

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

Prepared by:

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Original 1990

Revision 001 1996

Revision 002 1999

Revision 003 2001

Revision 004 2003

Revision 005 2006

Revision 006 2007

Revision 007 2008

Revision 008 2009

Revision 009 2010

This plan is available at <http://ehs-alert.fms.bap.cmu.edu/pdf/CHPFinal.pdf>

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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 official University 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 the 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 to 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 at <http://ehs-alert.fms.bap.cmu.edu/pdf/CHPFinal.pdf>

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 organizational charts in the current "Carnegie Mellon Faculty/Staff Directory."

**Roles and Responsibilities** | **President**

- The president has ultimate responsibility for chemical safety at the university and must, with other administrators, provide continuing support for the University’s Chemical Hygiene Plan

***Roles and  
Responsibilities***

(CHP).

**Administration**

- The provost, vice provosts, and deans shall require department heads to adhere to the CHP.
- 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 (EH&S) is responsible for the training of EH&S staff and providing appropriate facilities, suppliers, references, instruments, etc., to survey and evaluate safety systems and processes.
- The Director of EH&S shall ensure the preparation, review, and distribution of the University's Emergency Response Plan.
- EH&S shall conduct periodic inspections of fire extinguishers.
- EH&S shall conduct periodic lab safety surveys.
- EH&S shall conduct periodic inspections of exhaust hoods.
- EH&S shall serve as an advisory source and create safety policies.
- EH&S shall maintain safety training records of appropriate faculty, staff, and students.

**Laboratory Safety Committee (LSC)**

- Advise EH&S 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 EH&S 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 Services**

- The Senior Director--Facility Operations shall make repair and maintenance of installed laboratory safety equipment a high priority.
- The Senior Director--Facility Operations 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. He or she further ensures that laboratory safety systems are maintained in a serviceable condition, according to specifications from EH&S. Fire extinguishers are maintained under the management of the EH&S Fire Safety Specialist.
- Work orders to repair or renovate laboratory facilities may be initiated by principal investigators, laboratory instructors, or by FMS or EH&S personnel.

**Chemical Hygiene Officer (CHO)**

- Work with administrators, staff, and students to develop and implement chemical hygiene policies and practices.
- 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.

## ***Roles and Responsibilities***

- 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 updated lists of the employees working in their laboratories. This is done on-line through the EH&S web site, under the Faculty/Student/Staff section. This ensures that EH&S is aware of all laboratory personnel for OSHA compliance issues.
- Ensure that appropriate personal protective equipment is available and that it provides adequate protection.
- Notify Environmental Health & Safety (EH&S) 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.
- 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 EH&S.
- Train laboratory workers regarding the specific work practices, and procedures according to the provisions of their laboratories' SOPs.
- Maintain a hazardous chemical inventory, specify those chemicals that are particularly hazardous substances (PHS), and maintain a hard copy of the corresponding Material Safety Data Sheets (MSDS) of PHSs in laboratory facilities under their control. Ensure the review of the inventory periodically.
- Ensure the performance of inspections for housekeeping and safety.
- Ensure that employees are familiar with electronic MSDS searches. Maintain hard copies of MSDS 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 MSDSs 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 are required to have this training. The training occurs at two levels:

- General chemical safety training is provided by the Department of Environmental Health and Safety. 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 accomplished before the employee is permitted to work unsupervised in the laboratory.

Refresher training in laboratory safety is to be performed every three years, through either re-attendance at the general EH&S initial training class or through the EH&S refresher training provided via email. Reading the monthly CHO Newsletter is highly recommended to ensure you 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 EH&S concurrently with the Lab Safety Class.]

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

EH&S 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) [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10106](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106) and its appendices.
- The availability of the Chemical Hygiene Plan.
- Location of reference material on the hazards (including Material 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 EH&S.

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. Receiving and Stockroom/Storeroom Training**

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

### *Information*

#### **Material Safety Data Sheets (MSDS)**

Material Safety Data Sheets (MSDSs) are critical elements to a chemical safety program. All laboratory employees should be able to read and understand the relevant MSDS and also know where they can be obtained. MSDS links are present on the EH&S web site, and should address most campus needs. Alternatively, search engine may be helpful in finding MSDS by searching for the chemical name and the phrase "MSDS". For MSDSs not available at this site (provided in the link following), or by internet search, employees should contact EH&S.

