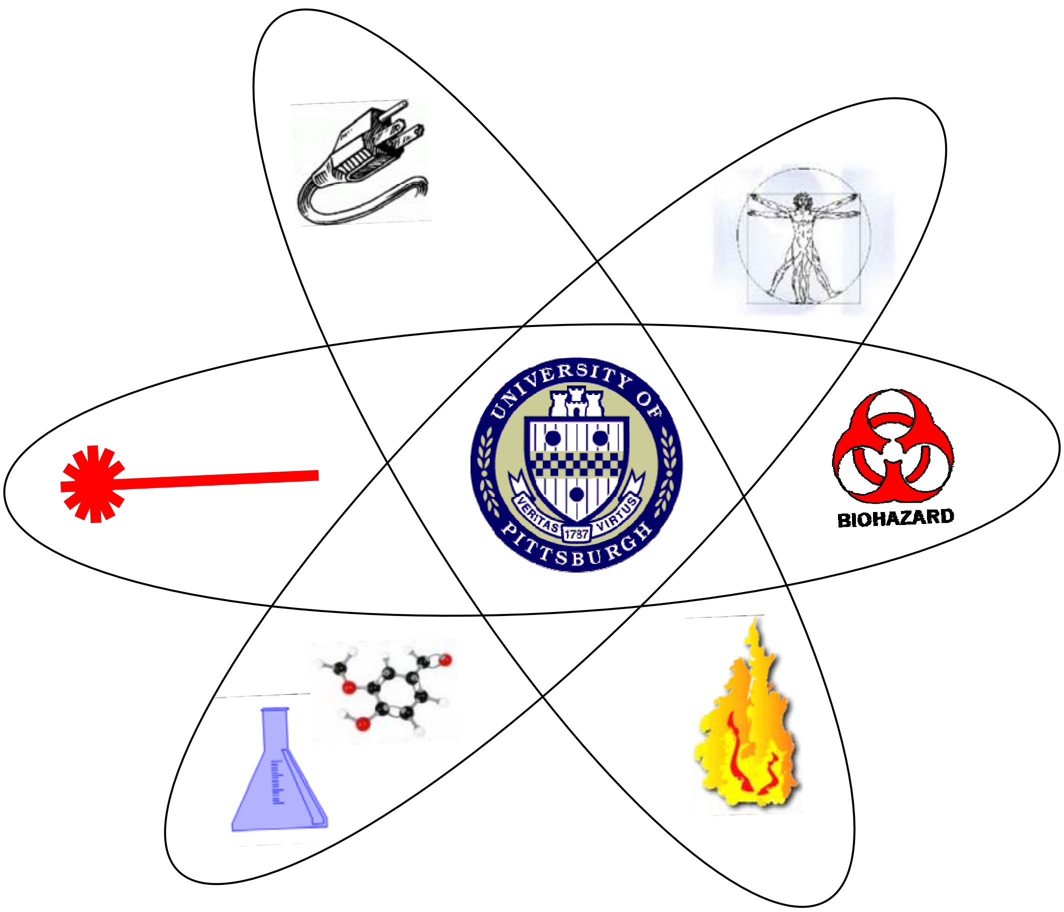
UNIVERSITY OF PITTSBURGH SAFETY MANUAL



Department of Environmental Health and Safety

2007

SECTION I – GENERAL SAFETY

SECTION II – FIRE SAFETY

SECTION III – GENERAL LABORATORY SAFETY

RESPONSIBILITY, AUTHORITY, AND RESOURCES

1. Faculty, Staff, and Students

This Safety Manual encourages and requires that employees exercise judgment in the workplace. Disregard of prudent practices or the recommendations in this Manual may be grounds for disciplinary action, per the discretion of supervisory personnel.

The primary responsibility for safety rests with each individual engaged in research, education and support activities at the University of Pittsburgh. University faculty, staff and students have responsibility to:

1.1 Attend applicable safety training programs;

1.2 Comply with safety rules prescribed by their Department, Dean, Director, and the Department of Environmental Health and Safety (EH&S)

1.3 Report any workplace hazard, unsafe condition, or accident to their supervisor.

2. Supervisors

Supervisory personnel are the cornerstone of the safety program at the University. Each University supervisor has responsibility to:

2.1 Plan and provide adequate safety measures in their area of responsibility in consultation with EH&S and their respective Dean, Director or Department Chairperson;

2.2 Be familiar with the environmental health and safety programs of the University and with the ***University of Pittsburgh Safety Manual;***

2.3 Implement safety programs and control measures for the specific systems or work environments in their department or area;

2.4 Report any occupationally-related accidents, injuries, or illnesses occurring in their areas of responsibility

2.5 Ensure that all subordinates in their area of responsibility have received adequate safety training.

2.6 Routinely inspect workplaces within their area of responsibility to verify safe conditions.

3. Deans, Directors, Department Chairpersons

Each Dean, Director, or Department Chairperson has responsibility for the implementation of the safety program within their unit.

4. Department of Environmental Health and Safety (EH&S)

4.1 Provides direction in all aspects of the environmental health and safety program.

4.2 Assists University faculty, staff, and students in establishing and maintaining safe work environments;

4.3 Develops and monitors compliance with Federal, State, and local laws and regulations pertaining to health, safety and the environment.

5. University Environmental Health and Safety Committee

The University Environmental Health and Safety Committee and its Subcommittees are composed of representatives from the University community. Their function is to provide a forum for discussion of University-wide environmental, health, and safety issues. The current Sub-committees are the Chemical Hygiene Officers' Committee and the University Biohazards Committee.

6. Building and Department Safety Committees

Good communication within each school, department or work area is vital for the success of the environmental health and safety program. The University Environmental Health and Safety Committee and the Department of Environmental Health and Safety endorse organized safety committees at the laboratory, building, department or school level to provide a forum for University employees to express their needs and concerns for safety, and to resolve such issues and concerns in conformance with the University environmental health and safety program.

EMERGENCY PROCEDURES

The Pittsburgh campus has specific Emergency Response Guidelines. Faculty, staff and students should contact their departmental chairperson for information. Supervisory personnel may obtain a copy of the Guidelines by contacting EH&S. Faculty, staff, and students from Regional Campuses and other University properties should refer to the specific emergency guidelines, and procedures for their respective areas.

1. Emergency Phone Numbers

   University of Pittsburgh at Oakland
   ALL EMERGENCIES **412-624-2121**
   FIRE **Pull fire alarm then dial 412-624-4141 from a safe area**

   Over 450 emergency phones are located throughout the Pittsburgh Campus. These phones ring directly to the University Police and automatically register the location of the caller.

2. Regional Campuses and University Properties

   Emergency phone numbers for each University Regional Campus are as follows:

   University of Pittsburgh at Bradford
   10333 from a campus phone
   814-368-3211 from an on campus phone

   University of Pittsburgh at Greensburg
   9865 from a campus phone
   724-836-9865 from an off campus phone

   University of Pittsburgh at Johnstown
   7222 from a campus phone
   814-269-7222 from an off campus phone

   University of Pittsburgh at Titusville
   4488 from a campus phone
   814-827-4488 from an off campus phone

3. Medical Emergencies

3.1 Call University Police at 412-624-2121 on the Pittsburgh Campus (off campus or at regional locations, dial 911 for medical emergencies) and clearly state:

- LOCATION of the injured person;
- DESCRIPTION of injury or emergency;
- YOUR NAME and LOCATION;

3.2 If possible, do not leave the victim alone.

3.3 Do not move the injured person unless there is IMMEDIATE DANGER of further injury;

3.4 At no time should a rescuer put themselves at risk;

3.5 Only individuals who have been trained in lifesaving techniques (i.e. American Red Cross First Aid, CPR, Emergency Medical Technician's program) and are willing to offer their abilities should initiate medical assistance.

4. Fire Emergencies

4.1 Alert people in the area to evacuate

4.2 Close doors to confine fire

4.3 Activate the nearest "pull box" located along the egress corridor or near exit door

4.4 Evacuate to a safe area following exit signs. Do **not use elevators**.

4.5 When safe to do so, call University Police or emergency number for campus.

4.6 Fire extinguishers should be used only by trained personnel. See Fire Safety Section of this Manual for more details regarding fire emergencies and alarms.

ACCIDENTS AND INJURIES

An accident is an unplanned occurrence that may result in damage to people, property, equipment, or the environment. When accidents are reported promptly, injured employees, students, and visitors receive timely medical care and unsafe conditions receive prompt corrective action.

University employees should report all on-the-job accidents, injuries, or illnesses to their Supervisor and provide as much information as you can about the injury or illness.

If emergency medical treatment is required call Pitt Police at 412-624-2121 (4-2121).

If you require non-emergency medical treatment, this treatment will be provided at:

Concentra Medical Center Oakland
120 Lytton Avenue, Suite 275
Pittsburgh, PA 15213
(412) 621-5430

To ensure that the University of Pittsburgh will pay bills associated with medical treatment, you **must** select from one of the licensed physicians or health care providers listed on the University Health Care Provider Panel.

If the on-the-job injury involves a Bloodborne pathogens exposure (such as a needle stick, contaminated sharp, blood/body fluid splash, etc.), or involves an animal or occurs in an animal facility medical treatment must be obtained at:

Employee Health Services
3708 Fifth Avenue
Medical Arts Building, Suite 500.59
Pittsburgh, PA 15213
(412) 647-3695

The Supervisor is responsible to:

- Complete a copy of the Employer's Report of Occupational Injury or Disease(LIBC 344), Additional Injury Report Information Sheet and signed Employee Acknowledgement. Send them to Workers' Compensation (412-624-1817) within one business day of your knowledge of the incident. These reports can be downloaded from either the Budget and Controller website or the EH&S website (under On the Job Injuries.)
- Immediately notify Workers' Compensation if an employee misses at least one day of work because of that injury.
- Notify Workers' Compensation when an employee returns to work after a workers' compensation leave.

All accidents should be investigated and reviewed by department supervisors as soon as possible with the expectation that root causes will be determined and this information will be used to improve safety, as well as to prevent similar accidents from occurring. EH&S is available to assist in this process. We encourage supervisors to complete an investigation for all injuries and illnesses, including "near misses". If you would like assistance with an investigation or have questions, please call EH&S at 624-9505.

BUILDING AND OFFICE SAFETY

1. All University buildings possess features that afford occupant safety in emergencies. All occupants of University buildings should observe the following guidelines for identifying and reducing hazards:

    1.1 Be aware of the emergency procedures or emergency signals for your building. Each University building is equipped with an emergency signaling system.

    1.2 Be familiar with the location of emergency exits and fire alarm pull stations.

    1.2 Know the short term and long term assembly areas external of your building.

    1.3 Never obstruct emergency exits, fire alarm pull stations or emergency equipment with furnishings or stored items. Do not conceal or obscure an exit door by draperies or decorations. Always observe the Decoration Guidelines in the Fire Safety section of this manual.

    1.4 Follow EXIT signs to evacuate any building. Do not place decorations, furnishings, or equipment on or near an EXIT sign that may block or diminish their visibility.

    1.5 No lock or fastening device of any type (e.g., padlocks, chains, etc.) that prevents egress from any building is to be installed on exit doors.

    1.6 Never block open a fire door unless the hold-open device is interconnected to the building fire alarm system.

    1.7 All electrically or magnetically locked doors in an egress will release immediately upon the activation of the building fire alarm system .

2. Office environments have particular hazards with potential to cause workplace injuries. The leading causes of office accidents are slips and falls, strains, over-exertion, falling objects, electrical shock, and repetitive trauma injuries. Follow these guidelines for safety in the office environment.

    2.1 Do not use any machine that smokes, sparks, or appears defective in any way. Immediately remove damaged or defective office machines from service.

    2.2 Close hand-operated paper cutters after each use and replace the blade guard.

2.3 If you open a copy machine or printer for troubleshooting, remember that some parts may be hot. Always follow the manufacturer's instructions for troubleshooting.

2.4 Unplug paper shredders before troubleshooting. Exercise caution with loose belts, jewelry, long hair, scarves, and neck ties near shredders.

2.5 Do not open more than one file cabinet drawer at a time. Secure top-heavy file cabinets by having them bolted to the floor or wall. Keep the bottom drawer full to stabilize the entire cabinet. Do not leave file cabinet drawers open while unattended.

2.6 Do not block ventilation grates with office equipment or furniture.

2.7 Avoid using extension cords.

2.8 Keep all cords and wires out of foot traffic areas and do not roll chairs over electrical cords or wires.

2.9 Never climb using shelves or chairs. Use a step stool or ladder.

2.10 Report slippery, damaged, or uneven floor surfaces, torn carpet, broken tile or poor lighting to your supervisor.

3. Elevators and Escalators: The following guidelines are for the safe use of elevators and escalators at the University of Pittsburgh:

3.1 Never tamper with elevator and escalator controls or interlocks.

3.2 Never block elevator doors open.

3.3 In the event of a fire or emergency, never use an elevator unless instructed by emergency responders.

3.3 An emergency phone is installed in each elevator to contact the University Police. In case of emergency, press the call button, and clearly state your name and location. University Police will summon emergency help. Remain calm. Never exit the car through the emergency hatch or through the doors when between floors. Wait for help to arrive.

4. Reporting Unsafe Conditions

   4.1 All employees are encouraged to report hazardous or unsafe conditions to their supervisor. University employees may also contact the Department of Environmental Health and Safety directly to report an unsafe condition.

5. The Work Environment

Supervisors and faculty are responsible for providing a safe work environment for the employees, visitors, and students in their respective areas. It is the responsibility of each supervisor, faculty member or manager to:

   5.1 Monitor the general condition of facilities and equipment within their areas of responsibility to identify potential hazards or unsafe conditions;
   5.2 Communicate hazards which have been identified to faculty, staff, students and the administration as appropriate;
   5.3 Investigate reports of unsafe conditions or seek assistance from EH&S regarding such reports;
   5.4 Plan and implement corrective actions for identified hazardous or unsafe conditions;
   5.5 Avoid reprimanding employees or students for executing their right to report unsafe conditions or request safety information;

6. Individuals with Disabilities

Individuals with physical or mental impairments that substantially limit their daily activities are protected by the Americans with Disabilities Act of 1990 (ADA). The University of Pittsburgh is proactive in providing facilities and programs with unrestricted access for disabled individuals. These principles are applied during the design, construction, and alteration of buildings and properties at the University of Pittsburgh. Consult the Office of Disability Resources and Services at (412) 648-7890 with questions or concerns regarding access or accommodations for all individuals.

INDOOR AIR QUALITY

The quality of the indoor working environment and indoor air can affect the performance, health, morale, and productivity of faculty, staff, and students. The most common complaints regarding indoor air quality are in reference to temperature, ventilation, humidity, and odors.

The accumulation of irritating contaminants is another potential source of indoor air quality problems. These contaminants within a building can originate from inside the building, such as smoking, molds, cleaning agents, new building materials and furnishings, or from external sources such as construction operations and pesticides.

Controlling contaminants at the source is the most effective means of promoting good indoor air quality. Proper ventilation is also important especially if controlling the pollutant at the source is not possible or practical. University building occupants should eliminate practices which restrict air movement, such as blocking air vents with furniture or covering supply vents to control temperature.

1. All verbal and written complaints associated with Indoor Air Quality (IAQ) should be forwarded to the Department of Environmental Health and Safety (EH&S), extension 4-9505. IAQ complaints or allegations may include but are not limited to:

- Temperature, humidity, and other comfort concerns,
- Room "stuffiness" or "closeness",
- Air contamination such as odors, vapors, mold, particulates or second hand smoke,
- Perceived medical conditions such as allergic type reactions and other health-related symptoms that became manifested or exaggerated while in a space or room.

2. A representative of EH&S shall promptly contact the complainant to obtain more information.

3. If the complaints are confined to temperature and comfort levels, EH&S will contact the appropriate building representative (Facilities Management, Property Management, or Housing) to attempt the necessary adjustments. In many of these instances, EH&S involvement may not be necessary when the concern is resolved directly by the building representative.

4. If the complaint involves concerns which exceed comfort conditions, EH&S will conduct a field visit to the site of alleged problems. Prior to the site visit, the supervisor of the complainant or the area manager will be notified of EH&S presence and nature of visit. The results of the EH&S assessment will be shared with the building representative to identify potential sources of the concern and potential abatement measures.

5. If faculty and staff allege health effects associated with the work site, they will be requested to visit Employee Health Services, 3708 Fifth Ave., Medical Arts Building, Suite 500.59, Monday-Friday 7:30am-4:00pm for a medical evaluation. If a student alleges health effects associated with the academic or University housing environment, they will be requested to visit Student Health

Services, 3708 Fifth Ave., Medical Arts Building for a medical evaluation. In either instance, EH&S shall notify Risk Management of the occurrence.

6. The results of the on-site EH&S assessment of the involved space, the detailed description of IAQ allegations, and the outcome of associated medical evaluations will be utilized to formulate an action plan for remediation. EH&S will provide recommendations to designated representatives of Facilities Management, Housing or Property Management as indicated by building for suggested remedial actions. EH&S may collect preliminary indoor air quality data to monitor the levels of carbon dioxide, temperature, and relative humidity in certain instances to assist in formulation of the remediation plan.

7. If all suggested remedial actions have been implemented and symptoms or complaints persist, EH&S will consider performing more extensive air sampling. Air monitoring is most feasible when specific pollutants or contaminants are suspected. In other cases, air monitoring results rarely exceed documented guidelines and are often inconclusive, since consensus air quality standards do not exist.

8. In the event that data is collected regarding the air in the involved space, EH&S will utilize the following established standards regarding acceptable indoor air quality:

- American Society of Heating, Refrigerating and Air Conditioning Engineers Incorporated, standard 62-1989
- ACGIH Threshold Limit Values
- EPA-published Environmental Standards

SMOKING

The ***University of Pittsburgh Policy No. 04-05-03*** (***Smoking)*** severely restricts the use of smoking materials in University facilities. Smoking is prohibited in all areas including classrooms, lecture halls, laboratories, clinics, libraries, museums, auditoriums, indoor athletic facilities, conference rooms, stairwells, elevators, hallways, common areas of residence halls, rest rooms, University vehicles, campus buses and other indoor public areas.

The ***University of Pittsburgh Procedure No. 04-05-03 (Smoking)*** provides the process for requesting the establishment of designated smoking areas (an exception to the University Smoking Policy) and for the approval and posting of No Smoking signs as required by the City of Pittsburgh Smoking Pollution Control Ordinance. In summary, the Director of Environmental Health and Safety is responsible for the approval of designated smoking areas.

University Administrative Officers are responsible for the enforcement of the University Smoking Policy and Procedure within their respective areas of responsibility, and determining the need and approving requests for designated smoking areas.

ASBESTOS

The inhalation of asbestos fibers in excess amounts can lead to chronic lung disease. Our knowledge of these health effects comes from studies of workers exposed routinely to high concentrations of airborne asbestos fibers. While asbestos can pose a health hazard when high concentrations of asbestos fibers are released into the air, intact asbestos materials do not pose a health risk. The presence of asbestos in a facility does not mean that the health of building occupants is endangered. A small disturbance of asbestos does not constitute a significant exposure risk.

Asbestos Containing Material (ACM) is properly managed through a comprehensive Operation and Maintenance (O&M) Program. The Department of Environmental Health and Safety (EH&S) manages the Asbestos Program and the O&M Program at the University.

1. THE OPERATIONS AND MAINTENANCE PROGRAM

The principle objective of the University of Pittsburgh's Operations and Maintenance (O&M) Program is to minimize the potential exposure of all faculty, students and staff to airborne asbestos fibers. The O&M program includes specific work practices and training to maintain asbestos containing materials (ACM) in good condition; ensure proper clean-up of asbestos fibers previously released; and assure compliance with all federal, state, and local regulations dealing with asbestos abatement, employee training, worker licensing, and waste disposal. **A copy of the entire O&M Program for asbestos is found on the EH&S website.**

2. RESPONSIBILITIES

2.1 An Asbestos Program Manager is appointed by EH&S to oversee asbestos-related activities on campus, including building inspections, and abatement actions.

2.2 The Asbestos Program Manager with the assistance of Facilities Management, Housing and Property Management will inform affected building occupants, contractors, and maintenance/custodial workers about asbestos hazards in their work areas and ensure that asbestos is properly identified, removed or capped, and disposed.

3. INFORMATION, NOTIFICATION, LABELING

3.1 The long term goal of the University is to maintain asbestos containing materials in a safe condition until its eventual removal. Established work rules and safety procedures must be followed by campus personnel who come in contact with asbestos containing material. To obtain information about asbestos concerns at the University, contact EH&S.

3.2 Signs are posted at the entrance to areas containing asbestos remediation activity to identify the presence of these materials beyond the posting. ACM labels and identification signs used at the University of Pittsburgh are worded as follows to comply with the OSHA regulations

Danger Asbestos **Cancer and Lung Disease Hazard** **Authorized Personnel Only** ***(If in a regulated abatement area, add)*** **Respirators and Protective Clothing** **Are Required in this Area**

4. TRAINING

4.1 General Awareness Training (Awareness)
Operations, maintenance and custodial staff involved in cleaning or repair tasks where ACM may be accidentally disturbed must attend a general awareness training course that includes:

- Background information on asbestos;
- Health effects associated with asbestos exposure;
- Location and type of ACM identified at a facility;
- How to control employee exposure;
- Recognition of and response to ACM damage and deterioration;

4.2 Abatement Worker or Supervisor Training (DoLI Abatement)
This training is intended for University Of Pittsburgh employees and their supervisors who may conduct small-scale asbestos abatement projects. The training involves 32-40 hours of detailed training on all aspects of asbestos abatement.

4.3 All applicable training will be provided prior to initial assignment of ACM related tasks. Refresher training will be provided annually to designated personnel.

5. MEDICAL SURVEILLANCE

Persons who are trained at level 2 or 3 must be included in the University's Respiratory Protection Program and the Medical Surveillance Program for asbestos workers. The content of the medical exam as specified by OSHA is repeated annually.

6. WORK PERMIT SYSTEM

6.1 A permit system has been developed for all work involving the potential disturbance of ACM such as renovations, equipment maintenance or small-scale removal. This permit system is coordinated through the Asbestos Program Manager. All asbestos related work must be deferred until the asbestos hazard can be removed or abated by "appropriate" personnel, or it is determined that no ACM will be adversely impacted by the work.

6.2 Small-scale asbestos jobs done by in-house abatement workers can be completed upon notification and approval by the EH&S Department on the designated forms.

6.3 Outside abatement contractors cannot perform ACM work at the University without first obtaining EH&S approval on the Allegheny County Health Department (ACHD) and Pennsylvania Department of Environmental Protection notification forms. A ten-day waiting period is usually required for all abatement works done at the University by outside contractors, unless an emergency condition can be demonstrated.

6.4 An ACHD "Asbestos Abatement Permit" is required on all large asbestos abatement projects. This permit application must be submitted when the quantity of ACM (friable or non-friable) exceeds 160 square feet. All applications for ACHD permits must be reviewed and signed by the University's Asbestos Program Manager or the Director of Environmental Health & Safety.

7. WORK PRACTICES FOR MAINTENANCE ACTIVITIES

Routine maintenance activities in buildings containing asbestos materials have the potential to disturb ACM and raise the level of airborne asbestos fibers. Maintenance workers are cautioned against conducting any work in a manner that may disturb ACM. The management permit system for maintenance work shall be instituted to ensure that proper procedures are employed whenever there is a possibility of disturbing ACM or releasing asbestos fibers.

8. WORK PRACTICES FOR RENOVATION AND REMODELING

8.1 Renovation
Building renovation, demolishing walls or replacing utility systems can involve disturbing ACM. Removal of all potentially affected ACM is recommended in these situations. Asbestos removal may be required by regulation if the amount of ACM likely to be disturbed is greater than 160 square feet or 260 linear feet. All procedures and precautions for asbestos removal required by OSHA, EPA, State, and County regulations are employed at the University. When considering a building renovation project, the location and type of ACM that may be affected is identified.

8.2 Remodeling
Where the remodeling involves direct contact with ACM (e.g., replacement of floor tile) all of the procedures and precautions required by EPA, DEP, ACHD and OSHA asbestos regulations for removal must be followed.

9. PROCEDURES FOR FIBER RELEASE EPISODES

Persons finding suspect ACM should contact EH&S to identify the materials asbestos content and the steps necessary prior to disturbing the material. Custodial and maintenance workers must report the presence of suspected asbestos debris, evidence of water or physical damage to ACM, or any evidence of a possible asbestos fiber release to the Project Manager or Building

Coordinator as soon as possible. The Project Manager or Building Coordinator in turn should notify the Asbestos Program Manager.

9.1 The area shall be isolated as soon as possible after the suspected ACM debris is discovered. Once confirmed and where doors can seal the area, they must be locked from the outside (exit doors and corridors must remain in operation) and have signs posted to prevent unauthorized personnel from entering the work area.

9.2 The HVAC system shall be temporarily modified to prevent the distribution of asbestos fibers. If possible doors, windows, registers, diffusers, etc. shall be sealed.

10. AIR MONITORING

Air monitoring of employees who may be exposed to asbestos during construction or maintenance activity is required.

10.1 Personnel air monitoring should be conducted at the initiation of each asbestos project or maintenance job that may expose workers to asbestos fibers. Additional monitoring requirements are based on the results of the initial monitoring or on changes to the routine for maintenance operations.

10.2 Daily air monitoring that is representative of each workers asbestos exposure when inside regulated asbestos areas or working with asbestos outside containment is also required.

10.3 If periodic air monitoring reveals that employee exposures are statistically below the OSHA 8-hour Time Weighted Average or below the Excursion Level of 1.0 f/cc for a 30-minute period, monitoring may be discontinued for those employees.

10.4 All asbestos air sample results used for exposure evaluations must be personal samples collected following procedures specified in Appendix A of the OSHA Construction Standard (29 CFR 1926.1101).

10.5 The EH&S Department shall notify affected employees and the department supervisor of their exposure results as soon as possible following receipt of the air monitoring test results.

11. PERIODIC SURVEILLANCE

Knowledgeable personnel groups perform inspections of asbestos containing materials in their buildings, and report damaged materials to EH&S. Department of Environmental Health and Safety personnel continually monitor for damaged ACM and frequently conduct a re-inspection of known ACM present on the campus (both friable and non-friable).

12. ASBESTOS DISPOSAL

12.1 All asbestos-containing material and asbestos contaminated waste is packed in double 6 mil disposal bags that are labeled per applicable regulations before being removed from the work area. Transite sheets or ACM lined equipment is also double wrapped. Other ACM waste is placed in drums which are sealed and labeled for storage and transport.

12.2 All asbestos waste is transported via enclosed truck or other approved vehicle by a licensed carrier. Final disposal of asbestos occurs at an authorized landfill. No unauthorized persons have access to the waste material.

ERGONOMICS PROGRAM

Ergonomics is the science of designing and arranging work areas in a manner that allows individuals to safely and effectively function in that work area. The University of Pittsburgh's Ergonomics Program is managed by the Department of Environmental Health and Safety (EH&S) and strives to provide ergonomic solutions to a variety of work-related problems.

Any worker can be at risk of injury in a poorly designed work area or using an improper method to complete a job task. For example, landscapers, plumbers, and mailroom workers can benefit from training on proper lifting techniques due to the nature of their jobs; and office workers must be aware of the proper selection, positioning and use of office equipment. A number of injuries to lab workers occurs in the form of slow-forming strains associated with poor body mechanics and repetitive motions.

1. An **Ergonomics Website** (http://www.ehs.pitt.edu/ergonomics/ergo-main-2.htm) has been established to provide workers with practical information on ergonomics. Faculty, staff and students will find helpful information on techniques, equipment, exercises and injury prevention along with self-assessment guidelines.

2. At the first indication of **occupationally-related joint or muscle aches or strains**, see your supervisor. The supervisor should contact EH&S for a no-cost assessment of your work station or work activities. If the symptoms are severe and allegedly work-related, the individual should be directed by the supervisor to Concentra Medical Services for medical consultation. At the conclusion of the EH&S analysis, the supervisor will be forwarded a written list of recommendations.

3. EH&S also offers **no-cost ergonomic analyses** for University faculty and staff on a pro-active basis.

4. For jobs that are physically demanding, especially jobs requiring lifting and materials handling, EH&S recommends and provides **back safety training**. The training is tailored to suit the needs of a specific work group or department, and consists of a presentation as well as consultation for improving the ergonomics of specific job tasks.

5. While the majority of EH&S consultations are related to computer workstations, **on-site ergonomic analyses and/or associated training** can be conducted for any campus task or job.

Any request for EH&S services or questions regarding ergonomics in the workplace, should be directed to EH&S at 412-624-9505.

RESIDENCE HALL SAFETY

1. Security of Residence Halls

Considerable effort and resources have been invested to maintain the safety and security of residents in University of Pittsburgh facilities. It is the responsibility of each resident to ensure that they and their guests adhere to the University security policies and procedures for Residence Halls (e.g. visitors must sign in and out of Residence Halls, and visitors must be escorted). Anyone observing suspicious persons or activities should immediately contact University Police (412-624-2121 on Pittsburgh Campus).

2. Environmental Safety of Residence Halls

It is the responsibility of the residents and staff of each University Residence Hall to report unsafe conditions or practices to the Resident Assistants, Residence Hall security staff, or University Police. Residence Life Staff and occupants of University Residence Halls should observe the following environmental safety guidelines:

2.1 Avoid contact with any biological or biohazardous materials such as blood, body fluids and wastes, needles, or any other type of potentially infectious substances. Anyone identifying such material should contact the Housing Department at (412) 648-1100, Security Desk of the Residence Hall, or University Police.

2.2 Report all uneven surfaces, tripping hazards and general hazards like broken glass immediately upon discovery to Housing, your resident Assistant or the Security Desk for your Residence Hall.

3. Residence Hall Fire Safety and Life Safety

All University Residence Halls are equipped with sprinkler protection, fire alarm systems and various fire protection systems such as smoke detectors, smoke alarms and heat detectors for resident protection.

3.1 Tampering with fire equipment and fire protection systems, arson or the deliberate initiation of fire or smoke, deliberate engaging fire alarm pull stations without sensing an emergency situation, failing to immediately evacuate during a fire alarm, or entering a building without authorization are all violations of the University of Pittsburgh Student Code of Conduct. Many of these acts of misconduct are also serious violations of State and local laws or fire codes.

3.2 Residents with disabilities or any impairment that prevents or diminishes the resident’s compliance with emergency or evacuation plan of the Residence Hall should notify EH&S. An individualized evacuation plan will be developed for the safety of the resident.

3.3 Residents of University Residence Halls should observe the following fire safety guidelines:

3.3.1 Keep halls and stairwells clear to ensure safe egress.

3.3.2 Do not prop open fire doors (e.g. doors to stairways).

3.3.3 Smoking is prohibited in all University buildings.

3.3.4 At no time should the placement or storage of items (such as clothing, books, posters, and other materials) obstruct doors, EXIT signs, sprinkler heads, fire hose cabinets, fire extinguishers, fire alarm pull stations, smoke/heat detectors, fire alarm notification devices, or light fixtures.

3.3.5 The following items are NOT permitted in University Residence Halls:

3.3.5.1 Toaster ovens, waffle irons, hot plates, deep fryers, and propane stoves

3.3.5.2 Torchiere-Style Tubular Halogen Lamps

3.3.5.3 Multi-outlet plug strips or surge suppressers other than UL-approved, 125V AC, 60Hz, 1875 watt or less, circuit protected;

3.3.5.4 All weapons, “weapon-like projectiles,” air guns, paint guns, stun guns, starter pistols, firearms, or ammunition;

3.3.5.5 Fireworks, sparklers, flares, or any type of flammable materials;

3.3.5.6 Explosives or incendiary devices (e.g. blasting caps, percussion caps, fertilizers, black powder), and any other type of material used in the manufacturing of explosives;

3.3.5.7 Candles, incense and devices using open flames

VISITORS TO RESTRICTED AREAS

As an extension of its educational responsibilities, the University of Pittsburgh allows and encourages community representatives, members of the public and students to visit University facilities. However, visitation by such groups and individuals to laboratories, maintenance shops and other restricted areas must be under the direct supervision of an authorized faculty or staff member, or part of an open house, guided tour, or supervised educational program that has the pre-approval of departmental management.

1. Areas housing potential or known hazards including (but not limited to) all research, teaching, and/or clinical laboratories; maintenance shops, mechanical/electrical spaces, and construction areas; and any area where chemicals are handled or stored shall have access restricted to authorized individuals. Authorized individuals are University of Pittsburgh faculty or staff, UPMC employees and other individuals such as contractors specifically invited to the restricted area for official University business, and/or University of Pittsburgh students with access privileges to specified restricted areas.

2. For the purposes of these guidelines, "children" refers to individuals under eighteen years of age who are not students or employees of the University. Children are not authorized to visit laboratories, maintenance shops and other restricted areas, except as a participant in department approved tour or educational program with the permission of an informed parent or guardian. At no time should children be exposed to the hazards or dangers of the laboratory, maintenance shop or restricted area.

3. Children of University faculty, staff and students are not authorized to be in laboratories, maintenance shops or other restricted areas on an attended or unattended child care basis.

4. Individuals under 18 years of age are not permitted into any area designated as a Biosafety Level 3 or posted as "Danger: Asbestos," "High Voltage," "Danger: Laser," and "Extremely Hazardous Area - Do Not Enter - Contaminated Area."

5. Individuals under 18 years of age are not permitted into any area with restrictive warning signs, such as "Authorized Personnel Only," "Restricted Area - Admittance to Laboratory Personnel Only," and other restrictive warnings unless pre-approved by the department chairperson.

6. Domestic pets or animal companions are prohibited in restricted areas of University buildings, except for service animals with express written consent of the department chairperson.

7. The functional unit chairperson or director, shop supervisor, or laboratory principal investigator bears primary responsibility for insuring that unauthorized individuals are not granted access to restricted areas in their responsibility areas and that University faculty, staff and students under their directions are aware and adhere to these guidelines.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment (PPE) is used to protect an individual from hazards associated with their work tasks or environment. Specific types of personal protective equipment include protective clothing, eyewear, respiratory devices, protective shields, gloves, and hearing protection. Personal protective equipment is not a substitute for engineering controls such as chemical fume hoods and biosafety cabinets, or for administrative controls and good work practices. PPE is used in conjunction with these controls to provide safety and maintain health.

The Department of Environmental Health and Safety (EH&S) is available to assess areas or tasks to identify hazards, to select or advise on the appropriate PPE for identified hazards, and to provide training in the proper care, maintenance, use, and disposal of PPE.

1. Responsibilities Regarding Personal Protective Equipment

    1.1 The University through faculty and supervisors is responsible for:

        1.1.1 Selecting PPE that fits each affected faculty, staff and student;

        1.1.2 Supplying PPE during the execution of job duties and experimentation that have been pre-determined to have potential hazards;

        1.1.3 Assuring the adequacy of any employee-owned PPE;

        1.1.4 Providing training to each PPE user on hazards and required PPE.

    1.2 The Department of Environmental Health and Safety is responsible for:

        1.2.1 Assessing work areas to identify hazards which necessitate the use of PPE

        1.2.2 Maintaining records of all hazard assessments

        1.2.3 Assisting in training on the proper use, care, and maintenance of approved PPE

        1.2.4 Providing guidance on the selection of PPE

        1.2.5 Evaluating the overall effectiveness of the PPE

    1.3 Supervisors are directly responsible for:

        1.3.1 Ensuring that the affected faculty, staff and students working in their respective areas receive the appropriate PPE;

        1.3.2 Ensuring that the affected faculty, staff and students working in their respective areas receive appropriate training for the use, care, and maintenance of PPE;

1.3.3 Ensuring that the affected faculty, staff and students working in their respective areas use PPE properly during their activities;

1.3.4 Seeking assistance from EH&S to evaluate and identify workplace hazards and to select appropriate PPE;

1.3.5 Notifying EH&S when new hazards are introduced into work areas or when hazardous processes are added or altered;

1.3.6 Ensuring defective or damaged PPE is immediately replaced or repaired.

1.4 PPE users are responsible for:

1.4.1 Attending training for the proper use of PPE;

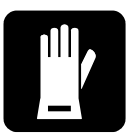
1.4.2 Maintaining PPE in a sanitary and reliable condition;

1.4.3 Using PPE properly;

1.4.4 Informing their supervisor or advisor of the need to re-evaluate PPE.

2. Care and Maintenance of PPE

PPE must not be shared between users unless it has been properly sanitized. It is also important to ensure that used or contaminated PPE that cannot be properly decontaminated is disposed according to University waste disposal procedures.
Disposable or “single use” PPE must never be re-used without approval of EH&S.



3. Hand Protection

Faculty, staff and students are required to use appropriate hand protection when their hands are exposed to hazards, such as:

- skin absorption from harmful substances;
- cuts, lacerations or abrasions;
- chemical exposure;
- thermal burns and/or temperature extremes
- potentially infectious material.

3.1 The selection of appropriate hand protection should be based on the characteristics of the gloves relative to the task being performed, the conditions present, the duration of use, and the identified potential hazards.

3.1.1 General Purpose Work Gloves: Leather or fabric gloves used to reduce the effects of using tools over extended periods of time (generally not suitable for protection from liquids or chemicals)

3.1.2 High temperature gloves**:** Leather gloves with heat reflective aluminized coating, wool lining, heat resistant acetate lining in cuff;

3.1.3 Low temperature or refrigerator gloves: Leather gloves with , insulated wool lining and knit wrist;

3.1.4 Cut/Puncture/Abrasion Resistant Gloves: high strength synthetic fibers

3.1.5 Chemical Resistant Gloves

3.1.5.1 Neoprene gloves protect against acids, caustics, oils, greases, most solvents;

3.1.5.2 Vinyl coated gloves provide abrasion resistance and protection against solvents, ammonia, alcohols, and most organic acids. Ideal for petrochemical operations;

3.1.5.3 Butyl gloves provide permeation resistance to most gas or water vapors and are ideal for protection against aldehydes, ketones, esters. They provide greater protection than neoprene, nitrile, and natural rubber for certain classes of chemicals.

3.1.5.4 Latex rubber gloves provide liquid resistance for food handling and laboratory work, and protection from exposure to potentially infectious material;

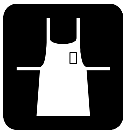
3.1.5.5 Nitrile gloves provide protection against a wide range of chemicals including aromatic, petroleum and chlorinated solvents, and offers liquid barrier protection for potentially infectious materials. These are ideal for faculty, staff and students with a documented sensitivity to latex.

3.2 Care and Use of Hand Protection

3.2.1 To preserve the useful life of gloves, wash chemicals or materials from reusable gloves after each use;

3.2.2 Store gloves away from the contaminating area or hazard to reduce deterioration;

3.2.3 Properly discard disposable or compromised gloves;
3.2.4 Check gloves prior to donning and periodically for signs of wear or deterioration, and replace as necessary;



4. Body Protection

Certain activities require protective apparel to minimize the potential for exposure to skin. This section is intended to provide faculty, staff and students with general guidelines for identifying activities that require protective apparel and selecting appropriate body protection for the associated hazards.

4.1 Chemical Resistant Clothing: Protective apparel designed to provide a barrier against a variety of chemical hazards. Chemical resistive clothing may be required for tasks where chemical splashing is anticipated or large volume transfers are conducted. Prior to selection of chemical resistant clothing, EH&S should be consulted;

4.2 Laboratory Apparel and Scrub Suits: A wide variety of styles and materials are available to protect employees during laboratory operations. The selected type of lab coat or other apparel is designed to protect the wearer against accidental splashes or day-to-day handling of chemicals;

4.3 Cleanroom Apparel: Cleanroom apparel is designed and classified to meet Federal requirements for the control of airborne particles.

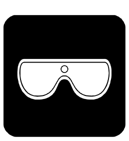
4.4. Care and Use of Body Protection: Body protection is specifically designed and designated as “reusable” or “disposable.”

4.4.1 When using disposable apparel, a new garment should be used for each operation, and the used garment should be properly discarded after each use.

4.4.2 When utilizing reusable protective apparel, it is important to follow the manufacturer’s cleaning instructions. Improper cleaning may compromise the integrity of the garment and reduce it’s capability for body protection or protection of clean room environments.

5. Ear and Hearing Protection

Ear plugs and muffs are available for any employee potentially exposed to noise levels at or above 85 dBA



6. Eye and Face Protection

Approved eye protection must be worn by all University faculty, staff, students, and visitors that engage in hazardous activities or are exposed to identified eye hazards within University buildings or on University property. Protective eye wear does not provide unlimited protection and is not intended as a substitute for engineering controls, such as equipment shields, and operational controls.

6.1 University faculty, staff and students that wear prescription eyeglasses while engaged in operations that involve eye hazards must wear protective eye wear that incorporates the prescription lens in the design or fits properly over the prescription eyeglasses;

6.2 Wearers of contact lenses must wear appropriate eye and face protection devices in hazardous environments.

6.3 Safety goggles and/or a face shield must be used when there is a significant hazard from chemical splashes or from projectile hazards such as fragments, chips, or flying particles;

6.4 Equipment fitted with appropriate filter lenses must be used to protect against light radiation. Filter lenses must have a shade number that is appropriate for the work being performed. See the Laser Safety section of this manual for more information.

6.5 All protective eye and face equipment must comply with ANSI Z87.1-1989, American National Standard for Occupational and Educational Eye and Face Protection;

6.6 Care and Use of Eye and Face Protection

6.6.1 Clean eyewear after each shift or work activity. Use anti-fogging agents to reduce or eliminate fogging.

6.6.2 Replace scratched or damaged eyewear

6.6.3 Thoroughly disinfect eyewear that was used by other employees with warm water and soap or a recommended disinfectant.

6.6.4 Store eyewear in a bag, drawer or protective case to prevent scratching, damage or contamination;

6.7 Recommended Types of Eye Protection for Identified Hazards

Workplace activities	Identified Hazards to Eye and Face	Recommended Eye Protection (Listed from least to most protective)
Woodworking, grinding, drilling, any operation that produces flying particles.	Impact from flying particles	Safety glasses with side shields Direct vent goggles Clear face shield over Safety glasses or impact protection goggles
Laboratory or chemical handling operations	Impact from broken glassware, splashes from liquid chemicals	Safety glasses with solid side shields Indirect vent goggles
Medical, clinical, or biological laboratory operations	Exposure to biohazardous or infectious materials	Safety glasses with solid side shields Face shield over Safety glasses
Laser operations	Exposure to direct or reflected laser radiation	Laser protective eye wear appropriate for individual laser
Welding operations (electric arc or gas welding)	Exposure to infrared radiation and hot sparks	Welding goggles, welding helmet or welding shield specific to type of welding operations

7. Respiratory Protection Program

See the Respiratory Protection Program, Section VII of this manual, for information on respirators and respiratory protection**.**

FINE ARTS, STUDIO ARTS, AND PRINTING OPERATIONS

1. In addition to the guidelines provided by the ***University of Pittsburgh Chemical Hygiene Plan,*** University faculty, staff and students working within Fine Arts, Studio Arts, and Printing Operations should observe the following guidelines in an effort to provide a safe and healthful working environment:

   1.1 Use non-toxic or less toxic solvents and chemicals when possible.

   1.2 Eliminate toxic metals and products containing toxic metals, such as lead and cadmium. Use cadmium-free silver solders and lead-free paint, glazes and enamels.

   1.3 Use water-based rather than solvent-based materials.

   1.4 Use liquid or pre-mixed materials to replace powders.

   1.5 Use wet techniques (such as wet sanding) instead of dry techniques to minimize dust or particulate production.

   1.6 Apply coatings by brushing or dipping instead of spraying.

   1.7 Dispose of all spent, excess or waste chemical-containing products by following University Chemical Waste Disposal guidelines.

   1.8 Never touch chemical powders or solutions without proper hand protection.

   1.9 Read and follow the manufacturer's instructions for safely mixing or preparing chemicals, particularly following all instructions for preparing chemicals in sequential order.

2. **POTTERY AND CERAMICS**

   2.1 Pottery clay contains silicates that can be harmful if inhaled. Many low-fire clays and slip-casting clays also contain talc, which can be irritating if inhaled. When mixing clay dust or breaking dry "grog," use local exhaust ventilation. Work with wet clay when possible.

   2.2 Pottery glazes may also contain free silica, including flint, feldspar, and talc. Long term exposure to these materials may cause permanent lung damage. Use safer alternative products when necessary; use in well-ventilated spaces; and when indicated, use respiratory protection when mixing or spraying glazes.

   2.3 Fumes and gases are often produced during the firing process. Ensure that all kilns are well ventilated to a safe area outside the building. Use infrared goggles or a face shield to view the kiln through the access port. Also, use the appropriate apparel, eyewear, and gloves to prevent injury from radiant heat and light generated from the kiln.

3. A variety of chemicals including fixers, developers, replenishers, and stabilizers are used in photographic development processes. Some of these processes generate hazardous materials such as silver, chromium, and corrosive substances that must be disposed of in accordance with Federal Regulations. Please follow these guidelines when working with photographic chemicals and equipment.

3.1 **PURCHASE**

3.1.1 Do not purchase excessive quantities of photographic chemicals. Purchase the only the minimum, useable amounts of chemicals as needed.

3.1.2 Photographic chemicals often have limited shelf life. Purchase only the amounts that would be used prior to expiration.

3.1.3 Photographic equipment that processes materials classified as a regulated waste should be selected or retro-fitted with a recovery system that prevents discharge of regulated material into the sanitary system.

3.2 **STORAGE**

2.1.1 Segregate all incompatible chemicals. Consult chemical-specific Material Safety Data Sheets (MSDS) for chemical incompatibilities and storage requirements.

3. 3 **HANDLING AND USE**

3.3.1 Wear appropriate protective equipment (lab coat, safety glasses, gloves, etc.) when handling photographic products and chemicals.

3.3.2 When collecting used photographic chemicals, label each container with a completed orange Chemical Waste label. Chemical Waste labels are available by contacting Environmental Health and Safety (EH&S).

3.3.3 All recovery systems must be emptied and serviced per manufacturer instructions.

3.4 **DISPOSAL**

3.4.1 Photographic processing chemicals must be collected and disposed through the University's chemical waste program. **Do not dispose photographic chemicals through the sanitary sewer or in the garbage.**

PERFORMING ARTS AND SPECIAL EVENTS

These guidelines are designed to assist University faculty, staff, students, and non-University personnel in developing safe productions that will not endanger the cast, crew, vendors, attendees, or the audience of performances and special events. Each person involved with the event should be familiar with the potential hazards and associated corrective actions. EH&S is available to review safety procedures for any event and provide recommendations to reduce the risk of injury or illnesses.

1. Producers of these functions should notify and consult the Department of Environmental Health and Safety (EH&S) at the earliest phase of production when any of the following special effects are planned:

   1.1 Open flames or pyrotechnic devices (e.g., flashpots, flash paper, luminaries,);

   1.2 Lasers;

   1.3 Unusual stage effects that pose safety or health concerns relating to but not limited to food, water, or waste; noise or light exposure; egress: fire safety; electrical safety; or suspended equipment (other than lighting and grids).

2. **Electrical repairs:** Repair or retrofit of electrical equipment is only to be conducted by qualified and University-approved personnel. Report any defects, accidents, or problems with electrical systems to Facilities Management at (412) 624-9500.

3. **Electrical Cords and Wiring:** Electrical extension cords are designed for temporary, not permanent, use. Use of thin, light duty extension cords is prohibited. Exposed electrical cords or wire on the floor must be taped, placed under an electrical chase, or protected by a floor guard to prevent tripping and wear. Stretched or pinched cords because overheating and fire. Never use more than one extension cord in series. See the Guidelines for Electrical Safety found in this Manual for more information.

4. **Lighting:** Never use ordinary paper, cellophane, or other combustible materials to cover light bulbs or lighting fixtures. Ensure that lighting equipment is secured and separated from combustible screens or scenery. Do not obstruct exits or egress paths.

5. **Light Control Area:** To reduce the risk of electrical shock, beverages are not permitted in the Light Control Area. Only trained and University-authorized personnel are permitted to work with lighting equipment, circuitry, dimmers, and controls.

6. **Fire Extinguishers:** Do not attempt to use a fire extinguisher (unless you have been properly trained by EH&S). Regardless of your training, activate the fire alarm before using an extinguisher.

