting a siphon.
- Confine long hair and loose clothing. Wear closed-toed shoes at all times in the laboratory; OPEN TOED SHOES ARE NOT PERMITTED TO BE WORN IN THE LABORATORY. Appropriate protective clothing (e.g., aprons, lab coats, safety glasses, etc.) should be kept in the laboratory and worn routinely.
- Be alert to unsafe conditions and see that they are corrected when detected.

- Do not leave hazardous experiments unattended. Standard Operating Procedures must be submitted and approved by the laboratory Principal Investigator or his/her designee when there are any plans to leave an experiment unattended.
- Avoid wearing earbuds in lab, Principal Investigators have the final say on permission. One ear should be left free to hear laboratory equipment alerts, safety equipment alarms, and building fire and emergency alarm system.

## Particularly Hazardous Substances

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### *Introduction*

The Occupational Safety & Health Administration's (OSHA) Laboratory Standard (29 CFR 1910.1450 (e) (3) (viii)), requires that provisions be made for employee protection for work with particularly hazardous substances. These include select carcinogens, reproductive toxins, and acutely toxic substances. Specific consideration should be given to the establishment of a designated area, the use of containment devices, and procedures for the safe removal of contaminated waste, and decontamination.

### *Definitions*

**Particularly Hazard Substances (PHS)** are defined as belonging to one of three groups:

1. Select carcinogens, acutely toxic chemicals, reproductive toxins and chemicals known to have undesirable biological effects. (Refer to the information document "[Particularly Hazardous Table](#)" for lists of PHS and guidance in identifying them.)
2. Chemicals for which reliable toxicity information is not available, but are highly suspected to be a PHS because of their similarity in chemical structure or function to known toxic agents.
3. Chemicals that are explosive or otherwise violently reactive, such as pyrophorics and water-reactive materials.

**Select carcinogens** are any substance that meets at least one of the following criteria:

- Regulated by OSHA as a carcinogen or;
- Listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) or;
- Listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer (IARC) Monographs or;
- Listed in either Group 2A or 2B by IARC or under the category "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
  - After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m<sup>3</sup>
  - After repeated skin application of less than 300 mg/kg of body weight, per week or
  - After oral dosages of less than 50 mg/kg of body weight per day

**Acute toxicity** is the ability of a chemical to cause a harmful effect after a single exposure. Parameters for assessing the risk of acute toxicity of a chemical are its LD<sub>50</sub> and LC<sub>50</sub> values. Acutely toxic chemicals meet the following criteria:

- Chemicals with an oral LD<sub>50</sub> in rats <50mg/kg
- Chemicals with a skin contact LD<sub>50</sub> in rabbits <200mg/kg
- Chemicals with an inhalation LC<sub>50</sub> in rats <200ppm/per hour

**Lethal Dose 50 (LD<sub>50</sub>)** is defined as the amount of a chemical that when ingested, injected, or applied to the skin of test animals under controlled laboratory conditions will kill one-half (50%) of the animals.

**Lethal Concentration 50 (LC50)** is the concentration of the chemical in air that will kill 50% of the test animals exposed to it.

**Reproductive toxins** are substances that cause chromosomal damage and substances with lethal or teratogenic effects on fetuses.

**Designated areas** are areas that may be used for work with particularly hazardous substances. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood or glove box.

***Responsibilities***

It is the responsibility of the principal investigator or laboratory manager to ensure that PHS determination is conducted on all existing chemical inventories and on all future chemical purchases. Furthermore, prior to beginning work with a PHS, or once the PHS determination is made, employees of Carnegie Mellon University shall complete a PHS Safety Protocol Form. All employees approved to work with a particularly hazardous substance shall comply with that form.

***Particularly Hazardous Substance (PHS) Safety Protocol Forms***

The purpose of the **Particularly Hazardous Substance (PHS) Safety Protocol Form** is to ensure that all employees (including faculty, staff and paid students) are adequately trained and familiar with the PHS chemical/physical properties, health hazard information, and toxicity data prior to the use of the material. Procedures for containment, storage, and waste management shall be described in detail. Safety precautions shall be addressed including: assignment of a designated area, personal protective equipment, ventilation requirements, and methods of monitoring exposure, first aid procedures, and spill or leak clean-up procedures.

