

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

Routine sampling scheduled by FM, 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 laboratory supervisor 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 laboratory supervisor, 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 CHO-P in consultation with the CHO-Q.
- Constant and fixed instrumental monitoring of airborne concentrations is required when a volatile and highly toxic substance is used. Monitoring is not usually justified or practical in laboratories, but may be appropriate when testing or redesigning hoods or other ventilation devices.

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., perchloric and hydrofluoric acid and phenol) exhibit additional hazards that must be addressed when they are used in the laboratory.

*Chemical
Hazard Types*

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

When a reaction is attempted for the first time small quantities of reactants should be used to minimize hazards.

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

- 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. Be familiar with the location of the closest fire extinguisher and pull stations.

All building occupants MUST evacuate when building alarms are sounded.

In the event of a fire or an explosion of any size or type, report it to the Director of Safety and Security.

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-P 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. In March of 2012, OSHA revised the Hazard Communication Standard which addresses the format of chemical container labels. Specifically, there is a new system of label requirements, designed to meet the Global Harmonization Standard, used throughout much of the world. Information on the new details of these changes is available from EHS-P through written documents and on the web site, <https://www.cmu.edu/ehs/Laboratory-Safety/chemical-safety/index.html>

Secondary use containers (containers used for dispensing from bulk containers or containers of “made-up” chemical mixtures) must 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.

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.
4. Locations of any area where particularly hazardous substances are used.

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, accessed at this location: <https://www.cmu.edu/ehs/Training/index.html>. 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.

EHS-P 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/index.html>

Stockrooms/Storerooms:

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

Stockrooms 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-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. Corrosive storage cabinet should not be made of metal.
- 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 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 by university personnel except under the oversight of EHS-P. This transportation is highly regulated and the University MUST ensure that all regulations are followed for such moves. These regulations include personal or commercial transportation by any vehicle, including cars, trucks, trains, buses, watercraft, vans or aircraft. Contact EHS-P for advice and guidance.

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

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.
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 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 supervisor 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.
 - Environmental Health and Safety-Pittsburgh
 - Review the MSDS/SDSs for the materials in question.
 - Section 6 of Prudent Practices in the Laboratory, 2011.

Particularly Hazardous Substances

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 of the 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 (PHS)” <https://www.cmu.edu/ehs/Guidelines/index.html#chem> 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 portion of a lifetime to dosages of less than 10 mg/m³
 - 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 LD₅₀ and LC₅₀ values. Acutely toxic chemicals meet the following criteria:

- Chemicals with an oral LD₅₀ in rats <50mg/kg
- Chemicals with a skin contact LD₅₀ in rabbits <200mg/kg
- Chemicals with an inhalation LC₅₀ in rats <200ppm/per hour

“Lethal Dose 50 (LD₅₀)” 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 laboratory supervisor 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 and submit it to EHS-P. All lab workers 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 **lab workers** (including faculty, staff and 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 laboratory supervisor shall approve all PHS Safety Protocol Forms where applicable. Consultation with the CHO-Q and/or EHS-P is recommended to ensure that procedures and safety precautions are adequate. The approved protocol will be kept on file in the laboratory (readily accessible for use in an emergency). A copy of a blank PHS Safety Protocol Form is located at <https://www.cmu.edu/ehs/Guidelines/index.html#chem>

Laboratory supervisor approval:

A written PHS Protocol must be approved and signed by the laboratory supervisor before work with PHS chemicals may begin. The entire PHS Safety Protocol Form shall be reviewed by the laboratory supervisor 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 laboratory supervisor 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. Copies should be given to the CHO-Q and EHS-P by uploading in BioRaft.

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

*PHS Safety
Protocol Forms*

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-P 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-P 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 have some form of secondary containment. 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 exposed 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.

Finely divided solid materials and PHS spill cleanup material 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 CHO-Q and CHO-P if you

	<p>suspect exposure. Seek medical attention if you suspect exposure. (recommend specific places to take patient)</p> <p>The Lab Standard and Carnegie Mellon University provides medical services to all employees who have received a hazardous chemical exposure along with the opportunity to receive medical attention.</p>
Items Not Covered	Any items not covered by this plan should be submitted to the EHS-P for consideration.
Animal Work with Chemicals of High Chronic Toxicity	Animal work is not allowed in Qatar campus.