7. **Flammable Liquids:** Flammable Liquids such as paints, lacquers, thinners and solvent-soaked rags must be stored in flammable storage cans or containers until they can be disposed properly

via the EH&S Chemical Waste Disposal Program. For more details see the Flammable and Combustible Liquid Guidelines found in the Fire Safety section of this Manual.

8. **Housekeeping:** Ensure that hazardous materials are properly labeled and disposed via the EH&S Chemical Waste Disposal Program, and follow the University recycling and waste disposal policies and procedures from Facilities Management.

9. **Tools and Equipment:** All persons operating power equipment should be trained in the safe operation of that equipment and the potential hazards involved. Discontinue the operation of defective or unsafe equipment as soon as the defect becomes known.

10. **Power Tools**: Before use, inspect all power tools for loss of integrity such as frayed cords, exposed wires, and missing ground plugs. Become familiar with the safe operation and limitations of the tool being used.

11. **Hand Tools:** Inspect all hand tools before use to ensure integrity, such as secure hand grips. Only use the tool for its designed function.

12. **Scaffolds, Ladders, and Work Platforms:** The use of “makeshift” extensions to a standard scaffold, ladder, or work platform is not permitted. Do not build or construct scaffolds, ladders, or work platforms “from scratch” without approval of EH&S.

ELECTRICAL SAFETY

The University of Pittsburgh is committed to safety in all aspects of operation. These guidelines were developed using national standards for electrical safety, so that a safe environment is maintained for faculty, staff, students and visitors.

The addition or alteration of permanent wiring, lighting or other electrical components requires the involvement of Facilities Management, Housing Facilities, or Property Management. Theatrical groups may add or alter temporary lighting, wiring or other appropriate electrical components provided that electrical safety standards are maintained. All electrical repairs must be done by qualified individuals.

The following guidelines are not all-inclusive. They are given as fundamental advice to be applied in all situations. For additional information, contact the Department of Environmental Health and Safety 412-624-9505, the Department of Facilities Management 412-624-9500 or utilize the references provided at the end of this document.

1. Controlling Electrical Hazards

   1.1 Never clip off ground pins on three-wire appliances or use two-wire adapters to wed incompatible equipment.

   1.2 Never use substandard two-wire household appliances, lamps, hair dryers and power bars.

   1.3 Never touch bare wires.

   1.4 Never intentionally overload a circuit.

   1.5 Never bypass fuses or circuit breakers.

   1.6 Keep electrical service and breaker panels accessible at all times. These electrical panels should have 36 inches of clearance in front and a 3 foot wide aisle leading to them. It helps to mark the floor around the area that must remain clear.

   1.7 Circuit breakers and fuse boxes must be either recognizable or labeled. Outlets, switches and junction boxes must be covered. All electrical boxes must be secured to the wall.

   1.8 Install ground fault circuit interrupters (GFCI) on any outlet in damp or wet locations, or within 6 feet from wet locations or water sources such as sinks. Also install GFCIs on outlets frequently used for power tools.

   1.9 Do not perform electrical work in damp locations or put a drink where it could spill in an electrical device or electronic component.

1.10 Lockout/Tagout procedures must be followed when equipment is de-energized. Call EH&S for more information on the University's Lockout/Tagout Program.

1.11 Only trained and authorized electricians should remove covers from electrical panels.

1.12 Electrical equipment that malfunctions should be immediately removed from service.

1.13 Unplug any lighting instrument before changing the lamp.

1.14 Always disconnect a plug by pulling on the connector body not the cable. Disconnect any device from the circuit before service.

1.15 Use wooden or fiberglass ladders when working on elevated electrical jobs (such as hanging and focusing lights). If metal ladders must be used, they must be insulated with high quality rubber footpads. Moveable metal scaffolds or adjustable ladders should have lockable rubber casters.

2. Temporary Wiring and Extension Cords

2.1 Coil temporary wiring neatly, and keep flexible cable out of traffic areas. Cover wires that cross walkways with treadles.

2.2 Check cable, cords, and connectors periodically and immediately replace any items that show signs of cracking, chipping or other deterioration.

2.3 Remove any grease, dust, or other accumulations from cables and connectors. These substances can act as insulation between the contacts of the connector, and they can pose a fire hazard.

2.4 Temporary cables, cords and wiring must not be spliced. Use proper connectors and terminations.

2.5 Avoid use of extension cords. Extension cords are only designed for temporary use. Use of thin, light duty extension cords can increase the risk of fire and shock. Make sure extension cords have adequate current capacity for the equipment being used.

2.6 Use extension cords that have GFCIs built into them.

2.7 Do not run flexible cords through holes in windows, doors, ceilings, floors, or walls. Cords may not be attached to building surfaces.

2.8 Avoid stretching or pinching cords between objects, and do not cover electrical cords with rugs. This can break interior wires, causing overheating and fires.

2.9 Cable running beyond 25 feet should be avoided as it may increase electrical resistance beyond its normally rated capacity.

2.10 By definition, theatrical lighting is temporary wiring. All NEC codes and OSHA regulations applicable to temporary wiring apply to theater lighting.

2.10.1 Be sure personnel, students, and trainees know the location of the master switch for stage lighting equipment.

2.10.2 Permit only authorized and trained personnel to work on lighting. Make sure that each individual knows his or her responsibilities as defined by a job description (in the *Handbook of Theatrical Apprentices* or some other suitable set of formal guidelines).

2.10.3 Arrange work schedules so that no other activities take place on stage while lights are being hung or focused.

2.10.4 Before hanging lights, crewmembers should make sure that there is nothing on their persons that would fall to stage level.

2.10.5 Portable light bulbs, including backstage lighting, should be guarded.

2.10.6 All lighting stands must be properly secured.

2.10.7 Portable stage switchboards must be connected to outlets of sufficient voltage.

2.10.8 Never overload dimmer boards. Make sure there is a completely dead (non-conducting) front on dimmers and light boards.

2.10.9 Report to a supervisor immediately after the detection of any irregularities, defective equipment or incidence of electric shock.

3. Power Tools for Electrical Safety

3.1 Purchase only power equipment that is either grounded or double insulated. A grounded tool has a three-conductor cord with a three-pronged plug that must be plugged into a grounded outlet. A double insulated tool has a two-conductor cord and a special insulation system that does not require grounding. These tools should have a label or a symbol on them indicating that they are double insulated.

3.2 Never carry a power tool by the cord.

3.3 Unplug power tools before loading them, changing blades or bits, making adjustments or cleaning them.

3.4 Never use electrical power tools on wet surfaces or in wet weather.

3.5 Never alter or remove machine or blade guards.

3.6 Eye protection should be worn when performing tasks with potential to generate flying particles or debris. Most power tool related tasks generate such hazards.

3.7 Consult EH&S or the University of Pittsburgh Shops Safety Manual for more information on power tool safety.

EMERGENCY EVACUATION AND FIRE EVACUATION PROCEDURES

These procedures are intended to ensure the safety of individuals throughout the campus community, and to ensure the orderly evacuation of campus properties in the event of a natural or man-made disaster, civil disturbance, or other emergency.

ALL EMERGENCIES: Dial 412-624-2121 or (x4-2121 or 811 campus telephones only).

FIRE: PULL FIRE ALARM* then dial 412-624-2121.

*Fire alarm pull stations are located throughout University buildings along paths of egress. Activation of fire alarm pull stations on the Pittsburgh Campus will notify building occupants, the City of Pittsburgh Bureau of Fire and the University Police. Additionally, over 450 dedicated emergency phones are located throughout the Pittsburgh Campus. These phones ring directly to the University Police and automatically register the location of the caller.

1. Responsibilities

In case of a major disaster or crisis situation on any campus properties, comprehensive *Emergency Response Guidelines* have been developed to define roles and provide detailed operational instructions for designated University officials to follow. University managers and supervisors at all levels shall ensure that personnel under their administrative control are aware of and observe the following procedures.

1.1 All University of Pittsburgh faculty, staff and students are responsible for knowing appropriate emergency information for their work areas, classrooms, and/or living areas. This includes emergency plans, exits, alternate routes of egress, and the location of fire alarm pull stations and external assembly areas.

1.2 Always follow posted “EXIT” signage to safely evacuate any building.

1.3 Emergency Evacuation Plan placards are posted in prominently traveled areas. These diagrams provide building occupants with a primary and alternative path of exit. Copies of the Emergency Evacuation Plans for all University of Pittsburgh buildings are maintained by Facilities Management.

2. Building Features

All University buildings are provided with a fire alarm system. The alarms are monitored 24 hours a day, 7 days per week by University Police and an external security firm.

2.1 Building occupants should be familiar with the alarm systems in their building. The alarm consists of bells, horns, or voice messages and/or strobe lights. These systems are arranged for either full building notification or zoned alarm notification. The typical zoned fire alarm system is designed to activate an audible signal (horns) and visual (strobe light) alarm on the floor of emergency, one floor above, and one floor below. Specific building design features that enhance life safety allow the use of a zoned notification system.

2.2 The alarm system can be activated manually at pull stations which are located along the egress path and adjacent to all exit doors.

2.3 Automatic activation of the fire alarm system can be initiated by one or more of the following devices: smoke detectors, heat detectors, or water flow detectors on fire pumps, sprinkler systems, and fire hose standpipe systems.

2.4 The most important building features are the primary and alternate egress paths. Follow the red or green EXIT signs, which always direct you to the stairwell or to the exterior of any building.

3. Emergency Procedures

3.1 The first person to become aware of an emergency situation should activate a pull station. If safe to do so, then notify University Police at 412-624-2121.

3.2 When an alarm signals on your floor, evacuate the building immediately. Follow the egress path designated by EXIT signs.

DO NOT USE THE ELEVATOR in a building under alarm conditions, unless directed to do so by an emergency responder. Stairwells provide areas of refuge within the building and provide safe egress from the building.

3.3 Classroom instructors are expected to interrupt class activity and instruct students to evacuate the building when the alarm activates. Faculty, staff and students are obligated to follow emergency procedures and obey the directions of emergency response personnel.

3.4 Upon exiting the building, it is important to move as far away from the building as possible and proceed to the pre-determined Assembly Area identified for the building. This reduces your exposure to hazardous conditions, allows for others to safely exit, and provides a clear area for emergency responders to do their job. Do not attempt to re-enter the building until University Police or fire department personnel give the “all clear” signal.

4. Individuals Requiring Assistance

4.1 Individuals who are not capable of complying with the evacuation plan, or who may have special needs or recognized disabilities should contact the Environmental Health & Safety (EH&S) Department for development of an Individual Evacuation Plan.

4.2 Occupants should be alert to the presence of persons requiring assistance to the exterior or the stairwells. Anyone who is aware of an individual needing assistance during an emergency should call the University Police and provide the name and location of the person needing assistance.

4.3 Should there be a question about interpretation of the *Americans with Disabilities Act of 1990 (ADA)*, or applicable University programs or facilities, please consult the Office of Disability Resources and Services at (412) 648-7890 or at their web site at www.drs.pitt.edu.

4.4 Faculty, staff and students interested in developing an Individual Evacuation Plan are encouraged to contact EH&S at 412-624-9505, or via e-mail at safety@ehs.pitt.edu. Copies of these plans are maintained on file with University Police for their use when responding to an emergency situation.

4.5 Those individuals requesting a plan can review “*Emergency Evacuation Preparedness: A Guide For People with Disabilities and Other Activity Limitations”*, by June Isaacson Kailes, which is available at the following web site http://www.cdihp.org/products.html#eeguide or a printable version at http://www.cdihp.org/evacuation/emergency_evacuation.pdf.

5. Assembly Areas

Building specific Assembly Areas have been identified to provide a location for evacuees to gather upon exiting their building. Evacuees should follow the direction of emergency response personnel to the appropriate Assembly Area.

Building	Long-Term Assembly Area	Short-Term Assembly Area
480 Melwood Street	Petersen Events Center	Connecting Parking Lot
530 Melwood Street (Motor Pool)	Petersen Events Center	Connecting Parking Lot
246 Oakland Avenue	Petersen Events Center	Bouquet Gardens
256 Oakland Avenue	Petersen Events Center	Bouquet Gardens
Allegheny Observatory	Petersen Events Center	West Park
Allen Hall	David Lawrence Hall	K Lot / Benedum
Alumni Hall	Cathedral of Learning	Cathedral of Learning
Amos Hall	David Lawrence Hall	David Lawrence Hall /WPU Patio
Bellefield Hall	Cathedral of Learning	Cathedral of Learning /Cathedral Lawn
Benedum Auditorium	Petersen Events Center	TH Lot
Benedum Hall	Petersen Events Center	Benedum Auditorium /PG Lot
Bio Tech Center	South Side Sports Facility	South Side Sports Facility Parking Lot
Biomedical Science Tower3	Petersen Events Center	Victoria
Bouquet Gardens (A thru H)	Posvar Hall Lobby	Posvar Hall Lobby / Posvar Hall Patio
Brackenridge Hall	David Lawrence Hall	David Lawrence Hal / Litchfield Towers Patio
Bruce Hall	David Lawrence Hall	David Lawrence Hall / Litchfield Towers Patio
Cathedral of Learning	Alumni Hall	Alumni Hall /Cathedral Lawn
Centre Plaza Apartments	Petersen Events Center	Amberson Garden Apartments
Chevron Science Building	Alumni Hall	Alumni Hall / K Lot / G Lot
Clapp Hall	Alumni Hall	Alumni Hall / RA Lot
Cost Sports Center	Petersen Events Center	Trees Hall /Fitzgerald Field House / OC Lot / Practice Field
Craig Hall	Petersen Events Center	Bellefield Hall

Building	Long-Term Assembly Area	Short-Term Assembly Area
Crawford Hall	Alumni Hall	Alumni Hall / RA Lot
David Lawrence Hall	Petersen Events Center	Law School Patio
Eberly Hall	Chevron Science Center	Chevron Science Center / K Lot
Engineering Hall	Chevron Science Center	Chevron Science Center / K Lot
Falk School	Petersen Events Center	Recreation Field
Fitzgerald Field House	Trees Hall	Trees Hall / Trees Hall Patio/ OC Lot
Forbes Avenue Shops	Petersen Events Center	Posvar Hal / Hillman Library / Law School Patio
Forbes Craig Apartments	Petersen Events Center	FB Lot Rear
Forbes Hall	David Lawrence	Rear of Building/Loading Dock
Fraternities	Trees Hall	Trees Hall / Petersen Events Center
Frick Fine Arts Building	Petersen Events Center	Fountain and Bellefield Area / N Lot
Gardner Steel Conference Center	Benedum Auditorium	Benedum Auditorium and Patio
Graduate School of Public Health (GSPH)	Benedum Hall	Benedum Hall / P Lot / PG Lot
Heinz Chapel	Petersen Events Center	Cathedral Lawn / Bellefield Hall
Hillman Library	Posvar Hall	Posvar Hall Patio
Holland Hall	David Lawrence Hall	David Lawrence Hall
Information Science Building	Petersen Events Center	RA Lot / LS Lot / RA Lot
Iroquois Science Building	Petersen Events Center	Forbes Tower / UPMC Lot
Keystone Building	Petersen Events Center	Forbes Hall rear lot
Langley Hall	Alumni Hall	Alumni Hall / RA Lot
Law School Building	David Lawrence Hall	David Lawrence Hall / Law School Patio
Learning Research and Developmental Center (LRDC)	Benedum Hall	Benedum Hall Patio / G Lot
Litchfield Towers (A, B, & C)	David Lawrence Hall	David Lawrence Hall
Lothrop Hall	Petersen Events Center	Scaife Hall / Victoria Hall / Falk Lot

Building	Long-Term Assembly Area	Short-Term Assembly Area
Mayflower Apartments	Petersen Events Center	Side Lot and Church Lot
McCormick Hall	David Lawrence Hall	David Lawrence Hall/WPU Patio
McGowan	IBEW Union Hall, 5 Hot Metal Street	IBEW Union Hall, 5 Hot Metal Street
Music Building	Langley Auditorium	Langley Auditorium / RA Lot
Music Building	Langley Auditorium	Langley Auditorium / RA Lot
Pennsylvania Hall	Petersen Events Center	Trees Hall/Petersen Events Center
Panther Hall	Petersen Events Center	Trees Hall/Petersen Events Center
Petersen Events Center	Trees Hall / Fitzgerald Field House	Trees Hall / Fitzgerald Field House / OC Lot / Towerview Garage
Posvar Hall	David Lawrence Hall	David Lawrence Hall / Posvar Patio
Ruskin Hall Apartments	Petersen Events Center	RA Lot
Salk Hall Annex	Petersen Events Center	Petersen Events Center / R Lot
Salk Hall Main	Petersen Events Center	R Lot
Scaife Hall	Petersen Events Center	BST Garage
Sennot Square (MPAC)	Petersen Events Center	Law School Patio
Space Research Coordination Center	Petersen Events Center	Chevron Building
Stephen Foster Memorial	Petersen Events Center	Cathedral of Learning Lawn
Sutherland Hall	Petersen Events Center	Trees Hall / Petersen Events Center
Teachers Center	Petersen Events Center	VA Hospital / S Lot
Thackeray Hall	Benedum Hall	Benedum Hall / SO Lot
Thaw Hall	Petersen Events Center	K Lot
Trees Hall	Fitzgerald Field House	Fitzgerald Field House / OC Lot
University Child Development Center	Petersen Events Center	Parking Lot
University Place Building	Petersen Events Center	PS Lot
Van de Graaf Building	Petersen Events Center	Benedum Hall
Victoria Building	Petersen Events Center	Petersen Events Center / Victoria Garage
William Pitt Union	Cathedral of Learning	Cathedral of Learning / Quad

6. Specific Fire Emergency and Evacuation Procedures

6.1 If You Discover a Fire:

1. Alert anyone in immediate danger.
2. Close the door to contain smoke or fire.
3. Activate the nearest fire alarm pull station (located along the egress route).
4. Call 811 or 412-624-2121 from a safe area to provide additional information regarding the situation. Only use a fire extinguisher if the fire is small and you have been trained in the proper use of an extinguisher.
5. Evacuate the building via designated stairwells and exterior exit doors. DO NOT USE THE ELEVATORS.
6. Proceed to an assembly point away from the building and plaza areas. Do not re-enter the building until the “all clear” signal is given.

6.2 If You Hear the Emergency Alarm Signal:

1. Prepare to evacuate. If possible and safe, prior to exiting you should turn off all laboratory gases and electrical equipment (especially hot plates); close containers of hazardous materials including infectious materials; and close all doors and windows.
2. If a door is hot, do not open it. There may be fire on the other side.
3. To verify that your floor is included in the emergency area, observe the strobe signals in the corridor (in those buildings equipped with such devices).
4. Close the door behind you and promptly evacuate the building via designated stairwells and exterior exit doors. Do not use the elevators.
5. Proceed to an assembly point away from the building and plaza areas. Do not re-enter the building until the “all clear” signal is given.

6.3 If Significant Smoke, Heat or Fire is Present:

1. If there is smoke, stay low to the ground where the cooler/cleaner air is located. If the primary egress route or stairway is blocked or smoke filled, use the alternate evacuation route as shown on the Emergency Evacuation Plans for each building.
2. If for any reason you cannot safely exit the room or building, place any available material (shirt, jacket, towel) at the bottom of the door to help seal it from smoke. If water is available the material should be completely soaked.
3. Call 811 or 412-624-2121 to inform University Police of your location.

4. If materials are available, a sign drawing attention to your location should be placed in the window.

5. If there are no outside signs of smoke or fire, the window can be partially opened to allow waving or placement of a signal for emergency responders.

7. Emergency Evacuation Training

The EH&S Department conducts semi-annual evacuation exercises for University residence halls, University-owned fraternity houses, and high rise University-owned apartments. Annual evacuation exercises are performed for all other high rise academic buildings. University departments may request an evacuation drill for their building by contacting EH&S.

FIRE SAFETY AND FIRE PREVENTION

These guidelines are intended to prevent fires and maintain University environments that are optimal for life safety.

1. No Smoking

University policies prohibit smoking in all University owned and leased facilities. Smoking should be limited to designated areas only. Interior loading dock areas, foyers and vestibules near entrances are not designated smoking areas.

2. Building Features

2.1 Do not tamper with fire detection notification devices, smoke or heat detectors, sprinkler heads or other fire protection devices.

2.2 Sprinkler heads should not be obstructed and at least an 18 inch clearance should be maintained below the level of sprinkler heads.

2.3 Do not prop open with wood wedges or other items fire or smoke doors (e.g., doors to stairways, doors at building subdivisions, and doors to labs).

2.4 Fire Extinguishers

The University provides and maintains over 5000 fire extinguishers throughout University properties. EH&S provides for the inspection of all fire extinguishers annually. The fire extinguishers are selected by type and location due to the hazards involved, as outlined in applicable City Codes and the National Fire Protection Association (NFPA) Code 10.

2.4.1 No one on campus is required to use a fire extinguisher during a fire emergency. A fire extinguisher may be used under the following conditions:

2.4.1.1 The individual is trained in the use of fire extinguishers. Training is provided for designated personnel and is available annually during the University's Fire Safety Day in October.

2.4.1.2 The fire is small (i.e. any fire that is isolated to a container or small area such as a trash can) and can be extinguished with one local extinguisher.

2.3.1.3 It can be determined exactly what is burning, and that the proper type and classification of fire extinguisher is available.

2.4.2 Never enter a room that is smoke filled. Never enter a room containing a fire without a backup person. Never enter a room if the top half of the door is warm to touch.

2.4.3 The following is offered as a reminder to personnel trained in the operation of a fire extinguisher: Keep your back to an unobstructed exit and stand six to eight feet away from the fire. Follow the four step **PASS** procedure:

Pull the pin: This unlocks the operating lever and allows the operator to discharge the extinguisher. (NOTE: Some extinguishers may have other release mechanisms);

Aim low: Point the extinguisher nozzle at the base of the fire;

Squeeze the lever: This discharges the extinguishing agent. Releasing the lever will stop the discharge. (Some extinguishers have a button instead of a lever);

Sweep from side to side: Moving carefully toward the fire, keep the extinguisher aimed at the base of the fire and sweep back and forth until the flames appear to be out. Watch the fire area--if the fire re-ignites, repeat the process.

2.5 Fire Hose

Fire standpipe systems with hose valves, hose lines or hose cabinets are prominently located throughout University buildings. Fire hose is only to be used for emergency purposes by responding fire fighters. Fire hose cabinets are intended for the storage of fire equipment only.

3. Corridor Utilization Guidelines

3.1 The storage or use of chemicals, hazardous waste, radioactive material, biological material, compressed gas cylinders, work stations, tables, desks, chairs and any equipment used for active laboratory procedures is strictly forbidden in egress corridors and stairwells.

3.2 Certain storage equipment such as refrigerators and filing cabinets may be *temporarily* placed in a corridor if a clear path of egress is maintained (minimum 44” clear width) and the equipment can be locked.

3.3 At no time can items stored in corridors obstruct emergency showers, utility access panels, exit doors, fire doors, EXIT signs, hose cabinets, fire extinguishers, fire alarm notification devices (horns, strobes or bells), fire alarm pull stations, smoke and heat detectors, or sprinkler systems.

3.4 Any storage of combustible items (paper, cardboard boxes, cloth, etc.) in egress corridors must be in fully enclosed cabinets.

3.5 At no time can any egress corridor be reduced in width by stored items to less than 44 inches.

4. Holiday Decorating Guidelines

4.1 Fire codes prohibit live cut decorations such as trees, holly and evergreen branches inside University buildings. Use artificial trees and decorations.

4.2 Avoid placing electrical decorations near sources of water or on anything made of metallic materials due to potential shock hazards. Be sure that all electrical decorations are UL approved. Avoid using extension cords. No more than three (3) sets of lights or decorations should be on one electrical circuit. Turn off all decorative lighting when unattended.

4.3 Lit candles or other open flames for decorative purposes are prohibited inside University buildings. General guidelines on their safe use during religious or commemorative services have been provided below.

4.4 Artificial trees, displays or other decorations should not obstruct emergency showers, utility access panels, exit doors, fire doors, EXIT signs, hose cabinets, fire extinguishers, fire alarm notification devices (horns, strobes or bells), fire alarm pull stations, smoke and heat detectors, or sprinkler systems.

5. Candles

Candles, incense and open flames are not permitted in University buildings. With prior approval by EH&S and adherence to guidelines below, candles or open flames may be permitted for ceremonies or religious events:

5.1 Should the use of candles require any portion of the fire detection system to be placed on hold during the event, a Fire Watch (see Section 11.2) must be provided during that time and coordinated with appropriate Facilities Management or Housing personnel.

5.2 The event should include personnel who are knowledgeable regarding the proper use of portable fire extinguishers and the nearest extinguisher location.

5.3 Lit candles must never be unattended. The above assigned personnel should remain to monitor the room during any breaks and to extinguish all candles when the event is over.

5.4 The location of the candles should not block any emergency equipment or exit.

5.5 Keep candles away from items that can catch fire such as clothing, books, paper, curtains, combustible wall coverings, or decorations.

5.6 Make sure candles are placed on a stable piece of furniture or in sturdy holders that will not tip over. Candles should fit in the holders securely and holders should be made from material that cannot burn.

5.7 Make sure the candleholder is big enough to collect dripping wax.

5.8 Avoid candles with combustible items embedded in them.

5.9 Extinguish taper and pillar candles when they get within two inches of the holder or decorative material. Votives and container candles should be extinguished before the last ½ inch of wax starts to melt.

6. Luminaries

6.1 Candle type luminaries should not be used indoors.

6.2 Electrical luminaries may be used indoors as follows:

6.2.1 The devices are UL approved and they are operated according to the manufacturers recommended guidelines.

6.2.2 Avoid locations near sources of water or on anything made of metallic materials due to potential shock hazards.

6.2.3 Use of extension cords should be avoided and no more than three (3) sets of lights or decorations should be on one electrical circuit.

6.2.4 Turn off when unattended and upon completion of the ceremony.

6.3 Candle and electrical luminaries can be used outdoors as follows:

6.3.1 Candles must have at least 2" of sand (or like non-combustible material) in the bottom of the bag. The candle must be of a size that will allow adequate space between the candles and bag so as not to ignite the bag.

6.3.2 Candles will not be placed within five (5) feet of combustible material, such as leaves, paper or decorations.

6.3.3 An individual should be designated to supervise and manage the luminaries, and ensure that luminaries are properly extinguished and discarded.

6.3.4 Candles must be extinguished at the end of the event unless the area is supervised.

6.3.5 Electrical luminaries and associated extension cords must be rated for outdoor use.

6.3.6 Electrical cords and extension cords will not be placed so as to cause a tripping or fire hazard.

7. Portable Heaters

7.1 Portable heaters are not designed for continuous use and should not be used as a primary heating source for any room or area.

7.2 Only UL approved portable heaters with an automatic safety switch that will turn the heater off if it is accidentally tipped over should be used. Portable heaters with exposed heating elements should be avoided.

7.3 Portable heaters must be plugged directly into an electrical outlet (do not use extension cords) and the cords should not be located across doorways, aisle ways, under rugs or in areas where the cord may be exposed to wet conditions or physical damage.

7.4 Maintain at least a 3 foot minimum clearance between the heater and any combustible materials (e.g. trash and/or recycling containers, furniture, files, curtains, combustible wall coverings).

7.5 Nothing should be placed on the heaters and the ventilation openings cannot be blocked or obstructed.

7.6 Portable heaters should be turned off and unplugged when not in use and when the area is not occupied.

7.7 Portable heaters are not designed for use in areas where flammable/combustible liquids or gases are used or stored, or where dust may be present (e.g. labs and workshops).

8. Outdoor Cooking Appliances

Outdoor cooking appliances such as charcoal, electric or gas grills are only permitted on University property if the following conditions are strictly adhered to:

8.1 Outdoor grills must be located on a hard, noncombustible flat surface (not on grass or wood decking).

8.2 Grills should be at least 10 ft. from any building’s door, window or air intake. Grills should not be located under building overhangs or areas of combustible construction.

8.3 Grills, tables, chairs, and other material associated with an event must not obstruct a means of egress.

8.4 All outdoor cooking appliances must be constantly attended while in use. The event should include personnel who are knowledgeable regarding the proper use of portable fire extinguishers. A 10 lb ABC type extinguisher should be provided in an accessible location within 10 ft. of the grill.

8.5 Upon completion of the event, all burner controls should be turned off. For charcoal grills, the coals should be thoroughly extinguished with water. In addition, it is recommended that the coals remain in the grill with the lid tightly secured until the following day at which time the coals and ash can be emptied into an appropriate trash container.

9. Propane

Propane is prohibited inside University buildings, unless approval is granted by EH&S. Propane tanks should not be used if they have dents, damage, rust or leaks. The following guidelines for propane use must be followed:

9.1 When not in use, the propane cylinder valve must be closed and the threaded connection capped in accordance with the manufacturer's instructions.

9.2 Do not smoke while handling the propane cylinder.

9.3 Do not use, store, or transport propane cylinders where the cylinder would be exposed to high temperature. Do not store spare cylinders under or near the grill.

9.4 Refer to the 'Storage and Handling of Flammable and Pyrophoric Gasses' Section of this manual for additional detail regarding propane safeguards.

10. Pyrotechnics

Approval for the use of Pyrotechnics must be obtained from the City of Pittsburgh's Bureau of Fire with appropriate permits obtained from the Bureau. EH&S shall be contacted prior to the proposed use of any pyrotechnics as this may also impact fire detection devices and provision of a Fire Watch.

11. Residence Halls and Fraternity Houses

In addition to the above fire safety guidelines, the following items are NOT permitted in residence facilities (residence halls, University fraternity houses, apartment buildings):

11.1 Cooking devices with grease or open heating elements such as toaster ovens, waffle irons, hot plates, deep fryers, or propane stoves with tanks attached.

11.2 Halogen lamps.

11.3 Only UL approved multi-outlet plug strips or surge suppressers (125V AC, 60Hz, 1875 watt or less) should be used. No more than one multi-outlet plug strip may be plugged into each duplex outlet.

11.4 All weapons, “weapon-like projectiles,” air guns, paint guns, stun guns, starter pistols, firearms, or ammunition.

11.5 Flammable and combustible liquids. Fireworks, sparklers, flares, or any type of flammable or combustible novelty; and explosives or incendiary devices such as blasting caps, percussion caps, fertilizers, black powder, and any other type of material used in the manufacturing of explosives.

12. Maintaining Fire Alarm and Fire Protection Systems

12.1 Testing of Fire Alarms

Each month, the fire alarm system of each building is tested by the Building Engineer to verify its operational condition. Prior to the test or during repair of the alarm system, a notice is posted on the entrance doors to the building and/or an announcement is made to notify occupants. These signs will identify the date and time of the testing. Occupants need not evacuate the building during a fire alarm test. Building occupants should listen for the fire alarm signal during the test and notify EH&S if not detected. If fire or smoke is detected during the test or outage, follow the above Emergency Evacuation Procedures and call 811 or 412-624-2121.

12.2 Maintenance and Impairments to the Fire Alarm and Protection Systems (“Fire Watch”)

Maintenance and repair of building fire alarm and protection systems are required to provide a safe and consistent level of defense against fire. During these repairs and maintenance, it may be necessary to temporarily disable the building fire alarm or fire protection systems. Detailed procedures have been developed by EH&S to help manage these impairments.

A fire watch is the process in which a building is physically monitored by designated University personnel (building engineers, security or other adequately trained individuals) during periods when fire alarm or fire protection systems are disabled. These personnel will continually walk the building and report any signs of fire via radio to University Police who in turn notify the City Bureau of Fire.

EH&S should be contacted with any questions on these procedures.

STORAGE AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

These guidelines provide requirements for all University faculty, staff, and students using, handling, or storing flammable and combustible liquids. These requirements are established to ensure faculty, staff and students know the physical characteristics of the material used and the protective measures necessary to prevent fire, explosion, or violent reaction.

1. Definitions

1.1 **<u>Flammable Liquid:</u>** A liquid having a flash point below 100°F (38°C) and a vapor pressure not exceeding 40 psi at 100°F (thus excluding liquefied petroleum gases, liquefied natural gases and liquefied hydrogen). Flammable liquids are subdivided as follows:

Class IA: Liquids with a flash point below 73°F (23°C) and a boiling point below 100°F. *Examples:* acetaldehyde**,** butyne, chloropropylene, dimethyl sulfide, ethyl chloride, ethyl ether.

Class IB: Liquids with flash point below 73°F and a boiling point at or above 100°F. *Examples:* acetone, benzene, carbon disulfide, ethyl alcohol, ethyl acetate, gasoline, hexane, isopropanol, methanol, toluene.

Class IC: Liquids with a flash point between 73°F and 100°F. *Examples:* amyl alcohol, butyl alcohol, isobutyl alcohol, methyl isobutyl ketone, styrene, turpentine, xylene.

1.2 **<u>Combustible Liquid:</u>** A liquid having a flash point above 100°F. Combustible liquids are subdivided as follows:

Class II: Liquids with a flash point at or above 100°F and below 140°F (60°C). *Examples:* No. 1, 2 and 3 fuel oils, kerosene, and hexyl alcohol.

Class IIIA: Liquids with a flash point at or above 140°F and below 200°F (93°C). *Examples:* aniline, benzaldehyde, butyl cellosolve, nitrobenzene and pine oil.

Class IIIB: Liquids with a flash point at or above 200°F. *Examples:* animal oils; ethylene glycol; glycerine; lubricating, quenching, and transformer oils; triethanolamine; benzyl alcohol; hydraulic fluids and vegetable oils.

1.3 <u>Boiling Point:</u> The temperature at which a liquid’s vapor pressure is equal to the atmospheric pressure. Liquids with low boiling points are very volatile.

1.4 <u>Flash Point:</u> The minimum temperature of a liquid at which sufficient vapor is liberated to form a vapor-air mixture that will ignite and propagate a flame away from the ignition source (flash fire not continuous combustion).

1.5 Flammable (Explosive) Limits/Flammable (Explosive) Range: The terms flammable and explosive are used interchangeably since unconfined vapors mixed in air will burn while confined vapors will produce an explosion. The minimum vapor concentration in air that, when ignited, will propagate a flame is the lower flammable limit (LFL or LEL). The maximum vapor concentration in air that when ignited will propagate a flame is the upper flammable or explosive limit (UFL or UEL).

1.6 Vapor Pressure: A measure of the pressure created by a liquid's vapor at a specific temperature. Flammable or combustible liquids with a high vapor pressure at room temperature are more hazardous than liquids with lower vapor pressures because they will produce more flammable vapor without heating.

1.7 Vapor Density: The weight of a volume of pure vapor or gas (with no air present) compared to the weight of an equal volume of dry air at the same temperature and pressure. A vapor density figure less than one indicates the vapor is lighter than air. A figure greater than one indicates the vapor is heavier than air.

1.8 Fire Area: An area of a building separated from the remainder of the building by construction having a fire resistance at least 1 hour (i.e. a single laboratory area).

1.9 Flammable Material Storage Cabinet: A storage cabinet constructed and arranged in accordance with NFPA and International Fire Code standards. Note: Cabinets that are typically located underneath bench tops and fume hoods are not considered approved cabinets unless they are provided with appropriate UL/FM labeling.

1.10 Flammable Liquid Storage Room: A room used for the storage of large quantities of flammable and combustible liquids which meets the construction, arrangement and protection requirements of the City of Pittsburgh, NFPA and International Building and Fire Code standards.

1.11 Safety Can: A metal container of not more than 5 gallon capacity which is UL/FM Approved and is provided with a flame arrestor, a spring-closing lid and spout cover designed to relieve internal pressure when subjected to fire exposure.

1.12 Approved Plastic Container: A plastic container meeting the requirements of and containing products authorized by the U. S. Department of Transportation (DOT) Hazardous Materials Regulations, 49 CFR or by Part 6 of the United Nations Recommendations on the Transport of Dangerous Goods (i.e. UN 1H1 – non-removable head type plastic containers or as authorized by DOT exemption). The 5 gallon "red" container commonly used for ethanol is an example of a container meeting these guidelines.

2. Hazards Description

Flammable liquids are easily ignited and difficult to extinguish. Combustible liquids require heating for ignition and are easier to extinguish. Flammable and combustible liquids produce a high heat release rate once ignited (i.e., fires produce high temperatures in a short period of time), and associated fires spread rapidly.

Vapors from flammable and combustible liquids can be present at room temperature and can form explosive mixtures with air. Some liquids are unstable or very reactive (e.g., burn when exposed to air without an ignition source, susceptible to spontaneous heating, react violently with other materials including water). These characteristics combine to create a significant fire and/or explosion hazard.

Since the vapors generated from flammable liquids are most often heavier than air, they will seek the lowest available level in a building. This movement of vapors can produce potentially dangerous conditions far removed from the actual vapor source. Flammable vapor, if not removed by ventilation, can flow to an ignition source and flash back to the vapor source.

The volatility of the liquid is increased when externally heated at or above its flash point. Overall, an increase in temperature will increase the hazard created by a flammable or combustible liquid by increasing its vapor's flammable range. Due to this, heated Class II and Class III liquids should be subject to all applicable requirements for Class I and Class II liquids respectively.

3. General Guidelines for Flammable and Combustible Liquids

3.1 The volume of flammable and combustible liquids in a lab, room or location is restricted by University guidelines, and International Fire Codes. EH&S should be contacted regarding any questions or for additional guidance.

3.2 Below grade locations should not be used for Class I flammable liquids. If this is unavoidable, EH&S must be contacted for review and guidance.

3.3 Volumes of flammable and/or combustible liquids should be kept to the minimum necessary for the work being done. The following guidelines provide the maximum allowable container size and type based on the flammable and/or combustible liquid classification.

Container Type	Liquid Classification and Maximum Container Size				
	IA	IB	IC	II	III
Glass	1 pt (0.5L)	1 qt (1L)	1.3 gal (5L)	1.3 gal (5L)	5 gal (20L)
Metal or Approved Plastic	1.3 gal (5L)	5 gal (20L)	5 gal (20L)	5 gal (20L)	5 gal (20L)
Safety Cans	2.6 gal (10L)	5 gal (20L)	5 gal (20L)	5 gal (20L)	5 gal (20L)

3.4 The use of glass and plastic containers (with the exception of small squeeze bottles) for flammable and combustible liquids should be avoided where possible. If flammable liquids are handled in glass or plastic containers, carriers designed to protect the containers during transit should be used to prevent spillage.

3.4.1 Class IA and Class IB liquids can be stored in glass containers of not more than 1.3 gallon (5 L) capacity if the required purity (such as ACS analytical reagent grade or higher) would be affected by storage in a metal container or if the liquid can cause excessive corrosion of the metal container.

3.4.2 Many suppliers furnish glass containers with shatter-resistant coatings that offer significant protection from accidental breakage and are recommended for use when hazardous chemicals need to be kept in glass rather than plastic or metal containers.

3.5 The combined volume of flammable and combustible liquid containers stored in a single fire area outside of a storage cabinet or flammable liquid storage room should be restricted as follows:

3.5.1 Not in Safety Cans: No more than 1 gallon of Class IA; 5 gallons of Class IB or Class IC; and no more than 10 gallons of Class I and Class II combined.

3.5.2 In Safety Cans: No more than 2.6 gallons of Class IA; 5 gallons of Class IB and Class IC; and no more than 25 gallons of Class I and Class II combined.

3.5.3 Class IIIA liquids should not exceed 60 gallons (230L).

3.5.4 Class IIIB liquids should not exceed four, 55 gallon drums. This applies only to mechanical areas containing hydraulic oils, lubricating oils, etc.

3.6 Flammable aerosols and unstable liquids should be treated as Class IA liquids.

3.7 Flammable and combustible liquids should be segregated and stored separately from incompatible materials such as acids, bases, corrosives and oxidizers.

3.8 Empty and partially full containers should be handled and stored like full containers, that is, in an area suitable for flammable liquid storage (e.g., storage room, flammable liquid cabinet). Contact EH&S for proper disposal methods for empty containers.

4. Storage of Flammable and Combustible Liquids

4.1 An approved flammable liquids storage cabinet is required when:

4.1.1 The aggregate volume of Class I and Class II liquids in an individual fire area not in safety cans exceeds 10 gallons.

4.1.2 The aggregate volume of Class I and Class II liquids in an individual fire area in safety cans exceeds 25 gallons.

4.1.3 The aggregate volume of Class IIIA liquids exceeds 60 gallons.

4.1.4 The aggregate volume of Class IIIB liquids exceeds 220 gallons. This applies only to mechanical areas containing hydraulic oils, lubricating oils, etc.

4.2 When a cabinet is provided, it shall be used for the storage of all flammable and combustible materials not in immediate use.

4.3 Flammable Material Storage Cabinets must be:

4.3.1 UL/FM approved and marked in conspicuous lettering:

“FLAMMABLE – KEEP FIRE AWAY”

4.3.2 Limited so that the maximum quantity of Class IA liquids is 30 gallons within the cabinet.

4.3.3 Unvented. If venting is required or requested, EH&S must be contacted for a specific evaluation and guidelines.

4.3.4 Equipped with self-closing and self-latching doors if purchased after 2005. If the cabinets were purchased prior to 2005 and came equipped with self-latching door mechanisms, it is recommended that this safety device be maintained as operational.

4.4 A maximum of three (3) flammable material storage cabinets shall be located within a single fire area.

4.5 Approved Flammable Liquid Storage Rooms are constructed and utilized in compliance with the following guidelines:

4.5.1 Containers of Class I and Class II liquids with a capacity greater than 5 gallons.

4.5.2 The quantity of Class III liquids exceeds 330 gallons (the maximum capacity of 3 flammable liquids cabinets).

4.5.3 Walls, floors and ceilings must be constructed of non-combustible materials and have a fire-resistive rating of not less than one hour. In many cases, a 2 hour rating may be necessary.

4.5.4 Doorways must be provided with non-combustible liquid-tight raised sills or ramps to contain spilled material.

4.5.5 Approved fire doors must be provided, and kept closed and latched at all times (or arranged to close automatically in case of fire).

4.5.6 The entrance to the room should be labeled in accordance with NFPA 704 – Identification of the Hazards of Materials for Emergency Response. Consult EH&S.

4.5.7 Proper ventilation must be provided. Storage and other materials should not obstruct the exhaust ventilation.

4.5.8 Heating is restricted to low pressure steam or hot water.

4.5.9 Lighting and electrical service must be properly rated for the materials being stored and/or dispensed in the room. Electrical wiring and utilization equipment for Class I liquid storage shall be Class I, Division 2, and electrical wiring and utilization equipment in inside storage rooms used for the storage of Class II and Class III liquids shall be suitable for general purpose.

4.5.10 The room should be kept free of compressed gasses, and all combustible materials such as empty boxes, styrofoam shipping containers, plastic supplies and materials, and trash containers.

4.5.11 As applicable, automatic detection and/or suppression systems are required in new or renovated rooms.

4.5.12 A carbon dioxide (CO_2) type fire extinguisher must be provided within 10 ft. of the door entrance external to a flammable liquids storage room.

4.6 Refrigerated Storage of Flammable and Combustible Liquids

4.6.1 Flammable and combustible materials that must be kept cold should be stored in refrigerators, freezers and coolers that are UL approved and rated for flammable material storage, and shall be stored in closed containers. Note that explosion-proof refrigerators are rarely necessary for University research applications. Consult with EH&S for proper refrigeration unit selection.

4.6.2 Modified or retrofitted refrigerators, freezers or coolers or standard domestic refrigerators must not be used.

5. Dispensing and Control of Ignition

5.1 Dispensing of Class I liquids to or from containers less than or equal to 5 gallons (20 L) in capacity shall be performed in one of the following locations:

5.1.1 In a chemical fume hood or,

5.1.2 In an area provided with ventilation adequate to prevent accumulations of flammable vapor/air mixtures from exceeding 25 percent of the lower flammable limit or,

5.1.3 Inside a flammable liquid storage room arranged for dispensing Class I flammable liquids.

5.2 Dispensing of Class I liquids to or from containers greater than 5 gallons (20 L) shall be performed in one of the following locations:

5.2.1 In a separate area outside the building or,

5.2.2 Inside a flammable liquid storage room arranged for dispensing Class I flammable liquids.

5.3 Class I liquids shall not be transferred between conductive containers of greater than 1.3 gallon (5 L) capacity unless the containers are electrically interconnected by direct bonding or by indirect bonding through a common grounding system.

5.3.1 The use of squeeze bottles is currently permitted, since their use greatly reduces spills and the small rate of intermittent discharge through a squeeze bottle's discharge tube has not proven to be a hazard.

5.4 The following applies for the dispensing of flammable and combustible liquids from containers greater than 5 gallons (20 L):

5.4.1 For dispensing of Class I flammable liquids, drum pumps should be used. For dispensing of Class II and Class III liquids, self-closing faucets may be used. Use drip cans below faucets with on-side dispensing operations of Class II liquids in areas where the ambient temperature can approach 100°F (38°C). A shallow metal drip pan is acceptable for use with Class II (except as noted) and Class III combustible liquids. The drum pumps, self-closing faucets, and drip cans should be UL/FM Approved.

5.4.2 When dispensing by faucet, the spout or the flexible metal hose MUST be in contact with the containers by a bonding strap or grounding wire cable.

5.4.3 When dispensing by pump, the dispensing hose must be equipped with a ground wire, both to ground the supply and the receiving container.

5.4.4 Rotary pumps must be equipped with proper hoses and grounding straps to the receiving container.

5.4.5 Where possible, dispensing from larger to smaller containers should utilize approved safety cans.

5.5.6 Provide safety bungs on drums of Class I liquids arranged for upright dispensing with a drum pump that is not equipped with pressure and vacuum relief vents. If ambient temperatures can approach 100°F (38°C), safety bung use should include Class II liquids. Also provide safety bungs on drums of Class II and III liquids arranged for on-side dispensing.

6. Heating Equipment for Flammable and Combustible Liquids

6.1 Heating equipment or heating baths with flammable liquids or combustible liquids heated to their flash points shall be placed in a chemical fume hood or shall be vented to a safe location to control vapors.

6.2 All unattended electrical heating equipment shall be equipped with a manual reset over-temperature shutoff switch, in addition to normal temperature controls, if overheating could result in a fire or explosion.

6.3 Heating equipment with circulation fans shall be equipped with an interlock arranged to disconnect current to the heating element if the fan fails.

6.4 Electrically heated constant temperature baths shall be equipped with over-temperature shutoff switches in addition to normal temperature controls, if overheating could result in a fire or an explosion.

6.5 Bath containers shall be of noncombustible materials.

6.6 Burners, induction heaters, ovens, furnaces, and other heat-producing equipment shall be located a safe distance from areas where temperature-sensitive and flammable materials and compressed gases are handled.

7. Safety Considerations

7.1 For all areas using flammable or combustible liquids, CO_2 fire extinguishers should be located within a 50 ft. travel distance.

7.2 Eliminate or exclude all sources of ignition within use and storage areas for flammable and combustible liquids.

7.3 Spark-proof tools should be used to eliminate friction sparks made by metal striking metal contact.

7.4 Oil or solvent soaked wiping clothes, rags or waste must be stored in a UL/FM Approved metal container with a self closing lid. The containers should be provided with an orange chemical waste sticker (available from EH&S) identifying the contents of the container (e.g. “Oil Soaked Rags”)

7.5 Users of flammable or combustible liquid should maintain absorbent material to control spills.

8. Spills

8.1 Minor Spills of Flammable or Combustible Liquids

8.1.1 Extinguish ignition sources.

8.1.2 Contain spilled material.

8.1.3 Use absorbent material to clean spill.

8.1.4 Place clean up material in chemical waste stream following guidelines for safe handling of flammable and combustible liquid found in this document.

8.2 Spills of flammable or combustible liquids that are beyond the clean-up capabilities of the persons using the materials shall be handled by the Department of Environmental Health and Safety. Such a spill constitutes emergency response and must be promptly reported to EH&S at 412-624-9505 or University Police at 412-624-2121.

STORAGE AND HANDLING OF FLAMMABLE AND PYROPHORIC GAS

These guidelines provide requirements for all University faculty, staff, and students using, handling, or storing flammable and pyrophoric gas. These requirements are established to ensure faculty, staff and students know the physical characteristics of the material used and the protective measures necessary to prevent fire, explosion, or violent reaction.

1. Definitions

1.1 Compressed Gas: Any material or mixture having, when in its container, an absolute pressure exceeding 40 psi (an absolute pressure of 276 kPa) at 70°F (21.1°C) or, regardless of the pressure at 70°F (21.1°C), having an absolute pressure exceeding 104 psi (an absolute pressure of 717 kPa) at 130°F (54.4°C).