The principal investigator or laboratory manager shall approve all [PHS Safety Protocol Forms](#) where applicable. Consultation with Environmental Health and Safety is recommended to ensure that procedures and safety precautions are adequate. The approved protocol shall be kept on file in the laboratory (readily accessible for use in an emergency), and be made available to EHS upon request.

**Principal investigator or laboratory manager approval:**

A written PHS Protocol must be approved and signed by the Principal Investigator or laboratory manager before work with PHS chemicals may begin. The entire PHS Safety Protocol Form shall be reviewed by the principal investigator or laboratory manager for accuracy. These procedures shall be reviewed and changed at the time of any process change.

Additional employees may be added to an existing PHS Safety Protocol Form, or an existing protocol form may be approved for use in another laboratory. In these cases, the protocol form must still be reviewed by the principal investigator and approved for use for each additional employee. All personnel authorized to use a PHS must complete the employee information sheets and attach it to the PHS Safety Protocol.

**Record keeping**

The original approved copy of the PHS Safety Protocol shall be kept on file in the laboratory. Employee information sheets should be kept on file with the PHS Safety Protocol Form in the laboratory.

**Designated areas**

PHS are to be used in designated areas ONLY. The designated area must be identified and the boundaries clearly marked (See: "Warning signs", below). Unauthorized personnel (i.e., persons who are NOT approved for use on the PHS Protocol form) are restricted from entry into a designated area while work with the PHS is being performed.

**Warning signs**

When the PHS is being used, designated areas must be posted with signs that denote the nature of the hazard. Contact EHS for appropriate signage, which will be supplied to properly address the type of designated area identified by the laboratory, and will provide suitable hazard warnings.

**Personal protective equipment**

Chemically compatible gloves shall be used with particularly hazardous substances. It is recommended that glove manufacturers and/or EHS be contacted for compatibility information and assistance in selecting the appropriate glove. Other protective equipment and apparel such as a fully closed laboratory coat and chemical splash goggles and/or a face shield may be required according to the approved PHS Safety Protocol Form. When handling Pyrophoric Material, specially rated fire protective equipment must be worn.

**Containment**

PHS should be used in a fume hood or glove box. Spill protection in the form of plastic backed matting or chemical resistant pans should be employed. All weighing operations involving PHS shall be performed in a certified laboratory hood, glove box, or approved vented enclosure. Air exhausted from glove boxes where PHS are handled must be vented to a certified hood or exhaust system.

**Storage**

PHS containers should be labeled as such (EHS can provide labels for this activity). Refer to other sections of the Chemical Hygiene Plan for general information on proper chemical storage, transportation and compatibility.

**Decontamination and Waste**

Every effort should be made to minimize spills or loss of PHS. All PHS compounds shall be disposed of as hazardous waste. During decontamination, all equipment should be thoroughly rinsed with a suitable solvent. This solvent should be collected as hazardous waste. Care should be exercised to prevent contamination of the outside of the waste container. In the event that decontamination is not feasible, the equipment should be placed in an impervious container that is sealed and properly labeled and disposed of as hazardous waste. All solid PHS wastes shall be sealed in double-lined plastic bags and disposed of as hazardous waste. Carnegie Mellon's Hazardous Waste Certification Tags, with all pertinent information, shall be attached.

When composed of finely divided solid materials, spills of PHSs should be cleaned by wet wiping, or mopping. Dry sweeping should not be done. Contaminated toweling used for the clean up of hazardous materials shall be disposed of as a PHS hazardous waste. Laboratory workers should leave protective apparel in designated areas and wash hands and arms before leaving designated areas if possible.

**Safety precautions**

Ensure that all laboratory occupants are aware of the hazards involved with each PHS. Keep first aid procedures and materials readily accessible for use during an emergency.

**Exposures**

Never exceed exposure limits (consult MSDS/SDS). Know how a particular chemical can enter the body and symptoms of exposure. Notify your supervisor and Environmental Health and Safety if you suspect exposure. Seek medical attention if you suspect exposure.

Carnegie Mellon University provides all employees who have received a hazardous chemical exposure the opportunity to receive medical attention.

**Items Not Covered**

Items not covered by this amendment should be submitted to the Carnegie Mellon Laboratory Safety Committee member on an ad hoc basis for consideration.