<http://www.cmu.edu/ehs/msds/index.html>

A current MSDS 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 EH&S webpage instructions.

#### **General Information**

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

## **Control Measures**

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### *Engineering Controls*

The best way to prevent exposure to airborne hazards is to prevent their escape into the working atmosphere by use of hoods 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 when there is reasonable potential for hazardous material exposure.

#### **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 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

## **Engineering Controls**

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, notify EH&S, and submit a work order to FMS, if appropriate.

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 EH&S; i.e., those that do 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.
- In new construction, the hood shall have a monitoring device to measure airflow.
- It is recommended that the utility controls be outside of the hood.
- 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 EH&S 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. No work with volatile hazardous chemicals shall be performed in hoods that do not vent outdoors.

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 EH&S 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 EH&S. 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 EH&S and ***must*** follow the Carnegie Mellon Respiratory Protection Program. Refer to the Carnegie Mellon University Respiratory Protection Program for further details: <http://ehs-alert.fms.bap.cmu.edu/pdf/RespProtPlan.pdf>.

**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.

Wear appropriate gloves when the potential for contact with hazardous materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically. Gloves should not be worn outside of the laboratory.

**3. Hearing Protection**

Hearing protection will be provided for anyone working in an area where the sound levels exceed 85 dBa. Contact EH&S to measure noise levels, to recommend proper hearing protection, and to evaluate the need for noise reduction engineering controls.

**4. 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 ANSI Z87.1 requirements.

***Standard  
Operating  
Procedures***

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

## **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, *Chemtracker*.

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

### Inspections

EH&S performs laboratory safety inspections at least annually to ensure that adequate safety equipment is available and functioning, personal protection is available, chemicals are properly used and stored, MSDSs are readily accessible and good housekeeping is being practiced. Inspections may be performed more frequently as deemed necessary by EH&S. 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 primary and secondary contact personnel for the lab. Access is through the EH&S web site, using one's Andrew ID. The web address for access is:

<http://www.cmu.edu/ehs/my-pages/index.html>

*Internal* housekeeping and chemical hygiene inspections are recommended and should be conducted by the principal investigator, laboratory instructor, or appointed representative at least quarterly. Refer to the format used in the above EH&S inspections for a checklist for these internal inspections. Here is a link to the format:

[http://ehs-alert.fms.bap.cmu.edu/pdf/InspectionForm\\_LabStd.pdf](http://ehs-alert.fms.bap.cmu.edu/pdf/InspectionForm_LabStd.pdf)

### Maintenance

Facilities Management Services (FMS) 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 EH&S. Malfunctioning eyewashes and safety showers should be marked "Do Not Use".

Laboratory personnel should inspect eyewashes frequently, by operating them until the water runs clear. FMS coordinates periodic 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**

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. EH&S 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. A working definition of "working alone" is only

## *Administrative Controls*

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 Principal Investigator to complete and submit to the EH&S office a "Permission to Work Alone" form, which is available on the EH&S web site. The form requires that careful consideration 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. Security may be contacted to provide periodic checks on those working alone, especially after normal business hours. EH&S will review all Working Alone forms.

### **Non-Carnegie Mellon Employees in the laboratory**

Special activities must be performed when persons who are not employees of Carnegie Mellon are present in the laboratory.

#### Students

All students *regardless of age* enrolled in regular or other university-sanctioned classes or related businesses (such as Carnegie Mellon's "Bring Your Child to Work Day") are addressed by the University's liability agreements. If these students are under age 18, hazardous material exposure must be minimal, and constant supervision by a staff member of the lab is required. No other action is needed.

#### Other persons under age 18

If the applicable persons are enrolled in an Outreach program, the issue of whether a waiver of liability will be required from the parent or guardian of the person will be decided on a case by case basis. Contact University Counsel for further details and information.