Emergencies and Exposures

Emergency Response Plan	<p>The University has prepared and has made available to appropriate persons an Emergency Response Plan. Details of the plan may be found in the Doha Chemical Safety Guidelines at https://www.cmu.edu/ehs/Guidelines/index.html. Questions about the content of any response activity should be addressed to the Director of Safety and Security at 974 4454 8434.</p>
Emergency Response Equipment	<p>Eyewashes</p> <p>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.</p> <p>Safety Showers</p> <p>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.</p> <p>Fire Extinguishers</p> <p>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. Fire safety equipment is tested at least annually per posted schedules.</p> <p>Spill Response</p> <p>A spill response kit must be present in or near each laboratory area that contains hazardous materials with a potential for release. The spill kit needs to accommodate a cleanup of the contents from the largest container of the hazardous material present and be appropriate for the specific class of hazard present in the lab, such as acids, bases and solvents. Please find more information at: https://www.cmu.edu/ehs/Laboratory-Safety/chemical-safety/documents/Spill%20cleanup%20Training%20Details.pdf.</p> <p>Accidents involving a large chemical spill, fires, or explosion shall be immediately reported to the Chemical Hygiene Officer in Doha and the Director of Safety and Security. If necessary, the Director of Safety and Security will contact the Qatar Foundation's Ministry of Environment, Radiation and Chemicals Protection Department.</p>
Emergency Response Guide for Labs	<p>Planning and Preparation</p> <p>A written Emergency Operations Plan has been prepared for Carnegie Mellon University Qatar. A summary document, Emergency Response Guidebook - Appendix C for Carnegie Mellon</p>

**Accident
Reporting**

University Doha Campus should be posted in each laboratory. This document identifies procedures for medical assistance, evacuation, and reporting of accidents. You may find the document here:

<https://www.cmu.edu/ehs/Laboratory-Safety/chemical-safety/documents/Appendix%20C%20New%20Lab%20ER%20Guide%20for%20CMU-Q%20.pdf>

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.

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

- Nature of the accident
- Hazardous material and quantities 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.

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:

<https://www.cmu.edu/ehs/Workplace-Construction/documents/WCforms.pdf> and distributed as indicated in the form.

All other accidents and near accidents (injuries, fires, spills, explosions) shall be reported in writing to the CHO-Q, Human Resources-Q and EHS-P as soon as possible after the occurrence.

**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 (from QF clinic in student center) performing the initial consultation will identify the need for further medical examination. (QF – Primary Health Care Center (QF-PHCC) contact number (974) 4454 1244)

Medical Examinations

1. The medical exam criteria will be determined by the licensed physician. (from QF clinic in student center)
2. For examinations resulting from exposures to OSHA regulated substances, the examination frequency will be the period set within the OSHA standard.
3. For examinations resulting from potential overexposure to hazardous substances, the

- licensed physician will determine the examination frequency.
4. 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.
 5. 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

For serious injury, call QF HSSE at (974) 4454 0999, they will call up the ambulance and the ambulance will directly bring the patient to Hamad Emergency.

First Aid

- Personnel trained in first aid are available during working hours.
- Emergency transport to local hospitals is available 24 hours a day. (Call QF HSSE at (974) 4454 0999 to request for an ambulance)
- First Aid shall only be performed by persons suitably trained to do so.

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-Pittsburgh 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 <https://www.cmu.edu/ehs/Hazardous-Waste-Management/index.html>.

Carnegie Mellon University Qatar Campus has its own process of hazardous waste disposal. The document may be found in the Doha Chemical Safety Guidelines at <https://www.cmu.edu/ehs/Guidelines/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 the **Laboratory Manager**. (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, contact EHS-P for further details of accumulation requirements.
- All broken glass must be disposed of in "broken glass" containers or in completely sealed cardboard boxes. The box must be in sound condition, lidded, and with a poly lining of at least 2 mils. 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.