***Animal Work  
with Chemicals  
of High Chronic  
Toxicity***

**Access**

For large-scale studies, special facilities with restricted access are preferable.

**Administration of the Toxic Substance**

When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar airflow directed toward HEPA filters.

**Aerosol Suppression**

Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood).

**Personal Protection**

When working in the animal room, wear latex, nitrile, or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed, due to incomplete suppression of aerosols, other apparel and equipment (e.g., shoe and head coverings, respirator).

**Waste Disposal**

Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products; otherwise, package the waste appropriately for burial in an EPA-approved site, as a biohazard waste.

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## **Emergencies and Exposures**

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***Emergency  
Operations Plan***

The University's Disaster Recovery and Business Continuity Services has prepared and has made available programs and plans for the campus community. Details of these programs and plans are found on the [Disaster Recovery and Business Continuity Services web page](#). Questions about the content of any response activity should be addressed to EHS (412-268-8182).

***Emergency  
Response  
Equipment***

**Eyewashes**

Plumbed eyewashes should be present in or near all lab areas in which there is a potential for hazardous chemicals to be splashed into the eyes. Individual laboratories are responsible for the periodic testing of their eyewashes. A minimum of monthly documented testing is required.

**Safety Showers**

A safety shower should be present in or near all lab areas in which there is a potential for toxicologically significant quantity of a hazardous chemical to be splashed onto the body. Facilities Management Services (FMS) performs annual testing of emergency showers.



***Emergency  
Response Guide  
for Labs***

***Accident  
Reporting***

**Fire Extinguishers**

A fire extinguisher must be present in or near each laboratory area. The extinguisher must be appropriate for the classes of fires possible in a particular laboratory. Individual laboratories are responsible for the periodic inspection of their fire extinguishers. A minimum of monthly documented inspection is required.

**Spill Response**

A spill response kit must be present in or near each laboratory area that contains hazardous materials with a potential for spillage. The spill kit needs to accommodate the largest container of each type of hazard present, and be appropriate for the specific hazards present in the lab, such as acids, bases and solvents. EHS can be called to assist in hazardous spills cleanups, and should be contacted for large, and highly hazardous spills (412-268-8182).

**Planning and Preparation**

A written Laboratory Emergency Response Guide has been prepared for and is circulated throughout Carnegie Mellon University. A summary document, Emergency Response Guide for Laboratories is available from EHS and should be posted in each laboratory. This document identifies procedures for medical assistance, evacuation, responding to fires, spills, and reporting of accidents.

**Accident Notification**

Accidents involving fire or explosions will activate installed automatic alarm sensors and fire extinguishing systems. Where automatic systems do not exist, manual alarms are installed in egress routes and must be activated during evacuation.

Accidents involving major chemical spills (as defined in Emergency Response Guideline), fires, or explosions shall be immediately reported to Carnegie Mellon University Police at 412-268-2323. Security will contact the appropriate Carnegie Mellon University and City of Pittsburgh fire/medical/hazmat response personnel including Carnegie Mellon EHS.

Reporting of accidents to Security should be clear and concise, including the following information:

- Nature of the accident
- Hazardous material involved
- Nature of any injuries
- Location
- Name of the caller
- Phone number where caller can be reached

Personnel at the immediate scene of the accident should take actions that will mitigate the extent of the accident without jeopardizing their health and safety. When in doubt, warn others in the area, evacuate the area, travel to a safe location, and call Security (412-268-2323).

### **Accident Investigation and Reporting**

Accidents involving injury or illness must be reported on the [Supervisor's Injury/Illness Report form](#) (available from Human Resources) and distributed as indicated in the form.

All other accidents and near miss accidents (minor injuries, spills, incidents) shall be reported to EHS (412-268-8182 or [emailed](#)) as soon as possible after the occurrence. "Near miss" incidents and accidents without injury can be reported on the "[Non-Injury and Near-Miss Incident Reporting Form](#)".

### ***Medical Consultations & Examinations***

#### **Medical consultations are offered for the following:**

1. Documented exposures above established action levels or airborne concentrations above the PEL, TLV, or other recognized exposure limit.
2. Personnel exhibiting signs or symptoms consistent with exposure to the chemicals with which they are working.
3. Personnel exposed to hazardous chemicals as a result of a significant spill, leak or explosion.