If persons under age 18 are NOT enrolled in an Outreach program or regular university function, as noted above, they are NOT permitted to be in the laboratory where hazardous materials are present.

#### Volunteers in the laboratory

Volunteer workers in the laboratory (who are NOT Carnegie Mellon employees nor students) are NOT permitted. This includes (but is not limited to) children of any age or spouses of employees. Exceptions will be considered on a case by case basis by EH&S.

#### Other Non-Carnegie Mellon Persons

A formal relationship with the outside personnel must be established in such cases. The employer of this outside worker must have a current agreement with Carnegie Mellon addressing the issues of the liability of the worker while at our site. This addresses both outside researchers using Carnegie Mellon facilities as well as repair or maintenance personnel in our laboratories. **The lab or department is responsible to ensure that such an agreement is in place.**

Where joint funding situations exist, University Counsel will need to evaluate the situation.

Unaccompanied visitors to the laboratories are not permitted (such as sales reps).

#### Waivers

In some of the above circumstances, the university may require waivers to be signed by the outside person (or their parent or guardian (for persons under age 18)). It is the responsibility of the laboratory or department to obtain such waivers, in a format approved by University Counsel. Templates of such waivers are available from EH&S, to act as a starting point in getting the waiver approved by University Counsel.

#### Final Authority

University Counsel is the final authority on the resolution of all issues associated with non-Carnegie Mellon employees present in the laboratory.

*Administrative  
Controls*

**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 at [www.cmu.edu/ehs](http://www.cmu.edu/ehs)

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## 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, 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 means of containment, such as cylinders of compressed gases, 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 Environmental Health and Safety (EH&S). All concerns of overexposure should be addressed to EH&S.

**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.

**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 EH&S 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.

***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

***Chemical  
Hazard Types***

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.

**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. For fires that are larger or of a material inappropriate for the extinguisher, contact Security at 8-2323. Be familiar with the location of an area fire extinguisher and any fire safety controls.

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 Security at 8-2323

***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 EH&S Laboratory Safety training and in the handout supplied at that class.

Labels on incoming containers of hazardous chemicals are not to be removed or defaced until product is emptied from the container.

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 container labels are available from EH&S.

Laboratories shall prominently post:

1. Emergency telephone numbers.
2. Location signs for safety showers, eye washes, fire extinguishers, and first aid equipment.
3. Warning signs at areas or equipment where special or unusual hazards exist.

(Contact EH&S for assistance in obtaining appropriate signage)

EH&S prepares and posts laboratory door safety signs outside each laboratory. Contact EH&S 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.

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 EH&S 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.

EH&S 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 that the University Procurement Services places restrictions on how hazardous chemicals may be purchased. Use of a Purchase Order is the preferred method; some materials are prohibited from purchase using a purchasing card. Check this link to view Procurement policies: [http://www.cmu.edu/finance/procurementservices/policies-procedures/documents/pcard-handbook\\_section-5.pdf](http://www.cmu.edu/finance/procurementservices/policies-procedures/documents/pcard-handbook_section-5.pdf)

**Stockrooms/Storerooms:**

Hazardous substances in storage should be segregated by hazard categories, following manufacturer recommendations. Containers of PHS materials should be placed in unbreakable 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.
- A UL-rated flammable storage cabinet must be used to store flammables when there are more than five gallons present in the lab.
- A corrosive storage cabinet is strongly recommended for storage of acids and bases.
- 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

**Transport &  
Shipment of  
Chemicals**

- storage.
- Chemical storage in hoods and on bench tops should be minimized.

**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 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, railway or navigable waters should NEVER be performed except under the oversight of EH&S. This transportation is highly regulated and the University MUST ensure that all regulations are followed for such moves. Visit the EH&S web page at <http://www.cmu.edu/ehs/chemical/shipping/index.html> to request a shipment be made or to learn more about the requirements.