1.2 Flammable Gas: A material that is a gas at 68°F (20°C) or less at an absolute pressure of 14.7 psi (101.325 kPa), that is ignitable at an absolute pressure of 14.7 psi (101.325 kPa) when in a mixture of 13 percent or less by volume with air, or that has a flammable range at an absolute pressure of 14.7 psi (101.325 kPa) with air of at least 12 percent, regardless of the lower limit.

1.3 Liquefied Petroleum Gas (LP-Gas): Any material having a vapor pressure not exceeding that allowed for commercial propane that is composed predominantly of the following hydrocarbons, either by themselves or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylenes.

1.4 Pyrophoric Gas: A gas with an autoignition temperature in air at or below 130°F (54.4°C).

1.5 Fire Area: An area of a building separated from the remainder of the building by construction having a fire resistance at least 1 hour.

1.6 Gas Cabinet: A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage and use arranged as follows:

1.6.1 Constructed of not less than 12 gauge (2.5 mm or 0.097 in.) steel, coated to prevent corrosion and provided with a self-closing and self-latching cylinder access door.

1.6.2 Provided with a noncombustible safety window (6.4 mm or 0.25 in. wire-reinforced safety glass or equal) that allows viewing of equipment controls and provided with self-closing access port(s) or windows of sufficient size that allow hand access to equipment controls.

1.6.3 Provided with an approved automatic sprinkler.

1.6.4 Provided with makeup air inlets that allow air circulation throughout the cabinet when the access port(s) or windows are closed.

1.6.5 Provided with exhaust ventilation that ensures the cabinet is at negative pressure in relation to the surrounding area and an average velocity of air flow at the face of open access ports or windows of 200 fpm (1.02 m/s) with a minimum of 150 fpm (0.75 m/s) at any measurement point.

1.6.6 Provided with gas detection and/or ventilation monitoring to signal both an audible and visual alarm in the event of gas leakage and/or a drop in velocity below the limits outlined above.

1.6.7 Gas cabinets shall NOT contain more than three containers, cylinders, or tanks.

1.6.8 Incompatible gases must be stored or used in separate gas cabinets.

1.7 Gas Room: A separately ventilated, fully enclosed room in which only compressed gases, associated equipment and supplies are stored or used which meets the construction, arrangement and protection requirements of the City of Pittsburgh, NFPA and International Building and Fire Code standards as follows:

1.7.1 Walls, floors and ceilings must be constructed of non-combustible materials and have a fire-resistive rating of not less than one hour. In some cases, a 2 hour rating may be necessary and/or explosion venting may be required.

1.7.2 Approved fire doors must be provided, and kept closed and latched at all times (or arranged to close automatically in case of fire).

1.7.3 The entrance to the room should be labeled in accordance with NFPA 704 – Identification of the Hazards of Materials for Emergency Response.

1.7.4 Proper ventilation must be provided. Storage and other materials should not obstruct the exhaust ventilation.

1.7.5 Lighting, heating and electrical service must be properly rated for the gases being stored.

1.7.6 The room should be kept free of all combustible materials such as empty boxes, trash containers and other miscellaneous items.

1.7.7 As applicable, automatic detection and/or suppression systems are required in new or renovated rooms.

1.8 Closed System: The use of a hazardous material (flammable/combustible liquid, gas, solid) involving a closed vessel or system that remains closed during normal operations where vapors or gas are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations. An example of a closed system is product conveyed through a piping system into a closed vessel or piece of equipment.

1.9 Open System: The use of a hazardous material (flammable/combustible liquid or solid) involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated or the product is exposed to the atmosphere during normal operations. An example of an open system is dispensing to or from an open beaker, container or dip tank. **Use of an open system does not apply to any gas use covered in this section.**

2. General Hazards Description

A great variety of compressed gases in cylinders are stored and handled in University laboratories and in other University operations such as cutting, welding, and outdoor cooking. The use of compressed gas has the potential to introduce hazards of fire and explosion, increased rates of combustion, exothermic reactions, or serious interference with manual firefighting efforts depending on the characteristics and properties of the specific gases.

Escape of flammable compressed gases due to failure of equipment, human failure, premature operation of safety relief devices, or rupture of cylinders exposed to fires in other materials has caused severe fires and explosions. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or have the potential to violently rupture into fragments.

Automatic sprinklers provide effective control of fires involving flammable-gas cylinders by cooling and preventing gas discharge caused by melting of fusible plugs, or released by relief valves of exposed cylinders. Provision of gas cabinets, shutdown of gas flow, leak detection and alarms may be required for certain gasses or to allow additional storage amounts without the need for a gas room.

3. General Guidelines for Flammable Gases

3.1 The volume of flammable gas in a lab, room or location is restricted by University guidelines and International Fire Codes. EH&S should be contacted regarding any questions or for additional guidance.

3.2 The volume of flammable gas shall be kept to the minimum necessary for the work being done. Just in time delivery should be used where possible.

3.3 The maximum internal volume (water volume) of all cylinders in each of the listed classifications, in use in the laboratory work area or single fire area, shall comply with the following based on internal cylinder volume at 70°F (21°C).

3.3.1 For a laboratory work area of 500 ft^2 or less, the internal cylinder volume equals 6.0 ft^3 or approximately three (3) "K" (9.25 inch diameter, 60 inch height) sized cylinders.

3.3.2 For a laboratory work area greater than 500 ft^2, the internal cylinder volume is 0.012 ft^3 per ft^2 lab work area, but not to exceed the maximum cubic feet of gas from the chart below (approximately five (5) "K" sized cylinders for flammable gas except hydrogen – see Section 4).

Material	Storage	Use-Closed System	Use-Open System
	Cubic Feet	Cubic Feet	Cubic Feet
Oxidizing Gas	1,500	1,500	NA
Flammable Gas	1,000	1,000	NA
Pyrophoric Gas	50	10	NA

3.3.3 The maximum quantity of lecture bottles in a single fire area should not exceed 20. The University strongly discourages the use of any non-returnable, non-refillable compressed gas cylinders (lecture bottles).

3.4 Flammable gasses should be separated by 20 ft. (6.1 m) from all pyrophoric, oxidizing and corrosive gasses except as follows:

3.4.1 The 20 ft distance shall be reduced without limit when separated by a barrier of noncombustible materials at least 5 ft (1.5 m) high that has a fire resistance rating of at least 30 minutes.

3.4.2 The 20 ft distance shall be reduced to 5 ft where one of the gases is enclosed in a gas cabinet or without limit where both gases are enclosed in gas cabinets.

3.4.3 Cylinders without pressure-relief devices shall be stored separately from flammable and pyrophoric gases with pressure-relief devices.

3.5 The following are requirements for outdoor storage of flammable gas:

3.5.1 The cylinders should not be stored within 10 ft of windows, doors, or other openings nor shall they be stored within 50 ft of ventilation intakes.

3.5.2 Storage areas shall be kept clear of dry vegetation and combustible materials for a minimum distance of 15 ft.

3.5.3 Cylinders stored outside shall not be placed on the ground (earth) or on surfaces where water can accumulate.

3.5.4 Storage areas shall be provided with physical protection from vehicle damage.

3.5.5 Storage areas shall be permitted to be covered with canopies of noncombustible construction.

3.6 All compressed gas cylinders shall be stored in an upright position.

3.7 All flammable gas cylinders, full or empty, shall be handled in the same manner. Store empty cylinders separately from full cylinders.

3.8 Compressed flammable gas cylinders, whether full or partially full, shall not be exposed to or heated by devices that could raise the temperatures above 125°F (52°C).

3.9 Always use non-sparking tools on compressed gas cylinders.

3.10 Static-producing equipment located in flammable gas areas shall be grounded.

3.11 Signs should be posted in areas containing flammable gases communicating that smoking or the use of open flame, or both, is prohibited within 25 ft of the storage or use area perimeter.

3.12 Compressed flammable gas cylinders should not be placed where they could become a part of an electrical circuit.

3.13 Compressed flammable gas cylinders shall not be exposed to dampness, salt, corrosive chemicals or fumes that could damage the cylinders or valve-protective caps.

3.14 Leaking, damaged, or corroded compressed flammable gas cylinders should be removed from service.

4. Hydrogen

Hydrogen gas has several unique properties that make it potentially dangerous. It has an extremely wide flammability range (LEL 4%, UEL 74.5%) that makes it easier to ignite than most flammable gases. Unlike most other gases, hydrogen's temperature increases during expansion. Many hydrogen fires result from the self-ignition of sudden hydrogen release through rupture disks and pressure relief valves.

Observe the following guidelines for hydrogen use and storage:

4.1 Limit the number of hydrogen cylinders to approximately 400 ft^3 or two (2) “K” type cylinders in a laboratory or single fire area.

4.2 Adequate ventilation should be provided and maintained throughout the area where hydrogen cylinders are in use.

4.3 Open the cylinder valve slowly. If a cylinder valve is opened too quickly, the static charge generated by the escaping gas may cause it to ignite.

4.4 Hydrogen embrittlement can weaken carbon steel, therefore cast iron pipes and fittings should not be used.

4.5 Piping, tubing, fittings, gaskets and thread sealants should be suitable for hydrogen service at the pressures and temperatures involved. Refer to American Society of Mechanical Engineers Code for Process Piping, ASME B31.3.

4.6 For gaseous hydrogen service, joints in piping and tubing should be made by welding or brazing or by use of flanged, threaded, socket, slip or compression fittings. Brazing materials should have a melting point above 1000°F (538°C).

4.7 Provide 20 ft of separation from Class I, II and IIIA flammable liquids, oxidizing gases and readily combustible materials.

4.8 Locate the cylinders 25 ft from open flames and other sources of ignition.

4.9 Hydrogen burns with an invisible flame. Caution should therefore be exercised when approaching a suspected hydrogen flame.

4.10 Provide 50 ft of separation from other flammable gas storage.

5. Acetylene

Acetylene is flammable gas with a normal explosive range with air of 2.3 to 80% acetylene. Special cylinders used for acetylene contain a porous material and acetone, in which the gas dissolves and becomes practically stable. The porous filler absorbs the acetone and eliminates large voids in which decomposition might occur. Because of its tendency to break down and release energy, acetylene is highly reactive and is widely used in chemical processes. The temperature of the oxyacetylene flame, 5400 to 6300°F (3000 to 3500°C), is the highest for any commercially practical mixture of gases.

The minimum autoignition temperature for acetylene-air mixtures is about 571°F (300°C). The presence of catalytic impurities such as rusts, scale, silica gel, charcoal, or potassium hydroxide can lower the ignition temperature substantially. The presence of copper, silver, or mercury acetylides combined with light shock can result in ignition or decomposition of acetylene at room temperatures.

Observe the following guidelines for acetylene use and storage:

5.1 Do not handle cylinders roughly, subject cylinders to hydrostatic test, or take any other action that can create large voids in the mineral filler.

5.2 Provide separate storage locations for acetylene and oxygen or chlorine cylinders. A gas-tight non-combustible partition will serve to separate a storage area for this purpose.

5.3 Store and use cylinders in an upright position to prevent loss of acetone.

5.4 Do not withdraw acetylene from a cylinder or manifold at a rate in excess of one-seventh of the total cylinder capacity per hour. Provide additional cylinders if needed to supply higher demand without exceeding this rate.

5.5 Use a pressure regulator at the discharge of an individual cylinder or manifold to reduce the gas pressure to 15 psi (105 kPa) or less.

5.6 Keep acetylene cylinder valves closed when gas is not being used, and open the valves only 1-1⁄2 turns when in use.

5.7 Use wrought-iron or steel pipe and steel or malleable-iron fittings. Welded joints are preferable because of the reduced probability of leakage. Alloys containing more than 67% copper should not be used for piping, valves, or fittings (with the exception of a torch tip, which is pure copper).

6. Liquefied Petroleum Gas (LPG)

Although Liquefied Petroleum Gases (LPG) are transported and stored as liquids, they are gases at atmospheric pressures and normal temperatures. They are as hazardous as other combustible gases, with the added danger that they are heavier than air, tend to remain in low places for a somewhat longer period, and have little or no natural odor.

The discharge from tank relief valves, if ignited, can create a large torch fire. The intense, radiated heat may seriously expose buildings and contents. If ignition is delayed, the discharge from tank relief valves may travel hundreds of feet and settle in low-lying areas or enter below grade building openings. If the gas enters a building, ignition may result in an explosion. Once ignited, the resulting flashback to the tank may involve other structures and contents.

Observe the following guidelines for LPG use and storage:

6.1 Containers of LPG should be stored outside of buildings at least 10 ft. from any doorway or other opening with the following exceptions:

6.1.1 For temporary demonstration purposes, a container with a maximum water capacity of 12 pounds (5 pounds of LPG) may be used.

6.1.2 For hand torches or similar appliances, a container with a maximum water capacity of 2.5 pounds (1 pound of LPG) may be used.

6.2 Cylinders should not be filled past their rated capacity. The weight limit is usually specified on the cylinder. If it has been overfilled, the pressure relief valve may release propane as the cylinder warms. Overfilling can lead to flash fires and explosions.

6.3 All cylinders having a propane capacity of 4 pounds through 40 pounds fabricated after 1998 must be equipped with an overfill prevention device (OPD) as a secondary means of protecting against overfilling (the primary means is to determine the fill limit by weight). Cylinders equipped with OPD's will have a triple-notched valve handwheel with the letters "OPD."

6.4 Used cylinders must be retrofitted with UL listed OPD's when being requalified under DOT regulations. Affected cylinders cannot be filled unless they are equipped with UL listed OPD's.

6.5 Cylinders should be kept away from heat sources, as the heat can build up pressure inside the cylinder and may cause the pressure relief valve to release propane.

6.6 The cylinders should be kept in a secure upright position with the valves closed and the thread caps secured when they are transported, stored, or used.

6.7 When disconnecting cylinders, whether full or empty, first close the shut-off valve, then disconnect the cylinder and snugly seal the valve with a plug, cap, or approved quick-closing coupling.

6.8 Never use propane from a cylinder without a regulator (except for forklift cylinders). Protect the regulator connector from scratches and dents. Ensure the regulator vent is clean and pointed downward, and the regulator is protected.

6.9 Cylinders that are visibly rusted or damaged shall not be refilled.

7. Oxygen

Oxygen is neither combustible nor explosive. However, the intensity of any ordinary fire or explosion increases as the amount of oxygen in the surrounding air increases. Materials, such as grease or oils that produce intense fires with air, burn in an atmosphere of enriched oxygen with explosive violence. Explosions have occurred in oxygen pressure gauges after being tested on common oil-filled gauge testers. Oxygen at atmospheric pressure in a closed system can combine explosively with lubricating oil at temperatures above 340°F (170°C).

Observe the following guidelines for oxygen use and storage:

7.1 Separate oxygen cylinders from cylinders or manifolds containing flammable gases and other combustible or easily ignited materials such as wood, paper, oil, and grease. Gas-tight fire partitions having at least ½ hour fire resistance rating are suitable as cutoffs. **Note:** This does not apply to properly arranged and safeguarded oxygen and acetylene tanks used for cutting and welding torches.

7.2 Do not use oil or grease for lubricating valves, gauge connections, or other parts of the oxygen system.

7.3 Use extra-heavy steel or nonferrous pipe and fittings if the oxygen pressure is over 150 psi (1 MPa). For lower pressures, standard-weight pipe and fittings are satisfactory. Cast-iron fittings should not be used.

In medical oxygen gas systems, Type K or L (ASTM B-88) copper tubing may be used. Brazed fittings should be used for 3⁄4-inch (19-mm) and larger tubing. Flared-type tubing fittings may be used in smaller sizes where the fitting is visible in the room.

7.4 Use welded joints whenever possible. If threaded joints are necessary, they should be carefully made using litharge and glycerin or proprietary materials compounded for oxygen service. Compounds containing oils should not be used. Gaskets should be entirely of noncombustible materials.

8. Pyrophoric Gas

Pyrophoric chemicals are those substances that react so rapidly with air and its moisture that the ensuing oxidation and/or hydrolysis lead to ignition. Ignition may be instantaneous or delayed. Spontaneous (instantaneous) ignition or combustion occurs when a substance reaches its ignition temperature without the application of external heat.

An example of a pyrophoric gas is silane. Silane has caused major losses due to fires in ducts, gas cabinets and supply systems; and explosions in ducts, vacuum pumps and cross-contaminated cylinders. These incidents have occurred in research facilities. The hazards are pyrophoric fires, explosions and/or deflagrations, and autoignition of a vapor cloud. All of these conditions can occur depending on leak location, excess flow control and shutdown of the silane gas. Pyrophoric fires are difficult to extinguish. When pyrophoric fires are extinguished, the gas supply must be shut down promptly by interlocks tied into fire protection and/or detection, because resulting pyrophoric gas build up has the potential to create vapor cloud detonation.

Observe the following guidelines when storing or using pyrophoric gas:

8.1 Minimally-sized cylinders of pyrophoric gases shall be limited per the above table and kept in approved gas cabinets.

8.2 Remote manual shutdown devices for pyrophoric gas flow should be provided outside each gas cabinet or near each gas panel. Automatic shutdown devices for pyrophoric gas flow activated by interlocks tied into fire protection and/or detection should be provided.

8.3 Pyrophoric gas flow, purge, and exhaust systems should have redundant controls that prevent pyrophoric gas from igniting or exploding. These controls include excess flow valves, flow orifices, mass flow controller sizing, process bypass line elimination or control, vacuum-pump inert-gas purging, dilution of process effluent with inert gas and ventilation, controlled combustion of process effluent, ventilation monitoring, and automatic gas shutdown.

8.4 Order cylinders with the smallest orifice as practicable (0.006 inch and not to exceed 0.010 inch).

8.5 Emergency back-up power should be provided for all electrical controls, alarms and safeguards associated with the storage and process systems.

8.6 All process systems components and equipment should be adequately purged using a dedicated inert gas cylinder.

COMBUSTIBLE METALS

These guidelines provide requirements for all University faculty, staff, and students using, handling, or storing combustible metals. These requirements are established to ensure faculty, staff and students know the physical characteristics of the material used and the protective measures necessary to prevent fire, explosion, or violent reaction.

1. Definitions

1.1 Alkali Metals**:** The alkali metals sodium, potassium, lithium, rubidium and cesium are the most reactive class of metals. They are highly combustible, react with water to generate hydrogen, and are easily ignited.

1.2 Combustible Metal: Any metal, composed of distinct particles or pieces, regardless of size, shape, or chemical composition, that will burn.

1.3 Combustible Metal Dust: Any finely divided metal 420 μm (microns) or smaller in diameter (that is, material passing a U.S. No. 40 standard sieve) that presents a fire or explosion hazard. Any time a combustible dust is processed or handled, a potential for explosion or fire exists. The degree of hazard will vary depending on the type of combustible dust, conditions, amount of material present, and processing methods used.

1.4 Chips: Particles produced from a cutting or machining that are not oxidized and that are not diluted by noncombustible materials. Chips vary in ease of ignition and rapidity of burning, depending on their size and geometry.

1.5 Ribbon: A piece of metal that is less than $\frac{1}{8}$ in. (3.2 mm) in two dimensions or less than $\frac{1}{20}$ in. (1.3 mm) in single dimension is considered a powder for the purposes of this standard.

1.6 Pyrophoric Material: A substance capable of self-ignition on short exposure to air under ordinary atmospheric conditions. Dispersions of alkali metals in organic solvents present special concerns. In addition to the water reactivity/pyrophoricity due to the reactive metal, the solvent presents the concerns of flammable or combustible liquids and vapors. In addition, the MSDS provided by the supplier of the material and "The Storage and Handling of Flammable and Combustible Liquids" Section of this manual, are applicable to address the hazards associated with combustible liquids and vapors.

2. General Hazards Description

Most metals are combustible to a varying degree, depending on the physical conditions. Many also undergo dangerous reactions with water, acids, and certain other chemicals. Some are subject to spontaneous heating and ignition. The hazard of an individual metal or alloy can vary widely depending on the particle size and shape that is present.

2.1 **Alkali Metals:**

2.1.1 **Sodium (Na):** Specific gravity, 0.97; melting point, 208°F (98°C). In University laboratories, sodium metal is most often used to remove excess water from flammable liquids during the distillation process. It is also used in the production of other sodium-based compounds and in the reduction of organic esters.

Sodium metal reacts violently with water to produce hydrogen gas and sodium hydroxide. The exothermic heat of this reaction can lead to auto-ignition of the hydrogen gas and/or the metal itself and create a severe fire or explosion hazard. Due to its low melting point, explosions of molten sodium may occur during reaction with water. Residual liquid present following the reaction contains a high percentage of sodium hydroxide, a caustic, corrosive material.

In finely divided form, sodium ignites spontaneously in air. Molten sodium reacts with most gases and liquids except the noble gases and nitrogen, and combines vigorously with hydrogen to form the hydride. Solid sodium reacts strongly with water, alcohol, polyhalogenated hydrocarbons, halogens, acidic oxides, sulfuric acid, mercury, and certain alloys of lead, tin, zinc and bismuth.

2.1.2 **Potassium (K):** Specific gravity, 0.86; melting point, 145°F (63°C). Similar to sodium in its pyrophoricity, chemical activity, and hazards although somewhat more reactive. It is violently reactive with sulfuric acid and most halogens. It will detonate in contact with liquid bromine.

2.1.3 **Lithium (Li):** Specific gravity, 0.53; melting point, 356°F (180°C). As the hydride, lithium offers the most concentrated method of storing and transporting hydrogen. Ignition and burning occur when lithium is heated to about 356°F (180°C). It reacts less vigorously than sodium with water or air, and usually does not ignite. It reacts strongly with chlorinated, fluorinated, and brominated organic compounds, halogens, and sulfuric acid. In the presence of moisture, lithium reacts exothermically with nitrogen at ordinary temperatures. Above the melting point, it rapidly forms the nitride. Near its melting point, it ignites in air and burns with a characteristic intense, brilliant white flame. Following treatment with nitric acid, it may explode on very light impact or friction. Lithium also reacts violently with hydrogen peroxide.

2.2 **Magnesium (Mg):** Specific gravity, 1.74; melting point of 1202°F (650°C). Its ignition temperature is near the melting point, although ignition of some forms may occur at lower temperatures. As a dust cloud or in ribbon form, magnesium can be ignited almost instantly. Loose shavings ignite fairly readily. It is less easy to ignite the surface of a compact pile of chips. Magnesium fines wet with oils may ignite spontaneously. Fines wet with acids, water, water-soluble oils, or oils containing fatty acids will generate hydrogen. Powders form explosive mixtures with air that may be ignited by a spark. Fines will also react with chlorine, bromine, iodine and oxidizing agents.

3. General Guidelines for Combustible Metals

3.1 The volume of combustible metals in a lab, room or location is restricted by University guidelines and International Fire Codes. EH&S should be contacted regarding any questions or for additional guidance.

3.2 The amount of combustible metal shall be kept to the minimum necessary for the work being done.

3.3 Combustible metals should be segregated and stored separately from incompatible materials such as water, acids, halogens, oils, and ordinary combustibles (paper, cardboard, etc).

3.4 Where possible, combustible metals should not be exposed to sources of heat, open flames or sparks.

3.5 The following safeguards should be applied to water reactive metals (sodium, potassium, magnesium):

3.5.1 They should be stored in cabinets in order to minimize exposure to water spray, pooling or drainage from sources such as sprinklers, domestic water, or process water lines or systems.

3.5.2 Ensure that the preparation area is completely dry of pooled water or any moisture.

3.5.3 Any tools such as knifes (when cutting metals such as sodium), tongs or other equipment used to handle or process the metals should also be kept free of water and moisture.

3.6 Excess metal chips, fines, ribbons or other leftover pieces from processes should be immediately collected and properly stored or disposed of in accordance with the University's chemical waste program to minimize additional hazards or possible exposures.

3.7 In order to prevent alkali metals from reacting with water during storage, handling or other usage, the metal shall be immersed in kerosene or mineral oil within a noncombustible, <u>sealed</u> container.

3.8 When using metals such as sodium for solvent purification, the solvent stills should be:

3.8.1 Kept in the fume hood at all times.

3.8.2 Clearly labeled to identify the contents of each still.

3.9 Class D type fire extinguisher shall be provided by EH&S and funded by the user in areas storing, handling or using combustible metals. Materials such as dry sand, clay or other dry, inert materials should also be available to help smother a potential combustible metal fire. **<u>DO NOT</u>** use water, carbon dioxide, AFFF foam or multi-purpose (ABC) type fire extinguishers on combustible metal fires.

4. Other Highly Combustible Metals

Hafnium, plutonium, thorium, uranium and zirconium are all highly combustible metals. The hazards of this group are similar to those of magnesium, and the same safeguards should be applied except as noted in the following:

Uranium isotopes 233 and 235, plutonium, and thorium are radioactive, and present the same fire and explosion hazards as other combustible metals. They have been known to ignite spontaneously. As coarse particles, metals in this group offer little hazard; but in powder form, they present severe dust explosion possibilities. Some burn readily in pure nitrogen or carbon dioxide gas, and explode on contact with oxidizing agents. Some heat spontaneously in air and must be stored and handled under a nonreactive liquid or gas. Chips and other fine particles ignite easily, and special care is needed to prevent ignition of chips by the friction of cutting. Fine particles of these metals should be shipped and stored in approved DOT containers.

When molten or when burning, all these metals react vigorously with water, foam, carbon dioxide vaporizing liquid, and dry chemical extinguishing agents. Applied directly to the burning material, these agents will intensify burning and may cause an explosion. Approved dry powder extinguishing agents, dry sand, graphite chips, limestone, or talc are used to smother fires.

Hafnium (Hf): Specific gravity, 13.36; melting point, 4032°F (2222°C). Fines are pyrophoric. The metal burns with little visible flame but with a high rate of heat release. Reacts with water to form hydrogen, which may ignite spontaneously. Its hazards are similar to those of zirconium. Crushing and sizing should be carried out under inert gas.

Plutonium (Pu): Specific gravity, 19.6; melting point, 1170°F (632°C). It is pyrophoric, highly toxic (particularly in the oxide form when burning), and radioactive. Chips, turnings, and fine particles may ignite spontaneously. It is easily ignited by friction.

Thorium (Th): Specific gravity, 11.6; density, melting point, 3090°F (1700°C). Thorium is pyrophoric and radioactive. As a dry powder it has a low ignition temperature. Thorium powder is shipped under helium or argon gases in special containers. When poured through air, it is subject to ignition by electrostatic spark. It should be handled cautiously with a nonsparking spoon or scoop. Containers and tools should be grounded. Ignition has occurred due to chemical reaction between finely divided thorium and water at ordinary temperatures.

Uranium (U): Specific gravity, 18.68; melting point, 2071°F (1132°C). The fire hazard of metallic uranium is similar to but more severe than magnesium. In finely divided form, it is pyrophoric. Spontaneous fires have occurred under argon, under vacuum, and under water. The high temperature reaction of uranium with steam is very violent. Radioactivity and products of combustion present a health hazard. Uranium powder should be handled in an inert atmosphere. Chips and turnings may be stored if completely immersed in water with ventilation to remove evolved hydrogen. Partial submersion or slight moistening accelerates spontaneous heating.

Zirconium (Zr): Specific gravity, 6.51; melting point 3326°F (1830°C). Fine particles in dust layers or clouds are pyrophoric, and may be ignited by heat, static or friction. Particles can be ignited in nitrogen gas above 986°F (530°C) and in carbon dioxide above 1040°F (560°C). Zirconium samples may explode during or following treatment with strong nitric acid or carbon tetrachloride. Samples have also exploded while being dissolved in a mixture of sulfuric acid and potassium acid sulfate. Particles form explosive mixtures with barium nitrate, potassium chlorate, and other oxidizing materials. In dry powder form, zirconium or zirconium-copper alloys in glass containers may explode by impact or friction if the container breaks. It ignites more easily than magnesium and is slightly less hazardous than uranium. Zirconium powder is commonly handled wet because it is then more difficult to ignite, although once ignited it will burn more violently. At least 25 percent moisture by weight should be present.

5.0 Miscellaneous Metals

Certain other metals in molten form or as fine particles present varying degrees of hazard. They may be subject to spontaneous heating, chemical activity, dust explosions, or ignition under favoring conditions.

Aluminum (Al): Aluminum is used both as a commercially pure metal and as an alloy. In finely divided powder or dust form, aluminum and its alloys are combustible in air and present a serious combustion explosion hazard. Aluminum will react violently with many chemicals. Aluminum particles and smaller turnings will react with water to form hydrogen gas which is highly flammable and explosive in favorable concentrations. The rapid vaporization of water in contact with molten aluminum can result in rapid phase transformation explosions. Halogenated extinguishing agents should not be used.

Antimony (Sb): Specific gravity, 6.62; melting point, 1166°F (630°C). It ignites and burns in air above 780°F (416°C).

Barium (Ba): Specific gravity, 3.5; melting point, 1300°F (704°C). In contact with water, it liberates hydrogen but usually without ignition.

Beryllium (Be): Specific gravity, 1.85; melting point, 2400°F (1316°C). It is also called glucinum. It decreases the combustibility of molten aluminum and magnesium. As a powder, ignition may occur if the metal is heated to about 1115°F (600°C). Burning occurs with an intense flame, but can be extinguished by water. Beryllium powder should be kept away from air and moisture and stored in tight containers, preferably under argon gas. Beryllium and its compounds are very toxic and contact with skin or inhalation of dust or fumes should be avoided.

Bismuth (Bi): Specific gravity, 9.80; melting point, 520°F (271°C). It burns in air with bluish flame when vaporized and oxidizes rapidly when molten. At red heat, bismuth decomposes steam. It reduces carbon dioxide, but does not react with nitrogen or hydrogen.

Calcium (Ca): Specific gravity, 1.55; melting point, 1562°F (850°C). In contact with water, calcium liberates hydrogen but usually without ignition. It is considered pyrophoric under some conditions and is normally shipped in lump form under argon.

Cadmium (Cd): Specific gravity, 8.65; melting point, 610°F (321°C). It oxidizes when heated, giving off dense brown fumes that decompose steam above 750°F (400°C). As a powder it decomposes hot water but without igniting.

Chromium (Cr): Specific gravity, 7.19; melting point, 3407°F (1875°C). It presents a moderate dust explosion hazard under favorable conditions of partial size dispersion and ignition source.

Copper (Cu): Specific gravity, 8.96; melting point, 1981°F (1083°C). Copper is not known to produce explosive properties when in finely divided form.

Iron (Fe): Specific gravity, 7.86; melting point, 2802°F (1540°C). Iron presents a dust hazard under favoring conditions of particle size and dispersion in air. It can be easily ignited in the form of dust or steel wool or as fine turnings or chips containing oil. Structural steel has a specific gravity of 7.83 and melting point of 2605°F (1430°C). When heated above 600°F (315°C), it begins to lose strength rapidly.

Lead (Pb): Specific gravity, 11.34; melting point, 621°F (327°C). At high temperatures lead volatizes and burns with white flame. At red heat, it is rapidly oxidized by air and at white heat by steam.

Manganese (Mn): Specific gravity, 7.43; melting point, 2246°F (1230°C). Its dust cloud can be ignited at 840°F (449°C) in air.

Molybdenum (Mo): Specific gravity, 10.2; melting point, 4750°F (2620°C). Molybdenum powder reacts vigorously with water vapor at 1300°F (704°C). It presents a slight dust hazard under favoring conditions of particle size, dispersion, and strong ignition source.

Silicon (Si): Specific gravity, 2.33; melting point, 2588°F (1420°C). A silicon dust cloud can be ignited in air at 1425°F (775°C). Pure silicon metal dust has been shown to be highly explosive under certain conditions.

Strontium (Sr): Specific gravity, 2.6; melting point, 1386°F (752°C). In contact with water, it liberates hydrogen readily, but usually without ignition.

Tantalum (Ta): Specific gravity, 16.62; melting point 5425°F (2996°C). It presents a moderate dust explosion hazard under favorable conditions of particle size, dispersion, and ignition source.

Tellurium (Te): Specific gravity, 6.24; melting point, 846°F (452°C). It presents a moderate dust explosion hazard under favoring conditions of particle size, dispersion and ignition source.

Thallium (Tl): Specific gravity, 11.85; melting point, 572°F (300°C). At red heat it decomposes water, producing hydrogen. It is very toxic.

Tin (Sn): Specific gravity, 7.29; melting point, 450°F (232°C). Its dust cloud can be ignited in air at 1165°F (630°C).

Titanium (Ti): Specific gravity, 4.51; melting point, 3040°F (1670°C). At red heat, 1300°F (704°C), the metal actively decomposes steam. Following strong nitric acid treatment, the metal may explode by the light impact or friction of handling with tongs. The powder can be ignited in pure carbon dioxide above 1260°F (682°C), in nitrogen above 1475°F (801°C), and in air at 626°F (330°C) to 1094°F (590°C). Powdered titanium immersed in water or wet with water at ordinary temperatures has been ignited by chemical reaction.

Tungsten (W): Specific gravity, 19.2; melting point, 6115°F (3380°C). As fine powder, tungsten may be pyrophoric. Hydrogen reduced powder may retain some absorbed hydrogen, presenting a dust explosion hazard. Tungsten reacts violently with molten nitrates, nitrites, and peroxides.

Zinc (Zn): Specific gravity, 7.13; melting point 786°F (419°C). In the form of dust, in contact with moisture, alkaline solutions, or acetic acid, zinc will heat spontaneously to ignition. Large pieces of zinc are difficult to ignite but once ignited will burn strongly. In oxygen, oxidation of the metal takes place rapidly at 300°F (149°C) and ignition occurs at 930°F (499°C) with a bluish flame. Steam is decomposed on contact with zinc at 660°F (349°C). Acids or caustic soda also liberate hydrogen on contact with zinc. In air, zinc burns to the oxide, forming white or bluish smoke. As a dust cloud, it can be ignited at 1110°F (600°C).

PROPER ATTIRE FOR INDIVIDUALS IN LABORATORIES

1. All employees, faculty, students, and visitors must wear appropriate attire in all laboratory areas to eliminate or minimize contact with chemicals, biological hazards, and other hazards.

   1.1 Shorts, miniskirts, or any apparel that does not cover the skin above the knee when seated should NOT be worn in the laboratory without appropriate over protection (e.g. a buttoned laboratory coat or closed front gown).

   1.2 Open toed shoes, sandals, or shoes made of loosely woven material should not be worn in the laboratory.

   1.3 Loose clothing and jewelry that can be caught in equipment or dipped into hazardous solutions should not be worn in the laboratory.

2. Gloves should be worn whenever there is a potential exposure of the hands. The gloves should have the necessary resistance to the chemical or hazardous material being used. Liquid barrier gloves should be used when handling biological agents or potentially infectious materials. See the guidelines for personal protective equipment for more information.

3. Eye protection should be worn during any task where there is potential exposure of the eyes via splashing of material or generation of flying objects. Eye protection may be required for laboratory entry at the discretion of the investigator or department.

4. Specialized protective clothing shall be worn when using materials that are extremely hazardous upon contact. EH&S should be consulted. See the guidelines for personal protective equipment for more information.

5. Gloves and all other personal protective equipment must never be worn outside of laboratory areas and are forbidden in public corridors, elevators, stairwells, and break rooms.

6. Gloves should be removed prior to use of the telephone, keyboard, equipment controls or doors, if these surfaces are considered "clean" or common.

SIGNAGE FOR LABORATORIES AND HAZARDOUS AREAS

All University laboratories and other rooms utilized for the storage of hazardous materials must be marked at each entrance for safe and effective emergency response. The following US DOT placards and descriptions for hazardous materials are referenced in the *US DOT Emergency Response Guidebook* and the Allegheny County Emergency Planning requirements. In most cases only significant hazards or larger quantities of materials require posting. An EH&S guideline is provided after each description.

An EXPLOSIVE is any substance or article, including a device designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion.

Post this placard any time any quantity of explosive material is present.

A FLAMMABLE GAS is any material which is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psi) of pressure
which-

(1) Is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air; or

(2) Has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12 percent regardless of the lower limit.

Post this placard if flammable gas exceeds 300 ft^3 at STP in aggregate volume.

OXYGEN, compressed in cylinders.

Post this Placard if more than 2 oxygen cylinders (empty or full) are present.

NON-FLAMMABLE, NONPOISONOUS GAS (including compressed gas, liquefied gas, pressurized cryogenic gas, compressed gas in solution, asphyxiant gas and oxidizing gas) which-

(1) Exerts in the packaging an absolute pressure of 280 kPa (40.6 psia) or greater at 20 °C (68 °F), and

(2) Does not meet the definition of a flammable or poison gas.

Only post this placard on large accumulation sites for such gas.

A POISON GAS is poisonous by inhalation, is a gas at 20°C (68°F) or less and a pressure of 101.3 kPa (14.7 psi), and which is known to be so toxic to humans as to pose a hazard to health during transportation; or in the absence of adequate data on human toxicity, is presumed to be toxic to humans because when tested on laboratory animals it has an LC50 value of not more than 5000 ml/m\3\

Post this placard any time any quantity of poison gas is present.

A FLAMMABLE LIQUID means a liquid having a flash point of not more than 60.5°C (141°F).

Post this placard if more than 10 gallons of flammable liquid are stored in the room.

A FLAMMABLE SOLID is a

(1) Desensitized explosive, or
(2) Self-reactive material that is thermally unstable and can undergo a strongly exothermic decomposition even without participation of oxygen (air), or
(3) Readily combustible solid which may cause a fire through friction that shows a burning rate faster than 2.2 mm (0.087 inches) per second when tested in accordance with UN Manual of Tests, and are metal powders that can be ignited and react over the whole length of a sample in 10 minutes or less.

Post this placard if more than 2kg of flammable solid is present.

A SPONTANEOUSLY COMBUSTIBLE material is
(1) A pyrophoric material: a liquid or solid that, even in small quantities and without an external ignition source, can ignite within five (5) minutes after coming in contact with air, or

(2) A self-heating material: a material that, when in contact with air and without an energy supply, is liable to self-heat. A material of this type which exhibits spontaneous ignition or if the temperature of the sample exceeds 200 °C (392 °F) during a 24-hour test period…
Post this placard any time any quantity of spontaneously combustible material is present.

A DANGEROUS WHEN WET material is a material that, by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 liter per kilogram per hour.

Post this placard any time any quantity of dangerous when wet material is present.

An OXIDIZER (**Division 5.1**) is a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

Post this placard if more than 5 kg of an oxidizer is present.

An ORGANIC PEROXIDE (**Division 5.2**) is any organic compound containing oxygen (O) in the bivalent -O-O- structure and which may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.

Post this placard if more than 2 liters of organic peroxide is present.

A POISON is a material, other than a gas, which is known to be so toxic to humans as to afford a hazard to health during transportation, or which, in the absence of adequate data on human toxicity:

(1) Is presumed to be toxic to humans because it falls within any one of the following categories when tested on laboratory animals
(whenever possible, animal test data that has been reported in the chemical literature should be used):

(i) A liquid with an LD50 for acute oral toxicity of not more than 500 mg/kg or a solid with an LD50 for acute oral toxicity
of not more than 200 mg/kg.

(ii) A material with an LD50 for acute dermal toxicity of not more than 1000 mg/kg.

(iii) A dust or mist with an LC50 for acute toxicity on inhalation of not more than 10 mg/L; or

(iv) A material with a saturated vapor concentration in air at 20 °C (68 °F) of more than one-fifth of the LC50 for acute toxicity on inhalation of vapors and with an LC50 for acute toxicity on inhalation of vapors of not more than 5000 ml/m^3.

Consult with EH&S regarding posting of areas for poisons.

A CORROSIVE material is a liquid or solid that causes full thickness destruction of human skin at the site of contact, or a liquid that exhibits a corrosion rate on steel or aluminum surfaces exceeding 6.25 mm (0.25 inch) a year at a test temperature of 55°C (130°F).

Post if more than 5 gallons of corrosive material is present.

This BIOHAZARD symbol is a general biohazard warning to be used where biological hazards, such as potentially infectious material, human body fluid, unfixed human tissue, human cell lines, viral, bacterial, rickettsial, fungal and parasitic agents, and/or biological waste are utilized.

SAFETY EQUIPMENT

1. Emergency (Safety) Showers

Emergency or safety showers are designed to deliver a gentle flood-type spray of tempered water over a person for a minimum period of 15 minutes to flush chemicals from the body or extinguish clothing fires.

1.1 Emergency Showers should be accessible to faculty, staff and students handling large quantities of chemicals.

1.2 Emergency showers are activated by a double pull chain or pull-bar which is located alongside the shower head.

1.3 An area immediately under the emergency shower head (minimum diameter of 44 inches) must be maintained free of all obstacles at all times. Floor drains are recommended but not required adjacent to emergency showers.

1.4 Emergency showers are inspected and flow tested annually by University Plumbers.

1.5 Emergency showers should not be used for any other purpose. Anyone having used an emergency shower to flush chemicals from their body should seek immediate medical attention after providing the recommended 15 minute flush.

2. Emergency Eyewash Stations

Eyewash stations supply a gentle flood-type spray of tempered water for a minimum of 15 minutes to flush contaminants from the eyes.

2.1 Emergency eyewash stations should be accessible to all areas where there is increased potential for eye injury, such as due to chemical splash or handling of potentially infectious materials.

2.2 “Stay-on” control valves are operated by a single motion such as a hand paddle or foot peddle. Eyewash stations must be activated weekly by personnel in the area of responsibility.

2.2.1 Eyewash stations can be used for other purposes. This helps with flushing of the lines and creates familiarity with equipment location.

2.2.2 Anyone having used an eyewash station to flush chemicals or particles from eyes should seek immediate medical attention after the 15 minute flush.

3. Eye, Face and Body Spray Hoses

Eye, face and body spray hoses are eye wash stations that also have a retractable or fixed hose that can flush eyes and other affected body parts.

3.1 Eye, face and body spray hoses should be equipped and maintained in a manner similar to eye wash stations (i.e. tempered water supply, stay-on valve and operation, used for other purposes, weekly integrity check by area staff)

3.2 Eye, face and body spray hoses should be equipped with dual nozzles to treat both eyes simultaneously when necessary.

SHIPPING

The International Air Transport Association (IATA) and US Department of Transportation (DOT) have regulations regarding shipments containing Dangerous Goods, which are defined as articles or substances capable of posing a risk to health, safety, property, or the environment and are shown in the list of dangerous goods in the IATA and DOT Regulations. These guidelines provide information to University faculty, staff, and students wishing to ship or transport Dangerous Goods.

Initial and recurrent training is required for anyone wishing to transport chemical or biological samples, diagnostic specimens, dry ice, genetically modified micro-organisms, or infectious substances. Environmental Health & Safety (EH&S) provides training to fulfill this requirement.

1. Definitions

1.1 **Dangerous Goods:** Articles or substances capable of posing a risk to health, safety, property, or the environment and are shown in the list of dangerous goods in the IATA and DOT Regulations.

1.2 **Diagnostic Specimens (or Category B Infectious Substance):** Human or animal material including but not limited to excreta, secreta, blood, and tissues being transported for research, diagnostic, or investigational activities.

1.3 **Infectious Substance (Category A):** Substances known or reasonably expected to contain pathogens, and can cause permanent disability or fatal disease to humans or animals.

1.4 **Genetically Modified Organisms (GMO) or Micro-organisms (GMMO):** Organisms in which genetic material has been purposely altered in a way that does not occur naturally. GMO/GMMOs are capable of altering animals, plants or microbiological substances in a way which is not normally the result of natural reproduction.

1.5 **Biological Products:** Products for experimental treatment of animals that are derived from living organisms that are manufactured in compliance with the requirements of national public health authorities (these products may have special licensing requirements); or finished biological products shipped prior to licensing for development or investigational purposes for use in humans or animals.

1.6 **Triple Packaging:** Combination packaging consisting of a (1) leakproof primary receptacle, (2) leakproof secondary packaging, (3) a rigid outer container.

1.7 **Packing Instruction:** A set of specific packaging requirements which must be used for each article or substance offered for shipment by air.

1.8 **Shipper's Declaration:** A form which must be completed in conjunction with shipments containing dangerous goods.

1.9 **Airway Bill:** A form which accompanies shipments of dry ice and diagnostic specimens.

1.10 **UN/ID Number:** A unique four digit number assigned to each Dangerous Good under the United Nations' classification system.

2. Training Requirements

Federal regulations require that anyone shipping Dangerous Goods be trained and certified. All, University personnel preparing, labeling, marking, or documenting shipments of Dangerous Goods must comply with the Regulations and the training requirements. EH&S has developed a training program for University personnel to assist in the shipment of Dangerous Goods. The training satisfies the IATA training requirement, and it offers specific information on proper classification, packaging, marking, labeling, and documentation of shipments containing Dangerous Goods. Training is required initially and must be repeated every two years.

3. Types of Shipments

The shipper is responsible for the proper classification and identification of the material being shipped. If you are not sure how to properly classify or identify a material for shipment, contact EH&S at 412-624-9505. Most shipments from the University fall into one of the following categories:

3.1 Diagnostic Specimens (or Category B Infectious Substances)

(examples: blood specimens, tissues, urine)

Materials fitting this classification must be shipped as "Diagnostic Specimens" or "Clinical Specimens" and assigned to UN 3373. Substances which are fixed or have been treated to neutralize pathogens are not subject to these regulations.

Packaging
All Diagnostic Specimens and Category B material must be triple packed in compliance with IATA Packing Instruction 650. The maximum quantity for the primary receptacle is 1 L. The outer packaging must not contain more than 4 L or 4 kg.

Labeling
The outer package must display the following:

- The text "Diagnostic Specimens" or "Clinical Specimens"
- The UN 3373 diamond-shaped mark
- The name and address of the shipper and receiver
- A Class 9 Miscellaneous label if shipping on Dry Ice
- Net weight of Dry Ice (if used)

Documentation
A Shipper's Declaration is not required, but an airway bill must be used. The airway bill must indicate "Diagnostic Specimens" and a name and telephone number for the person responsible for the shipment.

3.2 Infectious Substance (Category A)
(examples: herpes B virus cultures, HIV cultures, Ebola virus)

Packaging
All infectious substances must be triple packed in compliance with IATA Packing Instruction 602. The maximum quantity that may be shipped on passenger aircraft is 50 mL or 50 g. The maximum quantity for cargo aircraft is 4 L or 4 kg.

Labeling
The outer package must display the following:

- The proper shipping name & UN number (Infectious Substance affecting humans, UN2814 or Infectious Substance, affecting animals, UN 2900)
- A 6.2 Infectious Substance label
- The name and address of the shipper and receiver
- Name and phone number of person responsible for shipment
- A Class 9 Miscellaneous label if shipping on Dry Ice
- Net weight of Dry Ice (if used)

Documentation
A Shipper's Declaration must be completed when shipping an Infectious Substance. The individual that signs the declaration must be trained and certified, and shall be responsible for the shipment.

3.3 Genetically Modified Organisms (GMO) or Micro-organisms (GMMO)

Genetically modified organisms must be classified as a Class 9 Miscellaneous material and assigned to UN 3245. If the GMO/GMMO meets the definition of a Category A Infectious Substance, it must be packaged and shipped as Category A.

Packaging
GMO/GMMOs are packed in the same way as Category A Infectious Substances, but there are no specific testing requirements for the package. Follow Packing Instruction 913. The maximum quantity per primary receptacle is 100 mL or
100 g.

Labeling
The outer package must display the following:

- The proper shipping name & UN number (Genetically Modified Micro-organism, UN3245)
- A Class 9 Miscellaneous label
- Name and address of the shipper and receiver

- Net weight of Dry Ice (if used)

Documentation
A complete Shipper's Declaration must be completed when shipping a GMO/GMMO. The individual that signs the declaration must be trained and certified and is responsible for the shipment.

3.4 Biological Products

Biological Products are divided into the following groups:

3.4.1 Biological products which are manufactured and packaged in accordance with the requirements of appropriate national authorities and transported for the purposes of final packaging or distribution and use for personal health care by medical professionals or individuals are not subject to these Regulations.

3.4.2 Substances which do not meet the definition above and are reasonably believed to contain infectious substances must be classified as Category A Infectious Substances, Category B Infectious Substances, or Diagnostic Specimens.

3.4.3 All Biological Products must be triple packed, and the labeling and documentation must comply with the respective Dangerous Good category described above.

3.5 Dry Ice

Dry ice is considered a Class 9 Miscellaneous Dangerous Good.