The licensed physician performing the initial consultation will identify the need for further medical examination.

#### **Medical Examinations**

1. The medical exam criteria will be determined by the licensed physician.
2. Where medical exam guidance exists, such as for OSHA regulated substances, these criteria will be included in the physician's exam.
3. For examinations resulting from exposures to OSHA regulated substances, the examination frequency will be the period set within the OSHA standard.
4. For examinations resulting from potential overexposure to hazardous substances, the licensed physician will determine the examination frequency.
5. The following information will be provided to the examining physician.
  - The MSDS/SDS for the applicable hazardous chemical(s)
  - A description of the conditions under which the exposure occurred, including monitoring data and accident reports.
  - A description of the signs and symptoms of exposure that the employee is experiencing.
6. Upon completion of the exam, the physician will provide the following reports.
  - Any medical condition of the employee which places them at risk as a result of exposure to hazardous chemicals found in their workplace
  - Recommendations for further examination
  - Results of the examination to the employee
  - A statement that the employee has been informed by the physician of the results of the exam and consultation

#### **First Aid**

- Personnel trained in first aid are available during working hours and emergency room facilities with medical personnel are located nearby. Emergency Medical Services and Carnegie Mellon University Police provide transport to local hospitals 24 hours a day. Coordinate through Security at 412-268-2323.
- First Aid shall only be performed by persons suitably trained to do so.

## Waste Disposal

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### *Hazardous Waste Program*

#### **Hazardous Waste:**

Information on the identification, handling, storage and collection of laboratory wastes, and personnel safety for waste generators, is presented in the [Carnegie Mellon University Hazardous Waste Written Program](#). This document includes procedures for hazard identification, hazardous waste accumulation, requesting removal of hazardous waste and the disposal process. Also included is information on waste minimization activities. Hazardous waste generator training is a requirement for all generators of hazardous waste. Regular refresher training in hazardous waste generation is strongly recommended (see the TRAINING section of this document).

### *Non-Hazardous Waste*

**Non-hazardous Waste** (as defined by EPA) must be handled in the following fashion:

- All "chemical sharps" or needles must be disposed of in "chemical sharps" containers. Available from the Mellon Institute Store Room, or preferred supplier. Sharps are defined broadly as any laboratory waste item that can puncture human skin. This includes needles, syringes with needles, lancets, scalpels, razor blades, precision knives, pipettes and pipette tips. Broken glass is specifically excluded as it is addressed below. Disposal of sharps that are contaminated with biological agents and/or radioactive materials are separate from chemically contaminated. Check the EHS web page for further details in the Biological and Radiation Safety Programs.
- All broken glass must be disposed of in broken glass containers or in completely sealed cardboard boxes. Filled containers should be completely sealed with sturdy tape (to prevent puncture), marked "For Disposal", and placed in the hallway outside the lab. Custodial services will pick-up and remove the container. The box must be in sound condition, lidded, and with a poly lining of at least 2 mils.
- Finely divided powders, such as silica gel or toners, must be placed in tightly sealed containers before disposal.
- Biological and/or radioactive wastes are addressed separately from other laboratory wastes. Visit the website or contact EHS for information about these wastes.

### *Sink Disposal*

Do not discharge any waste to the sewer that is or may:

- an irritant
- malodorous
- a lachrymatory agent (producing tears)
- interfere with the biological activity of a waste water treatment plant
- create a fire hazard
- cause structural damage or obstruct the flow of the system

## Physical Hazards

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### *Compressed Gases*

#### **Compressed Gases**

Please refer to the [EHS Guideline: Compress Gas Cylinders](#) for additional information and requirements, such a use of gas cabinets, detection and warning systems and special controls, for certain high hazard compressed gases.