Sink Disposal

- Finely divided powders, such as silica gel or toners, must be placed in tightly sealed containers before 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

Compressed Gases

Compressed Gases

Please refer to Environmental Health & Safety-Pittsburgh'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. These documents are available at EHS-P website:

Compressed Gas Cylinders - Guideline

<https://www.cmu.edu/ehs/Laboratory-Safety/chemical-safety/documents/EHS%20Guideline%20-%20Compressed%20Gas%20Cylinder.pdf>

Toxic and Highly Toxic Gas Handling Program

<https://www.cmu.edu/ehs/Laboratory-Safety/chemical-safety/documents/Toxic%20and%20Highly%20Toxic%20Gas%20Handling%20Program.pdf>

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. Oxidizers (oxygen) and flammable gases must be stored 20 feet apart or separated by a fireproof partition. 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 valve located 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 poisonous gas such as chlorine, carbon monoxide or hydrogen sulfide are used in quantities larger than a standard lecture bottle size, they must be contained in a gas cabinet that is tied into a hazardous exhaust system and leak detection with alarms must be present, properly tested and maintained. Small lecture bottles must be used in a chemical fume hood.
11. Wherever hydrogen is present, all tubing must be of braided stainless steel hose. Alternative tubing materials will be approved by EHS-P on a case by case basis, to ensure that the

alternative meets fire protection requirements.

Contact EHS-P for additional information on the handling of compressed gas cylinders.

Compressed gases present hazards due to their high pressure 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 **thermal** gloves should be used when handling dry ice. Dry ice should be added slowly to the liquid portion of the cooling bath to avoid boiling and subsequent splashing.
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 EHS-P. For information and training dates, contact EHS-P.

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 Pittsburgh maintains documentation of the annual review of the Chemical Hygiene Plan.
3. EHS-P oversees the University's chemical inventory program, ChemTracker.
4. HR maintains all medical records relating to chemical exposure and potential chemical exposures.

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.

Appendix

Laboratory 3025/3026 Safety Inspection Checklist - Biology

**Post lab checklist for Laboratory Staff in Biology Labs - Genetics, Biochemistry, Phages, Research*

INSPECTOR NAME: _____ DATE/TIME: _____

BIOLOGICALS	YES	NO	NA	COMMENTS
Are all temperature-sensitive substances put back in its proper storage (freezer, fridge)?				
Are unused plates stored back in the fridge?				
Are all students biological samples labelled properly before storage?				

CHEMICALS	YES	NO	NA	COMMENTS
Are all toxic chemicals properly capped and temporarily stored in the assigned hood?				
Are all temperature-sensitive chemicals stored back in its proper storage (freezer, fridge)?				
Are all solid chemicals by the balances properly capped and ready for storage?				
Are all chemical reagent bottles, media bottles, etc. properly labelled?				

EQUIPMENT & ELECTRICALS	YES	NO	NA	COMMENTS
Are all equipment in a safe condition and/or turned off prior to leaving?				
• Shakers				
• Centrifuge (floor)				
• Geringe Autoclave				
• PCR work station (check if UV light is off)				
• Water bath				
• Heating blocks				
• Microscope				
• Fridge (4°C) (Showing correct temperature settings and doors are properly closed?)				
• Incubators (Showing correct temperature settings and doors are properly closed?)				
• Balances (doors of analytical ones are closed, power is off for all)				

FIRE & PRESSURE	YES	NO	NA	COMMENTS
Is the portable propane torch off? (in 3026)				
Are the LPG gas valves off in each benches?				

Is the LPG Emergency Stop button pushed to off the gas supply? (check both 3025 and 3026)				
Is the Carbon dioxide gas main valve off? Or in standby?				
Are the vacuum valves off in each benches?				