Packaging
Dry ice must be packed in compliance with IATA Packing Instruction 904 and packed in a manner that allows for the release of carbon dioxide gas.

Labeling
The outer package must display the following:

- The proper shipping name & UN number (Dry Ice, UN1845)
- A Class 9 Miscellaneous label (Class 9 not required for UPS)
- Net weight of Dry Ice (UPS requires < 5 lbs)
- Name of the material being refrigerated (i.e. – diagnostic specimen, clinical sample)
- Name and address of the shipper and receiver

Documentation
A Shipper's Declaration is not required (unless shipping an Infectious Substance or Genetically Modified Organism). The airway bill must indicate "Dry Ice, UN1845."

4. Triple Packaging

Diagnostic Specimens, Infectious Substances, and Genetically Modified Organisms must be triple packed accordingly to IATA.

4.1 The primary container holds the material that is being shipped. It must be leak proof.

4.2 The secondary container holds the primary container(s). It must also be leak-proof and meet specific pressure test standards when shipping liquids. Absorbent material must be placed between the primary and secondary containers.

4.3 The outer package must be rigid and UN-certified when required by the applicable Packing Instruction. If a UN-certified container is not required, the outer package must be of good quality and strong enough to withstand handling encountered during transport.

5. Shipper's Declaration

The Shipper's Declaration must:

- be typewritten or computer generated in English.
- be printed in black and have red hatchings in the left and right margins.
- include three copies of the form (two for the carrier and one copy for your records which must be retained for 375 days).
- be signed and dated by an individual that has completed the required training.

6. CDC Select Agents

The U.S. Department of Health and Human Services Centers for Disease Control and Prevention (CDC) and the US Department of Agriculture (USDA) have collaborated to develop a list of biological agents, toxins, and high consequence livestock pathogens that have the potential to pose a severe threat to public health. Specific shipping regulations and restrictions apply to these agents. Please contact EH&S if you plan on shipping any select agent.

7. Importing to the United States

The Bureau of Customs and Border Protection processes all shipments entering the United States. An Import Permit may be required to deliver packages entering the United States. Contact the Bureau before shipping the material.

8. Exporting from the United States

Depending on the details of the shipment, an export permit may be required when shipments are being sent to another country. EH&S recommends contacting the Bureau of Customs and Border Protection prior to sending shipments outside the United States.

9. Importing or Transporting Controlled Material/Organisms/Vectors

The United States Department of Agriculture (USDA) regulates the intrastate transportation and importation of animals and animal-derived materials. Generally, a USDA veterinary permit is need for materials derived from animals or exposed to animal sources. Materials which require a permit include animal tissues, blood, and cells of livestock or poultry origin.

MAGNET SAFETY

Superconducting magnets, such as Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) equipment, pose unique safety concerns. These concerns include cryogen safety, strong magnetic fields and the potential for creation of oxygen deficient atmospheres. The highest potential for the most serious of these hazards exists during magnet start-up, cryogen filling and maintenance activities. Once magnets are operational and magnetic fields have been established, the hazards are minimal as long as operators, maintenance personnel, patients and/or visitors understand the proximity limits and procedures to follow when working near the magnet.

1. Hazards Associated with Magnets

1.1 Magnetic Fields

1.1.1 Ferromagnetic objects are strongly attracted to the magnet, and can become potentially lethal projectiles. Personnel can be severely injured and/or equipment can be damaged if hit by objects that are attracted to the magnet at a high rate of speed. In the case of MRI units, life threatening situations can occur if a person is pinned against the magnet by a large ferromagnetic object. Absolutely no ferromagnetic objects are allowed inside a magnet room or within the pre-determined radius of the magnetic field.

1.1.2 Examples of items which must not enter the magnetic field or room include: regular fire extinguishers, air tanks, axes (fire fighters), guns, radios, flashlights, wheelchairs, stretchers, and defibrillators. Smaller metallic objects like badges, jewelry, watches, keys, dentures, glasses, hearing aids, hair accessories must also be removed before entering the magnet room or magnetic field. Credit cards and magnetic storage media can be destroyed by the field.

1.1.3 Metallic implants and prostheses and foreign metallic bodies (even those which are not ferromagnetic) can move or dislodge, causing severe injury. Examples include aneurysm clips, implanted pins, shrapnel, insulin pumps, prosthetic limbs, cochlear implants, pacemakers, and cardiac or neural defibrillators.

1.1.4 Magnets generate strong electromagnetic fields and magnetic fields that can inhibit the operation of magnetically-sensitive equipment (certain implants or external devices), resulting in death or serious injury to the user. The most common item in this category is the cardiac pacemaker. Persons with pacemakers should be restricted to areas where the magnetic field is less than 5 Gauss.

1.1 Cryogen hazards (cryogens are extremely cold substances)

1.2.1 Liquid helium is used to maintain the magnetic field in NMR and MRI systems. Liquid nitrogen is also used. Both liquids are extremely cold (liquid helium -452°F, liquid nitrogen -320°F), colorless, and odorless. A sudden boil-off of cryogens and accompanying loss of magnetic field (called a “quench”) poses a significant safety risk. During a system quench (deliberate or accidental), gases generated by the rapid boil-off of liquid helium and nitrogen should get vented outside, but there exists potential for gaseous helium and nitrogen to be released into the magnet room. These gases will appear as a dense white fog, and visibility may be obscured in the vapor cloud. The released gases displace oxygen in the air, and this can cause rapid asphyxiation and unconsciousness without warning.

1.2.2 Contact with liquid or cold vapors can cause severe frostbite.

1.2 Fire Hazards

1.2.1 The cryogenic gases are not flammable; however, the extreme cold that exists during and immediately after a quench may cause air to condense and create liquefied oxygen on surfaces. Any liquid dripping from cold surfaces should be presumed to be enriched oxygen and treated as a potential fire hazard.

1.2.2 Exposure of the magnet to intense heat (such as the conditions that exist during a serious structure fire) could cause the magnet to rupture violently if pressure relief devices fail. Cooling the magnet with water helps prevent the rapid venting of cryogens.

2. General Guidelines for Magnets

2.1 Magnet Locations

2.1.1 NMR and MRI magnets must be located in areas with restricted access to the public.

2.1.2 No work stations shall be designed or placed within the 5 gauss field of a magnet. The 5 gauss line should not extend into public thoroughfares or building egress routes. Individuals should be able to enter and exit the room without passing through strong magnetic fields.

2.1.3 Magnetic fields must remain within the limits of the room or occupied area realizing that normal wall, ceilings and floor materials do not block static magnetic fields. In the case of an NMR type magnet, the strongest magnetic fields may occur at the bottom and top where shielding is less, which means that consideration must be given to occupied areas above and below the magnet.

2.1.4 At least one magnetically compatible fire extinguisher should be mounted immediately external to magnet rooms

2.2 Room Size – For NMR magnets, the magnet room must be large and high enough to accommodate the helium cloud resulting from a quench (loss of superconducting field). During a quench, one half of the helium volume (between 40 and 100 liters for most NMR magnets) will boil off and be violently ejected from the helium vent on top of the magnet within one minute. This vapor cloud will seek the highest point in the room as it warms and expands up to 700 times in volume. During the next few minutes the remaining helium will boil off. Nothing can be done to stop a magnet quench once it begins.

2.2.1 An NMR magnet room should always be sized so the space between the ceiling and the level of seven feet in the room is large enough to contain the initial volume of helium gas released from a quench. There must be adequate exhaust ventilation in the room of at least 10 air changes per hour.

2.2.2 Oxygen sensors with associated local alarms must be installed in magnet rooms where there exists the potential for asphyxiation. Alarms for oxygen monitors installed in the magnet rooms should activate when levels of oxygen are below 10%.

2.2.3 For MRI units which utilize larger volumes of cryogens or for NMR magnets in smaller rooms or in rooms with inadequate ventilation, helium vent pipes hard-ducted to the helium quench valve or automated exhaust fans tied to oxygen monitors must be installed.

2.2.4 Supplemental ventilation, oxygen alarms and emergency procedures must be established when magnets are installed in below grade pits. These are particularly important for NMR magnets. Liquid nitrogen vapors will collect in low areas and expand to create an oxygen deficient environment. Because of this significant hazard only experienced personnel should be allowed in the room during start-up.

2.3 Signage

2.3.1 Approved signage must be posted at all entrances to NMR magnet rooms prohibiting entry by unauthorized personnel and conspicuously warning of magnetic fields.

2.3.2 A visible indicator demarcating the 5 gauss line should be installed after magnet start up. The indicator can be a temporary barrier or permanent floor marking.

2.4 Cryogen Safety – The following hazards are of primary concern especially during filling operations of NMR magnets.

2.4.1 The minimum personal protective equipment requirements are thermal gloves, face shield, lab coats, closed (covered) shoes, and long pants.

2.4.2 Standard Operating Procedures are required for Dewar filling and transport, cryogen spills and clean-up, response to emergency alarms including oxygen sensor alarms and magnet quench.

2.4.3 Training is required regarding emergency procedures for magnet quench (catastrophic loss and discharge of coolant), causes and consequences of a quench, how to prevent quenching, actions and notifications in the event of a quench, and evacuation procedures.

3. Emergency Procedures

3.1 Procedures for Staff

3.1.1 Magnetic Resonance (MR) personnel with access to the magnet rooms must be knowledgeable regarding magnetic fields, cryogen hazards, oxygen sensors and alarms, and the emergency response procedures listed for “EMERGENCY RESPONDERS” in this document.

3.1.2 On-site personnel and visitors without training must follow the direction of MRI personnel regarding hazards.

3.2 Medical Emergency

3.2.1 If the individual is conscious and oxygen levels are safe for entry, assist the person to safety.

3.2.2 If the individual is not conscious or if assistance from an outside emergency medical team is requested or required, call Pitt Police at 412-624-2121.

3.2.3 Contact the designated personnel in charge of the area.

3.2.4 Personnel must be posted at all direct entries to the magnet room(s) to greet emergency response personnel, provide this document to emergency responders and remind them of the existing hazards. Available personnel must be ready to direct and assist responders, and to ensure that only MR compatible equipment is brought into magnet rooms.

3.3 Fire Emergency

3.3.1 All staff should review and familiarize themselves with the guidelines and procedures listed in the “Fire Safety and Life Safety” section of this manual.

3.3.2 Be aware of the compatible fire extinguisher locations adjacent to magnet rooms.

3.3.3 Follow the applicable Emergency Procedures as outlined above.

3.3.4 From a safe location, contact the designated personnel in charge of the magnet area and inform them of a fire emergency.

3.3.5 Personnel must be posted outside the building or at all direct entries to magnet room floors to provide this document to emergency responders and remind them of the existing hazards.

4. Procedures for Emergency Responders

If knowledgeable magnetic resonance (MR) personnel are on site, emergency responders are advised to consult them regarding hazards.

A floor plan should be attached to this document to indicate locations of magnetic fields, oxygen detection equipment, MR-compatible fire extinguishers, flammable chemical storage, and manual magnet quench activator (as applicable) and electrical power shutdown controls. These guidelines are intended to aid responders in specific scenarios.

If a low oxygen level alarm is active, no one should enter the magnet room.

4.1 If a recent quench displaced oxygen from the room, there may be dense white fog making it difficult to open the magnet room door due to increased pressure. Also, any liquid dripping from surfaces should be presumed to be enriched oxygen and treated as a fire hazard.

4.2 If oxygen levels are safe, and fire, sparks or emergency electrical conditions exist within the magnet room:

4.2.1 Confirm that a low oxygen level alarm is not active (refer to 4.1 above). Presence of dense white fog may be an indicator of a magnet quench and should not be assumed to be smoke or fire without verification.

4.2.2 Emergency responders planning to enter the magnet room must remove ALL metal without exception (see Hazard Description above). Anyone with non-removable metal (e.g. pacemakers or implanted devices) can not enter the room. Allow entry to necessary personnel only.

4.2.3 Only MR-compatible fire extinguishers can be brought into the magnet room.

4.3 If oxygen levels are safe and it is necessary to enter the magnet room to assist an injured person:

4.3.1 Confirm that a low oxygen level alarm is not active (refer to 4.1 above).

4.3.1 Emergency responders planning to enter the magnet room must remove ALL metal without exception (see Hazard Description above). Anyone with non-removable metal (e.g. pacemakers or implanted devices) can not enter the room. Allow entry to necessary personnel only.

4.1.1 Resuscitation aided by metallic devices can not be administered inside the magnet room. Evacuate the victim to an area outside the magnet room and restrict entry into the magnet room by others.

4.2 **If someone is pinned against the magnet by a ferromagnetic object:**

4.2.1 Emergency responders planning to enter the magnet room must remove ALL metal without exception (see Hazard Description above). Anyone with non-removable metal (e.g. pacemakers or implanted devices) can not enter the room. Allow entry to necessary personnel only.

4.2.2 Determine whether the object pinning the victim can be removed without causing further injury. If removal is successful, immediately evacuate the victim to an area outside the magnet room and restrict entry into the magnet room by others. Resuscitation aided by ferromagnetic devices can be administered once the victim is outside the magnet room.

4.2.3 If a life-threatening emergency exists and there is no other way to free the victim without eliminating the magnetic field**,** then it will be necessary to initiate a magnet quench (bring down the magnetic field).

4.2.4 The magnet quench procedure will create a dangerous environment. Expect a loud noise from the escape of cryogens and a release of dense white fog. There is a high risk of asphyxiation and potential for frostbite. As the magnetic field decreases, the object pinning the victim may fall and could cause further damage. Also, any liquid dripping from surfaces should be presumed to be enriched oxygen and treated as a fire hazard.

4.2.5 Do not perform this procedure unless you are prepared to immediately evacuate yourselves and the victim if oxygen is displaced from the room. Follow these remaining steps ONLY if a quench is required.

4.2.6 Pressure generated by the quench may prevent doors from opening, so prop open the magnet room door. Allow no others to enter the room through the open door.

4.2.7 All personnel must know to leave the room and not return until the helium has dissipated and the room is safe to reoccupy.

4.2.8 Initiate the quench after consultation with MR personnel.

4.2.9 Under no circumstances should ferromagnetic objects be brought into the magnet room unless magnetic resonance trained personnel verify that the magnetic field is no longer detectable.

CRYOGENS

Cryogenic liquids are refrigerated, liquefied gases having a boiling point colder than a temperature of -130^{o}F at a pressure of one atmosphere absolute. These liquids are normally stored at low pressures in multi-walled, vacuum-insulated storage containers. Examples of cryogenic liquids include oxygen, nitrogen, argon, neon, krypton, xenon, hydrogen, helium, liquefied natural gas (LNG)/methane, and carbon dioxide.

1. Potential Hazards

1.1 Extremely cold temperatures: Cryogenic fluids can freeze human tissue on contact. Protective clothing and eye protection is required to protect against splashes of cryogenic fluids.

1.2 Extremely high pressure: If heat enters the storage vessel of a cryogenic liquid, rapid vaporization and expansion of the liquid could result, thus increasing the pressure in the container. Container capacity must allow for that portion of the cryogenic fluid which will be in the gaseous state.

1.3 Asphyxiation: A cryogenic liquid form of inert gases (helium, neon, argon, krypton, xenon), that escape the storage container will rapidly expand and displace the oxygen necessary to support life in the room.

1.4 Flammability: Many cryogens are also flammable gases such as hydrogen, methane, and carbon monoxide. Liquefied gases such as helium, neon, nitrogen, and hydrogen are capable of condensing oxygen from the air and causing creation of an oxygen enriched environment which increases the potential of fire.

1.5 Embrittlement of associated materials used with cryogenic systems: Due to drastic changes in the properties of materials when exposed to the extremely low temperatures the method of connection and connecting equipment used must receive careful consideration. If the properties of a material considered for use with cryogenic liquids are unknown, an experimental evaluation on a pilot or reduced scale should be conducted prior to using the material in a cryogenic system.

2. Safe Handling Procedures for Cryogenic Materials

2.1 All personnel that handle cryogenic liquids must be trained in the use of specialized equipment designed for the storage, transfer, and handling of these materials.

2.2 In addition to laboratory attire, eye protection and insulated protective gloves must be worn to prevent skin contact with the extremely cold surfaces associated with the cryogenic system;

3. Transfer

3.1 Any transfer operations of cryogenic liquids into open containers must be conducted slowly to minimize boiling and splashing of the cryogenic liquid.

3.2 Transfer operations must be conducted only in well ventilated areas to prevent the possible accumulation of gas which can replace the oxygen in the surrounding atmosphere and cause asphyxiation or buildup of flammable vapors.

4. Storage

4.1 Store cryogenic fluids only in double wall, evacuated containers (Dewar flasks) of either metal or glass.

4.2 Avoid all contact of moisture with cryogenic materials. A small amount of moisture freezing across the opening of a Dewar flask, or its safety relief valve, could cause a pressure buildup and potential explosion. The cloudy vapor that appears when a liquefied cryogenic gas is exposed to the air is condensed moisture, not the gas itself.

4.3 Wrap the exposed glass of Dewar flasks with cloth woven tape to prevent flying glass in the event of rupture.

4.4 Caution must be observed when lowering objects or experiments into Dewar of cryogenic liquids to prevent an object from freezing tight in the neck of the flask. The obstruction of the Dewar opening will cause excessive and dangerous buildup of internal pressure in the flask and could potentially rupture the vessel.

4.5 Never handle or carry Dewar flasks by the neck, as the neck is the main support for the inner liner of the container. Always use handles provided on the container.

4.6 All cryogenic liquid vessels must be stored in a secure location to prevent access by untrained personnel.

4.7 No smoking, open flame, or spark-producing equipment is permitted in an area where flammable cryogenic liquids or oxygen are loaded/unloaded, stored, handled, or used.

For additional information regarding the safe use of cryogenic liquids and systems, contact the Department of Environmental Health and Safety at (412) 624-9505.

LABORATORY INSPECTION PROGRAM

The Department of Environmental and Safety (EH&S) strives to support the core laboratory research and teaching mission of the University of Pittsburgh. EH&S conducts a comprehensive laboratory inspection program to ensure that work within laboratories is occurring safely and in compliance with applicable laws, guidelines and University procedures.. All laboratories at the University of Pittsburgh are inspected annually. Inspections are conducted for new investigators upon their arrival at the University.

Principal investigators (PI) are the key to research safety programs. PI's are responsible to train and supervise lab workers, and to ensure that the conduct of workers and research is compliant with all safety and health standards. The lab inspection program aids the investigator in providing education and advice. The inspection focuses on ensuring:

- All workers are aware of the risks associated with the work in the lab, including animal hazards, physical hazards, biological hazards, and chemical hazards.
- All workers are trained on how to mitigate those risks, through facility design, engineering controls, safe work practices, and protective equipment.
- Workers comply with regulatory requirements, such as potential exposure to bloodborne pathogens or other infectious materials, and storage, handling, and disposal of hazardous chemicals

Specifically, the lab inspection covers the following items:

- Laboratory security
- Personnel training and documentation
- Laboratory safety design
- Hygiene and personal protective equipment
- Laboratory practices
- Sharps safety
- Chemical storage, handling, and disposal
- Spill and infection control
- Biological safety cabinets, fume hoods and other containment equipment
- Biological and chemical decontamination and waste disposal
- Animal experiments

The lab inspection process begins when the lab inspector contacts the PI to schedule the inspection. It is recommended, but not required, that the PI responsible for the laboratories accompany EH&S on the inspection. If the PI is not available, the individual accompanying EH&S on the inspection should be familiar with all of the work occurring in the laboratories. To prepare for the inspection, the EH&S laboratory inspector reviews the PI's Institutional Animal Care and Use (IACUC) protocols, recombinant DNA protocols, and EHS registration workbooks to better understand the work occurring in the lab.

EH&S utilizes a standardized laboratory inspection checklist during the inspection, which is found immediately following these guidelines. The lab inspector visits all of the labs used by the PI, including shared laboratories, such as shared cell culture rooms. The lab inspector communicates all recommendations verbally during the inspection. Concerns that require follow-up may be handled by the lab inspector or forwarded to other qualified EHS staff.

A written inspection report is sent to the PI and the lab contact shortly after the inspection. As necessary, copies of the reports are forwarded to the department chairperson, department chemical hygiene officer, and/or respective Dean. The report includes a summary of the work that is occurring in the PI’s labs and on the PI’s research protocols. The report includes a summary of the recommendations for improved lab safety. “Critical action items” generally include items related to regulatory requirements such as biological and hazardous chemical waste disposal, safe handling of biohazards, work with animals, and handling of safety equipment. “Opportunities for improvement” include other items that may not be an immediate safety concern, but warrant further examination by the PI. The report includes a completed copy of the inspection checklist.

On occasion, extremely critical safety hazards are identified on laboratory inspections. In such cases, EH&S will perform a prompt follow-up, and seek or oversee corrective action. If a condition is identified as posing a severe imminent hazard to safety or health, the operation can be suspended by EH&S and the University's administration after consultation and approval by the Dean of that particular school, the Office of the Provost, the Office of the Senior Vice Chancellor for the Health Sciences, or the Executive Vice Chancellor.

After the inspection, the lab inspector may return to the laboratory to verify that recommendations have been implemented and also provide additional follow-up for special projects, such as the use of safety engineered sharps devices. If the scope of the laboratory work changes significantly, such as an increase in the biosafety level of the laboratory, EH&S will conduct another inspection.

ANIMAL EXPOSURE SURVEILLANCE PROGRAM.

All faculty, staff, postdoctoral fellows and students who work with animals and/or their body fluids, fresh tissues, bedding or caging must be enrolled in the Animal Exposure Surveillance Program. The Animal Exposure Surveillance Program allows the University to monitor your level of risk in using animals, to offer you appropriate prophylactic protection from diseases associated with animal use, and to monitor your health during employment at the University.

Enrollment is achieved by completing a questionnaire regarding your medical status, which is then utilized to identify health risks during a brief medical consultation with a University appointed clinician. Enrollment will be conducted by the University's Employee Health Nurse at Employee Health Services, Medical Arts Building, 3708 Fifth Avenue, 5th Floor.

Upon enrollment in the Animal Exposure Surveillance Program, you will be screened for allergies to animals. Also upon enrollment, your risk of developing active tuberculosis will be assessed. The clinical staff member performing this assessment will determine the necessity for tuberculin screening. The screening will enable the University to identify past exposures to tuberculosis and develop a regimen of prophylaxis and/or treatment.

Your level of risk for exposure to other pathogens such as rabies, vaccinia, tetanus, hepatitis B and other human bloodborne pathogens will also be assessed during enrollment in the University's Animal Exposure Surveillance Program. Additionally your level of risk for exposure to many zoonotic diseases (diseases naturally present in animals) will be assessed, including psittacosis, toxoplasmosis and Q fever. See supplemental table at end of document for more information on zoonoses.

All faculty and staff with exposure to human bloodborne pathogens will be entered in the University of Pittsburgh Bloodborne Pathogen Exposure Control Program upon hire or upon initiating work with materials potentially containing bloodborne pathogens. All persons entered in this Program are offered the hepatitis B vaccination at no charge.

HEALTH AND SAFETY INFORMATION FOR ANIMAL USERS

All faculty, staff, students and fellows are responsible for compliance with appropriate safety and health standards. Faculty, staff, students and fellows are to follow safe work practices and report all unsafe conditions.

Supervisors and faculty are the keystone of the University of Pittsburgh Safety Program. Supervisors and faculty train employees to develop and maintain safe work practices. Supervisors and faculty must frequently inspect the workplace to ascertain unsafe conditions.

The University's Department of Environmental Health and Safety (EH&S) is responsible for providing guidance and direction in all phases of the Safety Program. Environmental Health and Safety conducts safety inspections, and advises management of unsafe conditions or noncompliance with policy, regulations and standards.

1. Incident and Injury Reporting

All incidents which result in an injury to faculty, staff or students MUST be appropriately documented and reported. In the event of a work-related incident involving an animal you should:

1. Clean the wound
2. Promptly report to your supervisor
3. Proceed to: Employee Health Services (M-F 7:30am-4pm)
   Medical Arts Building, 3708 Fifth Ave, Suite 500.59
   Phone: 412-647-3695

On evenings, weekends and holidays proceed to UPMC Presbyterian Hospital Emergency Department.

Assist your supervisor in documenting the incident or injury on the Report of Incident form.

If the injury is life threatening, or if the injured individual believes his or her injury is of an emergent nature, call the emergency number for Oakland campus: 412-624-2121.

2. Physical Hazards for Animal Users

If you receive an animal bite, scratch or splash, stop work. Wash the site with soap and water. Report all bites, scratches and splashes to your supervisor and proceed to Employee Health Services.

If bitten, scratched or splashed by a monkey, notify DLAR of the identification number for the animal and its location so that the veterinarian may examine the animal and take appropriate steps to determine the potential hazard. Notify your supervisor and immediately obtain a non-human primate exposure kit. Please familiarize yourself with these instructions regarding wound care and medical evaluation prior to working with monkeys. Immediately proceed to Employee Health Services for treatment and evaluation after initial wound care.

If your eyes, nose or mouth have been splashed/exposed to potentially infectious material, flush the site with water for fifteen minutes using the eyewash; and proceed to Employee Health Services.

Musculoskeletal disorders are syndromes characterized by discomfort, impairment, disability or persistent pain in joints, muscle tendons or other soft tissues with or without physical manifestations. These may result from moving equipment such as cage racks or drums of detergent. Follow established procedures for moving and lifting equipment, and use mechanical aids such as drum jacks and dollies when possible. If you experience any of these conditions while performing your job, please report to the occupational injury clinic currently, Concentra Medical Centers, 120 Lytton Ave, Suite 275. If you would like a proactive ergonomic assessment of your work site, ask your supervisor to contact Environmental Health and Safety at 412-624-9505.

Wet floors are a prominent physical hazard in animal areas. Do your part in promptly reporting or abating wet floor surfaces. If it is necessary to transverse wet floors, use extreme caution. Proper non-slip shoes or protective boots are recommended for environments that consistently have wet floor surfaces. When possible, post wet floor signage to alert coworkers and visitors of this hazard.

High pressure water and steam are physical hazards for animal users who utilize autoclaves, power washers and other equipment. Avoid skin contact with high pressure water and steam. When unloading an autoclave, verify that the pressure is near zero prior to opening the door. Slowly crack open the door and allow the steam to gradually escape. Allow materials in the autoclave to cool for 10 minutes prior to removal, and use heat resistant gloves and a face shields as necessary.

Electricity is another prominent physical hazard. Extension cords are prohibited by fire safety standards, unless an emergency situation is declared by University administration. Use caution with power equipment, radios and other electrical devices, particularly in areas with wet floors, and water or steam sources.

All individuals using radioactive materials and/or animals containing radioactive materials must be registered with the University of Pittsburgh Radiation Safety Office (412-624-2728).

3. Chemical Hazards for Animal Users

The University of Pittsburgh Chemical Hygiene Plan (www.ehs.pitt.edu) provides guidance for faculty, staff and students working with hazardous materials. Material Safety Data Sheets (MSDS) give employees a means to find information about the hazards associated with any material in their workplace. They summarize information about the hazards, handling procedures, emergency first aid and required protective equipment regarding each substance. If you have a concern about any substance in your workplace, discuss the situation with your supervisor. If the supervisor is unable to answer your questions, contact Environmental Health and Safety (412-624-9505.)

Labeling is important. All unattended containers must have a label of the common name in English to identify the contents. If applicable, secondary containers must also include the concentration and/or expiration date.

Cleaning agents are a common chemical utilized by animal users. All cleaning agents must be stored in labeled and tightly capped containers at all times. Consult the product label or the MSDS for appropriate protective equipment when handling cleaning agents. Always wear face protection and gloves when handling and dispensing concentrated cleaners. Chemical aprons and heavier chemical-resistant gloves may be needed.

Anesthetic agents have long been associated with health hazards. Chronic exposure to these agents have possible effects on the liver, kidney, nervous system and reproductive system. Engineering controls, such as chemical fume hoods, that scavenge waste gases from the source, are the best methods to control these hazards. Environmental Health and Safety is available to perform monitoring for exposure to waste anesthetic gases.

Formaldehyde, formalin, and paraformaldehyde, are commonly used to fix or preserve animal tissues. Formaldehyde is irritating to eyes, skin, and mucous membranes. Allergic respiratory reactions and possible tissue damage may result from prolonged contact. Formaldehyde is also a probable human carcinogen and suspected reproductive hazard. Formaldehyde should be used only in a chemical fume hood or at a downdraft table that draws air away from the worker and out of the work area. Personal protective equipment (PPE) is required for work with formaldehyde. Skin and eye protection such as safety glasses and lab coats must be worn when handling formaldehyde or fixed tissues. Gloves must be worn whenever formaldehyde is handled. Nitrile gloves are recommended over latex gloves. Formaldehyde waste must be collected and disposed through the chemical waste disposal program. Annual training is required for employees who meet the 0.1 ppm exposure limit. Environmental Health and Safety is available to monitor for formaldehyde exposure.

Hazardous chemicals, such as toxins, carcinogens, mutagens, or reproductive hazards, may be administered to animals as part of an approved research protocol. Environmental Health and Safety generates a Risk Assessment document for each IACUC protocol. The Risk Assessment identifies all hazards listed in the protocol, including chemical hazards, and the requirements for conducting the research safely. These requirements may include using engineering controls to minimize exposures to hazardous chemicals such as: chemical fume hoods; microisolator cages, for containing excreted or exhaled hazardous chemicals; and bedding dump stations, for containing contaminated bedding.

Excess chemicals should be disposed through the University's Chemical Disposal Program managed by Environmental Health and Safety. Never place chemicals in the trash or in the biohazardous waste stream. Bedding from animals exposed to hazardous chemicals may need to be collected specially and incinerated.

If your skin or eyes are exposed to a chemical, flush the affected area with large amounts of running water using an eyewash for 15 minutes. Then proceed to UPMC Presbyterian Hospital Emergency Department.

In the event of a chemical spill:

1. Evaluate the spill. Are the materials corrosive, flammable, toxic or explosive?
    a. Identify all materials by common name.
    b. Estimate how much is spilled.
    c. Evaluate the degree of danger to staff, patients, visitors or animals.
    d. Evaluate the degree of danger to equipment or property.
2. Contain the spill.
3. If the spill cannot be contained, evacuate the area. Also evacuate if the spill is likely to produce irritating, flammable or explosive vapors. Immediately call the emergency number for your building.
4. Spills of innocuous material or small amounts of acids, bases and flammable material can be cleaned up by lab personnel or properly equipped staff in the area.
5. All spills of toxic or explosive materials and large spills of corrosive or flammable material will be cleaned by Environmental Health and Safety. Immediately call the emergency number for your building.

4. Biological Hazards for Animal Users

Animals carry enteric bacteria that can produce disease in humans. Transmission of these organisms to man is by the fecal-oral route. Hand washing is the most effective way to prevent infections to yourself and to coworkers. All animal handling areas should be equipped with a hand sink that is stocked with soap and paper towels. Wash hands often.

Animals may also be naturally infected with viruses, or may be infected with biological agents as part of an approved research protocol. These biological agents may include wild-type or genetically engineered viruses, bacteria, or human cells. These agents may be shed in urine or feces, and animal blood, body fluids, and tissues, may become potentially infectious. Care must be taken in handling live animals, soiled bedding and cages, and animal blood, body fluids, and tissues.

Any exposure to potentially infectious materials should be reported immediately. Exposure to the mucous membranes (eyes, nose, and mouth) should be handled by flushing the exposed area with copious amounts of running water for 15 minutes. Exposure to the skin should be handled by washing the affected area with soap and water. After washing or rinsing, proceed to Employee Health Services. If your exposure is high risk for bloodborne pathogen infection as determined by Employee Health Services clinical staff using CDC Guidelines, post exposure prophylaxis may be recommended. These medications have been shown to be most effective in reducing the risk of HIV infection when initiated within 1-2 hours of exposure.

The basis of Standard Precautions is to treat all human subjects and specimens and all non-human primate subjects and specimens as infectious. Gloves should be used for all cleaning, specimen handling tasks and for handling animals. Always wear face protection when there is the potential for splash or exposure to infectious agents. Laboratory coats, scrubs and/or uniforms should also be worn to prevent skin exposure to biological hazards.

Biohazardous or potentially infectious materials may be administered to animals as part of an approved research protocol. EH&S generates a Risk Assessment document for each IACUC

protocol. The Risk Assessment identifies all hazards listed in the protocol, including biological hazards, and the requirements for conducting the research safely. These requirements may include using engineering controls to minimize exposures to biohazards such as the following: biological safety cabinets; microisolator cages for containing excreted biohazards; and bedding dump stations for containing contaminated bedding. Safety-engineered sharps devices also serve as engineering controls for handling of biohazards.
Sharps injuries may occur when using needles, scalpels, or other sharps devices. Sharps are defined as any item which can puncture human skin. Safety-engineered sharps devices should be utilized wherever possible to reduce the potential for exposure to an infectious agent or a hazardous chemical. Safety-engineered sharps devices include retractable injection needles and sheathing blood collection devices. Needles and sharps are never to be discarded directly into the general waste stream or biohazard trash bags. All needles and sharps must be discarded directly into approved sharps containers. Standard needles should not be recapped or left out in work areas; they should be used and then immediately disposed in approved sharps containers without recapping. Approved sharps containers must be placed in all areas where sharps may be utilized or generated. Filled sharps containers must be properly secured prior to disposal, and are disposed in dedicated waste streams or biohazard boxes lined with red bags
All macaque monkeys are potential carriers of herpes virus-B, also called herpes simiae. While human infection with herpes virus-B is rare, the unfortunate consequences may be death or severe neurological disease. Humans can become infected with herpes virus-B by receiving a bite or scratch from an infected non-human primate, from contact with tissues or splashes with body fluids from an infected non-human primate, or by injury from a cage or sharp that has been contaminated with material from an infected non-human primate. Treat all macaque monkeys as though they are infected with this virus. Prevent infection by always wearing face protection (eyewear and mask), long sleeve lab coat or other protective clothing, and gloves when working with monkeys. Use the provided implements to restrain or capture these animals.

If any individual incurs a bite or a scratch from a non-human primate, stop work, immediately notify your supervisor and clean the wound per the ‘monkey bite kit’ instructions. Note the animal's identification number and provide to DLAR. Proceed to Employee Health Services.

Non-human primates are very susceptible to tuberculosis. Tuberculosis is a chronic disease, primarily of the pulmonary system, caused by bacteria of the genus *Mycobacterium tuberculosis*. All non-human primates entering the University of Pittsburgh are quarantined to allow for thorough tuberculin testing. After the quarantine period, non-human primates are periodically tested to monitor for colony infection.

In order to protect humans who work or come into contact with non-human primates, and in order to protect non-human primates who come into contact with humans, each group is tuberculin tested on a routine basis. All individuals who have access to non-human primates are tuberculin tested every six months.

Also all individuals who directly handle non-human primates must be enrolled in the University Measles Protection Program, which validates the individual’s immunity to measles and protects the non-human primate colonies. This Program is administered through Employee Health Services.

All infectious materials and all contaminated equipment or apparatus should be decontaminated before being washed or stored. Autoclaving is the preferred method for decontamination and disinfection for contaminated equipment such as rodent cages and water bottles. All areas and equipment involving any contact with sheep or goats or products of conception from sheep or goats shall be cleaned and disinfected on a regular basis and immediately after each invasive procedure. Transport carts shall be decontaminated after use. Use appropriate disinfectants, and follow the manufacturer's recommendation for concentration, contact time, and expiration. Disposable materials associated with potentially infectious agents and exposed animals should be disposed in red labeled biohazard bags and boxes.

The containment of infectious agents is performed according to the applicable biosafety level.

- Biosafety Level 1 (BSL-1) generally involves agents of no known or minimal potential hazard to laboratory personnel and the environment.
- Biosafety Level 2 (BSL-2) includes all Biosafety Level 1 practices plus containment equipment such as certified biological safety cabinets, protective barriers such as lab coats, gloves, and face protection, and limited access to the laboratory. BSL-2 involves agents of moderate potential hazard to personnel and the environment.
- Biosafety Level 2+ is a University designation, which signifies that specified BSL-2 agents are to be used only in the full containment practices for Biosafety Level 3.
- Biosafety Level 3 (BSL-3) is designated for research utilizing indigenous or exotic agents which may cause serious or potentially lethal disease as a result of exposure by the aerosol route.

5. Research Registration and Inspection Programs

In order to control and monitor biological hazards in the work environment, the University of Pittsburgh is establishing research registration programs in accordance with federal guidelines. All research involving biological agents or materials, recombinant DNA, or animals must be properly registered with designees of the University.

Experimental animal studies are not to be initiated without prior approval from the Institutional Animal Care and Use Committee. Visit www.iacuc.pitt.edu for more information.

All principal investigators conducting recombinant DNA research are required to register such protocols with the Institutional Biosafety Committee. Research involving recombinant DNA requires strict adherence to the most current NIH guidelines. Visit www.rcco.pitt.edu/rDNA/ for more information.

Each principal investigator is to register with EH&S all biohazardous agents and materials presently in use for investigative research and all agents maintained in stock culture collections for research and/or teaching purposes. Visit www.ehs.pitt.edu/biosafety/biochemreg.htm for more information.

It is the responsibility of the principal investigator to demonstrate his/her understanding of the hazards associated with biological and chemical hazards identified in the IACUC protocol, to assure that individuals working with the registered agents and materials are appropriately trained, and to assure that the protocols are conducted in compliance with University policies and applicable standards.

Environmental Health and Safety conducts a comprehensive inspection program to ensure that work within laboratories is occurring safely. Research laboratories are inspected annually. The lab inspection focuses on ensuring that all workers are aware of the risks associated with the IACUC protocol, including animal hazards, physical hazards, biological hazards and chemical hazards, that all workers are trained on how to mitigate those risks, that the EHS Risk Assessment is readily available for workers to review, that the lab meets the biosafety level (BSL) assigned for the IACUC protocol, and that appropriate chemical hygiene practices are implemented in the laboratory. Environmental Health and Safety also inspects all animal housing facilities twice yearly.

6. Allergies

Allergy is an important risk associated with animals. If you have a stuffy nose or other respiratory symptoms that seem to last longer than a common cold (weeks instead of days), or if you develop hives or redness and itching of the skin, you may be suffering from an allergy. If you develop these symptoms when exposed to a certain animal species, then you're likely to have an animal allergy. The majority of animal users don't suffer from allergies to the animals under their care; However, animal users have a higher incidence of allergy and asthma than workers who do not work with animals.

If you feel you may suffer from an allergy to the animals you work with, report it to your supervisor and proceed to Employee Health Services for evaluation. Allergy can usually be managed by a combination of medical and workplace strategies. It's important to consult with Employee Health Services to determine the cause of allergy in order to manage it effectively.

The following practices may help reduce your exposure to animal allergens:

- When possible, use engineering controls. For example, perform animal manipulations in a ventilated hood or certified biosafety cabinet. Dispose of soiled bedding using a controlled dump station. House animals in filter-top or microisolator cages to control particulates. If these controls are not possible, a dust mask or surgical mask may be helpful.
- When you are not working in a hood or cabinet, make sure that the animal room or other work area is adequately ventilated and that all the air handling equipment in the room is in good order. If there is doubt, your supervisor should contact Facilities or Environmental Health and Safety. Animal rooms should deliver at least 10 air changes per hour.
- Do not wear your street clothes when working with animals. Wear appropriate personal protective equipment (PPE) for handling animals. Garb requirements are posted at the entrance to each housing facility. Garb may include scrub shirts and pants, disposable Tyvek gowns or suits, shoe covers, hair nets, surgical masks, face shields, and latex and nitrile gloves. These also assist in reducing your skin contact with animals.
- Wash your hands frequently. Wash hands, face and neck before leaving the work area.
- Avoid touching your hands to your face while working with animals and animal equipment.

- Keep cages and your work area clean.

7. Emergencies
All faculty, staff and students should be aware of the procedures. In the event of fire or other emergency:

- Remove anyone from immediate danger.
- Close the door to confine smoke, fire or hazardous conditions.
- Pull the nearest fire alarm box.
- Call the emergency number for your building: 412-624-2121 on the Oakland Campus, or, 911 if you are off-campus.

Part of the emergency response protocols include hazard warning signage. This placard provided by EH&S is required to be posted at the entrances to all laboratories and research areas to indicate the hazards contained therein. These warning placards must contain the names and emergency telephone numbers of two individuals who are familiar with the hazards contained within the area. It is the responsibility of the principal investigator or the area supervisor to include the emergency contact information on the placards. If your area does not have the proper warning signage at its entrances, contact Environmental Health and Safety.

Contact the Department of Environmental Health and Safety
Telephone: 412-624-9505
Address: B-50 Benedum Hall
E-mail: Safety@ehs.pitt.edu

Supplemental information: Table of common zoonotic diseases

Zoonosis	Animal reservoir	Symptoms	Transmission	Control
Herpes B virus (Cercopithecine herpesvirus)	Rhesus macaques, pig-tailed macaques, and cynomolgus monkeys.	Fever, rash, weakness, nausea, leading to fatal encephalomyelitis.	Needlestick, animal bite or scratch, splash of blood or body fluids or feces to mucous membranes.	Surveillance and history of animals. Athough animals that repeatedly test negative may harbor the virus.
Lymphocytic choriomeningitis virus	Wild mice. Reported in mice, rats, guinea pigs, hamsters, non-human primates, swine, dogs.	Flu-like illness, rash, enlargement of lymph nodes	Inhalation, needlestick, splash to mucous membranes, exposure to aerosols from bedding and feces.	Animal surveillance. Screening of all tumor cells and cell lines.
Q fever (*Coxiella burnetii*)	Sheep, goats, cattle. Reported in cats and rabbits.	Flu-like illness with fever, headache, chest pain, with potential for liver or cardiac illness.	Exposure to aerosols from urine, feces, milk, and birth products.	Animal surveillance. Animal biosafety level 3 housing of infectious animals.
Rabies	Wild dogs, bats, raccoons. Reported in domesticated dogs and cats.	Anxiety, fever, headache, leading to fatal viral infection.	Bite or splash of saliva to mucous membrane, exposure to aerosols in caves with roosting bats.	Pre-exposure immunization of animals and workers.
Toxoplasmosis (*Toxoplasma gondii*)	Parasite. Cats and other mammals (sheep, goats) are infectious within a few weeks of initial exposure to the parasite.	Flu-like symptoms, occasional eye damage. Eye and brain damage in infants born to mothers exposed to parasite for the first time during or just before pregnancy.	Skin contact or inhalation of particles from contaminated feces.	Surveillance of workers to determine if exposure has ever occurred. Prior exposure usually confers immunity, except in the case of immunocompromised persons. BSL-2 housing of infected animals.
Tuberculosis (*Mycobacterium tuberculosis*)	Non-human primates. Reported in mice, cats, swine, and rabbits.	Infection of pulmonary system and potential for systemic dissemination.	Repeated close contact with exposed individuals or animals, especially aerosols produced by coughing.	Surveillance of incoming animals; periodic monitoring of animals; quarantine of infected or suspicious animals; periodic surveillance of workers.

PREVENTING ODORS FROM DRY SINK TRAPS

Laboratory workers periodically report unusual odors in their work areas that smell nothing like any of the chemicals used in their labs. Typical odors are described as “sulfur-like” or sewer gas, mercaptan or hydrogen sulfide odors.
If the smell is localized and appears to be unrelated to the ventilation system or neighboring labs, it frequently is traced to a dry sink trap, or unused floor drain.

Drain traps normally filled with water to create a seal between the building's sanitary sewer line and the system designed to ventilate the sewer gas. Without the water seal in a drain trap, sewer gas is drawn into the room, particularly when the lab has a fume hood or another type of specialized exhaust system.

1. Lab personnel can prevent sink traps and floor drains from drying out by running or pouring a quart of water into the drains once per week or month.
2. In labs where cup sinks or floor drains are no longer used, contact University plumbers to permanently or temporarily seal these drains.

The illegal practice of pouring hazardous chemicals into lab sinks can also contribute to problem odors in labs. Never dispose of lab chemicals down the drain.

MOVING LABORATORY EQUIPMENT

1. Processing A Request

1.1 The Principle Investigator, department administrator, or designated contact submits an online request for moving of laboratory equipment at www.bc.pitt.edu/1click/. This request must be submitted for either an internal move within a building or to another University building or for equipment that will be taken to Surplus Properties.

1.1.1 Environmental Health and Safety (EH&S) is required to inspect and approve for moving all equipment that has been used or stored in a laboratory. (Examples – freezers, incubators, centrifuges, computers). Note that on the "1Click" website, question #3 requesting EH&S inspection must be checked for EH&S to receive the information about moving lab equipment.

1.1.2 Contact EH&S if a biological safety cabinet is going to be relocated to discuss additional decontamination requirements.

1.1.3 EH&S does **NOT** need to be contacted (via Question #3) for equipment that is not in a laboratory setting (Examples – Office furniture, computers in an office, etc.).

1.2 EH&S will reply to the designated contact to schedule an inspection of the equipment to be moved. This date is scheduled as close to the move date as possible.

1.3 Laboratory equipment must be decontaminated before EH&S can approve the equipment to be moved. Please see below for decontamination guidelines. Equipment that is dirty at the time of inspection will not be tagged.

1.4 EH&S personnel will 'tag' the equipment after verifying proper decontamination. This tag notifies the University Movers that the equipment has been approved for moving.

1.5 Once cleared by EH&S for removal, the equipment may **NOT** be used.

1.6 All equipment in laboratories using radioactive materials must be cleared by the Radiation Safety Office prior to EH&S clearance. Radiation Safety can be reached at 412-624-2728.

2. Decontamination Guidelines

2.1 Put on appropriate personal protective equipment. At a minimum, gloves and safety glasses should be worn. Consult with EHS or laboratory SOP's, if necessary.

2.2 Spray a disinfectant on the equipment. In most cases, a 1:10 bleach solution should be used to disinfect biological agents.
2.3 Allow disinfectant to remain on the equipment for the appropriate contact time (15-20 minutes for diluted bleach).
2.4 Wipe disinfectant from the equipment with water or with a mild detergent and water.

COMPRESSED GASES

A compressed gas is defined as any mixture of gases in a container with a pressure exceeding 40 psi. at 70^{o}F, or 104 psi. at 130 ^{o}F; or any flammable liquid with an absolute vapor pressure exceeding 40 psi. at 100 ^{o}F.

1. Container Requirements for Compressed Gases

1.1 All compressed gas cylinders or containers delivered to or shipped from the University must be marked, labeled, stored, and handled in accordance with all applicable rules and regulations, including DOT, OSHA, and NFPA standards.

1.2 The contents of each cylinder and container must be clearly identified (by tag or stamp) on the cylinder.

1.3 University faculty, staff and students must not remove or alter any identification on a compressed gas cylinder.

1.4 Do not purchase a larger cylinder size than necessary. Only gases in returnable containers should be selected for purchase.

2. Storage of Compressed Gas Cylinders

2.1 Storage areas for compressed gas cylinders must be designed to accommodate the gases used and provide adequate spacing and/or segregation, in accordance with applicable building codes and regulations. Compressed gas cylinder storage areas must be segregated from exit corridors and egress paths.

2.2 Storage areas should be designated by hazard class and marked clearly with appropriate warning signs that restrict access.

2.3 Consideration must be given to separate storage of full and empty containers. Incompatible gases must be segregated by at least 20 feet or an appropriately rated and designed wall or barrier.

2.4 The cylinder storage area should be dry and well-ventilated, and be of fire-resistant construction when necessitated by the gas in storage.

2.5 Compressed gas cylinders must not be stored near sources of heat and ignition, or near corrosive chemicals or fumes.

2.6 Compressed gas cylinders must not be stored near unprotected platform edges, or in any location where heavy moving objects may strike or fall on them.

2.7 All compressed gas cylinders (whether empty or full) must be secured in an upright position using an approved chain, strap, or floor device to prevent falling. There should be no more than five cylinders per securing device.

2.8 Approved chains or straps should be secured around the top 1/3 of the cylinders. Securing devices should never be around the neck, regulator, or bottom 1/3 of the cylinder.

2.9 All compressed gas cylinders must be fitted with a protective valve cap or guard while in storage.

2.10 If use of small non-refillable cylinders is unavoidable (lecture bottles), they should be secured in a device, cage or box designed for cylinders 18" or smaller.