1. Compressed gas cylinders shall be stored and secured in an upright position.

2. In areas of gas cylinder storage, cylinders shall be segregated according to their properties. Additionally, signs shall be posted identifying type of cylinders permitted and identifying any potential hazard. When more than one cylinder is stored together, cylinders shall be kept tightly nested and secured with straps or chains.
3. On cylinders not equipped with a valve shutoff, a wrench shall be provided and kept on the valve at all times to permit rapid emergency shutoff.
4. Cylinders shall be stored with the protective valve cap in place. No cylinder shall be stored with the regulator still installed.
5. Cylinders of compressed gases should be securely strapped or chained to a wall or bench top.
6. Close the gas cylinder at the top of the tank when not in use.
7. All compressed gas cylinders and chemical containers should be stored away from heat sources and direct sunlight.
8. Only use regulators and equipment approved for the gas being handled.
9. Cylinder handling will be performed using equipment appropriate for the task, i.e., cylinder hand carts.
10. Wherever carbon monoxide or hydrogen sulfide are present in quantities greater than one standard lecture bottle size, detection alarms must be present and properly tested and maintained.
11. Wherever hydrogen is present, all tubing must be of braided stainless steel hose. Alternative tubing materials will be approved by EHS on a case by case basis, to ensure that the alternative meets fire protection requirements.

Compressed gases present hazards due to their compressed nature, in addition to any hazard presented by the gas itself (for example, flammable, corrosive or oxidizing gases).

***Electrical Hazards***

The hazards associated with the use of electricity include electrical shock and electrical fires caused by shorts and overloaded circuits or wiring. In addition, sparks from electrical equipment can serve as an ignition source for flammable or explosive vapors or combustible materials. Most incidents are a result of unsafe work practices, improper equipment use, and faulty equipment.

***Trip Hazards***

Equipment, tubing, cables, and other items, such as boxes and floor clutter can become trip hazards in laboratories. Aisles and hallways need to be free of items that impede egress, at a minimum of 36 inches. Store all materials in cabinets, on shelves, and out of the paths of travel. Eliminate floor clutter. Be sure to position equipment such that wires and tubing do not cross aisles. If wiring or tubing must run across an aisle, suspend it from the ceiling via an overhead rack, or affix it to the floor with a cord protector or durable tape.

***Pressure and Vacuum Devices***

**Pressurized and vacuum operations (including use of compressed gas cylinders)**

Reactions should never be carried out in, nor heat applied to, an apparatus that is a closed system unless it is designed to withstand the pressure that may be created. Pressurized apparatus shall have an appropriate pressure relief device.

***Cryogenics***

**Low temperature procedures (cold traps and cryogenic hazards)**

Cryogenic liquids are:

- a. Refrigerated, liquefied gases having a boiling point colder than a temperature of minus 130F at a pressure of one atmosphere absolute.
- b. Stored at low pressures in multi-walled, vacuum-insulated storage containers.
- c. Examples of cryogenic liquids include oxygen, nitrogen, argon, neon, krypton, xenon, hydrogen, helium, liquefied natural gas (LNG)/methane, and solid carbon dioxide (dry ice).

Before working with cryogenics, please refer to the [EHS Guideline: Cryogenics](#) for additional information and handling instructions when there is a potential exposure to the cryogen.

***High  
Temperature  
Applications***

**High Temperature Equipment Safety**

High temperature equipment in a laboratory, such as furnaces and ovens, present hazards due to their elevated temperatures.

***Ergonomics***

Laboratories present special challenges in the prevention of repetitive stress injuries. EHS offer's consultations for Ergonomic evaluations of the work space. To request an evaluation, please [contact EHS](#).

***Nanomaterials  
and Related  
Inhalation  
Hazards***

**Nanomaterials and Related Inhalation Hazards**

Work with nanomaterials and work with equipment that may generate nanomaterials may pose hazards yet undermined, due to the limited safety research performed addressing these materials. For information on nanomaterials and reducing exposure to them, please [contact EHS](#).

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## Recordkeeping

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***Records***

**Records Retention**

1. Carnegie Mellon Department of Human Resources (HR) maintains illness and accident reports.
2. EHS maintains documentation of the annual review of the Chemical Hygiene Plan.
3. EHS oversees the University's chemical inventory program, CHEMTRACKER. For additional information, please visit [CHEMTRACKER](#)
4. Human Resources (HR) maintains all medical records relating to chemical exposure and potential chemical exposures.

**Internal Program Evaluations**

Records of EHS laboratory inspections and hood evaluations will be maintained in the EHS office for a minimum of three years. Laboratory inspections are maintained through BioRAFT. For additional information please visit [BioRAFT](#).

**External Program Evaluations**

Reports of external (regulatory) inspections will be retained by EHS.