BIOHAZARD WASTES	YES	NO	NA	COMMENTS
Are all the waste plates properly collected and disposed of in the red biohazard bins?				
Are all the waste disposable pipets, tips, microfuge tubes properly collected in label containers and disposed of?				
Are all used reusable glass pipets collected ready for washing?				
Are all sharps (needles, syringes, broken glass) properly collected and disposed of?				
Are the accumulated biohazard wastes in the red bins ready for autoclave and disposal?				

OTHER HAZARDOUS WASTES	YES	NO	NA	COMMENTS
Are the waste culture media properly disposed?				
Are the toxic wastes (DMSO, APS, including PHS - Trypan blue, ethidium bromide, sodium azide, others) labelled and moved to the waste hood of 2198 for storage?				

HOUSEKEEPING	YES	NO	NA	COMMENTS
Are the work benches clean, decontaminated and free from chemical spills, dirty paper towels, used gloves, unsorted lab ware and other messes?				
Is the weighing balance area clean from chemical spills, used weighing boats and dirty glassware?				
Is the sink area clean and free from dirty paper towels and unsorted lab ware?				
Are the used/dirty glassware loaded in the washer?				

SECURITY	YES	NO	NA	COMMENTS
Did you ensure that the door to the laboratory is closed and locked when leaving?				

Laboratory 2198 Safety Inspection Checklist - Chemistry

**Post lab checklist for Laboratory Staff in Chemistry 207 and 101*

INSPECTOR NAME: _____ DATE/TIME: _____

CHEMICALS	YES	NO	NA	COMMENTS
Are all chemicals returned to the assigned dispensing hood?				
Are all chemicals in the dispensing hoods properly capped?				
Are all solid chemicals by the balances removed and put back in storage?				
Are all the containers of analytical solutions made by the students labelled?				
Is storage above eye level avoided? (for analytical solutions made by the students)				

EQUIPMENT & ELECTRICALS	YES	NO	NA	COMMENTS
Are all equipment in a safe condition and/or turned off prior to leaving?				
<ul style="list-style-type: none"> HPLC-1 (if in operation, set to shut down after the run has completed) 				
<ul style="list-style-type: none"> HPLC-2 (if in operation, set to shut down after the run has completed) 				
<ul style="list-style-type: none"> UV-Vis-1 				
<ul style="list-style-type: none"> UV-Vis-2 				
<ul style="list-style-type: none"> ICP-AES (power of main instrument is always on) 				
<ul style="list-style-type: none"> IC 				
<ul style="list-style-type: none"> pH meter 				
<ul style="list-style-type: none"> Hotplates/stirrer (for analog type -make sure both knobs are set to off, power cable is unplugged) 				
<ul style="list-style-type: none"> Melting point apparatus (power cable is unplugged) 				
<ul style="list-style-type: none"> Sonicators (backroom) 				
<ul style="list-style-type: none"> Water distiller (backroom) 				
<ul style="list-style-type: none"> Balances (doors of analytical ones are closed, power is off for all) 				

FIRE & PRESSURE	YES	NO	NA	COMMENTS
Are the propane gas valves off in each benches?				
Are the main valves of compressed gases off?				
<ul style="list-style-type: none"> Propane gas (back room) 				
<ul style="list-style-type: none"> Argon gas (classroom) 				
Are the vacuum valves off in each benches?				

HAZARDOUS WASTES	YES	NO	NA	COMMENTS
Are all the chemical wastes in the dispensing hood properly disposed?				
Are all chemical wastes/broken items of students properly collected and disposed of?				
Are the wastes containers in the waste hood properly capped/covered?				

<i>HOUSEKEEPING</i>	<i>YES</i>	<i>NO</i>	<i>NA</i>	<i>COMMENTS</i>
Are the student benches clean and free from chemical spills, dirty paper towels, used gloves, unsorted glassware and other messes?				
Is the weighing balance area clean from chemical spills, used weighing boats and dirty glassware?				
Is the sink area clean and free from dirty paper towels and unsorted glassware?				

<i>SECURITY</i>	<i>YES</i>	<i>NO</i>	<i>NA</i>	<i>COMMENTS</i>
Did you ensure that all doors to the laboratory are closed and locked when leaving?				