2.11 Toxic gases (such as carbon monoxide and hydrogen sulfide) should be stored and used in a chemical fume hood. If this is not feasible, the area of use should be equipped with a detection system specific to the toxic gas or inhalation hazard.

3. Safe Handling of Compressed Gas Cylinders

3.1 Persons handling compressed gas cylinders must:

3.1.1 Be familiar with the hazards of the compressed gas.

3.1.2 Always use a cylinder cart or other transport device to move cylinders in a secured fashion. Never drag a cylinder by valves or caps, or roll a cylinder in the horizontal position. Compressed gas cylinders should be transported with the cylinder cap securely fastened.

3.1.3 Never use a compressed gas cylinder as a support or door stop.

3.1.4 Keep caps on cylinders unless connected to dispensing equipment systems.

3.1.5 Never expose cylinders to temperature extremes, direct flame, or heat.

3.2 Empty compressed gas cylinders must be:

3.2.1 Closed

3.2.3 Secured at all times

3.3.3 Labeled to indicate “Empty”

3.3 Compressed gas piping, regulators, and flow control equipment must be:

3.3.1 Compatible with the chemical and physical properties of gas.

3.3.2 Capable of withstanding gas supply pressures.

3.3.3 Installed and operated by trained and qualified persons familiar with the specific hazards of the gases in use.

3.3.4 Grounded to minimize sparks due to static discharge when using flammable gas.

3.3.5 Provided with a means for safely purging the system and devices to prevent backflow of gases or liquids into the gas storage cylinders when using hygroscopic corrosive gases, such as anhydrous hydrogen chloride.

3.3.6 Leak tested upon installation and monthly thereafter around valve gland, regulator connections, and fittings.

4. Emergency Procedures for Compressed Gas Cylinders

4.1 Personnel should be aware of common emergency situations involving compressed gases and their associated hazards, such as:

4.1.1 An unsecured cylinder may tip and become damaged in a manner that the release of internal pressure can cause the cylinder to become a dangerous high-speed projectile.

4.1.2 A fire threatening the cylinder can cause a rupture or explosion.

4.1.3 A flammable gas leak can cause a buildup of explosive gases.

4.1.4 A leak can cause high concentrations of gas that exceed safe breathing levels or an inert gas leak can cause an oxygen-deficient atmosphere that is a threat to life safety.

4.1.5 An unplanned chemical reaction may cause a cylinder rupture or explosion of apparatus.

4.2 Fire emergencies involving compressed gas cylinders should be handled with extreme caution:

4.2.1 Do not take unnecessary risks to save equipment-- evacuate the area.

4.2.2 Only when safe to do so, release pressure in affected pipelines and shut off equipment prior to evacuation.

4.2.3 If safe to do so, shut off gas supply to ignited flammable gas leaks or allow fire to burn out while controlling the ignition of surrounding materials.

4.2.4 Never attempt to extinguish a flammable gas leak without stopping the flow of gas.

4.2.5 Any compressed gas cylinder involved in a fire must be taken out of service and returned to the supplier.

4.3 Some common leak points and their potential repairs:

4.3.1 Valve outlet /regulator connection: dirt in connection, damaged connector or washer.

4.3.2 Valve stem spindle: tighten adjustable gland nut ¼ turn with valve stem loosened or tighten lock nut if present on gland fitting.

4.3.3 Cylinder valve to cylinder joint: cannot be repaired in the field, remove from service. Label and return to supplier.

4.3.4 Valve closure: tighten valve or if defective, set aside, label and return to supplier.

4.3.5 Leaking gas control equipment/pipelines: isolate gas supply, release pressure, and purge equipment of hazardous gas before attempting repair.

5. Disposal of Compressed Gas Cylinders

5.1 Contact your cylinder vendor to return damaged, excess, or unknown cylinders.

5.2 If the cylinder is non-returnable, call EH&S for cylinder disposal via the chemical waste disposal program.

6. Pressurized Equipment and Pressure Vessels

Common examples of pressure vessels or pressurized equipment are steam boilers, autoclaves, compressor tanks, pressurized research equipment, reactors, and calorimeters. University employees should follow these basic safety guidelines when working with pressure vessels or pressurized equipment:

6.1 Pressurized equipment used at pressures at or above 103 kPa gauge (15 psig) must be designed and constructed by qualified individuals for use at the expected temperature, pressure, and other operating conditions.

6.2 Pressure equipment must be fitted with a pressure relief device, such as a rupture disc, relief valve, or blowdown valve. This pressure relief device must be vented to a safe location.

6.3 Laboratory pressure vessels or equipment operated at pressures above 103 kPa gauge (15 psig) must be operated and maintained according to manufacturers' instructions, the design limitations of the equipment, and applicable codes and regulations.

6.4 This equipment must be inspected on a regular basis (at least annually).

6.5 Any significant change in the condition of the equipment, such as corrosion, cracks, distortion, scale formation, chemical attack, weakening of the closure, or the inability of the equipment to maintain pressure, should be documented.

6.6 Equipment that exhibits any of the above changes must be removed from service immediately, and shall not be returned to service until repaired and approved by a qualified person.

GUIDELINES FOR CHEMOTHERAPEUTIC/ANTINEOPLASTIC WASTE DISPOSAL

Chemotherapeutic/antineoplastic wastes include spent or excess cytotoxic compounds, liquid and solid waste from cell cultures treated with such agents, expended personal protective equipment, and spill cleanup materials. Some examples of chemotherapy/antineoplastic agents include adriamycin (doxorubicin), bleomycin, cisplatin, cyclophosphamide, etoposide, fluorouracil, streptozotocin, taxol and vincristine. Internet resources for chemotherapy, genotoxic, and antineoplastic agents include http://www.bccancer.bc.ca/HPI/DrugDatabase/DrugIndexPro/default.htm, and http://toxnet.nlm.nih.gov/.

1. Chemotherapeutic wastes that are mingled with biohazardous wastes are classified as chemotherapeutic wastes and must be managed as such. Chemotherapeutic/antineoplastic wastes must be disposed separately from biohazardous or regular municipal waste according to state regulations.

2. Solid chemotherapeutic wastes **cannot** be disposed in the regular trash or in biohazard bags.

3. Liquid chemotherapeutic wastes **cannot** be disposed down the drain or sanitary sewer.

4. Chemotherapeutic waste containers are yellow and white, puncture-proof and leak-proof, and are labeled “Chemotherapeutic Waste.” Containers are available through the UPMC Purchasing Warehouse, or the University's Biological Sciences stockroom, and scientific suppliers. The chemotherapeutic waste containers may be listed as “chemotherapy sharps containers.”

5. **Oakland Campus: Chemotherapeutic/Antineoplastic Disposal Guidelines**

5.1 Unused portions of chemotherapy agents (powders and liquids) are disposed through the EH&S chemical waste disposal program.

5.1.1 An orange chemical waste label must be completed and placed on the container.

5.1.2 EH&S picks up chemical waste on a regular basis. Contact EH&S for the schedule, locations, and with questions about chemical waste pickup.

5.2 Used liquid chemotherapeutic waste must be collected in leak proof containers which are constructed from glass or plastic with tight fitting lids. This liquid waste includes spent chemotherapeutic waste, as well as liquid cell culture waste from cells treated with chemotherapeutic agents.

5.2.1 When the collection container is ¾ full, an absorbent such as Green Z (available from the Biological Sciences stockroom or from www.safetec.com/greenz.php3) should be added to thicken the liquid waste. Absorbent is used to protect custodians and waste handlers from exposures to spills and splashes.

5.2.2 The waste container should be capped and placed in a chemotherapeutic waste container.

5.3 Solid chemotherapeutic waste, including items such as contaminated plastic ware from cell cultures treated with chemotherapy agents, should be collected in bags and then placed in chemotherapeutic waste containers.

5.3.1 Solid waste does **not** include syringes used to inject animals with chemotherapeutic agents.

5.3.2 <u>Empty</u> used syringes can be disposed in sharps containers and do not require special handling.

5.3.3 Empty all syringes of remaining chemotherapeutic agent per section 5.1.

5.4 When the chemotherapy waste container is full, it should be sealed and placed in a standard biohazard box.

5.5 The box should be labeled with the name of the investigator and a phone number.

5.6 "Chemotherapeutic waste" should be written on the box, and the box should be placed in the normal biohazard waste pickup area.

6. Hillman Cancer Center laboratories: Chemo/Antineo Disposal Guidelines

NOTE: The use of chemotherapeutics in patient areas is at all times governed by the UPMC Presbyterian Shadyside Waste Management Plan.

6.1 Liquid chemotherapeutic waste should be collected in leak proof containers with tight fitting lids, which are constructed from glass, plastic or other materials compatible with the waste to be disposed of. When possible the original shipping container should be re-used to collect / accumulate liquid waste products during the research process.

6.2 Liquid waste should be accumulated until the container is approximately 3/4 full. Green Z universal absorbent, or other absorbent which the manufacture has certified suitable to be used with chemotherapeutic agents, should be added to the container to absorb the liquid.

6.3 Waste containers with the absorbent added should then be placed inside the chemotherapeutic disposal containers.

6.4 Items that have come in contact with chemotherapeutic agent, including but not limited to spill cleanup materials, pipets, glassware not intended for reuse, personal protective equipment, and paper towels should be collected in the chemotherapeutic waste disposal containers.

6.5 Full disposal containers should be sealed, labeled with the researchers name and lab number, and placed in the corridor for removal.

6.6 Sealed chemotherapeutic waste disposal containers, which have been placed in the corridor, will be removed by Environmental Services personnel and transferred to the designated chemotherapeutic waste area. Infectious and chemotherapeutic waste streams are maintained separately and are not co-mingled.

6.7 Because not all chemotherapeutic agents are classified as Hazardous Waste, but are always considered chemotherapeutic waste, chemotherapeutic waste should not be disposed of via the hazardous waste disposal program.

MERCURY

Mercury is a silver liquid metal that vaporizes at temperatures as low as 10^{o}F. Mercury vapor is colorless and odorless and may cause a toxic effect when inhaled. Most health effects result from chronic exposure, and the symptoms include fatigue, anorexia, weight loss, inflammation of gums, and tremors. The symptoms of acute over-exposure are bronchitis, cough, chest pain, excessive salivation or metallic taste. Short-term exposures to low level mercury vapors present little hazard.

1. Mercury Spills

1.1 For **large mercury spills** (>25 ml) such as broken manometers, immediately call **EH&S at 4-9505 or the University Police at 4-2121**. Prevent people from walking through the spill area. Notify others to leave the immediate area. Close all doors to the room and wait outside the area for EH&S responders.

1.2 **Small spills** of mercury, such as broken thermometers, can be cleaned up immediately by laboratory personnel if contained, or by EH&S if area contamination is suspected.

2. Spill Clean-Up

2.1 At a minimum a lab coat, disposable nitrile gloves, and shoe covers should be worn during cleanup of mercury spills to prevent skin absorption or contamination of clothing.

2.2 When possible clean up all mercury spills with a specially designed HEPA filtered vacuum with a charcoal filter. EH&S will respond with this equipment when necessary.

2.3 **Under no circumstances** should mercury be swept with a broom or vacuumed with an ordinary vacuum cleaner. These procedures will disperse mercury vapors and droplets quickly into the air spreading the contamination.

2.4 Very small amounts of mercury can be cleaned up by lab personnel using an index card or rubber squeegee to form a larger bead that can be vacuumed up or amalgamated.

2.5 Beads of mercury can also be collected with a disposable pipette, a water-trapped vacuum line attached to a disposable pipette or a hand-operated vacuum pump.

2.6 Mercury-absorbing powders, if available, can be used to amalgamate mercury in non-accessible locations.

2.7 Mercury waste and materials used in spill cleanup must be placed in a sealed bottle or in a double layer of plastic bags and labeled for disposal by EH&S through the chemical waste program.

2.8 After all visible mercury has been collected, the area should be washed with a detergent solution, rinsed, and allowed to dry before use.

2.9 In areas that cannot be completely cleaned of mercury, a sulfur slurry should be applied to oxidize the metal and reduce the possibility for airborne vapors. Excess sulfur powder should be vacuumed or wet cleaned during final clean-up after it has had time to react with the mercury.

2.10 Carpets heavily contaminated during a mercury spill may have to be removed if EH&S monitoring of mercury vapor levels after vacuum cleaning determines this need.

3. Disposal

All mercury and mercury-containing wastes must be packaged, labeled and disposed via the EH&S Chemical Waste Program and according to the University's "Guidelines for Disposal of Chemical Waste".

GUIDELINES FOR SAFE USE OF CHEMICAL SYRINGES

Syringes are used in research labs for multiple tasks including injection of gases or liquids into chromatographs, chemical apparatus or animals. Syringes can range from precision micro-syringes to inexpensive disposable units. Needle-stick injuries remain a significant hazard during syringe use, but is not the subject of this guideline. See our "Needle Stick Prevention Guidelines" at, www.ehs.pitt.edu. This guideline addresses proper syringe use and chemical handling to prevent eye and face injury due to syringe spray-back.

Syringe spray-back accidents typically occur when the syringe or injection needle become plugged. If the syringe becomes plugged, do not push the plunger harder. High pressures inside the syringe can cause the plunger seal to fail or the barrel to crack spraying out liquid. The following steps are recommended for safe syringe use.

1. Use only new disposable syringes or decontaminated re-usable syringes.
2. Examine all syringes for evidence of physical damage before use.
3. Check the plunger for ease of motion before drawing up liquids or gas.
4. Check again for free plunger movement after installing needles or tubing.
5. Syringes with frozen plungers or plugged needles should be removed from service.
6. Clean re-usable syringe after each use following the manufacturer's instruction.
7. Special wash solvents, detergents, and brushes may be needed for cleaning. Use a squeeze bottle to force cleaning liquid through syringe.
8. Always wear eye protection or a face shield when cleaning syringes and handling chemicals in a lab.
9. For stubborn stains or contamination ultrasonic cleaning in an appropriate solution may be effective.
10. After cleaning, the syringe plunger should be removed for drying and all seals checked. Syringe bodies should also be dried using compressed air.
11. Reassemble the syringe and plunger for storage.
12. Avoid using lubricants on plungers unless required by the manufacturer.
13. Plugged needles usually occur from coring rubber septa. These can usually be cleared with fine wires that come with the needle. If not replace the needle.
14. Some syringes are temperature sensitive and rapid heating or cooling should be avoided. Check with the manufacturer for maximum and minimum use temperatures
15. Take steps to secure the plunger when drawing a sample or injecting material into a high pressure system thereby preventing plunger blowout and chemical release.

If you have additional questions about chemical syringe safety please contact EH&S at 412-624-9505

LABORATORY SAFETY SURVEY PROGRAM

The Department of Environmental and Safety (EH&S) strives to support the core research and teaching mission of the University of Pittsburgh. EH&S implements various environmental surveys to assist faculty, staff, and students in implementing best practices and maintaining compliance with applicable laws and University procedures.

1. EH&S conducts laboratory safety surveys in all (wet laboratory) each calendar year. A wet laboratory is defined as any laboratory using chemical or biological agents.
2. The laboratory safety survey findings are documented by the EH&S staff and forwarded to the principle investigator. As necessary, copies of the survey reports are forwarded to the chemical hygiene officer, department chairperson, and/or respective dean.
3. A written plan of correction should be submitted to EH&S within one month of receipt of the survey report.
4. On occasion, extremely critical safety hazards are identified on laboratory surveys or environmental surveys. EH&S will perform follow-up and seek immediate corrective action on such findings. EH&S will utilize the line management of the principle investigator to assist with enforcement of corrective actions.
5. Environmental surveys and laboratory surveys conducted by EH&S are typically announced and are always conducted in a congenial and non-confrontational manner.
6. If a condition is identified as posing an eminent hazard to safety or health, the operation can be suspended by EH&S and the University's administration <u>after</u> consultation and approval by the Dean of that particular school, the office of the provost, the office of the Senior Vice Chancellor for the Health Sciences, or the Executive Vice Chancellor.

GUIDELINES FOR RELOCATION OF CHEMICALS

The movement and relocation of chemicals has the potential to create hazardous conditions. University faculty, staff, and students must be cautious when handling and packaging chemicals prior to relocation. It is important to consider proper segregation and to assure that incompatible chemicals are packed separately. The following guidelines have been established to minimize the hazards associated with the movement and relocation of chemicals. Please consult with EH&S prior to moving chemicals.

1. Internal Relocation

These guidelines apply only to chemicals being moved within a building or within connected buildings at the University. Over-the-road transportation of chemicals is governed by federal regulations and must be performed by a licensed hazardous materials transporter. See part 2.

1.1 Segregation

Chemicals should be properly segregated prior to packaging. Segregate incompatible chemicals by placing in separate containers (e.g. acids from bases, oxidizers from organics).

1.2 Packaging

1.2.1 Compatible chemicals may be packed together in sturdy cardboard boxes.

1.2.2 Packing medium such as newspaper, paper towels, styrofoam, bubble wrap, or vermiculite should be used to cushion the chemical containers prior to movement.

1.2.3 Boxes should be closed and secured by packing tape.

1.2.4 Boxes must be labeled or have a chemical inventory attached.

1.3 Movement/Relocation

Ensure that the boxes of chemicals are secure prior to movement. Use caution when moving the chemicals through the building. Use a leak-proof secondary container and/or a cart.

2. Transport of Chemicals via Public Road

On-campus movements of hazardous materials that utilize or cross a public road or street are subject to federal regulations from the U.S. Department of Transportation (DOT). These regulations require proper chemical segregation, packaging, marking, labeling, and documentation of each hazardous chemical shipment. Please use the following guidelines when planning to transport regulated chemicals via public roads.

2.1 Contact Environmental Health and Safety (EH&S) at 412-624-9505 at least two weeks prior to your move date. EH&S will determine if the chemicals to be moved are DOT-regulated. All non-DOT-regulated chemicals can be transported by a general mover using the packaging instructions in the University “Guidelines for Internal Relocation of Chemicals”.

2.2 EH&S will coordinate the movement of DOT-regulated chemicals and will contact a hazardous materials transportation contractor to aid in the move as necessary. Contractor costs associated with the move will be absorbed by the relocating laboratory or function and its affiliated department.

2.3 Under the supervision of EH&S, the hazardous materials contractor will properly segregate, package, mark, label, and document the regulated chemicals.

2.3.1 Regulated chemicals will be packaged in DOT-approved containers provided by the contractor.

2.3.2 Documentation of the shipment will accompany the chemicals during transport.

2.4 The contractor will transport the regulated chemicals to the desired building and move them to a final destination for unpacking.

2.5 Laboratory personnel are responsible for unpacking the materials. The empty transport containers must be returned to EH&S during the next scheduled bi-weekly chemical waste pick-up.

GUIDELINES FOR ETHIDIUM BROMIDE DISPOSAL

Although ethidium bromide is not regulated as a hazardous waste, its mutagenic properties may present a human health hazard if it is placed in the trash or poured down the sanitary sewer system. Use the following procedures when disposing ethidium bromide solutions and gels, and ethidium bromide contaminated materials.

1. Ethidium Bromide Solutions

1.1 Do not discard ethidium bromide gels or ethidium bromide solutions containing organic solvents or alcohol down the sewer. Only aqueous solutions containing < 10 µg/ml (10 ppm) may be released to the sanitary sewer.

1.2 Aqueous solutions containing > 10µg/ml ethidium bromide must be treated (S&S extractor with charcoal filter, or the Green Bag method) prior to sewer disposal; or the solutions must be disposed via the University's Chemical Waste Program. If the material is going to be treated, the solution can be filtered. Once the solution is filtered, pour the filtrate down the drain, place the filter in a sealed plastic bag. D**o not use red bags. Pl**ace a WASTE CHEMICALS label on the sealed bag. The filter and the ethidium bromide should be disposed of through the Chemical Waste Program. Call 4-8952 to schedule a pick up.

2. Gels Containing Ethidium Bromide

Place gels in sturdy plastic bags, then place the bag in a cardboard box. Use an orange Chemical Waste label, identify as "Ethidium Bromide gel", and process through the Chemical Waste Program. Dry gels should also handled in this manner

3. Gloves and Contaminated Debris

Gloves and paper towels that are visibly contaminated with ethidium bromide should be placed in a bag or box. D**o not use red bags.** Label the container with a waste chemical label to identify the material and dispose through the Chemical Waste Program.

4. Glassware

Test tubes contaminated with ethidium bromide should be emptied prior to disposal. Dispose of the liquid according to the above procedures. Contaminated test tubes should be washed with bleach prior to disposal in a broken glass box.

5. Sharps

Sharps and needles contaminated with ethidium bromide should be disposed into sharps containers. An orange CHEMICAL WASTE label must be placed on the sharps container to identify the contents. All sharps containers labeled as chemical waste should be disposed via the University Chemical Waste Program.

DISPOSAL OF EMPTY CHEMICAL CONTAINERS

Chemical containers which are not completely empty and still contain residual amounts of chemicals could potentially be classified as hazardous waste. Therefore, special considerations must be taken when disposing of containers. The following guidelines have been developed to ensure that empty chemical containers are disposed of properly.

1. Chemical containers must be completely emptied prior to disposal. Be sure that there is no residual material in the container.

2. If the original product container is in good condition, consider reusing the container to collect waste chemicals. The waste chemicals should be compatible with the container and the original contents of the container.

3. Consider the type of chemical that was in the container. **If the chemical is identified on the list of Acutely Hazardous Wastes (see attachment), the empty container should NOT be rinsed and MUST be disposed of through the Chemical Waste Program.**

4. If the chemical is NOT on the attached list of Acutely Hazardous Wastes, the container should be triple-rinsed with water or in some cases, a solvent capable of removing the original chemical. If the rinsing solvent is hazardous (e.g. acetone, methylene chloride), the rinsate must be collected and disposed through the Chemical Waste Program.

5. Once the container has been triple-rinsed, the cap may be removed, and the container should be air-dried.

6. When the container is dry, deface the original label. Write “EMPTY” on the label. Ensure that the cap has been removed, and dispose of the container and cap in the general trash. If the container is glass and the chemical is not on the Acutely Hazardous Waste list, it should be disposed of in a broken glass receptacle. Any glass container or item does not need to be broken to be placed in a broken glass receptacle.

7. If you are unable to remove any residual amount of chemical in the container, the container must be disposed of through the Chemical Waste Program.

Acutely Hazardous Wastes

The following chemicals are considered to be acutely hazardous wastes, and empty containers formerly containing these chemicals must be disposed of through the Chemical Waste Program.

- Acetaldehyde, chloro-
- Acetamide, N-(aminothioxomethyl)-
- Acetamide, 2-fluoro-
- Acetic acid, fluoro-, sodium salt
- 1-Acetyl-2-thiourea
- Acrolein
- Aldicarb
- Aldicarb sulfone
- Aldrin
- Allyl alcohol

- Aluminum phosphide
- 5-(Aminomethyl)-3-isoxazolol
- 4-Aminopyridine
- Ammonium picrate
- Ammonium vanadate
- Argentate(1-), bis(cyano-C)-, potassium
- Arsenic acid
- Arsenic oxide
- Arsenic pentoxide
- Arsenic trioxide
- Arsine, diethyl-
- Arsonous dichloride, phenyl-
- Aziridine
- Aziridine, 2-methyl-
- Barium cyanide
- Benzenamine, 4-chloro-
- Benzenamine, 4-nitro-
- Benzene, (chloromethyl)-
- 1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-
- Benzeneethanamine, alpha,alpha-dimethyl-
- Benzenethiol
- 7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate
- Benzoic acid, 2-hydroxy-, compnd. with (3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo [2,3-b]indo 1-5yl methyl carbamate ester (1:1)
- 2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
- Benzyl chloride
- Beryllium
- Bromoacetone
- Brucine
- 2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[methylamino)carbonyl] oxime
- Calcium cyanide
- Carbamic acid, [(dibutylamino)-thio]methyl-2,3-dihydro-2,2-dimethyl-7-benzofuranyl ester
- Carbamic acid, dimethyl-, 1-[(dimethyl-amino)carbonyl]-5-methyl-1H-pyrazol-3-yl ester
- Carbamic acid, dimethyl-, 3-methyl-1-(1-methylethyl)-1H-pyrazol-5-yl ester
- Carbamic acid, methyl-, 3-methylphenyl ester
- Carbofuran
- Carbon disulfide
- Carbonic dichloride
- Chloroacetaldehyde
- p-Chloroaniline
- 1-(o-Chlorophenyl)thiourea
- 3-Chloropropionitrile
- Copper cyanide
- M-Cumenyl methylcarbamate
- Cyanides (soluble cyanide salts), not otherwise specified
- Cyanogen
- Cyanogen chloride
- 2-Cyclohexyl-4,6-dinitrophenol
- Dichloromethyl ether
- Dichlorophenylarsine
- Dieldrin
- Diethylarsine
- Diethyl-p-nitrophenyl phosphate
- O,O-Diethyl O-pyrazinyl phosphorothioate
- Diisopropylfluorophosphate
- 1,4,5,8-Dimethanonaphthalene,1,2,3,4,10,10-hexa-chloro-1,4,4a,5,8,8a,-hexahydro (1alpha,4alpha,4abeta,5alpha,8alpha,8abeta)-
- 1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa-chloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta)-
- 2,7:3,6-Dimethanonaphth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha,7beta, 7aalpha)-
- 2,7:3,6-Dimethanonaphth [2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta,7aalpha)-, & metabolites
- Dimethoate
- alpha,alpha-Dimethylphenethylamine
- Dimetilan
- 4,6-Dinitro-o-cresol, & salts
- 2,4-Dinitrophenol
- Dinoseb
- Diphosphoramide, octamethyl-
- Diphosphoric acid, tetraethyl ester
- Disulfoton
- Dithiobiuret

- 1,3-Dithiolane-2-carboxaldehyde, 2, 4-dimethyl-O-[(methylamino)-carbonyl] oxime
- Endosulfan
- Endothall
- Endrin
- Endrin, & metabolites
- Epinephrine
- Ethanedinitrile
- Ethanimidothioic,2-(dimethylamino)-N-[[(methylamino) carbonyl]oxy]-2-oxo, methyl ester
- Ethanimidothioic acid, N-[[(methylamino)carbonyl]oxy]-, methyl ester
- Ethyl cyanide
- Ethyleneimine
- Famphur
- Fluorine
- Fluoroacetamide
- Fluoroacetic acid, sodium salt
- Formentanate hydrochloride
- Formparanate
- Fulminic acid, mercury(2+) salt
- Heptachlor
- Hexaethyl tetraphosphate
- Hydrazinecarbothioamide
- Hydrazine, methyl-
- Hydrocyanic acid
- Hydrogen cyanide
- Hydrogen phosphide
- Isodrin
- 3(2H)-Isoxazolone, 5-(aminomethyl)-
- Manganese, bis(dimethylcarbamodithioato-S,S')-
- Manganese dimethyldithiocarbamate
- Mercury, (acetato-O)phenyl-
- Mercury fulminate
- Methanamine, N-methyl-N-nitroso-
- Methane, isocyanato-
- Methane, oxybis[chloro-
- Methane, tetranitro-
- Methanethiol, trichloro-
- Methanimidamide, N,N-dimethyl-N-[-3-[[(methylamino)-carbonyl]oxy]phenyl]-, monohydrochloride
- Methanimidamide, N,N-dimethyl-N'-2-methyl-4-[[[(methylamino)-carbonyl]oxy]phenyl]-, monohydrochloride
- 6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
- 4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7atetrahydro-
- Methiocarb
- Methomyl
- Methyl hydrazine
- Methyl isocyanate
- 2-Methyllactonitrile
- Methyl parathion
- Metolcarb
- Mexacarbate
- alpha-Naphthylthiourea
- Nickel carbonyl
- Nickel cyanide
- Nicotine, & salts
- Nitric oxide
- p-Nitroaniline
- Nitrogen dioxide
- Nitrogen oxide
- Nitroglycerine (R)
- N-Nitrosodimethylamine
- N-Nitrosomethylvinylamine
- Octamethylpyrophosphoramide
- Osmium oxide, (T-4)-
- Osmium tetroxide
- 7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
- Oxamyl
- Parathion
- Phenol, 2-cyclohexyl-4,6-dinitro-
- Phenol, 4-(dimethylamino)-3,5-dimethyl-methylcarbamate (ester)
- Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
- Phenol, 2,4-dinitro-
- Phenol, 2-methyl-4,6-dinitro-, & salts
- Phenol, 3-(1-methylethyl)-, methyl carbamate
- Phenol, 3-methyl-5-(1-methylethyl)-methyl carbamate
- Phenol, 2-(1-methylpropyl)-4,6-dinitro-
- Phenol, 2,4,6-trinitro-, ammonium salt
- Phenylmercury acetate
- Phenylthiourea
- Phorate
- Phosgene
- Phosphine
- Phosphoric acid, diethyl 4-nitrophenyl ester
- Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester

- Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
- Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino) -2-oxoethyl] ester
- Phosphorofluoridic acid, bis(1-methylethyl) ester
- Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
- Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
- Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
- Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester
- Physostigmine
- Physostigmine, salicylate
- Plumbane, tetraethyl-
- Potassium cyanide
- Potassium silver cyanide
- Promecarb
- Propanal, 2-methyl-w-(methyl-sulfonyl)-O-[(methylamino)carbonyl]oxime
- Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
- Propanenitrile
- Propanenitrile, 3-chloro-
- Propanenitrile, 2-hydroxy-2-methyl-
- 1,2,3-Propanetriol, trinitrate
- 2-Propanone, 1-bromo-
- Propargyl alcohol
- 2-Propenal
- 2-Propen-1-ol
- 1,2-Propylenimine
- 2-Propyn-1-ol
- 4-Pyridinamine
- Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
- Pyrrolo[2,3-b]indol-5-old,1,2,3a,8,8a-hexahydro-1,3a,8-trimethyl-, methylcarbamate (ester), (3aS-cis)-
- Selenious acid, dithallium(1+) salt
- Selenourea
- Silver cyanide
- Sodium azide
- Sodium cyanide
- Strychnidin-10-one, & salts
- Strychnidin-10-one, 2,3-dimethoxy-
- Strychnine, & salts
- Sulfuric acid, dithallium(1+) salt
- Tetraethyldithiopyrophosphate
- Tetraethyl lead
- Tetraethyl pyrophosphate
- Tetranitromethane
- Tetraphosphoric acid, hexaethyl ester
- Thallic oxide
- Thallium oxide
- Thallium(I) selenite
- Thallium(I) sulfate
- Thiodiphosphoric acid, tetraethyl ester
- Thiofanox
- Thioimidodicarbonic diamide
- Thiophenol
- Thiosemicarbazide
- Thiourea, (2-chlorophenyl)-
- Thiourea, 1-naphthalenyl-
- Thiourea, phenyl-
- Tirpate
- Toxaphene
- Trichloromethanethiol
- Vanadic acid, ammonium salt
- Vanadium oxide
- Vanadium pentoxide
- Vinylamine, N-methyl-N-nitroso-
- Warfarin, & salts, when present at concentrations greater than 0.3%
- Zinc bis(dimethylcarbamodithioato-S,S')
- Zinc cyanide
- Zinc phosphide, when present at concentrations greater than 10%
- Ziram

CHEMICAL WASTE DISPOSAL

QUICK REFERENCE GUIDELINES

GENERAL

Waste chemicals are picked up from University buildings on a bi-weekly schedule. The schedule of pick-ups is every second Friday, starting at 8:30 A.M. and proceeding until completion. In the event of a University holiday falling upon a pick-up day, the pick-up will be rescheduled for the preceding Wednesday. Notice of rescheduling will be posted at the pick-up point.

Waste should be taken to the collection points <u>on the morning of the scheduled pickup.</u> If your building does not have a standard collection point, pick-up arrangements can be made by contacting the Environmental Health & Safety Office (624-8526 or 624-8952).

LABELING CHEMICALS FOR DISPOSAL

- All chemicals must be identified and labeled.
- An orange Waste Chemicals label should be filled out completely & placed on the bottle. Labels should include chemical name, quantity, name of person preparing chemical for disposal, department, telephone extension, and date.
- Common chemical names should be used on labels. (**No formulas or abbreviations**)
- List all known chemical constituents for each container (**Do not** label as "solvent waste", halogenated/non halogenated waste, etc.) Estimate concentrations.
- Labels can be obtained from the Environmental Health & Safety Office (x 4-9505).

PREPARATION OF CHEMICALS FOR DISPOSAL

- Waste chemicals destined for disposal should be segregated into compatible groups and packaged in a sturdy cardboard box.
- Consult the Material Safety Data Sheet for the materials to determine compatible groupings.
- Five-gallon solvent cans in good condition do not need to be over packed.
- Drums greater than five-gallon capacity will not be picked up on regularly scheduled rounds. Arrangements for pick-up of drums can be made by contacting the Environmental Health and Safety Office (x 4-8526 of x 4-8952).
- Packaging should be done to minimize the possibility of breakage or leakage during handling (all bottles should be tightly capped to prevent leakage).
- Containers should be placed upright in the box to prevent spilling of the contents.
- Bottles should not come in contact with each other, and the space between bottles should be filled with a cushioning material to prevent bottle movement during handling.

- Bottles of liquid chemicals should be packed with absorbent materials to contain the material in the event of breakage.
- **Do not** place any chemical waste in Biological Waste containers (bags, boxes, etc.).
- Total weight of the box should not exceed 35 pounds.

GUIDELINES FOR FLAMMABLE LIQUID DISPOSAL

Waste from chemicals possessing a flashpoint less than 60 ° C (140 ° F) are classified as hazardous wastes. According to federal law (40 CFR 261.20) and state and local regulations, all hazardous wastes must be captured, collected, and disposed through the University's Chemical Waste Disposal Program. **No flammable materials should be poured down the drain.** The University of Pittsburgh is committed to protecting the environment through compliance with these laws and the "Zero Discharge" initiative.

Disposal Guidelines

- Disposal of materials into the sanitary sewer is regulated by federal, state and local law.
- Chemical wastes possessing a flashpoint of less than 60 ° C (140 ° F) is classified as ignitable hazardous waste. *Please contact EH&S to make a hazardous waste determination of any materials in question.*
- All hazardous wastes must be captured, collected, and disposed through the University's Chemical Waste Disposal Program managed by EH&S.
- Flammable liquids that must be collected include ethanol, methanol, acetonitrile, and aqueous solutions of these solvents. For example, EHS has determined that Western blot transfer buffer containing 10% or 20% methanol is a hazardous waste due to the solution's flammability; and it must be collected and disposed through the Chemical Waste Disposal Program.
- Collect flammable liquid waste solutions in the original container, or in a suitable glass, plastic, or metal container.
- Label the container with an orange Chemical Waste label, and identify the chemical constituents. 'Waste' or 'solvent waste' are insufficient labels.
- All chemical containers, including those for collecting excess and/or waste must be kept closed.
- Once full, date the container, and place it in the designated accumulation area or contact EH&S (4-8952) to schedule a pick up.

Contact Environmental Health & Safety with any questions regarding chemical waste disposal at 412-624-8952 or 412-624-9505.

GUIDELINES FOR CARBON MONOXIDE GAS USAGE IN LABORATORIES

Carbon monoxide (CO) is a colorless, odorless and tasteless toxic gas. CO gas is also produced when there is incomplete combustion of carbon containing fuels (e.g. coals, petroleum, peat, natural gas).
CO gas has a health hazard rating of 3, which designates a serious health hazard. Inhalation of carbon monoxide can cause headache, dizziness, mental dullness, weakness, sleepiness, nausea, vomiting, unconsciousness and death. The storage and usage of carbon monoxide in a laboratory environment requires special handling procedures. Please use the following guidelines when storing and using carbon monoxide gas:

1. Carbon monoxide gas cylinder storage / usage
   - 1.1 International Fire Codes prohibit quantities greater than 20 cubic feet of highly toxic gases (such as CO) to be stored or used outside of exhausted gas cabinets or certified chemical fume hoods.
   - 1.2 Carbon monoxide should be purchased in quantities smaller than 20 cubic feet or in quantities that can be easily stored and used in a gas cabinet or chemical fume hood.
   - 1.3 Carbon monoxide gas cylinders should be secured with an approved chain, strap or floor bracket.
   - 1.4 Carbon monoxide gas cylinders (flammable gas) should be stored at least 20 feet from oxidizer gas cylinders (ex. Oxygen).

2. Carbon monoxide gas detectors
   - 2.1 At least one CO gas detector should be continually utilized in laboratory spaces where CO gas cylinders are stored and / or actively used.
   - 2.2 The operation of the detectors should be regularly checked (monthly) and batteries should be replaced every 6 months.
   - 2.3 If CO gas cylinders will be operated unattended (e.g. overnight test procedures) then CO gas detectors must be interconnected to the building emergency power source. The regulator should be linked to the building power source that would enable the regulator to shut the flow of gas off in the event of a power outage if the CO gas is run unattended.

3. Laboratory door signage
   - 3.1 Door signage should be placed outside of laboratories and storage rooms in which carbon monoxide gas cylinders are stored and / or used.
   - 3.2 Room entry requirements on the door signage should include the following:
     - 3.2.1 CARBON MONOXIDE (CO) gas storage Toxic gas.
     - 3.2.2 Entry into the laboratory is prohibited upon activation of the carbon monoxide alarm, except by authorized or emergency personnel.
     - 3.2.3 University of Pittsburgh EH&S, emergency responders or other personnel equipped with CO gas detection equipment must conduct air quality measurements prior to entrance into the laboratory or CO storage site.
     - 3.2.4 Upon clearance, authorized personnel are permitted to enter laboratory space or storage room to facilitate necessary repairs to equipment or gas cylinders.

LABORATORY ELECTRICAL EQUIPMENT

Electrically powered laboratory equipment may be used for heating, cooling, mixing, lighting, pumping or analytical instrument operations in the lab. Heating mantles, magnetic stirrers, rheostats, vacuum pumps, X-ray units, lasers and hot plates represent just some of the equipment that can pose an electric shock, explosion or fire hazard if used improperly in the lab. Installation of hardwired equipment must be performed by an electrician.

1. All electrical equipment must be certified by a nationally recognized testing laboratory (such as FM or UL) to ensure that the equipment is free from reasonably foreseeable risk due to electrical hazards. Electrical equipment must not be modified unless explicitly approved by the manufacturer, or inspected by an electrical inspector before being placed in service.

2. As a minimum, the electrical inspection must insure that:
   1) Equipment is sufficiently enclosed to prevent accidental contact with energized parts.
   2) Exposed metal parts are bonded and grounded.
   3) Over-current protection is appropriate for intended use.
   4) Connections are tight and insulation intact.

3. Regular Inspections of electrical equipment should be made by a competent person within the laboratory. These visual and physical inspections are to include:
   a) Obvious damage or defects in the accessories, connectors, plugs or sockets.
   b) Flexible cords are effectively anchored to equipment, plugs and sockets.
   c) Damage to flexible cords –.
      - the inner cores of flexible supply cords are not exposed or twisted;
      - the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the inner cores are visible.
   d) Warning indicators for maximum load on power strips are intact and legible.
   e) Controls are in good working order, i.e. they are secure, aligned and appropriately identified.
   f) Covers and guards are present and secured.
   g) Ventilation inlets and exhausts are unobstructed.

4. If upon routine inspection any of the above flaws are detected, the electrical equipment should be immediately removed from service. Contact the equipment vendor, a qualified electrical repair organization or your Facilities Management representative for repair information.

5. All electrical outlets, within 6' of water, must be protected by ground fault circuit interrupters (GFCI). Contact Facilities Management to have this protective circuitry installed.

6. Avoid the use of extension cords. If necessary, they should not be stretched across floors or located in areas where they can be damaged or pose a tripping hazard. Extension cord use should be limited to temporary installations and must be of the proper length and gauge for the intended current (Amps).

7. All faculty and staff working in the lab should be instructed how to de-energize electrical service to equipment in case of an accident or fire. Lab personnel are not to reset tripped circuit breakers. This must be done by a Building Engineer or electrician. Breakers should identify the circuit they control.

8. Electrical equipment used in close proximity of flammable liquids and gases must be properly electrically classified. Where possible non-sparking induction motors or air motors should be used should be used to operate vacuum pumps, mechanical shakers, stirring motors and rotary evaporators.

Additional electrical safety information is available in the General Safety Section of the University Safety Manual.

PHOTOGRAPHIC CHEMICALS AND EQUIPMENT

A variety of chemicals including fixers, developers, replenishers, and stabilizers are used in photographic development processes. Some of these processes generate hazardous materials such as silver, chromium, and corrosive substances that must be disposed of in accordance with Federal Regulations. Please follow these guidelines when working with photographic chemicals and equipment.

1. PURCHASE

1.1 Do not purchase excessive quantities of photographic chemicals. Purchase the only the minimum, useable amounts of chemicals as needed.

1.2 Photographic chemicals often have limited shelf life. Purchase only the amounts that would be used prior to expiration.

1.3 Photographic equipment that processes materials classified as a regulated waste should be selected or retro-fitted with a recovery system that prevents discharge of regulated material into the sanitary system.

2. STORAGE

2.1 Segregate all incompatible chemicals. Consult chemical-specific Material Safety Data Sheets (MSDS) for chemical incompatibilities and storage requirements.

3. HANDLING AND USE

3.1 Wear appropriate protective equipment (lab coat, safety glasses, gloves, etc.) when handling photographic products and chemicals.

3.2 When collecting used photographic chemicals, label each container with a completed orange Chemical Waste label. Chemical Waste labels are available by contacting Environmental Health and Safety (EH&S).

3.3 All recovery systems must be emptied and serviced per manufacturer instructions.

4. DISPOSAL

4.1 Photographic processing chemicals must be collected and disposed through the University's chemical waste program. **Do not dispose photographic chemicals through the sanitary sewer or in the garbage.**

CHEMICAL HYGIENE PLAN TABLE OF CONTENTS

This Chemical Hygiene Plan has been developed to help you work with laboratory chemicals safely and in a manner that complies with prevailing regulations and recommended standards.

The purpose of the Chemical Hygiene Plan is to describe proper practices, procedures, equipment and facilities that have been designed and implemented to protect faculty, staff, and students from the effects of hazardous chemicals in the laboratory. Each department or unit using lab chemicals will appoint a Chemical Hygiene Officer who is responsible for department-specific or unit-specific aspects of the Chemical Hygiene Plan. The Department of Environmental Health and Safety directs and supports individuals, supervisors, and Chemical Hygiene Officers in maintaining safe laboratory environments. This Chemical Hygiene Plan and OSHA's Standard, "Occupational Exposure to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450), commonly referred to as the "Lab Standard," applies to all University laboratories handling hazardous chemicals.

1. RESPONSIBILITY, AUTHORITY, AND RESOURCES

1.1 University Administration

The Chancellor of the University is ultimately responsible for implementation and support of all compliance efforts; however, primary authority for development of and compliance with this Plan has been delegated to the Director of the Department of Environmental Health and Safety.

1.2 Deans, Directors, and Department Chairs

Those having administrative authority of functions that operate laboratories with hazardous chemicals are responsible for the appointment of Chemical Hygiene Officers and implementation of this Plan in their functional units.

1.3 Chemical Hygiene Officers

Each department or other administrative unit which uses laboratory chemicals must appoint a Chemical Hygiene Officer. The Chemical Hygiene Officer assists department chairs, principal investigators and laboratory supervisors in the implementation of the Chemical Hygiene Plan and unit-specific procedures by:

1.3.1 Working with laboratory supervisors to monitor and provide guidance for the safe procurement, use and disposal of chemicals.

1.3.2 Assisting with safety audits and training.

1.3.3 Assisting in the review of hazard assessments and engineering/process controls.

1.3.4 Assisting in the selection of protective equipment for laboratory workers.

1.3.5 Serving on the Chemical Hygiene Officers' Committee.

1.4 **Chemical Hygiene Officers' Committee**

The Chemical Hygiene Officers' Committee is comprised of all Departmental Chemical Hygiene Officers and is responsible for:

1.4.1 Establishing goals and acceptable performance levels for chemical hygiene activities and Chemical Hygiene Officers.

1.4.2 Performing an annual assessment of the effectiveness of the Chemical Hygiene Plan.

1.4.3 Providing recommendations on the type(s) and frequency of Chemical Hygiene training.

1.4.4 Determining the necessity of changes related to the Chemical Hygiene Plans.

1.4.5 Promoting information exchange on chemical use, storage, and disposal.

1.5 University Chemical Hygiene Officer

The Department of Environmental Health and Safety designates the University Chemical Hygiene Officer, who is responsible for:

1.5.1 Review of all department or unit specific procedures to ensure they meet the goals and objectives of the University Chemical Hygiene Plan.

1.5.2 Provision of resources to support program goals such as chemical waste disposal, spill response, hazard assessment, exposure monitoring, chemical fume hood monitoring, and Chemical Hygiene training.

1.5.3 Advising departmental Chemical Hygiene officers on the current legal requirements concerning hazardous chemicals.

1.6 Laboratory Supervisors and/or Principal Investigators (PI)

The laboratory supervisor or PI:

1.6.1 Ensures implementation of the Chemical Hygiene Plans in compliance with the OSHA Lab Standard.

1.6.2 Maintains an inventory of hazardous chemicals or regulated substances in use in his or her laboratory, and provides lab workers ready access to material safety data sheets (MSDS).

1.6.3 Reports incidents with potential for exposures or environmental contamination to EH&S and the departmental Chemical Hygiene Officer.

1.6.4 Instructs lab workers in the conduct of lab procedures, in the handling of hazardous substances, and in the proper disposal of chemicals.

1.6.5 Ensures that engineering controls such as chemical fume hoods are used properly and are in good working order.

1.6.6 Ensures that appropriate personal protective equipment is available at no cost to staff and is in use.

1.6.7 Contacts EH&S to arrange for workplace air sampling, wipe sampling or other monitoring in response to potential exposures as required.

1.6.8 Encourages lab personnel to maintain cleanliness and minimize clutter in the lab.

1.6.9 Ensures all teaching assistants and **students** are aware of the chemical, health, and safety hazards they may encounter in the laboratory. Students in the lab must follow procedures outlined in this Plan. Teaching assistants ensure that students follow established procedures and maintain safety in the lab.

1.7 Laboratory Workers

Faculty and staff working in laboratories are subject to the requirements of this Chemical Hygiene Plan and to lab-specific procedures as directed by a laboratory supervisor. All laboratory workers must:

1.7.1 Attend required Chemical Hygiene training within 30 days of appointment to a position using chemicals in a lab and every three years thereafter.

1.7.2 Consult with the lab supervisor before initiating unfamiliar, non-standard, or hazardous laboratory procedures.

1.7.3 Understand the function and use of protective equipment.

1.7.4 Use all available safety devices and engineering controls.

1.7.5 Consult the MSDS before handling a chemical with which they are not familiar.

1.7.6 Immediately report to their supervisors any problems, accidents or observations regarding chemical health and safety.

1.8 University Support Services

1.8.1 Facilities Management maintains engineering control systems according to required specifications, tests safety showers, and maintains safety showers and eye washes.

1.8.2 Purchasing transfers any MSDS and other hazardous chemical information to the purchaser and to the Department of Environmental Health and Safety.

1.8.3 Human Resources maintains demographic information on employees covered by the Plan and supports the administration of training programs.

2. GENERAL GUIDELINES FOR HANDLING HAZARDOUS CHEMICALS

2.1 It is possible to handle all chemicals safely, especially in a controlled laboratory environment. Understand the potential hazards associated with materials and procedures in your lab. Obtain and review Material Safety Data Sheets (MSDS) before using chemicals.

2.2 Ensure that necessary supplies and equipment are available for handling small spills. See procedures in following section. Also, know emergency numbers of the University (x4-2121) and basic emergency response actions. A basic chemical spill procedure should be posted in each lab or area where chemicals are handled.

2.3 Know the location and proper use of safety equipment such as emergency showers, eye wash stations, fire extinguishers, and fire alarms. In the event of skin or eye contact with chemicals, immediately flush the area of contact with cool water for 15 minutes. Remove affected clothing. Get medical help by calling x4-2121.

2.4 Do not work alone in the laboratory if you are working with chemicals.

2.5 Purchase minimum amounts of hazardous materials necessary to accomplish work and dispense only amounts necessary for immediate use.

2.6 Use hazardous materials only as directed and for their intended purpose.

2.7 Never smell or taste any chemical as a means of identification.

2.8 Avoid direct contact with any chemical. Use engineering controls (such as certified fume hoods) or personal protective equipment to avoid exposure.