**Chemical  
Segregation**

Refer to the Material 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

**General  
Laboratory  
Rules**

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

1. 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.
2. 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.
3. 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.
4. Use equipment only for its designed purpose.
5. Use only those chemicals for which the quality of the engineering controls and protective equipment is appropriate for safe handling.
6. Eating, drinking, smoking, gum chewing, or application of cosmetics should not occur 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.
7. Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operations.
8. 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. Use equipment only for its designed purpose.
9. Wash areas of exposed skin well before leaving the laboratory. It is especially important to wash hands routinely before leaving. Leave all protective equipment in the lab when

## General Laboratory Rules

- exiting. This includes lab coats and protective gloves.
10. Avoid practical jokes or other behavior that might confuse, startle, or distract other workers.
  11. Do not use mouth suction for pipetting or starting a siphon.
  12. Confine long hair and loose clothing. Wear closed-toed shoes at all times in the laboratory; **NO SANDALS ARE 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.
  13. Hazardous experiments should not be 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.
  14. Be alert to unsafe conditions and see that they are corrected when detected.
  15. 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 MSDSs for the materials in question.
    - Section 2E1 of Prudent Practices in the Laboratory, 1995.

## 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, procedures for safe removal of contaminated waste, and decontamination procedures.

### *Definitions*

**“Particularly Hazard Substances”** 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” (<http://ehs-alert.fms.bap.cmu.edu/pdf/cmuphstable.pdf>) for lists of PHSs 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

## Definitions

- 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 (LC<sub>50</sub>)**” 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.

## PHS Safety Protocol Forms

The purpose of the **PHS Safety Protocol Form** is to ensure that all employees (including faculty, staff and paid students) are adequately trained and familiar with the particularly hazardous substance's 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, 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 EH&S upon request. A copy of a blank PHS Safety Protocol Form is located at <http://www.cmu.edu/ehs/chemical/forms.html>

PHS Safety Protocol Forms may also be obtained from the Environmental Health & Safety Office, 3rd Floor, Facilities Management Services Bldg.

### **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**

PHSs 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 EH&S 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 EH&S 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.

**Containment**

PHSs 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 PHSs shall be performed in a certified laboratory hood, glove box, or approved vented enclosure. Air exhausted from glove boxes where PHSs are handled must be vented to a certified hood or exhaust system.

**Storage**

PHS containers should be labeled as such (EH&S 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 PHSs.

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.

<b><i>PHS Safety Protocol Forms</i></b>	<p>Carnegie Mellon's Hazardous Waste Certification Tags, with all pertinent information, shall be attached.</p> <p>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.</p> <p>Laboratory workers should leave protective apparel in designated areas and wash hands and arms before leaving designated areas if possible.</p> <p><b>Safety precautions</b> 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.</p>
<b><i>Exposures</i></b>	<p>Never exceed exposure limits (consult MSDS). 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.</p> <p>Carnegie Mellon University provides all employees who have received a hazardous chemical exposure the opportunity to receive medical attention.</p>
<b><i>Items Not Covered</i></b>	<p>Any items not covered by this amendment should be submitted to the Carnegie Mellon Laboratory Safety Committee on an ad hoc basis for consideration.</p>
<b><i>Animal Work with Chemicals of High Chronic Toxicity</i></b>	<p><b>Access</b> For large-scale studies, special facilities with restricted access are preferable.</p> <p><b>Administration of the Toxic Substance</b> 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.</p> <p><b>Aerosol Suppression</b> 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).</p> <p><b>Personal Protection</b> When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed because of incomplete suppression of aerosols, other apparel and equipment (e.g., shoe and head coverings, respirator).</p> <p><b>Waste Disposal</b> 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.</p>

## **Emergencies and Exposures**

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<b><i>Emergency Operations Plan</i></b>	<p>The University has prepared and has made available to appropriate persons an Emergency Operation Plan. Details of the plan may be found at <a href="http://www.cmu.edu/ehs/emergency-response/index.html">http://www.cmu.edu/ehs/emergency-response/index.html</a>. Questions about the content of any response activity should be addressed to Environmental Health &amp; Safety (8-8182).</p>
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***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.

**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.

**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.

***Emergency  
Response Guide  
for Labs***

**Planning and Preparation**

A written Emergency Operations Plan has been prepared for and is circulated throughout Carnegie Mellon University. A summary document, Emergency Response Guide for Laboratories is available from EH&S and should be posted in each laboratory. This document identifies procedures for medical assistance, evacuation, and reporting of accidents. Fire safety equipment is tested at least annually per posted schedules.