2.9 Smoking, drinking, eating, the storage of foodstuffs, and the application of cosmetics are forbidden in areas where chemicals are in use.

2.10 The American Chemical Society and the University of Pittsburgh recommend that all chemicals be dated upon delivery to the laboratory, and be checked for integrity on an annual basis at a minimum.

2.11 Label all secondary containers with a common name or chemical description.

2.12 Store chemicals in compatible categories, not alphabetically.

2.13 DO NOT USE damaged, cracked, or badly scratched glassware.

2.14 Never use mouth suction for pipetting or to start a siphon.

2.15 Wash hands immediately after working with chemicals.

2.16 Only trained personnel are permitted to handle hazardous chemicals in the lab.

3. GENERAL CHEMICAL SPILL PROCEDURE

3.1 Evaluate the Spill

a. Determine the hazards associated with the spilled material. For example, is the material corrosive, flammable, toxic, or explosive?

b. Identify all materials by common or chemical name.

c. Estimate how much is spilled.

d. Evaluate the degree of danger to employees, students, or visitors.

e. Evaluate the degree of danger to equipment or property.

3.2 Contain the spill if safe to do so. Utilize absorbent pads and other materials or action designed to prevent the spilled material from spreading and causing increased damage.

3.3 Evacuate the area if the spill cannot be contained, or if the spilled material produces irritating odors, flammable vapors or explosive vapors (extinguish all sparks or ignition sources).

3.4 Clean up the spilled material.

a. Large spills (> 1 gallon) of toxic, corrosive or flammable materials shall be handled by EH&S. Immediately call the Emergency Telephone Number (Oakland 412-624-2121). Have the following information available:

- Your name and phone number.
- Location of spill.
- Description of what was spilled (state any compounds which may form toxic compounds).
- Any steps you have taken to control the spill.
- Any injuries that have occurred.

b. Spills of acids, bases, and flammables (less than one gallon) can be cleaned up by laboratory personnel using appropriate neutralizers/absorbents and proper personal protective equipment. If assistance is requested, contact EH&S.

c. Spills of innocuous material can be cleaned up by laboratory personnel or equipped staff.

3.5 Dispose of all contaminated materials through the University Chemical Waste Program.

3.6 Employees who have been exposed to hazardous chemicals due to a spill or other uncontrolled situation shall promptly report to the UPMC Presbyterian Emergency Room. A Report of Incident shall be completed by the individual’s supervisor.

3.7 Consult EH&S with any questions regarding chemical spills and spill clean up.

4. TOXIC MATERIALS

4.1 Acutely toxic materials are characterized by prompt (or slightly delayed) health effects, such as burns, allergic reactions, respiratory irritation, and immediate damage to organs such as the skin and eyes.

4.1.1 ANY chemical whose properties are unknown should be treated as though it is acutely toxic.

4.1.2 Those materials defined as "poisons" due to possessing one (or more) of the following toxicological parameters:

a) Oral LD_{50} of 50 mg/Kg or less.

b) Dermal LD_{50} of 200 mg/Kg or less.

c) Inhalation LC_{50} 2 mg/L or 200 ppm or less.

4.2 The effects of exposures to chronically toxic materials occur over a longer period of time and are characterized by cumulative damage to organs or organ systems. (For the purpose of this discussion, carcinogenic and reproductive hazards are not included. See following sections) Chemicals which are defined here as chronic toxins include hepatotoxins (e.g., carbon tetrachloride, vinyl chloride), nephrotoxins (e.g., ethylene glycol), neurotoxins (e.g., acrylamide), agents which act on the hematopoietic system (e.g., benzene), and others affecting specific organs.

4.3 Precautions Specific to Toxic Material

4.3.1 Use and store toxic substances only in designated (or restricted) areas, preferably under a negative pressure with respect to the rest of the building, and in the smallest amounts possible. Post the room or area with appropriate warning signs to restrict entry, as necessary.

4.3.2 Use toxins in a certified chemical fume hood, glove box, or other containment device.

4.3.3 Store toxic chemicals in original containers only. Secondary containers should be avoided for toxic chemicals.

4.3.4 Store and transport toxic chemicals in secondary containment trays;

4.3.5 Thoroughly decontaminate or dispose of contaminated clothing or shoes as chemical waste. Contaminated washes and materials from experiments should be decontaminated chemically and stored in closed, suitable, labeled, impervious containers.

4.3.6 Protect vacuum pumps against contamination by using scrubbers or suitable filters. Decontaminate vacuum pumps, glassware or other equipment before removing it from the designated (or restricted) area.

4.3.7 Wet mop or HEPA-vacuum [High Efficiency Particulate Air Filter] to decontaminate surfaces; do not dry sweep.

4.3.8 If using toxicologically-significant quantities (amount depends on the substance) on a regular basis, contact your department's Chemical Hygiene Officer so that, in conjunction with the Department of Environmental Health and Safety, a determination on required medical surveillance can be made.

5. CARCINOGENIC AND REPRODUCTIVE HAZARDS

5.1 Carcinogens are substances capable of producing cancer in mammals and are regulated by OSHA as a carcinogen, listed by the National Toxicology Program (NTP) as a carcinogen (or potential carcinogen) in its most recent Annual Report on Carcinogens, and/or listed by the International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen. Updated lists are available from the Department of Environmental Health and Safety. Carcinogens currently in common use at the University include bromodeoxyuridine (BrDU), acrylamide, chemotherapy agents, and formaldehyde.

5.2 Reproductive toxins are substances that affect either male or female reproductive systems or capabilities and include agents which damage the genetic material (mutagens) or the developing fetus (teratogens). See the University SOP for Reproductive Hazards found in this Manual. Reproductive toxins currently in common use at the University include ethidium bromide and acrolein.

6. FLAMMABLES AND COMBUSTIBLES

Flammable and combustible materials are those chemicals which generate sufficient vapors to cause a fire when an ignition source is present. The minimum temperature at which a liquid gives off sufficient vapor to allow ignition is the “flashpoint.” See the Fire Safety portion of this Manual for specific guidelines on flammable and combustible liquids, metals, and gases.

7. CORROSIVES

7.1 Corrosive chemicals are those substances that, by direct chemical action, cause visible destruction or irreversible alterations of living tissue or deterioration of metal surfaces. Corrosive liquids and solids are responsible for many injuries in the lab. Corrosive gases are also serious hazards because they can be readily absorbed into the body by skin contact, inhalation, or eye contact.

7.2 Some categories of corrosive liquids include inorganic acids (e.g., hydrochloric [muriatic], nitric, sulfuric), organic acids (e.g., acetic, butyric, formic), inorganic basic solutions (e.g., ammonia, sodium hydroxide), other inorganics (e.g., bromine, phosphorous trichloride) organic basis solutions (e.g. triethylamine), and other organics (e.g., acetic anhydride, liquified phenol).

7.3 Precautions Specific to Corrosive Chemicals

7.3.1 Eye protection and gloves appropriate for the material to be handled should always be worn when handling corrosive materials. Depending on the type of operation, and quantity of chemicals(s) used, a faceshield and impervious apron/boots may also be appropriate.

7.3.2 An eyewash and/or safety shower must be readily accessible to areas where corrosives are used and stored.

7.3.3 Dehydrating agents such as sulfuric acid, phosphorous pentoxide, and calcium oxide should be mixed with water by adding the agent to water to avoid violent reaction and spattering.

7.3.4 Strong oxidizing agents such as chromic and perchloric acids should be clearly labeled, stored and used in glass or other inert containers. Corks and rubber stoppers should not be used.

7.3.5 Acids and bases must be stored separately.

7.3.6 To transport strong acids and bases from location to location, use safety rubber bottle carriers or non-breakable PVC-coated bottles.

8. PEROXIDE FORMERS

Chemicals which react with oxygen to make peroxides form materials that can explode with impact, heat or friction. Peroxide-forming compounds can be divided into three hazard categories based on method of reaction and storage time. A partial list is presented in the Standard Operating Procedures for Peroxide Formers found in this Manual.

9. REACTIVE CHEMICALS

Reactive chemicals are substances which may undergo a variety of violent reactions with the spontaneous liberation of heat and/or gases in such a rapid fashion that safe dissipation is not possible. This category includes explosives, oxidizers, reducers, water/acid/air sensitive and unstable chemicals. These substances are capable of producing toxic gases or explosive mixtures, being explosive themselves, reacting with water violently, or they may contain cyanide or sulfide. The reactivity of individual chemicals in specific chemical classes varies considerably and may be substantially modified by aging or contamination.

9.1 Class I Reactive Chemicals are normally unstable and may readily undergo violent change without a detonator.

9.1.1 Pyrophoric chemicals (e.g., phosphorous, metal powders of magnesium, aluminum and zinc) will undergo spontaneous ignition in contact with air. Store in inert environments and prevent contact with air or water.

9.1.2 Polymerizable chemicals (e.g., divinyl benzene and acrylonitrile) will undergo spontaneous polymerization in contact with air. Such materials should be kept cool, and be stored or utilized away from moisture and water.

9.1.3 Chemicals classified as oxidizers (e.g., perchloric and chromic acids) will undergo violent reactions when in contact with organic materials or strong reducing agents. Hazards can be minimized by using and storing minimal amounts, emphasizing proper storage away from organic and flammable materials, and reducing chemicals.

9.2 Class II Reactive Chemicals react violently with water. Examples include chlorosulfonic acid, acetyl halides, phosphorous trioxide and titanium tetrachloride. Obviously, these chemicals should be kept away from water, and handled in laboratory fume hoods. Most of these materials are corrosive, as are their decomposition products, so appropriate personal protective equipment must be worn.

9.3 Class III Reactive Chemicals decompose violently in water with evolution of heat and flammable gases. Examples include alkali metals, alkaline earth metals, metal hydrides and metal nitrides. While avoiding contact with water, ensure that ventilation is adequate to disperse any evolved flammable gases. As water may accelerate the fire, dry sand should be used to smother the chemicals.

9.4 Class IV Reactive Chemicals react rapidly with water, generating acutely toxic gases or vapors. Typical chemicals in this class include alkaline metal phosphides and isocyanates. Use these materials with adequate ventilation and prevent contact with water.

9.5 Class V Reactive Chemicals such as metal cyanide salts, organic cyanide compounds, metal sulfide salts, and organic sulfides/mercaptans are acid-sensitive and may produce extremely toxic hydrogen cyanide and hydrogen sulfide gases on contact with acids. The same effect may occur with materials which form acids in the presence of moisture or liquid water. Provide adequate ventilation to minimize the severe inhalation hazard of hydrogen cyanide and hydrogen sulfide. Do not store in cabinets with acids, oxidizers and other reactive chemicals.

9.6 Class VI Reactive Chemicals can detonate or explode if heated above ambient temperature or if exposed to an ignition source. Examples include sodium amide, metal azides, brominated organic compounds, organic perchlorates and ammonium nitrate and chlorate.

9.7 Class VII Reactive Chemicals such as organic azides, some metal azides, benzoyl peroxide and peroxidized ethers may detonate or decompose explosively under ambient temperature and pressure, without any external ignition source. Materials in this class should only be handled by experienced and trained individuals, after consulting the MSDS and the Department of Environmental Health and Safety.

9.8 Class VIII Reactive Chemicals are explosive materials that should be handled by experienced and properly equipped personnel. Class A explosives include TNT, mercury fulminate and diazo-dinitrophenol. Class B explosives (49 CFR 173.88) include stabilized nitrocellulose and nitroglycerin. Forbidden reactive chemicals include diethylene glycol dinitrate, unstabilized nitroglycerin and unstabilized nitrocellulose.

10. PROCUREMENT OF CHEMICALS

All chemicals will be procured through the University Purchasing Department in the smallest quantity consistent with the intended use. If chemicals are to be transferred to the University from another individual or institution, prior approval must be obtained from the Department of Environmental Health and Safety.

11. PROCUREMENT AND USE OF RADIOISOTOPES

The Laboratory Supervisor must submit all proposed uses of radioisotopes to the Radiation Safety Committee for approval. The Radiation Safety Office must approve all purchases and transfers of radioactive materials. Contact the Radiation Safety Office (624-2728) for details.

12. DISTRIBUTION AND TRANSPORT OF CHEMICALS

12.1 Always transport chemicals in carry buckets or on a wheeled cart with raised edges to serve as secondary containment.

12.2 If no freight elevator is available, chemicals may be transported on a passenger elevator with extreme caution. When possible, isolate the elevator from public use while transporting chemicals.

12.3 Transport all chemical containers "closed" so that no vapors are released to the atmosphere.

12.4 Transport compressed gas cylinders using a hand truck specifically designed for that purpose and use a suitable strap, chain or other restraint during transportation. Compressed gas cylinders must be restrained with suitable racks, straps, chains or stands immediately upon delivery.

12.5 Any chemicals shipped from the University must be:

a) Appropriately packaged labeled per Department of Transportation requirements.

b) All personnel preparing shipments containing chemicals (e.g. dry ice or formalin) must be certified. Certification is available through EH&S training.

c) Any chemical shipped from the University must be accompanied by a signed and completed Material Transfer Agreement.

13. CHEMICAL STORAGE

13.1 Before storing any hazardous material, read the label and MSDS for more specific instructions on storage and handling.

13.2 Each laboratory must maintain a current inventory of chemicals.

13.3 Chemical storage rooms and areas must be posted with signage that indicates the significant hazards of stored chemicals.

13.4 Store chemical containers "closed" at all times so that no vapors are released to the atmosphere exemptions must be made for vessels whose contents place the vessel under pressure. Vessels with pressure-relief caps should be utilized in these instances for storage.

13.5 As a general rule, avoid storing chemicals on the floor or above eye level.

13.6 Chemicals must only be stored in compatible groups. Only segregated chemicals can be stored alphabetically. Incompatible groups of chemicals must not be stored in close proximity to one another.

13.6.1 Compatibility Families of Inorganic Chemicals

1. Metals, hydrides.
2. Halides, sulfates, sulfites, thiosulfates, phosphates, halogens.
3. Amides, nitrates*, nitrites*, azides*, nitric acid.
4. Hydroxides, oxides, silicates, carbonates.
5. Sulfides, selenides, phosphides, carbides, nitrides.
6. Chlorates, perchlorates*, perchloric acid*, hypochlorites, peroxides*, hydrogen peroxide.
7. Arsenates, cyanides, cyanates.
8. Borates, chromates, (per) manganates.
9. Acids (except nitric).
10. Sulfur, phosphorous, arsenic, phosphorous pentoxide*.

*These chemicals deserve special attention due to their potential instability.

13.6.2 Compatibility Families of Organic Chemicals

1. Acids, anhydrides, peracids.
2. Alcohols, glycols, amines, amides, imines, imides.
3. Hydrocarbons, esters, aldehydes.

4. Ethers*, ketones, ketenes, halogenated hydrocarbons, ethylene oxide.
5. Epoxy compounds, isocyanates.
6. Peroxides*, hydroperoxides*, azides*.
7. Sulfides, nitriles.
8. Phenols, cresols.

*These chemicals deserve special attention due to their potential instability.

14. ELIMINATION, MINIMIZATION, OR SUBSTITUTION

When evaluating or re-evaluating an experiment, process or operation, investigate the possibility of eliminating the use of hazardous materials, substituting a less hazardous chemical, or minimizing the volume of hazardous chemicals used. For example, one may be able to wash glassware with an aqueous-based detergent instead of an organic solvent or chromic acid-based material. One can replace known highly toxic materials (e.g., benzene, n-hexane, chlorinated hydrocarbons) with analogous materials which are less toxic (e.g., xylene, isohexane, n-methyl pyrrolidone). Also, microscale techniques should be used whenever possible. Closed vessels should always be used in lieu of open vessels, when feasible.

15. CONTROL MEASURES AND EQUIPMENT

The preferred method of minimizing employee exposure to hazardous materials is through the use of engineering controls. Principal investigators, laboratory supervisors and chemical users should maintain a continual awareness of the specific hazards associated with the chemicals being used. Once engineering controls are implemented, users must follow established procedures and utilize the engineering controls. Users must promptly report to building management any malfunctions or local alarm conditions associated with installed engineering controls.

15.1 Laboratory Fume Hoods

Laboratory fume hoods (aka chemical fume hoods) are engineering controls designed to protect lab personnel from release of airborne chemical contaminants. A secondary purpose is to protect people and property against small fires and explosions.

15.1.1 The primary measure of a hood's efficacy is its face velocity, measured in linear feet per minute (lfpm) through the open sash. Most chemical fume hoods at the University are designed to operate at 100 lfpm with an 18” sash opening.

15.1.2 All chemical fume hoods should be equipped with a manometer or other hood monitor at the time of new installation, or at the time of renovation for existing chemical fume hoods. This monitor should be used continually to check proper hood function. In the event of monitor malfunction, contact EH&S.

15.1.3 Chemical fume hoods are safety backup devices for condensers, traps and other devices that collect vapors and fumes. Never use a fume hood to "dispose" of chemicals by evaporation.

15.1.4 Only apparatus and chemicals essential to the specific procedure or process should be placed in the hood. Do not use hoods for extended chemical storage.

15.1.5 The work or apparatus inside the hood should be placed at least six inches inside the hood. Also, air baffles inside fume hoods must remain clear of obstructions for proper air flow and protection.

15.1.6 Never remove hood sashes.

15.1.7 Replace cracked or damaged hood sashes promptly.

15.1.8 In the event of power failure or other hood failure, stop work, cover or close all chemicals, close the sash on the hood, and notify a supervisor.

15.1.9 All chemical fume hoods must be certified annually for proper operational air flow by the Department of Environmental Health and Safety or designee. PI's or supervisors are responsible to report hoods that are delinquent for annual certification to EH&S.

15.2 Chemical Use Areas

The potential for employee exposure to hazardous chemicals is greatly reduced by restricting the use of chemicals to a designated area equipped with the proper control devices. This designated area can be a glove box, fume hood, bench or an entire laboratory depending on the manipulations required.

15.3 Fire Safety Equipment

15.3.1 Each laboratory must have access to fire extinguishers capable of extinguishing the type of fire that may be generated by the materials used in the lab.

15.3.2 The Department of Environmental Health and Safety arranges annual fire extinguisher inspections by a qualified professional.

NOTE: See the Fire Safety and General Lab Safety sections of this manual for more information.

15.4 Emergency Showers and Eye Wash Stations

15.4.1 Eye wash stations and emergency showers must be accessible to work areas where the potential for eye or skin exposure to corrosive materials exists.

15.4.2 All lab personnel must be instructed by their supervisor on the location and use of this equipment.

15.4.3 Lab personnel should ensure that access to eye wash stations and emergency showers is not restricted or blocked. No electrical appliance should be permitted within the spray area of an eyewash/safety station.

15.4.4 Eye wash stations should be flushed at least weekly by lab personnel. Malfunctioning eye wash stations should be reported immediately to building management. This weekly flushing must be documented by lab personnel.

16. CHEMICAL EXPOSURE

If an overexposure to chemicals is suspected, report immediately to your supervisor. An exposure assessment must be performed by the supervisor. The Department of Environmental Health and Safety can be consulted by the Laboratory Supervisor or Chemical Hygiene Officer in any instance where overexposure is suspected. If assessment indicates that an employee could have been exposed to a hazardous chemical in a manner that may have caused harm, a medical consultation (and possibly a subsequent examination) at no cost to the employee is to be performed at Employee Health Services, Room 500.59 Medical Arts Building, 3708 Fifth Avenue.

17. LABELS

17.1 Labels are required on all containers in the lab.

17.2 A proper label must identify the material in the container. When possible, use a common name in English and avoid formulas and abbreviations.

17.3 Unlabeled chemicals should be handled as hazardous waste. All containers of chemical waste must be labeled in accordance with University of Pittsburgh guidelines.

17.4 Chemicals synthesized or developed in the laboratory must be assumed to be toxic if no data are available. Suitable handling procedures must be prepared and implemented. All containers of chemicals prepared in the laboratory must be marked with the chemical name, primary hazard(s) [if known], the responsible person(s) and the date.

18. SIGNS

18.1 Each laboratory entrance must be posted with a room number and emergency notification signs that contain contact names and emergency phone numbers. These signs must also list the significant hazards found in that lab. Laboratory supervisors are required to request the necessary signage from the Department of Environmental Health and Safety, and ensure these signs are conspicuously posted at each lab entrance. See the laboratory signage section of this Manual.

18.2 Hazard signs warning of severe or unusual hazards such as unstable chemicals, lasers, radioactive and biohazard agents must also be posted at lab entrances and/or on specific equipment or areas housing such hazards.

19. MATERIAL SAFETY DATA SHEETS

Material safety data sheets should be obtained and reviewed for each chemical **before** use in the laboratory. Electronic MSDS are available through the Department of Environmental Health and Safety. If chemicals developed in University laboratories are to be provided to another user outside of the lab, a material safety data sheet and label must be prepared. Consult EH&S for proper format of MSDS.

20 CHEMICAL HYGIENE TRAINING

20.1 The University requires that employees be informed of the presence of hazardous chemicals when assigned to a work area and prior to new exposure situations (i.e., those situations involving new hazardous chemicals and/or new work procedures). Such training is to be provided by the department in conjunction with laboratory supervisors.

20.2 All individuals working in University labs must attend Chemical Hygiene Training within 30 days of employment. Refresher training is required every three years. This training can be completed on-line at www.ehs.pitt.edu. Only faculty may complete the initial Chemical Hygiene training on-line.

21. CHEMICAL WASTE

When a material has no further use and has been declared excess or a waste by the user, it must be clearly labeled as a waste. The responsibility for the identification and handling of hazardous waste within the University rests with the individuals who have created the waste. The Department of Environmental Health and Safety is available to provide technical guidance, assistance and information.

21.1 The Environmental Protection Agency (EPA) regulates hazardous waste management with statutes found in 40 CFR 260-270. A material can be defined as a hazardous waste either because of its general characteristics or because of a specific listing.

21.1.1 Ignitability (EPA Code D001) describes:

- Liquids with a flashpoint below 60^{o}C (140^{o}F)--e.g., most organic solvents such as methanol, ethanol, isopropanal, and xylene.
- Solids capable of causing fire by friction, absorption of moisture, or spontaneous chemical change and when ignited burn vigorously and persistently to create a hazard (e.g., picric acid).
- Flammable, compressed gasses (e.g., hydrogen, methane).
- Oxidizers (e.g., potassium permanganate).

21.1.2 Corrosivity (EPA Code D002) describes:

- Aqueous solutions with pH less than 2 or greater than 12.5.
- Liquids capable of corroding steel at a specific rate.

21.1.3 Reactivity (EPA Code D003) describes:

- Substances that react with water violently and may produce toxic gases (e.g., potassium, sodium).
- Substances that are normally unstable.
- Chemicals containing cyanide or sulfide that generate toxic gases.
- Capable of detonation when exposed to an initiating source or to heat under confinement.

21.1.4 Toxicity (EPA Code D Series) describes:

- Wastes which contain one or more certain heavy metals (e.g. silver, cadmium, mercury), and/or one or more of 23 organics and 8 pesticides as determined by the Toxicity Characteristic Leaching Procedure (e.g. benzene, DDT).

21.1.5 Some 500+ materials are specifically listed by EPA as hazardous waste on the EPA "D", "F", "P" and "U" lists. Contact EH&S with any questions regarding chemical waste..

21.2 In order to comply with federal regulations and personnel safety requirements, it is important that "unknowns" not be generated. The generation of such materials can be avoided by labeling **all** containers of chemicals or reaction mixtures.

21.3 Mixed wastes are biological and/or radioactive wastes that are also chemical wastes. Biological and radioactive wastes have disposal procedures which differ dramatically from those associated with hazardous wastes, and the disposal of mixed wastes typically presents unusual problems. Every effort should be made to avoid the generation of mixed wastes. If mixed wastes are generated, EH&S must be contacted to determine appropriate disposal procedures.

21.4 Hazardous waste should be collected in a container that is in sound condition and appropriate for the waste type. Containers should not be overfilled and must be capped with a screw-type cap. All containers must be labeled to characterize the contents, provide the date of first use, name of generator, and contain the word "waste" on the label.

21.4.1 Specific Container Selection

- Flammable liquids: glass bottles, steel cans, high density plastic containers.
- Concentrated acids and bases: 2.5 liter "acid" bottles, no metal.
- Aqueous solutions: glass/sturdy plastic bottles, plastic cans.
- Trace contaminated solid wastes: double 4-6 mil polyethylene bags.
- Hydrofluoric acid: plastic container with plastic screw-type cap.

21.5 Collecting and Commingling Hazardous Waste

21.5.1 If different chemical wastes are mixed together in a single container for disposal (commingling), then the same type of chemicals must be mixed together to make a common segregation group (see below). Only compatible chemicals may be mixed together within segregation groups.

21.5.2 Collect these types of hazardous wastes separately from each other (examples included);

1. Halogenated -- e.g. chloroform, methylene chloride.
2. Hydrocarbon -- e.g. xylene, ether, hexane, acetone.
3. Nitrogeneous -- e.g. triethylamine, diisopropylamine.
4. Sulfurous -- e.g. dimethylsulfoxide, dimethylsulfate.
5. Corrosive -- e.g. sulfuric acid.
6. Aqueous solutions -- e.g. diaminobenzidine, ethidium bromide, heavy metals.
7. Oils -- e.g. motor oil, pump oil.
8. Solid lab wastes such as gels containing acrylamide and ethidium bromide.

21.5.3 Care should be taken not to mix wastes which will react with each other, even if they are within the same compatibility group (e.g. although acids and bases are both corrosives, they should not be mixed in the same container except under controlled conditions by experienced personnel).

21.6 The following labeling procedures should always be adhered to:

21.6.1 Only labels supplied by the Department of Environmental Health and Safety are acceptable for containers of excess chemicals.

21.6.2 Each container must have a label once waste is first placed in the container.

21.6.3 Fill out the label in pencil (due to chemical resistance).

21.6.4 Include name, room number, building, department and date of first entry.

21.6.5 List **all** components of commingled waste. Do not use formulas, abbreviations, or nomenclature, if feasible.

21.6.6 Record pH of aqueous wastes.

21.6.7 Do not cover original container labels with University chemical waste label, if possible.

21.7 Laboratories must not accumulate chemical wastes for more than 30 days before placing it in a designated University hazardous waste pick-up area.

21.8 One of the University's high priority goals is to reduce the amount of hazardous waste generated. Benefits of waste reduction include increased safety of personnel, reduced environmental contamination, and decreases in expenditures.

HAZARD COMMUNICATION PROGRAM

Nearly every workplace contains chemicals which pose potential health problems to employees if exposure occurs in a concentration or in a manner not prescribed. The University of Pittsburgh recognizes its responsibility to provide all employees that are potentially exposed to hazardous chemicals with the necessary tools to protect themselves.

This University of Pittsburgh Hazard Communication Program has been developed and is administered by the Department of Environmental Health and Safety (EH&S). The purpose of this Program is to:

- Identify hazardous chemicals in the workplace
- Evaluate the potential hazards of chemicals to which employees may be exposed
- Communicate hazard information
- Identify protective measures for faculty, staff, and students
- Insure availability of Material Safety Data Sheets
- Educate employees

1. LISTS OF HAZARDOUS CHEMICALS IN THE WORKPLACE

At the University of Pittsburgh, individual work sites, laboratories or departments are responsible for maintaining chemical inventory lists of hazardous chemicals. Where possible, lists should be maintained on a computer database for ease of access and updating. Copies of the list must be available for the employee who may be potentially exposed to a hazardous chemical.

2. HAZARD EVALUATION

Chemical manufacturers and importers are required by OSHA to review available scientific evidence concerning the hazards of the chemicals they produce or import, and to report the information to employers who distribute or use their products. Downstream employers, such as the University of Pittsburgh, rely on those evaluations to determine the measures necessary to protect employees from potential hazards of any chemical.

3. LABELS AND OTHER FORMS OF WARNING

3.1 The University of Pittsburgh relies upon labeling provided by the manufacturer on newly purchased chemicals. It is the user department’s responsibility to assure that each chemical container in the workplace is labeled or tagged. This label must contain the identity of the chemical, hazard warnings appropriate for employee protection, and the name and address of the manufacturer or other responsible party (includes distributors or importers). Employees shall not remove or deface existing labels on incoming containers of hazardous substances.

3.2 Employees are not required to label portable containers into which hazardous chemicals are transferred (aka secondary containers) provided that the employee who makes the transfer remains in attendance with the secondary container and uses all of the contents during the work shift. When the hazardous chemical might remain in the container for use at a later time or by another individual, it must be properly labeled with the chemical name.

3.3 When a container is reused for another compatible hazardous chemical, the original label must be removed and the container relabeled to identify the new material. All containers should be labeled to identify their contents.

3.4 Fixed containers such as a storage tank must be labeled with the identity of the chemical it contains and the appropriate hazard warning. Alternative written identification systems for fixed containers may be implemented as long as they convey the same information.

3.5 The hazard warning can be any type of message, words, pictures, or symbols that provide general information regarding the hazards of the chemicals. Employees must be trained in the hazard warning system utilized. Widely accepted systems for hazard identification and labeling include;

ANSI Z129.1-2000: Hazardous Industrial Chemicals - Precautionary Labeling uses a word hierarchy, or **signal word** to convey levels of hazard. The three signal words are **DANGER, WARNING, and CAUTION.** The meaning of each signal word is provided below:

Signal Words for Chemical Hazards

SIGNAL WORD	GENERAL MEANING
DANGER!	**If this product gets in or on you, immediate harm will be caused.**
WARNING!	**If this product gets in or on you, in sufficient quantity, you will suffer harm.**
CAUTION!	**If this product gets in or on you in large quantity over an extended time, you may be harmed.**
The following is not a SIGNAL word, but does appear on a label to provide specific information.	
POISON! 	**This product will make you ill if it enters your body by any route of entry.**

Hazardous Material Identification System (HMIS) provides a 0-4 scale (0=low, 4=high) for health, flammability, and reactivity hazards. The "mode of entry" and "protective equipment" are depicted by a letter referring to a system of protective equipment. There are a number of variations to this type of labeling. An example of an HMIS label is provided below.

HMIS Hazard Rating Label

NFPA 704 - Standard System for the Identification of the Hazards of Materials for Emergency Response provides the following hazard rating for the Health, Flammability, and Reactivity classifications of chemicals:

Health Hazard Rating (BLUE on label)
4 - Lethal
3 - Serious or permanent injury
2 - Temporary incapacitation or residual injury
1 - Significant irritation
0 – No Hazard

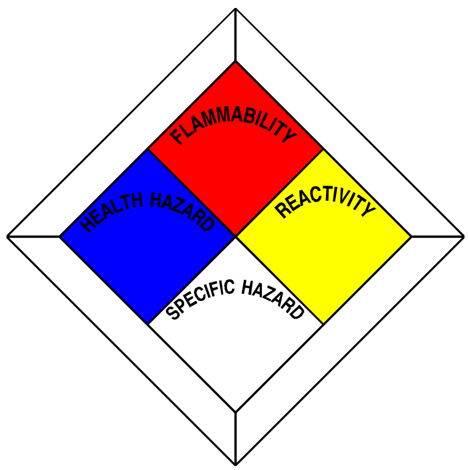
Flammability Hazard Rating (RED on label)
4 - Flash point below 73^{o}F
3 - Flash point 73^{o}F to 100^{o}F
2 - Flash point 100^{o}F to 200^{o}F
1 - Flash point greater than 200^{o}F
0 - Will not burn

Reactivity Hazard Rating (YELLOW on label)
4 - Capable of Detonation or Explosion
3 - Shock and heat may detonate

2 - Violent chemical change under increased heat or pressure
1 - Unstable under increased heat or pressure
0 - Stable

Specific Hazards (WHITE on label)
OX - Oxidizer
~~W~~ - Water Reactive (Use NO water)

NFPA Hazard Rating Symbol



4. MATERIAL SAFETY DATA SHEETS

4.1 A Material Safety Data Sheet (MSDS) is a document that provides information about the hazards of a chemical or product. State and Federal law requires that all chemical manufacturers, distributors and importers develop an MSDS for each hazardous chemical they produce or import, and provide the MSDS at the time of shipment to a chemical user, such as the University of Pittsburgh.

4.2 It is the responsibility of each manager or supervisor to maintain copies of or provide access to the MSDS for all hazardous chemicals used within their area. EH&S maintains a limited inventory of hard copy MSDS and provides these documents to managers and supervisors upon request. The primary method of accessing an MSDS at Pitt is through an electronic database. Links to these sites are available at www.ehs.pitt.edu . If you do not have access to an internet connection, you can request a copy of the MSDS for any chemical in your workplace through your supervisor, who can contact EH&S if necessary.

4.3 An MSDS provides the user with important information regarding the chemical they are about to use. The MSDS provides significantly more information than the container label.

4.4 MSDS should be requested for all hazardous chemicals ***prior*** to use in the workplace. All employee's have the right to review an MSDS before working with a hazardous chemical, and at any time that the chemical is present in the workplace.

4.5 MSDS vary in style but are required to contain the following information:

- Identity of the material as used on the label
- Chemical name of hazardous ingredient(s) present at greater than 1%, OR 0.1% for carcinogenic substances
- Exposure Limit Values, i.e. Permissible Exposure Limit (PEL) set by OSHA or the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists
- Physical and chemical properties
- Health hazards, including signs and symptoms of over exposure, and the individual health conditions that may be aggravated by exposure
- Primary routes of exposure
- Target organs
- Precautions for safe handling, including personal protective equipment
- Applicable control measures
- Emergency and first aid procedures
- Spill control or release mitigation actions
- Date
- Manufacturer's name, address, telephone and emergency contact information

5. EMPLOYEE INFORMATION AND TRAINING

5.1 Departments shall provide employees with information and training on hazardous chemicals used or stored in their work area at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

5.2 Departments shall furnish employees with an explanation of:

- Location of hazardous materials in the workplace.
- Methods and observations that may be used to detect the presence or release of hazardous chemicals in the work area.
- The physical and health hazards of the chemicals in the work area.
- The measures employees can take to protect themselves from these hazards.
- Location and availability of hazard communication information, such as this Program, site-specific chemical inventory list and MSDS.

5.3 EH&S includes general labeling and MSDS information as part of the Chemical Hygiene Training Program. This training is scheduled on a regular basis throughout the year and is posted on the EH&S website. Chemical Hygiene Training is from EH&S as an on-line module, and department or work site specific training can also be conducted by EH&S.

6. MEDICAL EMERGENCIES

For medical emergencies on the Pittsburgh Campus, call 412-624-2121.

Under certain circumstances, the manufacturer may withhold the specific chemical identity and other specific identification of a hazardous substance from the MSDS. However, chemical manufacturers and importers are required by OSHA to immediately disclose the specific chemical identity of a hazardous chemical to a treating physician or nurse when the information is needed for proper emergency or first-aid treatment. In the event of a chemical-related medical emergency, call the emergency number for your campus and proceed to your campus' designated medical center for treatment.

7. NON-ROUTINE TASKS

The department head, supervisor, PI or designee shall provide any person required to perform a non-routine task with appropriate hazard communication training and sufficient time to review appropriate hazard information prior to initiation of the task. This information should include MSDS's, labels, and any other appropriate hazard information. All tasks involving hazardous chemicals that are being used for the first time, or are only rarely used shall be considered non-routine tasks.

MATERIAL SAFETY DATA SHEET (MSDS) EXPLANATION, SAMPLE AND GLOSSARY

Material Safety Data Sheets (MSDS) are available through your supervisor or on-line at the Department of Environmental Health and Safety website. Call EH&S at 412-624-9505 for assistance, if necessary. OSHA specifies the information that must be included in English on an MSDS; formats will vary depending on manufacturer:

Section I. Chemical Identity

The chemical and common name(s) is provided for single chemical substances. An identity on the MSDS must be cross-referenced to the identity found on the label.

Section II. Hazardous Ingredients

For a chemical mixture that has been tested in whole to determine hazards, the chemical and common names of ingredients that are associated with the hazards, and the common name of the mixture is listed. If the mixture has not been tested as a whole, the chemical and common names of all ingredients determined to be health hazards and comprising 1% or greater of the composition is listed. Chemical and common names of carcinogens must be listed if they are present at levels of 0.1% or greater.

Section III. Physical and Chemical Characteristics

The physical and chemical characteristics of the product are listed. These include facts such as boiling and freezing points, density, vapor pressure, specific gravity, solubility, volatility, and the product's general appearance and odor.

Section IV. Fire and Explosion Hazard Data

The compound's potential for fire and explosion is described. The fire hazards of the chemical and conditions under which it could ignite or explode are identified along with recommended extinguishing agents and fire-fighting methods.

Section V. Reactivity Data

Substances that the chemical is not compatible with or reacts with are listed. Information on any hazardous decomposition products, such as carbon monoxide, is also included in this section.

Section VI. Health Hazards

The health hazards of the chemical, including signs and symptoms of exposure, are listed. Medical conditions that may be aggravated by exposure to the product are also listed.

The route of entry (i.e.the primary pathway by which the chemical enters the body) is provided. There are four principal routes of entry: inhalation, ingestion, injection, and skin absorption. The

MSDS also supplies exposure levels that are deemed unhealthful, as determined by standards or recommended by the manufacturer.

Section VII. Precautions for Safe Handling and Use

The precautions for safe handling and use of the product along with procedures for cleaning up spills are described.

Section VIII. Control Measures

Any applicable control measures for using the product, including engineering controls, safe handling procedures, and personal protective equipment are provided.

Sample MSDS for Acetone

Section 1 - Chemical Product and Company Identification

MSDS Name: Acetone
Catalog Numbers: 57025
Synonyms: Dimethylformaldehyde; Dimethyl ketone; 2-Propanone; Pyroacetic acid; Pyroacetic ether.
Company Identification:

For information, call: 800-524-0294
Emergency Number: 800-524-0294
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
67-64-1	Acetone	100.0	200-662-2

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless. Flash Point: -4 deg F. Causes respiratory tract irritation. Causes eye irritation. Breathing vapors may cause drowsiness and dizziness. Prolonged or repeated contact may dry the skin and cause irritation. **Danger!** Extremely flammable liquid and vapor. Vapor may cause flash fire.
Target Organs: Central nervous system, respiratory system, eyes, skin.

Potential Health Effects
Eye: Produces irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury.
Skin: May be absorbed through the skin. Repeated or prolonged exposure may cause drying and cracking of the skin.
Ingestion: May cause irritation of the digestive tract. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to

respiratory failure.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause motor incoordination and speech abnormalities.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic inhalation may cause effects similar to those of acute inhalation.

ection 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. May be ignited by heat, sparks, and flame. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water. Cool containers with flooding quantities of water until well after fire is out.
Flash Point: -4e deg F (-20.00 deg C)
Autoignition Temperature: 869 deg F (465.00 deg C)
Explosion Limits, Lower:2.5%
Upper: 12.8%
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

Section 6 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area.

Section 7 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Acetone	500 ppm TWA; 750 ppm STEL	250 ppm TWA; 590 mg/m3 TWA 2500 ppm IDLH	1000 ppm TWA; 2400 mg/m3 TWA

Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 8 - Physical and Chemical Properties

Physical State: Liquid
Appearance: colourless
Odor: acetone-like
pH: 7
Vapor Pressure: 180 mm Hg
Vapor Density: 2.0 (Air=1)
Evaporation Rate:7.7 (n-Butyl acetate=1)
Viscosity: Not available
Boiling Point: 133.2 deg F
Freezing/Melting Point:-139.6 deg F
Decomposition Temperature: Not available.
Solubility: Soluble.
Specific Gravity/Density:0.79 (Water=1)
Molecular Formula:C3H6O
Molecular Weight:58.08

Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid: High temperatures, ignition sources, temperatures above 220°C.
Incompatibilities with Other Materials: Strong acids, strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 67-64-1: AL3150000
LD50/LC50:
CAS# 67-64-1:

Carcinogenicity:
CAS# 67-64-1:
ACGIH: A4 - Not Classifiable as a Human Carcinogen
Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: TDLo(Oral, rat) = 273 gm/kg;Reproductive - Paternal Effects - spermatogenesis (incl. genetic material, sperm morphology, motility, and count).
Neurotoxicity: No information available.
Mutagenicity: Sex chromosome loss and nondisjunction(Yeast - Saccharomyces cerevisiae) = 47600 ppm; Cytogenetic analysis(Rodent - hamster Fibroblast)= 40 gm/L.
Other Studies: Standard Draize Test: Administration onto the skin (human) = 500 mg/7days (Mild). Standard Draize Test: Administrat ion onto the skin (rabbit) = 500 mg/24H (Mild). Standard D raize Test(Eye, Rabbit) = 20 mg; Severe.

Section 12 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 67-64-1: waste number U002 (Ignitable waste).

MSDS Creation Date: 7/26/1999
Revision #7 Date: 2/26/2002

MSDS Glossary

Action Level. The exposure level (concentration in air) at which OSHA regulations to protect employees takes effect (29 CFR 1910.1001-1047); e.g. workplace air analysis, employee training, medical monitoring, and recordkeeping. Exposure at or above action level is termed occupational exposure. Exposure below this level can also be harmful. This level is generally half the PEL.

Acute Exposure. Exposure of short duration, usually to relatively high concentrations or amounts of material.

Air Purifying Respirator - A respirator that uses chemical sorbents to remove specific gases and vapors from the air or that uses a mechanical filter to remove particulate matter. An air purifying respirator must only be used when there is sufficient oxygen to sustain life.

Allergen. A substance that causes an allergic reaction.

Allergy. A condition in which an initial symptomless exposure to a specific allergen later gives rise to a sensitivity to further exposure. Symptoms may be exhibited in a variety of ways, usually by respiratory distress or skin eruptions.

Asphyxiant. A vapor or gas that can cause unconsciousness or death by suffocation (lack of oxygen). Most simple asphyxiants are harmful to the body only when they become so concentrated that they reduce (displace) the available oxygen in the air (normally about 21%) to dangerous levels (18% or lower). Examples of simple asphyxiants are carbon dioxide, nitrogen, hydrogen, and helium. Chemical asphyxiants like carbon monoxide (CO) reduce the blood's ability to carry oxygen, or like cyanide, interfere with the body's utilization of oxygen.

Autoignition Temperature. The minimum temperature at which a substance ignites without application of a flame or spark. Do not heat materials to greater than 80% of this temperature.

Boiling Point, BP. The temperature at which a liquid's vapor pressure equals the surrounding atmospheric pressure so that the liquid rapidly vaporizes. Flammable materials with low BPs generally present special fire hazards [e.g. butane, BP = -0.5ºC (31ºF); gasoline, BP = 38ºC (100ºF)). For mixtures, a range of temperature is given.

Carcinogen. A material that either causes cancer in humans, or, because it causes cancer in animals, is considered capable of causing cancer in humans.

Ceiling Limit, C. The concentration not to exceed at any time. "An employee's exposure [to a hazardous material] shall at no time exceed the ceiling value" (OSHA).

Chronic Exposure. Continuous or intermittent exposure extending over a long time period, usually applies to relatively low material amounts or concentrations.

Chronic Health Effect. An adverse effect on a human or animal body with symptoms that develop slowly over a long time period and persist or that recur frequently. See Acute Health Effect.

Chronic Toxicity. A material's property that produces chronic health effects (see above), usually resulting from repeated doses of or exposure to the material over a relatively prolonged time period. Ordinarily used to denote effects noted in experimental animals.

Combustible. A term the NFPA, DOT, and others use to classify certain materials with low flash points that ignite easily. Both NFP A and DOT generally define combustible liquids as having a flash point of 38ºC (100ºF) but below 93.3ºC (200ºF).

Corrosive. A chemical that causes visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact, or that causes a severe corrosion rate in steel or aluminum.

Cryogenic. Relating to extremely low temperatures as for refrigerant gases

Engineering Controls. Engineering control systems reduce potential hazards by isolating the worker from the hazard or by removing the hazard from the work environment. Methods include substitution, ventilation, isolation, and enclosure. This is preferred over administrative controls and personal protective equipment.

Explosive. A material that produces a sudden, almost instantaneous release of pressure, gas, and heat when subjected to abrupt shock, pressure, or high temperature.

Exposure Limits. The concentration in workplace air of a chemical deemed the maximum acceptable. This means that most workers can be exposed at given levels or lower without harmful effects. Exposure limits in common use are: 1) TLV-TWA (threshold limit value-time-weighted average); 2) STEL (short-term exposure limit); and 3) C (ceiling value).

Flammable. Describes any solid, liquid, vapor, or gas that ignites easily and burns rapidly. Both NFPA and DOT generally define flammable liquids as having a flash point below 38ºC (100ºF)

Flammable Limits (Flammability Limits, Explosive Limits). Minimum and maximum concentrations of a flammable gas or vapor between which ignition can occur. Concentrations below the lower flammable limit (LFL) are too lean to burn, while concentrations above the upper flammable limit (UFL) are too rich. All concentrations between LFL and UFL are in the flammable range, and special precautions are needed to prevent ignition or explosion.

Flash Point(FP), Lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue. FP is determined by laboratory tests in cups.

Fume. An airborne dispersion of minute solid particles arising from the heating of a solid (such as molten metal, welding).

Gas. A formless fluid that occupies the space of its enclosure. It can settle to the bottom or top of an enclosure when mixed with other materials. It can be changed to its liquid or solid state only by increased pressure and/or decreased temperature.

General Ventilation (Also known as dilution ventilation). The removal of contaminated air and its replacement with clean air from the general workplace area as opposed to local ventilation, which is specific air changing in the immediate area of a contamination source. An example of local ventilation is a laboratory fume hood.

Hazard Communication. Requires chemical manufacturers and importers to assess the hazards associated with the materials in their workplace (29 CFR 1910.1200). Material safety data sheets, labeling, and training are all results of this law.

Hazardous Chemical, Material. In a broad sense, any substance or mixture of substances having properties capable of producing adverse effects on the health or safety of a human. Included are substances that are carcinogens, toxic, irritants, corrosives, sensitizers, and agents that damage the lungs, skin, eyes, mucous membranes, etc.

HEPA. High-efficiency particulate air filter. Has a 99.97% removal efficiency for .03-micron particles.

Incompatible. Describes materials that could cause dangerous reactions and the release of energy from direct contact with one another.

Irritant - A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.

Label. Any written, printed, or graphic sign or symbol displayed on or affixed to containers of hazardous chemicals. A label should identify the hazardous material, appropriate hazard warnings, and name and address of the chemical manufacturer, importer, or other responsible party.

Latency Period. Time that elapses between exposure and first manifestations of disease or illness. Latency periods can range from minutes to decades, depending on hazardous material and disease produced.

Local Ventilation. The drawing off of contaminated air directly from its source. This type of ventilation is recommended for hazardous airborne materials. Treatment of exhausted air to remove contaminants may be required.

Lower Explosive Limit, Lower Flammable Limit. Refers to the lowest concentration of gas or vapor (% by volume in air) that bums or explodes if an ignition source is present at ambient temperatures.

Material Safety Data Sheet. Also MSDS. Material safety data sheet. OSHA has established guidelines for descriptive data that should be concisely provided on a data sheet to serve as the basis for written hazard communication programs. The thrust of the law is to have those who make, distribute, and use hazardous materials responsible for effective communication.

Mutagen - A substance or agent capable of altering the genetic material in a living cell.

Neurotoxin - A material that affects the nerve cells and may produce emotional or behavioral abnormalities.

NFPA. National Fire Protection Association.

NIOSH. National Institute of Occupational Safety and Health.

Nonflammable. Incapable of easy ignition. Does not bum, or bums very slowly. Also, a DOT hazard class for any compressed gas other than a flammable one.

Nuisance Particulates. Dusts that do not produce significant organic disease or toxic effect from "reasonable" concentrations and exposures.

Odor Threshold. The lowest concentration of a material's vapor (or a gas) in air that is detectable by odor.

OSHA. The Occupational Safety and Health Administration. Part of the U.S. Department of Labor.

Oxidizer. The DOT defines an oxidizer or oxidizing material as a substance that yields oxygen readily to stimulate the combustion (oxidation) of organic matter. Chlorate (CIOI23), permanganate ($Mn0_4$), and nitrate (NO) compounds are examples of oxidizers. Note that they all contain large amounts of oxygen (0).

PEL. Permissible Exposure Limit. Established by OSHA. This may be expressed as a time-weighted average (TWA) limit, short-term exposure limit (STEL), or as a ceiling exposure limit. A ceiling limit must never be exceeded instantaneously even if the TWA exposure limit is not violated. OSHA PELs have the force of law. Note that ACGIH TLVs and NIOSH RELs are recommended exposure limits.

Physical Hazard. Means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, and organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Polymerization - A chemical reaction in which one or more small molecules combine to form larger molecules. A hazardous polymerization is such a reaction that takes place at a rate that releases large amounts of energy.

PPE. Personal protective equipment. Devices or clothing worn to help insulate a worker from direct exposure to hazardous materials. Example include gloves and respirators.

RCRA. *Resource Conservation and Recovery Act,* PL 94-580.

Reactivity. A substance's tendency to undergo chemical reaction either by itself or with other material with the release of energy. Undesirable effects such as pressure buildup, temperature increase, or formation of noxious, toxic, or corrosive by-products may occur because of the substance's reactivity to heating, burning, direct contact with other materials, or other conditions in use or in storage.

Reproductive Health Hazard/Toxin. Any agent with a harmful effect on the adult male or female reproductive systems or on the developing fetus or child. Such hazards affect people in many ways, including loss of sexual drive, mental disorders, impotence, infertility, sterility, mutagenic effects on germ cells, teratogenic effects on the fetus, and transplacental carcinogenesis.

Respirator. A variety of devices that limit inhalation of toxic materials. They range from disposable dust masks to self-contained breathing apparatus (SCBA). All have specific uses and limitations. Their use is covered by OSHA, 29 CFR 1910.134 See SCBA, Chemical Cartridge Respirator.

Routes of Entry. To do bodily damage, a material must contact the body. The method of bodily contact is called the route of entry. The routes of entry are: I) absorption (eye or skin contact); 2) ingestion; and 3) inhalation.

Synonyms. Alternative names by which a material may be known.

Spontaneously Combustible - A material that ignites as a result of retained heat from processing, or which will oxidize to generate heat and ignite, or which absorbs moisture to generate heat and ignite.

Target Organ Effects. Chemically-caused effects from exposure to a material on specific listed organs and systems such as liver, kidneys, nervous system, lungs, skin and eyes.

Teratogen - A substance or agent, exposure to which by a pregnant female can result in malformations in the fetus.

TLV. Threshold limit value. A term used to express the airborne concentration of a material to which most workers can be exposed during a normal daily and weekly schedule without adverse effects. ACGIH expresses TLV s in three ways: 1) TLV TWA, the allowable time-weighted average concentration for a normal 8-hour workday or 40-hour week; 2) TLV STEL, the short-term exposure limit or maximum concentration for a continuous exposure period of 15 minutes (with a maximum of four such periods per day, with at least 60 minutes between exposure periods, and provided that the daily TLV- TWA is not exceeded); and 3) Ceiling (C), the concentration not to exceed at any time.

Toxicology. The study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions. The basic assumption of toxicology is that there is a relationship among the dose (amount), the concentration at the affected site, and the resulting effects.

Toxic Substance. Any chemical or material that: 1) has evidence of an acute or chronic health hazard and 2) is listed in the NIOSH *Registry of Toxic Effects of Chemical Substances* (RTECS), provided that the substance causes harm at any dose level; causes cancer or reproductive effects in animals at any dose level; has a median lethal dose (LD_{50}) of less than 500 mg/kg of body weight when administered orally to rats; has a median LD_{50} of less than 1000 mg/kg of body weight when administered by continuous contact to the bare skin of albino rabbits; or has a median lethal concentration (LD_{50}) in air of less than 2000 ppm by volume of gas vapor, or less than 20 mg/L of mist, fume, or dust when administered to albino rats.

Upper Explosive Limit, Upper Flammable Limit. VEL, UFL. The highest concentration of a material in air that produces an explosion or fire, or that ignites when it contacts an ignition source (high heat, electric arc, spark, or flame). Any concentration above the UEL in air is too rich to be ignited. See Flammable Limits.

Vapor. The gaseous state of a material normally encountered as liquid.

Vapor density - The weight of a vapor or gas compared to the weight of an equal volume of air is an expression of the density of the vapor or gas.

VOC. Volatile organic compounds. Used in coatings and paint because they evaporate very rapidly. Regulated by the EPA per the *Clean Air Act.*

HAZARDOUS WASTE DISPOSAL PROCEDURES

These guidelines are intended to ensure that hazardous wastes generated on campus are properly disposed and managed according to federal regulations.

The United States Environmental Protection Agency (US EPA) regulates hazardous waste management with statutes found in 40 CFR 260-270. Environmental Health and Safety (EH&S) coordinates disposal of chemical waste from University facilities and operations. EH&S provides waste disposal services to the University community at no cost to the waste generator. Therefore, waste generators are encouraged to properly manage all of their chemical waste.

Some common wastes generated on campus include:

- Unused chemicals that are no longer needed
- Expired chemicals
- Process wastes
- Broken mercury thermometers, mercury containing devices, heavy metals
- Spent acids, bases, and solvents which are used in laboratory procedures
- Oil based paints, aerosol cans, pesticides
- Oils (motor, cutting, pump, lubricating, etc.)

The following guidelines apply to chemical wastes generated by University operations. These guidelines do not apply to biohazardous/red bag waste or radioactive wastes.

In order to properly manage waste chemicals, the waste generator should be familiar with:

1. **Hazardous waste characterization**
2. **Waste container management**
3. **Waste packaging**
4. **Proper labeling**
5. **University waste pick up procedures**

1. Hazardous Waste Characterization

1.1 Characteristic Hazardous Wastes

Wastes exhibiting any of the characteristics listed below are hazardous:

1.1.1 Ignitability (EPA Waste Code – D001)

- liquids with a flashpoint below 140° F
- solids capable under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard
- ignitable compressed gases
- oxidizers

1.1.2 Corrosivity (EPA Waste Code - D002)

- aqueous solutions with a pH ≤ 2 or pH ≥ 12.5
- liquids that corrode steel at a rate > ¼” per year at 130°F

1.1.3 Reactivity (EPA Waste Code – D003)

- a substance that is normally unstable and readily undergoes violent change without detonating
- a substance that reacts violently with water
- a substance that forms potentially explosive mixtures with water
- a substance, when mixed with water generates toxic gases, vapors or fumes
- a cyanide or sulfide bearing waste which generates toxic gases or vapors when exposed to pH conditions between 2 and 12.5
- a substance capable of detonation if heated under confinement
- a substance readily capable of detonation or decomposition at standard temperature and pressure
- a forbidden explosive

1.1.4 Toxicity (EPA Waste Codes D004 – D043)

- a waste that exhibits the characteristic of toxicity using the Toxicity Characteristic Leaching Procedure (TCLP) test. This characteristic group includes certain heavy metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) and/or one or more of 23 organics and eight pesticides.

1.2 Listed Hazardous Waste

There are over 500 individual materials that are specifically listed by the US EPA as listed hazardous waste.

1.2.1 F–Listed Hazardous Waste

- hazardous wastes from non-specific sources, including spent solvents

1.2.2 K–Listed Hazardous Waste

- hazardous wastes from specific sources

1.2.3 P–Listed (Acute) Hazardous Waste

- discarded commercial chemical products, off specification products, certain container residues and spill residues

1.2.4 U-Listed (Toxic) Hazardous Waste

- off-specification commercial chemical products, chemical intermediates, commercial chemical products

Once a material has no further use, it typically becomes subject to the hazardous waste regulations. Discharging wastes and chemicals to the sanitary sewer is strictly prohibited. Please contact EH&S to make a waste determination prior to discharging any chemicals to the sewer system.

1.3 Mixed Wastes

Mixed wastes are biological and/or radioactive wastes that are also hazardous chemical wastes. Biological and radioactive waste regulations differ from the regulations associated with hazardous wastes. Therefore, disposal of mixed wastes presents EH&S with a variety of disposal issues including more stringent regulations and substantial increases in disposal costs. Every effort should be made to avoid generating mixed wastes. If a mixed waste is generated, both EH&S and Radiation Safety should be contacted to determine appropriate disposal procedures.

2. Waste Container Management

All waste should be collected in a container that is in good condition and appropriate for the waste type. Containers which show signs of rust, dents, or deterioration should not be used. The container should be compatible with the material stored in it, and it should be capped at all times, except when adding wastes. Funnels should never be left in a waste container. Containers should be dated when they are filled. Full containers should not be stored in the laboratory for excessive periods of time.

Generally the original container is acceptable to be used to collect waste. If you generate large quantities of waste, a five gallon container may be used to collect the waste.

Containers should be closed at all times. Do not leave funnels in waste containers.

2.1 General Container Specifications

- the container should be in sound condition
- the outside of the container should be clean and uncontaminated
- the container and cap should be compatible with the waste
- the container should allow for proper headspace expansion; 1.5 inches for flat top containers, 3 inches for tapered containers
- the container should be labeled properly

2.2 Container Selection

- Flammable liquids: glass bottles, high density plastic containers
- Acids and bases: original “acid” or “base” bottles, no metal containers
- Aqueous solutions: glass bottles, high density plastic containers
- Trace contaminated solid waste: 4-6 mil polyethylene bags (double bagged)
- Hydrofluoric acid: plastic bottle with plastic screw-on cap

3. Packaging

3.1 Packaging

- Waste chemicals should be segregated and packed in sturdy cardboard boxes
- Five-gallon solvent containers do not need to be overpacked
- Packaging should be done to minimize the possibility of breakage or leakage during handling (all bottles should be tightly capped)
- Bottles should be placed upright in the box
- The space between the bottles should be filled with a cushioning material to prevent movement during handling (foam peanuts, newspaper, vermiculite)
- Do not place any Chemical Waste in Biological Waste containers (bags, boxes, etc.)
- All bottles, containers, or bags of waste should be individually labeled

- Total weight of each individual box should not exceed 35 pounds

4. Proper Labeling

All chemicals should be labeled and identified. Wastes should be accurately labeled to ensure safety, to prevent waste from becoming an unknown, for regulatory compliance, and to improve the efficiency of handling.
An orange "Waste Chemical" label should be filled out completely and placed on the bottle (do not cover the original label, where applicable).

4.1 Label Contents

The label should include the following:

- the common chemical name (no formulas, abbreviations or nomenclature)
- quantity of material
- name of person preparing the chemical for disposal, department name, and telephone number in case there are questions associated with the material
- enter the date on the label when the container is filled

Be sure to list all known individual chemical constituents for each container (do not label as "solvent waste", "halogenated waste", "solid waste", "aqueous waste", etc.).

4.2 Unknowns

Try to avoid generating "unknown" wastes by adhering to proper labeling procedures. If unknowns are discovered, it may be possible to determine the identity by:

- reviewing past and current projects being worked on in the laboratory
- asking questions to co-workers
- identifying the pH
- contacting EH&S for assistance with identification

5. University Waste Pick-up Procedures

The University is classified as a Large Quantity Generator (LQG), and is required to remove all generated wastes within 90 days. Therefore, laboratories should not accumulate wastes for more than 30 days before placing the waste in the designated pick-up area.

Waste chemicals are picked up from University buildings on a bi-weekly schedule. The schedule of pick-ups is every second Friday, starting at approximately 8:00 AM and proceeding until completion. In the event of a University holiday falling upon a pick-up day, the pick-up will be rescheduled for the preceding Wednesday.

Waste should be taken to the collection points prior to the scheduled pick-up. Contact EH&S for locations of designated collection points. If your building does not have a designated collection point, pick-up arrangements can be made by contacting EH&S.

Source Reduction/Waste Minimization

These guidelines are intended to ensure that chemical users on campus are aware of the importance of source reduction and waste minimization. Benefits of source reduction/waste minimization include increased safety of personnel, reduced risk of environmental contamination, and a decrease in waste disposal expenditures.

The University generates a significant quantity of chemical waste. EH&S has prepared and implemented a source reduction strategy which describes ways to reduce or eliminate the amount or toxicity of waste.

The following minimization activities are utilized to help reduce the amount and/or toxicity of wastes:

- **Product Substitution –** Use less hazardous or non-hazardous materials. Examples include substitution of enzymatic cleaners and detergents for chromic acid cleaning solutions, replacement of flammable and or toxic solvents with water based materials, replacing mercury thermometers with spirit filled or electronic thermometers, using latex paints in place of oil-based paints.
- **Microscale Chemistry –** Scale down techniques where possible to reduce waste.
- **One More Step –** When possible, all reactions should be taken one more step, if the additional step will result in a less hazardous material without an increased safety risk. (refer to *Destruction of Hazardous Chemicals in the Laboratory* by George Lunn & Eric Sansone, 2nd Edition, 1994 (Wiley)).
- **Waste Segregation –** Ensure appropriate segregation. Keep non-hazardous wastes out of the hazardous waste streams.
- **Education –** All chemical users should attend Chemical Hygiene training. EH&S offers additional waste minimization guidance through this program.
- **Inventory –** Maintain an accurate inventory of chemicals. Ensure that all containers are accurately labeled to ensure that “unknowns” are not generated.
- **Chemical Redistribution –** Utilize the EH&S Chemical Redistribution Program to donate or request unused surplus chemicals.
- **Purchasing Practices –** Only purchase in useable amounts.
- **Other Techniques –** Elementary chemical neutralization, improved inventory control practices, and good management and training are all techniques which can be utilized to minimize waste.

GUIDELINES FOR CONTROLLING CHEMICAL EXPOSURES IN LABORATORIES

The preferred method of minimizing employee exposure to hazardous materials is through the use of engineering controls such as chemical fume hoods or local ehhaust systems. Principal investigators, laboratory supervisors and chemical users should maintain a continual awareness of the specific hazards associated with the chemicals being used and utilize engineering controls when possible. Users must promptly report to building management any malfunctions or local alarm conditions associated with installed engineering controls.

1. Laboratory Fume Hoods

Laboratory fume hoods (aka chemical fume hoods) are engineering controls designed to protect lab personnel from exposure to airborne contaminants. A secondary purpose a fume hood is to protect people and property against small fires and explosions.

1.1 The primary measure of a hood's efficacy is its face velocity, measured in linear feet per minute (lfpm) through the open sash. Most chemical fume hoods at the University are designed to operate at 100 lfpm with an 18” sash opening.

1.2 All chemical fume hoods should be equipped with a hood monitor or other flow sensing device at the time of new installation, or during renovation of an existing chemical fume hoods. This monitor should be used continually to check proper hood function. In the event of monitor malfunction, contact EH&S or Facilities Management.

1.3 Chemical fume hoods are safety backup devices for condensers, traps and other devices that collect vapors and fumes. Never use a fume hood to "dispose" of chemicals by evaporation.

1.4 Only apparatus and chemicals essential to the specific procedure or process should be placed in the hood. Do not use hoods for extended chemical storage.

1.5 The work or apparatus inside the hood should be placed at least six inches inside the hood. Also, air baffles inside fume hoods must remain clear of obstructions for proper air flow and protection.

1.6 Never remove hood sashes and replace damaged hood sashes promptly.

1.7 In the event of power failure or other hood failure, stop work, cover or close all chemicals, close the sash on the hood, and notify a supervisor.

1.9 All chemical fume hoods must be certified annually for proper operation by the Department of Environmental Health and Safety or designee. PI’s or supervisors are responsible to report hoods that are delinquent for annual certification to EH&S.

2. Other Chemical Control Devices

Other engineering control devices, such as flex ducts, snorkle vents, glove boxes, benchtop containments or biosafety cabinets can be used to control chemical exposures in a lab. Proper use of these devices not only restricts chemical use to a designated area but can greatly reduce potential employee exposure hazards by capturing and exhausting chemical contaminants at the point of generation.

SAFE HANDLING OF PEROXIDE FORMING CHEMICALS

Certain chemical compounds can form explosive peroxides during use or storage. These chemicals can react with oxygen to create peroxides, compounds that can explode with impact, heat, or friction. Peroxide-forming compounds can be divided into hazard classes based on the method of reaction as described in the Tables below. Follow these guidelines for control and safe use of peroxide formers.

1. Purchase peroxide formers with inhibitors added by the manufacturer whenever possible.

2. Do not purchase large quantities of peroxide forming chemicals. Purchase the amount that you will use in a 3 month time period.

3. Date all peroxide formers upon receipt and again upon opening. Discard peroxide formers 6 months after opening the containers or 12 months after receipt even if unopened. [Note that peroxide formers in the Table 1 list must be disposed of within 3 months after opening.] If within the expiration time frame and no crystal formation is evident, these chemicals can be properly disposed through the University's bi-monthly waste pick-up.

4. DO NOT OPEN a container of peroxide forming chemical that has obvious crystal formation. Do not handle container or force open lid. Treat as potentially explosive material. Immediately call EH&S for assistance (412-624-9505).

5. Store peroxide formers (especially those in Table 1) under nitrogen or other inert gas, or keep and use them in an inert atmosphere chamber. **Note:** Some inhibitors actually need small amounts of oxygen to prevent peroxide formation and it is recommended that inhibited chemicals are not stored under an inert atmosphere.

6. Store peroxide formers in sealed, air-impermeable containers such as dark amber glass with a tight-fitting cap. DO NOT store these chemicals in open, partially empty, or transparent containers as these conditions promote formation of peroxides.

7. Avoid the distillation of peroxide formers without first testing for the existence of peroxides in the material. Most explosions with the use of peroxide formers occur when a material is distilled to dryness. Leave at least 10-20% bottoms. Stir such distillations with a mechanical stirrer or a bubbling inert gas. Air or an oxygen containing mixture should never be used for bubbling as a stirring.

TABLE 1: Severe Peroxide Hazard: Chemicals that can spontaneously decompose, becoming explosive after exposure to air without concentration. These chemicals must be stabilized or decontaminated and discarded <u>within 3 months of opening</u>.

Isopropyl ether	Potassium amide	Divinylacetylene
Potassium metal	Sodium amide (sodamide)	Vinylidene chloride
Butadiene (liquid monomer)	Chloroprene (liquid monomer)	Tetrafluoroethylene (liquid monomer)

TABLE 2: Concentration Hazard: These chemicals require external energy for spontaneous decomposition, forming explosive peroxides when distilled, evaporated or otherwise concentrated. Test for peroxides and discard these chemicals <u>within 6 months of opening</u>.

Acetal	Diethyl ether	Methyl isobutyl ketone
Acetaldehyde	Diethylene glycol dimenthyl ether (diglyme)	4-Methyl-2-pentanol
Benzyl alcohol	Dioxanes	2-Pentanol
2-Butanol	Ethylene glycol dimethyl ether (glyme)	4-Penten-1-ol
Cumene	4-Heptanol	1-Phenylethanol
Cyclohexanol	2-Hexanol	2-Phenylethanol
2-Cyclohexen-1-ol	Methylacetylene	2-Propanol
Cyclohexene	3-Methyl-1-butanol	Tetrahydrofuran
Decahydronaphthalene	Methylcyclopentane	Tetrahydronaphthalene
Diacetylene		Vinyl ethers
Dicyclopentadiene		Other secondary alcohols

TABLE 3: Shock and Heat Sensitive: These chemicals are highly reactive and can auto polymerize as a result of internal peroxide accumulation. The peroxides formed in these reactions are extremely shock and heat sensitive. NOTE: The liquid chemicals in this group should be tested for peroxides and discarded <u>within 6 months of opening</u>.

Acrylic acid	Chlorotrifluoroethylene	Vinyl acetate
Acrylonitrile	Methyl methacrylate	Vinylacetylene (gas)
Butadiene (gas)	Styrene	Vinyl chloride (gas)
Chloroprene	Tetrafluoroethylene (gas)	Vinylpyridine
		Vinyladiene chloride

Many other chemicals may also form peroxides under the right conditions. A list of such chemicals can be found on the EH&S website.

NOTE: These tables and the referenced list represent prominent organic and inorganic compounds that are able to form peroxides under the right conditions. The lists are not comprehensive. The investigator should refer to the MSDS or other reference material, contact the chemical manufacturer, or contact EH&S to determine if the chemicals they are using are potential peroxide formers.

GUIDELINES FOR THE SAFE USE OF FORMALDEHYDE AND PARAFORMALDEHYDE

Exposure to formaldehyde can be irritating to the eyes, nose, and upper respiratory tract. In certain individuals, repeated skin exposure to formaldehyde can cause sensitization that may result in allergic dermatitis. Formaldehyde is a suspected human carcinogen and a suspected reproductive hazard.

The aqueous solution formalin is 37-40 percent formaldehyde. Paraformaldehyde is the crystallized polymer of formaldehyde that is weighed out and dissolved in solution for experimentation or cell and tissue fixation. Typically 3-10% formalin or paraformaldehyde solutions are used to perfuse or fix tissues.

OSHA has adopted a permissible exposure limit (PEL) of 0.75 ppm (parts per million) for airborne formaldehyde averaged over an 8-hour work shift (TWA). Formaldehyde can be smelled at less than 0.5 ppm. A short-term exposure limit (STEL) of 2 ppm for 15 minutes has also been established. For an assessment of airborne formaldehyde in the work area or lab, contact EH&S at x4-9505 via your supervisor or PI.

1. Formaldehyde training is required for anyone exposed above 0.1 ppm for an 8-hour period.

2. All work with concentrated formalin solutions must be done in a certified chemical fume hood. If work tasks cannot be done in a fume hood or other ventilated engineering control device, EH&S must be contacted to assure that hazardous exposures to faculty, staff and students are prevented. Recommendations for protocol modification or protective equipment will be made based on sampling results.

3. Formaldehyde exposures can occur while dissecting or working with tissue specimens perfused with or fixed in formaldehyde. Chemical exposures can be minimized by working in a ventilated device. Eliminating puddles of formaldehyde in the specimen by rinsing or blotting the excess with paper towels can reduce evaporation and exposure.

4. Gloves must be worn whenever formalin or tissues preserved or fixed with formaldehyde are handled. While latex gloves provide some protection against formaldehyde, butyl or nitrile gloves are recommended and should be used when contact is anticipated.

5. Formaldehyde splashed in the eye can cause irreversible damage to the cornea. Safety glasses with side shields must always be worn when working with formaldehyde.

6. Labeling and Signage Requirements

   6.1 All forms of formaldehyde or paraformaldehyde containing 0.1 % formaldehyde or greater must be labeled in a manner to include the word "formaldehyde" and the concentration.

6.2 Signs warning of flammability hazards should be posted on the doors to any area where over 10 gallons of formaldehyde are stored or utilized.

7. Special Safety Precautions

7.1 If formaldehyde contacts the body, flush with water for at least 15 minutes and report to Concentra Medical Center, 120 Lytton Ave, Suite 275 or UPMC Emergency Department.

7.2 All solutions of formaldehyde and tissues preserved in formalin must be stored in tightly sealed, properly labeled, containers to prevent leakage, spills and evaporation.

7.3 Do not pour formalin or formalin waste into sinks or drains. Formalin waste solutions must be placed in tightly sealed, labeled containers and segregated for disposal via the EH&S Chemical Waste Program.

7.4 All spills of formalin solutions must be cleaned up immediately.

7.4.1 Wear gloves and eye protection.

7.4.2 Cover spill with paper towel or other suitable absorbent material. Do not mop up a spill with reusable mops. If dry absorbents are used, scoop the absorbed formaldehyde solution with a dustpan into a plastic bag.

7.4.3 Double bag, seal, and label the material. Call EH&S at 624-9505 for assistance.

7.4.4 Dispose of all formalin containing material via the EH&S Chemical Waste Program.

7.5 If the spilled formaldehyde causes severe eye, nose, or throat irritation, immediately evacuate the area. Close all doors to contain vapors, and call Environmental Health and Safety at 624-9505.

8. Several common protocols involving formaldehyde have already been evaluated by EH&S, and based on the air monitoring results, formaldehyde exposure has been demonstrated to be sufficiently low enough to be excluded from the training requirements. These activities include:

a. Animal perfusion done inside a chemical fume hood
b. Small animal perfusion involving 10cc or less formaldehyde
c. Paraformaldehyde weighing and solution preparation done inside a certified chemical fume hood
d. Northern blot assays done inside a certified chemical fume hood
e. Cell fixing done inside a certified chemical fume hood or biosafety cabinet
f. Tissue immersion into formaldehyde in screw cap vials
g. Microscopic evaluation of fixed tissue or cells

9. Paraformaldehyde

9.1 Open containers of paraformaldehyde crystals or powder dissolved in solution give off formaldehyde vapors. Users should minimize exposures to paraformaldehyde and avoid the weighing and dissolving steps by purchasing “ready to use” buffered formalin solutions in concentrations ranging from 2 to 10 percent and using these solutions in chemical fume hoods.

9.2 Paraformaldehyde is moderately toxic by skin contact. It has recently been designated as a probable human carcinogen. Skin contact with paraformaldehyde may cause itching and rash that may lead to skin allergy upon repeated exposure. It has also been reported to cause reproductive and mutagenic problems in humans exposed long term.

9.3 Breathing paraformaldehyde powders or vapors will irritate the nose and throat after prolonged exposure causing a cough, shortness of breath and possible lung damage including pulmonary edema. Chronic inhalation exposures may lead to an asthmatic or allergic condition with wheezing and chest tightness. Acute exposure may cause irritation to the eyes and respiratory tract.

9.4 All weighing and handling of paraformaldehyde should be done with adequate ventilation using chemicals fume hoods, vented balance enclosures or other local exhaust ventilation. Pre-weighed packets or purchase of prepared formalin solutions should be substituted if possible to minimize potential exposures.

10. Respiratory protection from formaldehyde vapors should not be necessary if other control measures are utilized. If ventilation measures are inadequate or not available, use of respiratory protection may be warranted. Consult EH&S. All users of respiratory protection must be enrolled in the University Respiratory Protection Program. Particulate filtering respirators (dust masks) provide no protection against formaldehyde vapors.

11. Paraformaldehyde or concentrated formalin solutions may react violently with strong oxidizing agents, ammonia, strong alkalis, isocyanates, peracids, anhydrides and inorganic acids. Contact and storage with these reactive chemicals should be avoided.

12. Paraformaldehyde and formalin solutions should be stored in a cool, well ventilated area away from heat, sunlight and moisture. Vapors emitting from paraformaldehyde and formalin solutions are flammable, and the Guidelines for the Storage and use of Flammable Liquids found in this manual apply.

GUIDELINES FOR WORKING WITH CARCINOGENS

Cancer-causing agents are known as carcinogens. There are 58 “known” human carcinogens and 188 substances “reasonably anticipated” to be human carcinogens. PIs and laboratory supervisors must take precautions to prevent carcinogen exposures to personnel and to prevent releases of carcinogens to the environment. This guideline promotes the safe use of carcinogens through the recognition, evaluation and control of exposures in all laboratories at the University of Pittsburgh.

1. Recognition:

1.1 Laboratory supervisors and PIs must identify chemical carcinogens in their protocols and chemical inventories. When chemical carcinogens are recognized, distinctive labeling shall be used to identify the hazards associated with the material.

1.2 Personnel should be trained on associated techniques for safely handling and storing carcinogens.

2. Evaluation: Personal exposures to any hazardous chemicals, including carcinogens, are dependent on the:

- quantity,
- concentration in air or in solutions,
- duration of exposure,
- physical or chemical properties,
- potential for exposure via inhalation, ingestion or skin absorption.
- availability and use of feasible control measures.

Each of these points must be considered prior to use of a carcinogen.

3. Control of carcinogen exposure should always follow this hierarchy:

3.1 Engineering controls (such as chemical fume hoods, local exhausts or scavenger systems) are highly recommended and are the most effective controls of carcinogen exposure.

3.2 Administrative controls, including written procedures for carcinogen use and disposal, substitution of less hazardous substances and reduced carcinogen quantities, are less effective but still warranted.

3.3 Personnel protective equipment (PPE) including lab coats, gloves, aprons, eye and face protection are the last line of defense, but are still necessary to reduce the risk of exposure in most instances.

GUIDELINES FOR WORKING WITH LABORATORY CHEMICALS THAT ARE REPRODUCTIVE HAZARDS

Certain laboratory chemicals have the potential to harm the reproductive systems of men and women, or to affect a developing fetus if used improperly. Since most chemicals have not yet been evaluated for their reproductive effects, the following guidelines were developed.

1. Engineered exhaust ventilation systems, such as chemical fume hoods or biological safety cabinets, provide a primary exposure control measure by keeping chemical, biological or radiological agents out of an employee's breathing zone. Researchers, especially those who are pregnant or of childbearing age, should always utilize these engineering controls when working with hazardous materials. If properly designed and correctly utilized to contain the hazardous materials in use, this ventilation/control equipment will prevent exposures to hazardous substances.
2. Consult Standard Operating Procedures (SOPs), Material Safety Data Sheets (MSDSs), Environmental Health and Safety (EH&S), the Principal Investigator and your laboratory supervisor to determine what chemicals or other agents used in your laboratory are recognized reproductive hazards, and the available methods to limit your potential exposures to these hazards.
3. Pregnant lab workers should also discuss the work they perform with their personal physician. Any work restrictions placed on you by your physician should be discussed with your lab supervisor immediately. Employee Health Services should also be contacted at 412-647-3659.
4. Specific federal and state regulations apply to pregnant workers exposed to radiation or radioactive materials. Contact the Radiation Safety Office (412-624-2728) for further information.
5. Substitute less hazardous reagents in experiments or if possible curtail certain lab activities for the duration of pregnancy.
6. Follow all of the safety procedures outlined in the General Safety, Lab Safety, and Chemical Safety sections of this manual.
7. Wash your hands with soap and water after handling chemicals or biological agents, and when leaving the lab.
8. Wear the appropriate personal protective equipment (PPE) when working with hazardous materials. Contact your supervisor or EH&S if you are uncertain about what PPE is needed.
9. Never eat, drink, apply cosmetics or make other hand-to-mouth contact in the laboratory.
10. If you would like assistance establishing safe chemical handling practices in your laboratory, notify your supervisor or contact EH&S at 412-624-9505.

GUIDELINES FOR THE SAFE USE OF HYDROFLUORIC ACID

Hydrofluoric acid (HF) is an extremely corrosive acid used for many purposes including mineral digestion, surface cleaning, etching, and biological staining. HF's unique properties make it significantly more hazardous than many other acids. This document discusses the health and safety hazards of HF and how to protect you from them. Also included are emergency procedures for dealing with HF exposures.

Health Hazards

The health hazards of HF are dependent upon the concentration and type of exposure.

1. HF is corrosive and readily destroys tissue. Exposure of the eyes to HF may result in blindness or permanent eye damage. HF readily penetrates human skin, allowing it to destroy and decalcify soft tissues and bone. Skin exposure to concentrated HF (approximately 50% or greater) immediately results in serious and painful destruction of tissue. Not only can skin contact cause burns, but systemic fluoride poisoning may also result.

2. One of HF's most insidious properties is that skin contact at lower concentrations (typically < 20%) may not produce pain or burning sensations until hours after the exposure. Because of the ability of HF to produce severe, delayed tissue damage without producing pain, all skin, eye, or tissue contact with HF should receive immediate first aid and medical evaluation, even if the exposure appears minor or no pain is felt.

3. Inhalation of HF vapor can seriously damage the lungs. Delayed reactions up to and including fatal pulmonary edema (flooding of the lungs with body fluids) may not be apparent for hours after the initial exposure. OSHA limits employees' exposure to airborne concentrations of HF to an average of 3 parts per million (ppm) over an 8-hour workday. Airborne concentrations of 10 to 15 ppm will irritate the eyes, skin, and respiratory tract. Thirty ppm is considered immediately dangerous to life and health and may have irreversible health effects. At airborne concentrations above 50 ppm, even brief exposure may be fatal. Long-term or chronic exposure to HF may result in fluorosis; a syndrome characterized by weight loss, bone embrittlement, anemia, and general ill health.

Safety Precautions for HF Use

1. Employee Information and Training- HF is a colorless liquid with a strong irritating odor at low concentrations (3 ppm). Employees who handle HF must receive training on the hazards of HF and what to do in the event of an exposure or a spill. A Material Safety Data Sheet (MSDS) on HF should always be kept in the immediate work area where HF is used. The MSDS, together with this Fact Sheet, can be used for initially training employees on the hazards of HF. EH&S is also available for providing assistance with training.

2. Lab Ventilation - HF at Concentrations greater than 5% should always be handled inside a certified chemical fume hood to minimize inhalation of vapors.

3. Eye Protection - Chemical goggles together with a face shield are recommended when handling concentrated HF. Due to HF's high corrosivity, safety glasses with side shields may not provide adequate eye protection.

4. Body Protection - Wear a lab coat with a chemical splash apron made out of natural rubber, neoprene, or viton. Never wear shorts, skirts above the knee or open-toed shoes when handling HF or other corrosive chemicals.

5. Gloves- Medium or heavyweight viton, nitrile, or natural rubber gloves are worn when working with HF. Always consult the manufacturer's glove selection guide when selecting a glove for HF. If you have any questions about which glove to choose, contact EH&S. A second pair of nitrile exam gloves should be worn under the gloves for protection against leaks. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands, and check your hands for any sign of contamination. Contaminated gloves must be disposed of as HF waste (see "Spill, Storage, and Waste Issues" section).

6. Eyewash/Emergency Shower- Since HF is corrosive and rapidly damages tissue, EH&S recommends a combination eyewash/shower to be nearby and accessible. The eyewash must be tested weekly to ensure it will operate when needed. The combination eyewash/ shower should be used to rinse the exposed area for at least 5 minutes, and then treatment of skin with calcium gluconate gel should be initiated.

7. Response to Skin Exposure-Calcium gluconate gel is a topical antidote for HF skin exposure. It works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Always keep calcium gluconate gel nearby whenever you're working with HF. Calcium gluconate can be ordered through the Chemistry Department Store Room.

Note: Calcium gluconate has a limited shelf life. It should be stored in a refrigerator and replaced after its labeled expiration date. Use nitrile exam gloves to apply calcium gluconate gel. Even after applying calcium gluconate, it is essential that a medical evaluation be made.

Spill, Storage and Waste Issues

1. Waste HF should be placed in a chemically compatible container with a sealed lid and clearly labeled using the University's hazardous waste label. Contact EH&S if you need additional labels or have any questions regarding the disposal of HF wastes.

2. Many chemicals containing fluorine, such as ammonium fluoride, sodium fluoride, sulfur tetrafluoride, and ammonium bi-fluoride, may react with acid or water to produce HF. Review the MSDS of all fluoride compounds carefully for safety precautions to reduce the risk of creating a HF hazard. If the manner in which the fluorine compound is used can create HF, follow the precautions for HF and keep topical antidote on hand.

3. EH&S is available to help train staff or students on the hazards and use of HF. EH&S can evaluate your chemical fume hood or HF use in your lab. Please call EH&S at 412 624-9505.

4. Safe Work Practices- If possible, avoid working alone when you're using HF. Do not eat, smoke, or drink where HF is handled, since the chemical can be swallowed. Always wash hands thoroughly after handling HF.

5. HF Spills- If HF is spilled outside a chemical fume hood, evacuate the area. Close the doors. Post the area with a sign to prevent others from entering. Call 811 on the Pittsburgh Campus. If the incident occurs during regular work hours (Monday–Friday, 8 a.m. to 5 p.m.), also call EH&S at 412-624-9505. Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they have the correct equipment, understand the hazards, and know how to clean up the spill safely and dispose of the waste properly. Lime soda, ash, sodium bicarbonate, or a spill absorbent specified for HF should be used for clean up. Organic spill kits that contain Floor-dri, kitty litter, or sand should not be used because HF can react with silica to produce silicon tetrafluoride, a toxic gas.

6. Storage- Store all HF and HF waste in labeled chemically compatible containers (e.g., polyethylene or Teflon). Glass, metal, and ceramic containers are not compatible with HF. HF should never be stored with incompatible chemicals such as ammonia or other alkaline materials. Always place HF on a low protected shelf or other location where it will not be accidentally spilled or knocked over.

Emergency Procedures for HF Exposures

All exposure to or contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor and no pain is felt. HF can produce delayed effects and serious tissue damage without necessarily producing pain.

Skin contact

1. Immediately proceed to the nearest eyewash/shower and wash affected area for a minimum of 5 minutes.

2. While washing the affected area, have someone call 412-624-2121 for emergency medical assistance.

3. Remove all contaminated clothing while in the shower.

4. Massage calcium gluconate gel into the affected area. Be sure to wear a nitrile glove on the hand spreading the gel. If calcium gluconate gel is not available, wash affected area for at least 15 minutes or until emergency medical assistance arrives.

5. Reapply calcium gluconate gel and massage it into affected area every 15 minutes until assistance arrives.

6. Proceed to physician for appropriate follow-up and/or treatment.

Eye contact

1. Immediately proceed to the nearest eyewash station.

2. Wash eyes with water for at least 15 minutes while holding eyelids open.

3. Do not apply calcium gluconate gel to eyes.

4. While washing eyes, have someone call 412-624-2121 for emergency assistance.

5. Proceed to emergency treatment center for appropriate follow-up.

Inhalation

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1. Leave the area where vapors are present

2. Close door to room.

3. Report condition to supervisor and/or co-workers

4. Call 412-624-2121 on Pittsburgh Campus for emergency medical assistance.

SAFE HANDLING AND DISPOSAL OF PICRIC ACID

Picric acid (trinitrophenol) is a yellow, water-soluble chemical that is highly sensitive to heat and shock. Picric acid is especially reactive with metals or metallic salts.

Dry picric acid (less than 30% solution) is friction and heat sensitive, and is considered a highly shock sensitive chemical. Metal caps and lids are especially susceptible to the formation of highly sensitive picrate salts. If dry crystals are present inside the container or cap threads, the friction from removing the cap may be sufficient to detonate the container.

1. PURCHASE

1.1. Do not purchase large quantities of picric acid. Purchase the minimum amount of picric acid for your work.

1.2. When possible, purchase picric acid in solution (not as a dry solid).

1.3. Label all picric acid with date received.

2. STORAGE

2.1. Store solid picric acid or picrate salts in distilled water (e.g., > 30% hydrated). Visually check the hydration every two months and add distilled water as necessary.

2.2. Label all picric acid with date of last hydration. Maintain an inventory of your picric acids and dates of hydration.

2.3. Do not store picric acid (solution or solid) in containers with metal caps or ground glass stoppers; these are especially susceptible to the formation of highly sensitive picrate salts.

3. HANDLING AND USE

3.1. After each use, wipe the bottleneck and cap threads with a damp cloth before closing the container of picric acid.

3.2. Do not use metal spatulas with picric acid solids.

3.3. DO NOT TOUCH OR OPEN a container of dry picric acid; a minor disturbance or the friction caused by opening a crystallized lid can cause an explosion. CALL EH&S IMMEDIATELY at 412-624-9505 for stabilization and disposal.

4. DISPOSAL

4.1. Picric acid must be properly disposed through the University's chemical waste program, as long as the chemical is hydrated and no crystal formation is evident.

4.2. If the picric acid is dry and/or crystal formation is evident, CALL EH&S IMMEDIATELY at 412-624-9505 for stabilization and disposal. DO NOT TOUCH OR OPEN CONTAINER. When in doubt, call EH&S for a determination.

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I. INTRODUCTION

In accordance with the OSHA Bloodborne Pathogens Standard, ***29 CFR 1910.1030***, the following Exposure Control Plan (ECP) has been developed for the University of Pittsburgh. The ECP is designed to minimize exposure to bloodborne pathogens (BBP), which are defined as: *Pathogenic microorganisms that are present in human blood, human body fluids, human tissues or other potentially infectious material.*

The ECP covers faculty, staff and students that may reasonably anticipate skin, eye, mucous membrane, or parenteral (under the skin) contact with blood or other potentially infectious materials during the performance of their job duties at the University of Pittsburgh.

In addition to blood, other potentially infectious materials are:

- The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids;
- Any unfixed tissue or organ other than intact skin from a human (living or dead);
- Human cell lines or cultures, human tissue cultures, human organ cultures;
- Blood, body fluids or other tissues from non-human primates
- Blood, body fluids or other tissues from experimental animals infected with BBP
- Liquid or solid culture medium or other materials containing biological agents capable of causing disease in healthy adults (i.e. equivalent to agents handled at Biosafety level 2 or above, visit http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm for more information).

The ECP will be reviewed and updated annually by the University of Pittsburgh. Implementation of the ECP is monitored and coordinated by the University Department of Environmental Health and Safety. The University Biosafety Officer manages and oversees compliance of the University's Bloodborne Pathogens program. Additional information can be found in the University Biosafety Manual and the webpage of the University Department of Environmental Health & Safety (www.ehs.pitt.edu). Questions or concerns can be addressed to the University Biosafety Officer at (412) 624-8919.

II. BBP EXPOSURE DETERMINATION

A **BBP Exposure Determination** is made without regard to the use of personal protective equipment (i.e., employees whose expected job functions include occupational exposure to blood or OPIM are considered to be exposed even if they wear personal protective equipment). The purpose of an exposure determination is to identify the University job classifications that are required to comply with this ECP.

Each University unit must develop a list of **job classifications** and/or job descriptions under their supervision that may have occupational exposure to bloodborne pathogens. Supervisors are responsible to enforce compliance with this Exposure Control Plan for all applicable employees.

Employees that provide first aid as a collateral duty, such as police officers, athletic trainers or those on AED (Automated External Defibrillators) emergency response teams, may have exposure to bloodborne pathogens and are covered by the Exposure Control Plan.

III. COMPLIANCE METHODOLOGY

A. Universal Precautions: Universal Precautions will be observed at the University of Pittsburgh in order to prevent contact with blood or other potentially infectious materials. All blood or other potentially infectious materials will be considered infectious.

B. Exposure Control Plan: Employees covered under this Exposure Control Plan receive an explanation of this Exposure Control Plan during their initial training session. It will also be reviewed in their annual refresher training. All employees have the opportunity to review this plan at any time during their work shifts by visiting www.ehs.pitt.edu/biosafety/ecp.htm. If requested by an employee, a copy of the Exposure Control Plan will be provided free of charge. The University of Pittsburgh Department of Environmental Health and Safety is responsible for reviewing and updating the Exposure Control Plan annually or more frequently if necessary to reflect new or modified tasks and procedures that affect occupational exposure.

C. Engineering Controls and Equipment: Engineering controls and equipment will be utilized to eliminate or minimize exposure to employees. Where potential for occupational exposure still exists after implementation of these controls, personal protective equipment shall also be utilized. The University of Pittsburgh will identify the need for changes in engineering controls and work practices through reviews of the Sharps Injury Log with follow-up exposure investigation and through discussion with the University Biohazards Committee of available safety procedures.

1. Sharps Containers: The person disposing of sharps is responsible for monitoring the container and disposing of the container when it is two-thirds full. The container is to be open when in use to allow unobstructed access and securely closed for disposal in a waste stream designated for biohazardous waste. Only approved sharps containers as determined by EHS are to be utilized.

2. Biosafety Cabinets: The person working in the cabinet will disinfect the work surface of the Biosafety Cabinet after each use. If the cabinet has a front drain, it will be checked monthly, disinfected, and drained if required. The cabinet will have an annual performance certification that the Principal Investigator is responsible for arranging. This certification is also required prior to initial cabinet user or prior to use after any cabinet relocation.

3. Sharps with Engineered Sharps Injury Protections: These devices are needle-less or otherwise altered with a built-in feature or mechanism that effectively reduces the risk of an exposure incident. It is recommended that these devices be utilized in all applications at the University when there is potential for occupational exposure to blood or OPIM involving sharps.

Implementation or active evaluation of engineered sharps devices is **mandated** in the following instances:

1. **University employees with human subject research or direct patient contact duties.** Examples include drawing blood or administering injections.

2. **University employees working with experimental animals at animal biosafety level 2+ (ABSL-2+) or above.** Examples include injection of lentiviral agents into animals or blood draws from animals exposed to lentiviral agents.

3. **University employees working at ABSL-2 and for whom EHS has determined through risk assessment present a high risk of significant exposure to dangerous pathogens via sharps injury.** Examples include rabies virus or Plasmodium species being injected into animals.

It is the responsibility of those with supervisory or managerial duties at the University of Pittsburgh to ensure that employees in these categories are utilizing engineered sharps devices. It is also the responsibility of the supervisor to include non-managerial staff in the evaluation of safety devices. A list of available devices by product class and product type is available from the International Health Care Worker Safety Center at the University of Virginia Health System at the following website address:
http://www.healthsystem.virginia.edu/internet/epinet/

Supervisors may visit the Environmental Health and Safety Website at www.ehs.pitt.edu (Biosafety page) to download evaluation forms for various classes of safety devices or contact EHS to develop a lab specific or protocol specific evaluation form. Supervisors should utilize these forms to solicit input from the non-managerial employees with respect to the selection of safety devices.

If a supervisor does not believe that utilizing an engineered sharps device is possible or warranted for a specific application, they must:

- Document which devices have been evaluated, the extent of the evaluation, and identify which employees performed the evaluations

- Document the rationale for not utilizing an engineered sharps device. This rationale is only acceptable if it demonstrates the device is medically contraindicated for the human or animal research subject, is unreliable in operation, or is incompatible with another essential component of the research.

This information must be sent to the Department of Environmental Health and Safety:

Department of Environmental Health and Safety (EHS)
B-50 Benedum Hall
624-8524 (fax)
Email biosafe@ehs.pitt.edu

4. Hand Washing Facilities: are available to the employees with potential exposure to blood or other potentially infectious materials.

After removal of personal protective gloves, employees shall wash hands and any other potentially contaminated skin area immediately or as soon as feasible with soap and water. If employees incur exposure to their skin or mucous membranes, those areas shall be washed or flushed with water as appropriate as soon as feasible following contact.

D. Work Area Controls and Procedures: Work Area Controls and Procedures will be utilized to eliminate or minimize exposure to employees. Where potential for occupational exposure still exists after implementation of these controls and procedures, personal protective equipment shall also be utilized.

1. Work Area Restrictions - General: In work areas where there is a reasonable likelihood of exposure to blood or other potentially infectious materials, employees should comply with the following work area restrictions:

- No eating, drinking, applying cosmetics or lip balm, smoking, or handling contact lenses;
- Food and beverages are not to be kept in refrigerators, freezers, shelves, cabinets, or on counter tops or bench tops where blood or other potentially infectious materials are present;
- Mouth pipetting is prohibited; automatic or manual pipetting devices should be provided.
- All procedures will be conducted in a manner that will minimize splashing, spraying, splattering, and generation of droplets of blood or other potentially infectious materials.

2. Work Area Restrictions for Research Facilities: This section applies to research laboratories engaged in the culture, concentration, experimentation, and manipulation of potentially infectious materials.

- Laboratory doors shall be kept closed when work with potentially infectious material is in progress;
- Access to the work area shall be restricted to authorized personnel. Only personnel trained on the potential hazards of BBP and who comply with the entry and exit procedures shall be allowed to enter;
- Vacuum lines shall be protected with liquid disinfectant traps and HEPA filters that are checked twice a year and replaced as necessary;
- Each laboratory shall contain a facility for hand washing and an eye wash station.

3. Needles: Contaminated needles and other contaminated sharps shall not be bent, recapped, removed, sheared or purposely broken. If no alternative is feasible, then the recapping or removal of the needle must be accomplished using a mechanical device or the one-handed technique.

4. Containers for Reusable Sharps: Contaminated sharps that are reusable are to be placed immediately or as soon as feasible after use, into appropriate containers. At the University of Pittsburgh these containers are puncture resistant, labeled with a biohazard symbol, and are leak proof on the sides and bottom.

5. Specimen Containers: Specimens of blood or other potentially infectious materials will be placed in a container that prevents leakage during the collection, handling, processing, storage, and transport of the specimens. The container used for this purpose will be labeled or color-coded in accordance with the requirements of the OSHA standard. Any specimens that could puncture a primary container will be placed within a secondary container that is puncture resistant. If outside contamination of the primary container occurs, the primary container shall be placed within a secondary container that prevents leakage during the handling, processing, storage, transport, or shipping of the specimen.

6. Contaminated Equipment: Equipment that has become potentially contaminated with blood or other potentially infectious materials shall be decontaminated as necessary unless the decontamination of the equipment is not feasible. If decontamination of equipment or portions there of is not feasible, then readily observable labels shall be attached to equipment which remains contaminated. The labels shall state which portions remain contaminated. The equipment should also be wrapped or contained to prevent exposure to contaminants.

7. Personal Protective Equipment (PPE): All personal protective equipment used at this facility will be provided without cost to employees. Personal protective equipment will be chosen based on the anticipated exposure to blood or other potentially infectious materials. The University of Pittsburgh Biosafety Manual and EHS are available for consultation on selection of appropriate personal protective equipment. The protective equipment will be considered appropriate only if it does not permit blood or other potentially infectious materials to pass through or reach the employees' clothing, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time that the protective equipment will be used. All personal protective equipment will be cleaned, laundered, and disposed of by the employer at no cost to employees. The employer, at no cost to the employee, will make all repairs and replacements to personal protective equipment.