***Accident  
reporting***

**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 Guidelines), fires, or explosions shall be immediately reported to Carnegie Mellon University Police at extension 8-2323. Security will contact the appropriate Carnegie Mellon University or City of Pittsburgh fire/medical/hazmat response personnel including EH&S.

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 (8-2323).

**Accident Investigation and Reporting**

Accidents involving injury or illness must be reported on the Supervisor's Injury/Illness Report form (available from Human Resources) located at this link:

[http://www.cmu.edu/hr/benefits/benefit\\_programs/forms/WCforms.pdf](http://www.cmu.edu/hr/benefits/benefit_programs/forms/WCforms.pdf) and distributed as indicated in the form.

All other accidents and near accidents (injuries, fires, spills, explosions) shall be reported in writing

**Accident reporting**

to EH&S as soon as possible after the occurrence.

EH&S will analyze accidents and “near misses” and provide recommendations to proper authorities.

**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 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 8-2323.
- First Aid shall only be performed by persons suitably trained to do so.

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## Waste Disposal

**Hazardous Waste Program**

**Hazardous Waste:**

Information on the identification, handling, storage and collection of laboratory wastes, and personnel safety of 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. The written program may be found at <http://www.cmu.edu/ehs/chemical/waste/index.html>. Hazardous waste generator training is a requirement for all generators of hazardous waste. Annual refresher training in hazardous waste generation is strongly recommended (see the TRAINING section on page 7 of this document).

***Non-Hazardous Waste***

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

- All "sharps" or needles must be disposed of in "sharps" containers available from EH&S. (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. For disposal of sharps that are contaminated with chemicals, biological agents and/or radioactive materials, check the EH&S web page for further details of both accumulation requirements and requesting disposal of filled containers.)
- 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 to the handlers), marked "For disposal", and placed in the hallway outside the lab. Custodial services will pick-up and remove the container.
- 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. Contact EH&S for information on these wastes.

***Sink Disposal***

Do not discharge any waste to the sewer that

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

## **Physical Hazards**

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***Compressed Gases***

**Compressed Gases**

Please refer to Carnegie Mellon's Toxic Gas Protocol for additional requirements, such a use of gas cabinets, detection and warning systems and special controls, for certain high hazard compressed gases. This document is available from EH&S (8-8182)

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.

**Compressed Gases**

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 EH&S on a case by case basis, to ensure that the alternative meets fire protection requirements.

Contact EH&S for additional information on the handling of compressed gas cylinders.

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).

**Pressure and Vacuum**

**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)**

1. Gloves and a face shield should be used when there is a potential exposure to the cryogen.
2. Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air, which leads to an explosion hazard.
3. Appropriate dry gloves should be used when handling dry ice, which should be added slowly to the liquid portion of the cooling bath to avoid foaming over.
4. Workers should avoid lowering their head into a dry ice chest; carbon dioxide is heavier than air and suffocation can result. Dispense cryogenics in areas with adequate ventilation.

**Ergonomics**

Laboratories present special challenges in the prevention of repetitive stress injuries. Laboratory personnel are urged to attend the Training Session "Laboratory Ergonomics" offered by EH&S. For information and training dates, go to this link:

<http://www.cmu.edu/ehs/training/index.html>

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## Recordkeeping

**Records**

**Records Retention**

1. Carnegie Mellon Department of Human Resources (HR) maintains illness and accident reports.
2. The Department of Environmental Health and Safety (EH&S) maintains documentation of the annual review of the Chemical Hygiene Plan.
3. EH&S oversees the University' chemical inventory program, CHEMTRACKER.
4. HR maintains all medical records relating to chemical exposure and potential chemical exposures.

***Records***

**Internal Program Evaluations**

Records of EH&S laboratory inspections and hood evaluations will be maintained in the EH&S office, for a minimum of three years.

**External Program Evaluations**

Reports of external (regulatory) inspections will be retained by EH&S.