All garments that are penetrated by blood shall be removed immediately or as soon as feasible. All personal protective equipment shall be removed prior to leaving the work area involved. It shall then be placed in an appropriately designated container or area for storage, washing, decontamination, or disposal. Employees must not wear or take home personal protective clothing that is visibly contaminated or thought to be contaminated with blood or other potentially infectious materials. Employees shall wash their hands immediately or as soon as feasible after removal of gloves or other PPE

8. Housekeeping: All contaminated work surfaces will be decontaminated after completion of procedures and immediately or as soon as feasible after any spill of blood or other potentially infectious materials, as well as at the end of the work shift if the surface may have become contaminated since the last cleaning.

The disinfecting agent should be selected based on the area or substance to be decontaminated as well as the suspected agents to be destroyed. Information concerning the utility and selection of disinfectants may be obtained by visiting the EPA Antimicrobial Information Network at http://ace.orst.edu/info/nain/

All bins, pails, and similar receptacles shall be inspected and decontaminated on at least a monthly basis. Any broken glassware that may be contaminated will not be picked up directly with the hands. Large pieces are to be picked up with forceps and the small pieces swept into a dustpan with a dust broom designated for this use only.

9. Regulated Waste Disposal: Includes liquid or semi-liquid blood or other potentially infectious materials, contaminated items that would release blood or other potentially infectious materials if compressed, items caked with dried blood or other potentially infectious materials and are capable of releasing these infectious agents during handling, and sharps.

All sharps shall be discarded as soon as feasible in sharps containers that are located in the facility. The sharps containers will be labeled with the biohazards symbol. Containers must be puncture-resistant and leak resistant.

Regulated solid wastes shall be placed in red polyethylene biohazard bags that are at least 3-mil thick. All solid wastes suitable for autoclaving (121 Degrees C, 60 -90 minutes) should be treated this way prior to removal from the premises.

Disposal is accomplished by placing the red biohazard bag in a labeled biohazard box, seal the box with tape, and place the sealed box in the designated area of the building for pickup. The box must be labeled with the University of Pittsburgh Bio-Hazardous Waste Label.

Regulated liquid wastes should be carefully poured into the appropriate disinfectant to inactivate the biohazardous agent. Following sufficient contact time, the disinfected liquid may be disposed of in the sanitary sewer. This should be done carefully to avoid aerosol generation and splashing. Afterwards the drain should be flushed with disinfectant of sufficient volume to fill the trap.

Note: More information on compliance methods can be found in the University of Pittsburgh Biosafety Manual (www.ehs.pitt.edu/biosafety/BSM.HTM).

10. Laundry Procedures: Laundry contaminated with blood or other potentially infectious materials will be handled as little as possible. Such laundry will be placed in appropriately marked bags at the location where it was used. Such laundry will not be sorted or rinsed in the area of use. All employees who handle contaminated laundry will utilize personal protective equipment to prevent contact with blood or other potentially infectious materials.

IV. HEPATITIS B VACCINATION PROGRAM

All University personnel (staff, students, faculty), who have been identified as having exposure to blood or other potentially infectious materials, must sign a ***University of Pittsburgh Consent to Vaccinate with Recombinant Hepatitis B Vaccine*** form within 10 working days of their initial assignment to work. This form verifies that personnel were informed of the potential health hazards that Hepatitis B virus represents in their work environment. In addition, the form records the individual's choice to either consent to receive Hepatitis B vaccine, to decline, or to attest to prior Hepatitis B immunization.

Employees (faculty and staff) consenting to vaccination will receive the Hepatitis B vaccine (HBV) at no cost. Vaccinations are provided through Employee Health Services. Employees who initially decline the HBV vaccine, but later wish to have it may then have the vaccine provided at no cost.

Students consenting to vaccination must arrange for the HBV vaccination independently. Students declining the HBV vaccination must present a waiver from their academic department verifying their knowledge of this decision.

V. PROCEDURE FOLLOWING EXPOSURE TO BLOODBORNE PATHOGENS

A bloodborne pathogen exposure incident occurs when potentially infectious material comes into contact with the eyes, mouth, other mucous membrane, damaged skin or penetration through the skin (parenteral or under the skin) during the performance of an employee's duties.

In the event of exposure to bloodborne pathogens:

1. Immediately wash or rinse the exposed area for 10 to 15 minutes.
2. Contact medical providers for post-BBP exposure evaluation and/or medical treatment provided in **Section V.A. Post-Bloodborne Pathogens Exposure Evaluation**;
3. Notify the supervisor immediately after the BBP exposure incident and provide detailed information about the incident. The Supervisor will submit the requisite forms to Workers' Compensation according to **Section V.B. Procedures for Evaluating the Circumstances of a BBP Exposure Incident.**

A. Post-Bloodborne Pathogens Exposure Evaluation

Immediately following washing, employees should contact the following medical providers for post-BBP exposure evaluation and/or medical treatment:

<u>Monday through Friday (7:30 AM to 4:00 PM)</u>

Employee Health Services-Oakland
(412) 647-3695

<u>All Other Times and Holidays</u>

Presbyterian University Hospital Emergency Department
(412) 647-3333

The following physicians have been designated to conduct post-BBP exposure evaluations, provide medical treatment, and maintain medical records for University of Pittsburgh employees:

Jay Harper, M.D.
Clinical Director of Occupational and Environmental Medicine

Post BBP-Exposure Evaluation will follow the guidelines outlined in “Employee Health Policy and Procedure Manual for Bloodborne Pathogen Exposures” and will include the following:

- Documentation of the route of exposure and the circumstances related to the incident;
- The employee will be offered the option of having blood collected for testing of the employees HIV/HBV/HCV serological status. The blood sample will be preserved for at least 90 days to allow the employee to decide if the blood should be tested for HIV status. However, if the employee decides prior to that time that testing will be conducted then the appropriate action can be taken and the blood sample discarded;

- If necessary, the identification of the source and, if possible, the status of the source will be determined. The blood of the source subject will be tested (after consent is obtained) for HIV/HBV/HCV infectivity;
- Results of testing of the source subject will be made available to the exposed employee but the applicable laws and regulations concerning disclosure of the identity and infectivity of the source individual will be strictly followed.

  Current Pennsylvania law concerning disclosure of the HIV status of an individual without consent is governed by the requirements of the ***Pennsylvania Confidentiality of HIV Related Information Act***. This law provides that an employee who has been notified of the identity and test result status of the source individual must not divulge this information to others unless the source individual signs a special written consent.
- The employee will be offered post-exposure prophylaxis in accordance with the current recommendations of the U.S. Department of Health and Human Services.
- The employee will be given appropriate counseling concerning precautions to take during the period after the exposure incident. The employee will also be given information on what potential illness to be alert for and to report experiences to appropriate personnel.

If the exposure involves a non-human primate or non-human primate tissue, the Standard Operating Procedures for Management of Herpes B Virus exposure or SIV exposure developed by Employee Health Services will be followed.

B. Procedures for Evaluating the Circumstances of a BBP Exposure Incident

Employees should notify their supervisor immediately after the exposure incident. The supervisor records the details of the exposure incident including the route of exposure, the infective agent and an estimate of the dosage.

The Supervisor will submit the Employers Report of Occupational Injury or Disease (LIBC 344) and the University of Pittsburgh Additional Injury Report Information Sheet to Workers' Compensation and record the details of the BBP exposure incident including the route of exposure, the infective agent, and an estimate of the dosage. Forms and detailed reporting procedures are provided on the University Workers Compensation Website at www.bc.pitt.edu. (“Faculty and Staff…On-the-Job Injuries”) or by calling 412-624-1198.

If the exposure involves a sharp, the supervisor will also collect and provide the following information regarding the exposure on the EH&S “SHARPS INJURY REPORT”:

- Employee Name;
- Social Security Number;
- Date of Incident (mm/dd/yy);
- Occupation;
- Department;

- Building;
- Type / Brand of Device;
- A brief description of how the injury occurred, including the task which was being performed as well as any protective equipment worn or utilized;
- Was an animal involved?
- Was immediate treatment sought? If so, where;
- Recommendation for preventing recurrence;
- Supervisor's Name;
- Date.

This online "Sharps Injury Report" form is located on the EH&S website at www.ehs.pitt.edu (Biosafety page). A paper copy can be obtained from EH&S by calling 412-624-9505.

The Department of Environmental Health and Safety compiles these "Sharps Injury Report" forms into a "Sharps Injury Log" for the recording of percutaneous injuries from contaminated sharps as required by OSHA. The Department of Environmental Health and Safety will annually review the Sharps Injury Log to determine if changes are necessary to the procedures outlined in the Exposure Control Plan and to ensure that appropriate changes are implemented.

VI. TRAINING PROGRAM

Training for all employees will be conducted for employees prior to initial assignment to tasks where occupational exposure to bloodborne pathogens may occur. The Environmental Health and Safety Department conducts BBP training twice monthly. Dates and times may be obtained by calling 412-624-9505 or visiting the EH&S webpage at www.ehs.pitt.edu. (Training Page). On-line bloodborne pathogen training is also available through Research and Practice Fundamentals website at http://rpf.health.pitt.edu/rpf/

All employees covered by this Exposure Control Plan must receive refresher training every 12 months.

Training for employees includes the following:

- Overview of bloodborne pathogens;
- Epidemiology, symptoms, and routes of transmission of bloodborne pathogens;
- Prevention techniques;
- Explanation of the use of and limitations of engineering controls, work practices and personal protective equipment;
- Spill cleanup procedures;
- Accident and Exposure follow-up procedures;
- Elements of ***29 CFR 1910.1030***;

- Exposure Control Plan, HBV vaccinations, Methods of compliance, Hazard Communication, Record Keeping; and

VII. RECORDKEEPING PROGRAM

University Employee Training records, Sharps Injury Log, and HBV inoculation records are maintained by the Department of Environmental Health and Safety - B-50 Benedum Hall, (412) 624-9505.

University Employee Medical Records are maintained by Employee Health Services - (412) 647-3695.

RESPONSIBILITY, AUTHORITY, AND RESOURCES FOR BIOSAFETY

1. Principal Investigators

The Principal Investigator (PI) is directly responsible for the safe operation of his/her laboratory. The PI must be knowledgeable of the guidelines described in this manual and must apply these principles and procedures to protect the health and well-being of the staff, students, and the general public against undesirable consequences of experimental work conducted under the auspices of the University of Pittsburgh. The responsibilities of the PI are:

1.1 Ensuring that laboratory practices and techniques, containment equipment, personal protective equipment, and laboratory facilities are commensurate with the biosafety level appropriate for the organisms and materials utilized

1.2 Registering with Environmental Health and Safety (EH&S) via electronic Workbook the possession and use of any agents or materials requiring Biosafety Level 2 (BSL-2) or higher containment

1.3 Submitting documentation to the Institutional Biosafety Committee for written approval prior to conducting any experiments utilizing recombinant DNA.

1.4 Submitting documentation to the Institutional Animal Care and Use Committee (IACUC) for written approval prior to conducting any experiments utilizing animals.

1.5 Establishing and maintaining the safety training of all personnel in the lab, including training on lab-specific procedures and the health hazards associated with the agents encountered in the laboratory.

1.6 Establishing a written emergency response plan to be followed in the event of a release of hazardous biological material(s) and verifying that all personnel have knowledge of their respective duties.

1.7 Communicating the hazards associated with the work area by posting the appropriate biohazard warning signs and assigning individuals to be notified in cases of emergency.

1.8 Reporting any spills, accidental release, potential exposures, and injuries involving biohazardous materials to the EH&S Biosafety Officer and implementing follow-up actions to prevent future recurrences.

1.9 Assuring that all potentially infectious waste, equipment, and clothing removed from the lab or site are properly disinfected.

2. Department Chairpersons and Directors of Research Institutes and Research Centers

The chief administrator(s) or research director of each department, school, research Institute, or research center is responsible for the safe operation of all laboratories under his/her jurisdiction. The responsibilities of the chief administrator are:

2.1 Ensuring that all individuals in the responsibility center have appropriate biosafety training and the opportunity to enroll in required or available occupational health programs.

2.2 Assisting in the elimination of all known unsafe acts and practices.

2.3 Nominating qualified members to the University Biohazards Committee.

3. University Biohazards Committee

The University Biohazards Committee is a subcommittee of the University Environmental Health and Safety Committee. It is established to review and approve biosafety issues, including the maintenance of an active and effective biosafety program as developed by the Department of Environmental Health and Safety for all University of Pittsburgh faculty, staff and students.

Schools or departments with biological research activities may nominate qualified members to serve on the Committee. Additional faculty members may be recruited to serve on the Committee based on area of expertise. The Committee consists of a Chairperson appointed from the University's faculty, the Biosafety Officer, the University's Employee Health Physician, and representatives of University departments that are users of biological materials or that have administrative responsibilities for such activity.

The Biohazards Committee works closely with and serves as a resource to the Department of Environmental Health and Safety, the Institutional Biosafety/rDNA Committee (IBC), and the Institutional Animal Care and Use Committee (IACUC). The responsibilities of the Biohazards Committee include:

3.1 Oversee the registration of biohazardous material and/or biological agents (except recombinant DNA work) to ascertain if precautions are adequate to protect personnel and the environment, and recommend measures necessary for safely working with such materials.

3.2 Review and/or propose procedures for maintaining safe work environments and for compliance with federal, state, and local regulations involving the procurement, use, containment, decontamination, disinfection, and/or disposal of biological agents or biohazardous materials.

a. Oversee the commissioning and de-commissioning of facilities requiring containment above Biosafety Level 2 (BSL-2) and Animal Biosafety Level 2 (ABSL-2). Review and approve associated Standard Operating Procedures for such facilities with regard to the design, commissioning and approval.

a. Review medical surveillance programs aimed at preventing laboratory-acquired infections.

b. Review incident reports involving biohazardous materials or biological agents, and recommend corrective actions to prevent recurrence, eliminate hazards or provide appropriate follow-up for exposed individuals.

c. Provide consultation on emergency response planning involving the proper handling, disinfection and disposal of biohazardous agents.

d. Mediate disputes over the proper handling, use, or disposal of biohazardous materials, and/or the proper containment of biological agents.

e. Review and approve substantial revisions or additions to the University of Pittsburgh Bloodborne Pathogen Exposure Control Plan.

f. Advise on training efforts developed to communicate relevant procedures and programs.

4. Biosafety Officer

The Biosafety Officer is a member of the Department of Environmental Health and Safety and interfaces with academic and research personnel utilizing biological materials for research or teaching activities. The Biosafety Officer ensures that biosafety programs are implemented throughout the University. Significant responsibilities of the Biosafety Officer include:

4.1 Reviewing plans and protocols for research, and approving biocontainment facilities, biocontainment equipment, and personal protective equipment.

4.2 Reviewing and approving standard operating procedures (SOPs) for research with BSL-3 materials and Select Agents.

4.3 Managing a program to conduct periodic audits on biocontainment, lab practices, lab and animal facilities, and equipment used in research.

4.4 Managing a program for investigating all accidents involving possible release and/or exposure to infectious or toxic materials and reporting findings and recommendations to prevent future occurrences to laboratory management and the Biohazards Committee.

4.5 Consulting with biological material users on decontamination procedures.

4.6 Serve as the Responsible Official for the CDC/USDA Select Agent Program.

4.7 Serve as a member of the Institutional Animal Care and Use Committee (IACUC) and Institutional Biosafety Committee.

4.8 Manage a program to review and assess health and physical hazards associated with IACUC protocols prior to approval

5. Institutional Biosafety Committee

Federal guidelines require the University to have an active expert committee to review the safety procedures for all research involving recombinant DNA. The Institutional Biosafety Committee (IBC/rDNA) is comprised of faculty members from the University of Pittsburgh and two members from the surrounding community, and is responsible for reviewing and approving all work involving recombinant DNA (rDNA). Inquiries to the IBC/rDNA are coordinated by the rDNA Office (383-1768) which is supported administratively by the Research Conduct and Compliance Office.

BIOSAFETY GUIDELINES

The University intends to comply with all aspects of biosafety practice presented by CDC, NIH, and US Department of Health and Human Services in the latest published editions of Biosafety in Microbiological and Biomedical Laboratories and the NIH Guidelines for Recombinant DNA and Gene Transfer. Additionally, strict adherence to standard microbiological practices and the use of Standard Precautions, defined as the assumption that all biological material contains potentially infectious agents, must be followed. The following listing of basic biosafety guidelines is considered fundamental to safe laboratory practice, but should not be viewed as comprehensive.

1. Mechanical pipetting aids shall be used when pipetting all material. Mouth pipetting is prohibited regardless of the material or manipulation.

2. Eating, drinking, storing food, handling contact lenses and applying cosmetics are not permitted in laboratory areas. Food should not be stored in refrigerators or freezers used to store biohazardous material.

3. Hands must be washed immediately after procedures involving biological material manipulation or handling, after glove removal and routinely before leaving the laboratory. All labs using biological materials must be equipped with a sink having hot and cold running water dispensed by a mixing faucet, and have soap and disposable hand towels immediately accessible.

4. Workers should decontaminate their work area following work with biological material and immediately after any spill.

5. Liquid-barrier gloves should be worn to protect faculty, staff and students from infection through contact with biological materials. Gloves must be removed prior to exiting the laboratory.

6. Procedures for the safe handling of sharps must be instituted, and efforts should be made to minimize exposure to potentially infectious material through the evaluation and use of safety-engineered sharps.

7. Laboratory coats or gowns should be worn while handling biological material. All protective equipment and laboratory garments must not be worn outside the laboratory. Laboratory clothing must be disinfected or clearly labeled as potentially infectious or dirty before removal from the laboratory.

8. All procedures should be performed in a manner that reduces the generation of aerosolized material. Operations such as centrifugation, sonication, and blending are known aerosol-generating procedures. Procedures or activities expected to produce potentially infectious aerosols must be performed in a certified biological safety cabinet or other equipment with integral engineering controls to contain aerosolized material.

BIOSAFETY GUIDANCE FOR PRINCIPAL INVESTIGATORS

1. The Principal Investigator (PI) is responsible for training his/her personnel on the potential hazards of the specific agents involved in the research, and the specific techniques to be used to handle the material safely. The Biosafety Officer is available for consultation and assistance.

2. The Principal Investigator is responsible for proposing the Biosafety Level (BSL) for the research/teaching project and associated handling of biological materials. The Biosafety Level is the combination of lab practices, safety equipment and laboratory facilities specifically appropriate for the operations performed, the agents handled and the laboratory function. The BSL assignment will be reviewed and approved by the Biosafety Officer and if recombinant DNA is involved, the Institutional Biosafety Committee.

   2.1 The first step in Biosafety Level (BSL) determination is to investigate if a BSL or risk group has previously been assigned for the proposed biological agent.

   2.1.1 Current BSL assignments can be found in the latest editions of <u>Biosafety in Microbiological and Biomedical Laboratories</u>, Health and Human Services, or the World Health Organization's Biosafety Manual.

   2.1.2 These BSLs were assigned assuming activities typically associated with the growth and manipulations of the quantities and concentrations of infectious agents required to accomplish identification or typing. If the protocol requires higher concentrations, larger volumes, or practices likely to endanger personnel, the BSL assignment may be increased.

   2.2 For purposes of recombinant DNA, risk groups are assigned based on the relative pathogenicity of an agent to healthy adults. Most often, risk group assignments equate to BSL, i.e. agents in risk group 2 are assigned to BSL-2. Risk Group assignments can be found in the Guidelines for Research Involving Recombinant DNA Molecules, NIH Guidelines.

   2.2.1 Risk group assignment should be used as a starting point for determining the BSL, but a thorough consideration of the agent and how it is to be manipulated must also occur. Factors to be considered in determining the BSL include agent factors (such as virulence, pathogenicity, infectious dose, environmental stability, route of spread, communicability, quantity, and the availability of vaccine or treatment), and gene product effects (such as toxicity, physiological activity, and allergenicity).

   2.2.2 Any strain that is known to be more hazardous than the parent (wild-type) strain should be considered for handling at a higher containment level. Certain attenuated strains or strains that have been demonstrated to have irreversibly lost known virulence factors may qualify for a reduction of the containment level compared to the risk group assigned to the parent strain

2.3 If the biological agent is not listed in these references, then the PI must assign a BSL using the best available information. Assistance in assigning BSLs is available from the Biosafety Officer, the Institutional Biosafety Committee and the Biohazards Committee.

BIOSAFETY LEVELS

There are four internationally accepted biosafety levels. These levels represent a combination of laboratory practices, techniques, protective equipment and facility features.

1. Biosafety Level 1 (BSL1)

1.1 BSL1 agents are viable microorganisms not known to cause disease in healthy adults. BSL1 agents are recommended for undergraduate teaching laboratories and for work performed on open laboratory benches.

1.2 BSL1 practices and facilities represent a basic level of containment that relies on standard microbiological practices with no special primary or secondary barriers.

1.3 A sink for hand washing is required within the laboratory. Special containment equipment is not required for manipulations of Biosafety Level 1 agents.

1.4 Biohazard warning signs indicating BSL1 can be posted on entrances, per the discretion of the Investigator.

2. Biosafety Level 2 (BSL2)

2.1 BSL2 agents are moderate-risk, viable microorganisms associated with human diseases of varying severity in healthy adults. These agents can be hazardous through various exposure routes, but not inhalation. The vast majority of research with biological agents at the University is conducted at BSL 2.

BSL2 is necessary when work is done using human-derived blood, body fluid, or tissues and using human cell lines where the presence of an infectious agent is unknown.

2.3 Biosafety Level 2 practices and techniques shall include all the standard microbiological practices used for Biosafety Level 1, in addition to limiting access to the laboratory.

2.4 Biohazard warning signs must be posted at each entrance to limit access to authorized individuals, provide contact and agent information, and indicate BSL2 hazards.

2.5. Primary barriers including certified biological safety cabinets are required for aerosol-generating manipulations of agents assigned to Biosafety Level 2 or tasks with splash potential of BSL2 material.

2.6 An autoclave must be accessible for sterilization of infectious waste generated in BSL2 facilities.

2.7 All BSL2 facilities must be maintained under negative pressure relative to corridors and adjacent public areas, and must have exhaust air that is not re-circulated.

2.8 Special practices required for work with Biosafety Level 2 agents include decontamination of all infectious material prior to disposal and implementation of an accident/incident plan that details exposure follow-up procedures and methods to clean up spills.

2.9 Biosafety Level 2+ (BSL-2+) is a combination of BSL-2 facility containment requirements with the utilization of BSL-3 practice requirements that includes the preparation of a laboratory operations manual and restricted laboratory access. BSL-2+ is required at the University of Pittsburgh for work with lentiviral agents, such as HIV and SIV, and recombinant DNA work with lentiviral-based vectors. See the Lentiviral Usage SOP for more information on the requirements for BSL-2+.

3. Biosafety Level 3 (BSL3)

3.1 Biosafety Level 3 agents and materials are high-risk, viable microorganisms associated with human diseases that are potentially lethal, and are hazardous through exposures resulting from autoinoculation, ingestion, mucous membrane exposure, and particularly through inhalation.

3.2 Biosafety Level 3 practices and techniques include all standard microbiological practices used for Biosafety Levels 1 and 2 in addition to limiting laboratory access to only those personnel required for the program and who have been trained in potential hazards and control measures on the specific BSL3 agent.

3.3 Operational procedures for BSL3 activity must be prepared, documented, and maintained in an operating Manual approved by the Biosafety Officer and the Biohazards Committee. It is the responsibility of the Principal Investigator of the BSL3/ABSL3 facility to develop and maintain this Manual. Copies of the Manual will be kept by the Principal Investigator, facility director (if different from the PI), EH&S, and if animals are utilized, the Division of Laboratory Animal Resources (DLAR). At a minimum, the Manual must contain the following components:

3.3.1 Approval Page signed by Principal Investigator, facility director, EH&S Biosafety Officer, Biohazard Committee Chairperson, and if animals are utilized, the DLAR Director.

3.3.2 Emergency Contact Numbers and Emergency Procedures,

- List of agents used in the facility and locations of use and storage,
- Facility entrance requirements,
- List of training requirements and records of training for all current personnel

- List of medical surveillance requirements for personnel and proof that personnel have met current requirements.
- Standard Operating Procedures and BSL3 work practices (e.g., agent handling, PPE, waste handling and disposal),
- Emergency procedures (e.g., spill, fire, personal injury)
- Autoclave verification program,
- MSDSs for hazardous chemicals and infectious materials,
- Annual reverification procedures and reports of activities for same,
- Other items as deemed necessary by the Biohazards Committee.

3.4 Appropriate personal protective equipment is required for all manipulations of agents assigned to Biosafety Level 3 including lab clothing, liquid barrier gloves, respiratory protection, and safety glasses.

3.5 All personnel authorized and trained to enter BSL3 laboratories must be enrolled in the University Respiratory Protection Program and the University occupational health screening program for BSL3 workers.

3.6 All manipulations of infectious agents in a BSL3 facility are performed in certified biological safety cabinets.

3.7 An autoclave must be available for sterilization of infectious waste and all other materials before it is allowed to leave the BSL3 containment area.

3.8 A spill cleanup kit containing materials to contain, disinfect, and cleanup laboratory spills must be available in the BSL3 containment area.

3.9 The University has adopted design guidelines and specific commissioning criteria for BSL3 facilities. Contact EH&S.

4. Biosafety Level 4 (BSL 4)

Biosafety Level 4 agents and materials are extremely high-risk, viable microorganisms associated with dangerous and exotic, life-threatening human diseases. Because of the lack of appropriate facilities and restriction by law, experiments involving agents that require Biosafety Level 4 containment facilities, and/or experiments involving nonindigenous pathogens with importation, possession or use prohibitions or restrictions (as defined by Federal regulation or administrative policies) are not permitted to be undertaken on the premises of the University of Pittsburgh.

BIOLOGICAL SAFETY CABINETS

Properly maintained and utilized biological safety cabinets (BSC) provide effective containment for the safe manipulation of potentially infectious agents and provide a sterile work environment for the protection of experimental material. High Efficiency Particulate Air (HEPA) filters are installed on the exhaust plenum of BSCs to protect the environment and the worker. HEPA filtering of the supply air within the BSC protects the research materials from room contaminants.

1. Only biological safety cabinets listed in the latest edition of the *National Sanitation Foundation (NSF) Standard 49* (Class II Laminar Flow Biohazard Cabinetry) shall be purchased. EH&S is available to consult on BSC selection and location.

2. Biosafety Cabinet Terminology

2.1 Class I BSCs are no longer manufactured on a regular basis. Usage of existing Class I BSCs should be limited to low risk biological agents in which protection of experimental material is not necessary.

2.2 A Class II BSC is a front-opening cabinet with inward air flow to protect personnel, HEPA-filtered vertical laminar air flow to protect the work, and HEPA-filtered exhaust for environmental protection. Class II BSCs are divided into Types A or B.

2.2.1 Class II Type A1 cabinets (formerly designated as Type A) utilize a design in which 70% of the cabinet air is recirculated to the cabinet work area through a HEPA filter; and the balance of the air can be exhausted through a HEPA filter back into the room or to the outside via a canopy exhaust connection.

2.2.2 Class II, Type A2 cabinets (formerly designated as Type B3) function the same as Class II Type A1, except all biologically contaminated ducts and plenums under negative pressure are surrounded by negative pressure ducts and plenums.

2.3 Class II Type B1 cabinets function in a manner in which 30% of the cabinet air is recirculated to the cabinet work area through a HEPA filter. The 70% balance of the air is exhausted through a dedicated duct to the atmosphere after passing through a HEPA filter.

2.4 Class II Type B2 cabinets have HEPA filtered downflow air drawn from the laboratory, and exhaust 100% of the inflow and downflow air to the atmosphere after filtration through a HEPA filter. There is no recirculation of air in the cabinet or air returned to the laboratory

2.5 Class III biological safety cabinets are totally enclosed with leak-tight construction. Operations in the cabinet are conducted through durable gloves attached to the cabinet, hence the term glove box. The cabinet is maintained under negative air pressure. Downflow air is drawn into the cabinet through HEPA filters. The exhaust air is treated by HEPA filtration. Class III BSCs are not recommended or necessary for most biomedical research that involves BSL 2 materials.

3. Biosafety Cabinet Selection

   3.1 Where biosafety cabinet applications will consist primarily of microbiological work and only minute or trace amounts of volatile hazardous chemicals will be utilized, a Type A2 cabinet with an exhaust canopy for discharge into the building exhaust system is recommended.

   3.2 It is permissible under the 2002 NSF 49/ANSI Guidelines to exhaust Type A2 cabinets back into the laboratory provided that NO volatile or toxic chemicals and/or radionuclides are utilized in the BSC.

   3.3 Where BSC applications could include work with more than minute quantities of volatile chemicals, or work with chemicals for which the physical properties or hazards are unknown or are known to present special hazards, a Type B2 cabinet is recommended. These cabinets provide 100% exhaust with no recirculation into the room or BSC. Exhaust from Type B2 cabinets must be interlocked with the blower or building exhaust system to prevent pressurization of the BSC.

   3.4 If the primary use of the BSC will be to contain volatile or hazardous chemicals, and protection of the research product is not required, a chemical fume hood should be considered. For applications that require product protection, such as transgenic animal or *in vitro* work, a chemical fume hood with not offer the necessary product protection.

4. All biological safety cabinets shall be certified annually per the testing specifications found in NSF 49 and the manufacturer's specification.

5. All new BSCs shall be certified following installation, and before initial use.

6. All Type A2 biological safety cabinets in BSL-3 facilities must be installed with a thimble/canopy connected to the exhaust air system.

7. Performance tests/certifications are to be conducted by a NSF-certified contractor experienced in BSC testing. Arrangements for performance testing and certifications are initiated by the Investigator or department owning the equipment.

8. Before disassembling or moving a biological safety cabinet, appropriate decontamination by an experienced contractor is required. Relocated BSCs shall be re-certified following re-installation, but before resuming use.

9. When maintenance work, filter changes, and performance tests require access to the sealed, potentially contaminated portion of the cabinet, appropriate decontamination of the entire BSC is required.

10. All BSCs must be clearly labeled with the class and type, the date of the last certification, the name of the person performing the test, and the company name.

11. Use of Gas Burners or Open Flames in Biosafety Cabinets

11.1 The use of gas burners in biosafety cabinets has led to fires, destroyed cabinets, and injured workers. **It is not recommended to use gas burners or open flames in biosafety cabinets. This recommendation is supported by the CDC.**

11.1.1 Depending on the type of BSC, a certain percentage of air is recirculated inside the BSC. If gas leaks out of a gas valve, it can accumulate inside the cabinet and ignite when the flame is lit.

11.1.2 Excess latex tubing can loop over the flame and be burned, causing a flame to shoot out of the gas valve.

11.2 The use of gas burners or open flames will compromise the function of the biosafety cabinet. The biosafety cabinet provides worker protection by drawing air into the cabinet and filtering microorganisms out through a HEPA filter. The heat produced from a gas burner can disrupt the fragile air barrier inside the biosafety cabinet and expose workers to air from inside the cabinet; and the heat can disrupt normal exhaust flows.

11.3 Eliminate use of gas burners within BSCs. Use only sterile disposable plastic ware instead of glassware that must be flamed. Rely upon good chemical disinfection, such as bleach or other commercial disinfectants, to clean equipment and surfaces. Use an electric device such as a Bacti-cinerator for high heat applications.

11.4 Use proper work practices to maintain a sterile environment inside to cabinet to eliminate the need for flame sterilization.

- Minimize movement in and out of the biosafety cabinet.
- Place all working materials inside the biosafety cabinet before beginning work. This will help preserve the air barrier in the front of the biosafety cabinet.
- Work from clean to dirty, by placing all contaminated materials on one side of the biosafety cabinet.
- Collect all wastes such as contaminated plastic ware in a bag in the biosafety cabinet and then dispose it in a larger biohazard bag outside of the cabinet when work is completed.

11.5 If a gas burner must be used, then a touch-plate gas burner should be substituted for a Bunsen burner.

- Once the pilot light is lit, it remains small, and the worker must touch a metal plate to increase the flame.
- Keep lengths of tubing as short as possible to avoid looping and burning through the tubing.
- Use butyl rubber tubing instead of latex tubing and inspect regularly.
- **Do not leave gas burners unattended**.

For more information on the performance, use, and certification of BSCs refer to the following references:

- National Sanitation Foundation Standard No. 49, Class II (Laminar Flow) Biohazard Cabinetry, (2002). Ann Arbor, MI.
- Biosafety in Microbiology and Biomedical Laboratories, US Dept. of Health and Human Services Publication No. CDC 93-8395, 4th Edition (1999). Center for Disease Control, Atlanta, GA.
- Primary Containment for Biohazards: Selection, Installation, and Use of Biological Safety Cabinets, 2nd ed., US Department of Health and Human Services, 2000.

INCIDENT REPORTING FOR EXPOSURE TO POTENTIALLY INFECTIOUS MATERIAL

It is important that faculty, staff and students understand the necessity for prompt action following any occupational exposure to potentially infectious material. An exposure incident to bloodborne pathogens or other potentially infectious material is defined as contact with the eye, mouth, or other mucous membrane, non-intact skin, or parenteral contact via a sharp or needle that occurs during the performance of assigned duties. The response to an exposure incident as previously defined is as follows.

1. Immediately wash the exposed area with soap and water. If the exposed area is the eye, flush with water only for 15 minutes.

   NOTE: It is not advisable to apply alcohol, bleach or other disinfectants to the exposed area. Wash with soap and water.

2. Promptly report the incident to your supervisor.

   NOTE: If the supervisor is not available, immediately proceed to step 3.

3. Immediately report for treatment

   3.1 During business hours (8 AM – 5 PM Monday-Friday) report to Employee Health Services Clinic, Suite 500.59, Medical Arts Building, 3708 Fifth Avenue, phone: 412-647-3695

   3.2 Weekends, holidays, and non-business hours report to UPMC Presbyterian Hospital, Emergency Department

   NOTE: Post-exposure prophylaxis may be recommended in the event of a high-risk exposure as defined by the CDC. Treatment is most efficacious when initiated within one hour of exposure. Exposure risk is determined by a trained occupational health practitioner. Therefore, prompt medical attention is key.

4. The exposed individual and the supervisor must fill out the Employer's Report of Occupational Injury or Disease Form (ODIC-334) and file with Worker's Compensation within 48 hours. The supervisor must also complete and submit the Sharps Injury Report Form and forward to EH&S.

BIOLOGICAL MATERIAL SPILLS

Each Principal Investigator/laboratory director must develop specific spill cleanup methods tailored to the biological agent(s), quantities, and procedures being implemented in the lab, and ensure that the appropriate spill response material is immediately accessible.

1. Minor Biological Spills

1.1 A Minor Biological Spill is one that the laboratory staff is capable of handling safely without the assistance of EH&S or emergency personnel. Minor biological spills involve BSL1 materials or releases of a small volume of BSL2 material inside a biological safety cabinet or other biocontainment device.

1.2 If the spill occurred inside a biological safety cabinet, close the sash and allow the cabinet to operate for at least 15 minutes before proceeding with the spill cleanup.

1.3 Alert people in area of spill and secure the affected area.

1.4 If any material has been splashed on you, follow the Procedure for Exposure to Poltentiall Infectious Material found in the Manual.

1.5 Remove and disinfect any contaminated clothing.

1.6 If you have not been exposed, don the appropriate personal protective equipment for the cleanup operation, which include at a minimum liquid barrier gloves, safety glasses, and lab coat.

1.7 Cover the spill with paper towels or other absorbent material to prevent further aerosolization.

1.8 Pour an approved disinfectant gently over the covered spill, working from the outside inwards.

1.9 Wait at least 15 minutes for the disinfectant to penetrate through the contained spill and achieve the required contact time for disinfection.

1.10 Do not utilize hands if glass or other sharps are involved in the spill. Use a tool (e.g. shovel, forcep) to remove the absorbent material and debris. Place in a biohazard bag for autoclaving and subsequent disposal.

1.11 Clean the original spill area with detergent.

1.12 Notify your supervisor of the incident.

2. Major Biological Spill

2.1 A Major Biological Spill is one that requires assistance of safety and emergency personnel. Major Biological Spills involve releases of BSL2 or higher materials outside of a biological safety cabinet, or spills of such materials that involve excessive splashing or aerosolization.

2.2.Alert people in the laboratory and secure laboratory to eliminate entrance of additional personnel.

2.3 If any material has been splashed on you, if you have been exposed, or if any of your personal protective equipment has been breached, follow the Procedure for Exposure to Potentially Infectious Material found in this Manual.

2.4 Remove and disinfect any contaminated clothing.

2.5 Notify your supervisor and the Department of Environmental Health and Safety (Biosafety Officer) at 412-624-9505 of the incident.

2.6 If the situation involves an imminently life-threatening injury, a release to the external environment or other catastrophic potential, call 412-624-2121.

2.7 Have persons knowledgeable of incident and laboratory available to assist EH&S responders and/or emergency personnel.

BIOLOGICAL WASTE DISPOSAL

1. SCOPE

All biological, infectious or pathological waste that is generated at the University of Pittsburgh must be properly disposed. NO infectious wastes are permitted to leave the premises or control of the Principal Investigator without first being disinfected or sterilized to ensure that the waste presents no harm to others or the environment. As with other classifications of waste, the responsibility for the identification, segregation and handling of biological waste within the University rests with the generator. The Department of Environmental Health and Safety (EH&S) is available to provide technical guidance, assistance and information regarding the proper handling and disposal of biological materials.

2. GENERAL

EH&S picks up biological waste materials from University waste pickup points at the Pittsburgh Campus weekly. The schedule of pick-ups is every Thursday, starting at 8:00 A.M. and proceeding until completion. In the event that a University holiday falls on a pickup day, the pickup will be rescheduled on a case-by-case basis (usually on the preceding Wednesday.) Refer to the EH&S website for the latest version of the biological waste pickup schedule. EH&S provides biological waste disposal boxes and labels free of charge, while the investigator is responsible for the purchase of biological waste bags and sharps containers.

2.1 Supplies

- **Biological waste bags:** Red biological waste bags can be purchased through the Biological Sciences Stockroom by calling 624-4275 and providing a Pitt Account number. The stockroom will deliver them to the caller. These bags are sized to fit the large Biological Waste boxes. If biological waste bags are purchased from an alternate source, the bags must meet ASTM D1709-04 and D1922-06a test criteria, and must be labeled with the biohazard symbol and should be red or orange in color.
- **Sharps containers:** Sharps containers can be purchased through the Biological Sciences Stockroom by calling 624-4275 and providing a Pitt Account number.
- **Biological waste boxes:** EH&S provides biological waste boxes to University Biological Waste Pickup Points or specific users upon request. University driver will deliver boxes on biological waste pickup days.
- **Biological waste labels (for Biological waste boxes):** EH&S provides Pitt biological waste Labels free to University users upon request. Labels can be delivered by University driver on biological waste pickup days, sent by campus mail, or picked up at the EH&S office (B-50 Benedum Hall).
- **Small biological spill kits and disinfectants:** such as Lysol and Clorox Bleach are available for purchase through the Facilities Management Stockroom by calling 412-383-3191 or 412-383-3192 and providing a Pitt Account number. The stockroom will deliver them to the caller.

3. HANDLING OF BIOLOGICAL WASTES

3.1 Solid Biological Waste

Solid wastes, such as plastic culture plates, should be disposed in approved biological waste bags. Solid, plastic waste used, during or in contact with potentially infectious material should be disinfected with an appropriate disinfectant prior to disposal of the solid waste in approved biohazardous bags.

Solid wastes, such as disposable lab coats or gowns, gloves and other articles of personnel protective equipment (PPE) without gross contamination should be disposed in approved biohazardous bags prior to leaving the biohazardous area.

Solid wastes suitable for autoclaving (121 º C for 60-90 minutes) should be treated in this manner prior to removal from the premises or control of the Principal Investigator(s).

All biological waste bags should be placed or contained in approved biological waste boxes (labeled with a Pitt biological waste label), and the boxes should be sealed with packing tape and placed in designated areas of the building for pickup.

3.2 Liquid Biological Waste

Liquid wastes (blood, virus stock, cell culture waste, etc.) should be carefully poured or collected into the appropriate disinfectant to inactivate potentially infectious materials. Appropriate disinfectants include bleach and EPA-registered disinfectants. The appropriate disinfectant should be selected based on complete inactivation of the agent and EH&S can be contacted (624-9505) to determine the appropriate disinfectant for the agent.

Following sufficient contact time, the disinfected solution should be poured directly down the drain. This should be done carefully to avoid splashing and aerosol generation. The drain should be flushed with disinfectant of sufficient quantity to at least fill the trap.

Large volumes of liquid wastes should be autoclaved prior to disposal down the drain.

3.3 Sharps

Refer to the Sharps Disposal SOP for more information.

4. HANDLING OF PATHOLOGICAL WASTE

Pathological wastes – means waste material consisting of only human remains, anatomical parts, and/or tissues. This type of waste should be collected in approved biological waste bags. The bags should be closed on a daily basis and placed in an approved biological waste box. The box should be sealed with packing tape and "PATHOLOGICAL WASTE" should be written on the top and side of the box in large letters using a permanent marker, and the box should be placed in the designated areas of the building for pickup. If the waste could become odorous prior to pickup, storage in an approved cold storage or freezer prior to packaging may be necessary.

SHARPS DISPOSAL GUIDELINES

Sharps are instruments that can puncture, cut, or scrape body parts. These include, but are not limited to syringes, needles, scalpel blades, razor blades, wires, Pasteur pipettes, lancets, and other sharp metal laboratory waste. Sharps are puncture hazards to laboratory staff and waste handlers.

All sharps must be disposed in puncture-resistant impervious rigid containers with self-closing lids. Do not fill sharps containers greater than 2/3 full. No sharps should be thrown in the regular trash.

Sharps contaminated with biohazardous materials

- Sharps must be placed in a red sharps container
- Sharps container must have biohazard label
- Sharps container must be disposed as biological waste (packed in biological waste box with completed red Biological Waste label, write "CONTAINS SHARPS" on label and box)

Sharps contaminated with chemical materials

- Sharps contaminated with chemicals should be placed in a sharps container
- Any biohazard markings on the container should be removed/covered
- Place a completed orange Chemical Waste label on the container (label as "NON-BIOLOGICAL SHARPS")
- Dispose sharps container through University's Chemical Waste Program
- Sharps container should be packed separately from other chemical waste

Additionally, any sharps that are not contaminated with biohazardous or chemical materials should still be properly containerized. Dispose these types of sharps as biological waste.

If you have any questions about the disposal of sharps, please call Environmental Health and Safety at 412-624-9505.

SHARPS USE AND SAFETY-ENGINEERED SHARPS DEVICE INITIATIVE

A Sharp is defined as any item that can puncture human skin. Sharps include needles, scalpels, razor blades, etc. Sharps injuries may occur when using exposed needles, scalpels, or any other Sharps device. Ideally, principal investigators (PIs) should eliminate the use of needles when possible and where safe and effective alternatives are available. However, when elimination of Sharps is not feasible, engineering controls should be used to reduce Sharps injuries.

1. Unsafe work practices also contribute to Sharps injuries. All Sharps, including Safety-Engineered Sharps Devices, must be properly disposed in approved Sharps containers. Anyone using Sharps should remember the following:

   1.1 All needles and Sharps must be discarded directly into approved Sharps containers.

   1.2 Standard needles should not be recapped or left out in work areas; they should be used and then immediately disposed in approved Sharps containers without recapping.

   1.3 Approved Sharps containers must be placed in all areas where Sharps may be utilized or generated.

   1.4 Sharps containers should be disposed when they are approximately 2/3 full. (Refer to the Sharps disposal section for more information.)

   1.5 If a Sharps injury occurs, a Sharps Injury Report form must be filled out. Refer to the Injury Treatment and Reporting for more information.

2. Use of Safety-Engineered Sharps Devices

Safety-engineered Sharps Devices are Sharps that contain engineering controls; safety features are built into the products. Safety-engineered Sharps Devices include retractable injection needles, scalpels with sliding shields, and sheathing blood collection devices. Safety-Engineered Sharps Devices should be utilized wherever possible to reduce the potential for exposure to potentially infectious materials or hazardous chemicals.

EH&S is currently working with researchers to implement Safety-Engineered Sharps Devices in an effort to protect faculty, staff, and students from risks associated with exposure to potentially infectious materials or hazardous chemicals via a Sharps injury. Implementation and active evaluation of Safety-Engineered Sharps Devices is mandated for the following groups:

   2.1 University faculty and staff that perform human subject research or have direct patient contact duties.

   2.2 University faculty and staff that work with experimental animals at animal biosafety level 2+ (ABSL-2+) or above.

2.3 University faculty and staff that work at ABSL-2 and for whom EH&S has determined a high risk of significant exposure to dangerous pathogens via Sharps injury.

2.4 University faculty and staff utilizing Sharps while working at biosafety level 2 (BSL-2) or above.

2.5 University faculty and staff utilizing Sharps while working with non-human primates and their tissues.

PIs should select Safety-Engineered Sharps Devices by remembering the following:

- The safety feature should work effectively and reliably
- The device should be acceptable to the user
- The device should not create an additional hazard
- When applicable, the device should not adversely affect the animal

EH&S is available to assist PI's with obtaining information on and samples of Safety-Engineered Sharps Devices.

Reference: NIOSH Alert: Preventing Needlestick Injuries in Health Care Settings, NIOSH Publication No. 2000-108, http://www.cdc.gov/niosh/2000-108.html

REGISTRATION PROCESSES FOR BIOLOGICAL SAFETY

1. Registration

1.1 Before beginning a project (classroom or experimental) involving work with biological materials at BSL2 or higher, the Principal Investigator or Instructor should complete the EH&S "Registration Workbook for Use of Biological and Chemical Agents," and send the completed electronic form to biosafe@ehs.pitt.edu. This registration is required for Institutional Animal Care and Use Committee (IACUC) approval of any new protocol and any renewed or modified protocol utilizing research animals; and for any Institutional Biosafety Committee (IBC) protocol utilizing recombinant DNA at BSL2 or above

1.2 Following receipt, a confirmation will be returned to the PI along with a detailed list of any necessary additions or revisions to the registration.

2. IACUC Registration

2.1 Upon receipt of the workbook, EH&S processes the registration, and begins protocol review, EH&S medical surveillance and training requirement review (MST), and the risk assessment (RA).

2.2 The table of required MST is compared to the current EH&S training record for all personnel listed on the protocol. A list of all personnel with expired MST dates is forwarded to the PI along with instructions on how to update the training.

2.3 EH&S prepares a risk assessment document summarizing the hazards and providing recommendations for conducting the project safely, including engineering controls, personal protective equipment, work practices, signage/labeling, and bedding/waste disposal. Following EH&S approval of the project, a copy of the risk assessment is sent to the PI and other impacted departments on campus (IACUC and DLAR).

Insert Sample RA

3. Recombinant DNA Registration.

3.1 When institutions receive NIH funding for research involving recombinant DNA molecules, they must comply with all provisions for containment and biosafety oversight set forth in the NIH Guidelines for Research Involving Recombinant DNA Molecules. Failure to adhere to the NIH Guidelines can result in suspension or termination of NIH funding for this type of research, or lead to a requirement for prior NIH approval of every recombinant DNA project at the University. Compliance with the NIH Guidelines is critical to the safe conduct of research and to the fulfillment of an institutional commitment to the protection of staff, the environment, and public health. The NIH Guidelines are available at: http://www4.od.nih.gov/oba/rac/guidelines/guidelines.html .

3.2 The University of Pittsburgh Institutional Biosafety Committee (IBC) has determined that all recombinant DNA work, whether or not defined as exempt by NIH guidelines, must be reported to and approved by the IBC.

3.3 IBC/rDNA Registration Applications can be obtained from the Recombinant DNA Office website: http://www.rcco.pitt.edu/rdna/ or the rDNA Office at 412-383-1768.

3. Select Agent Registration

Insert the SOP

GUIDELINES FOR WORKING WITH SELECT AGENT TOXINS

1. Scope

The Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC) and the U.S. Department of Agriculture (USDA) have regulations for the possession, use and transfer of select biological agents and toxins that could pose a threat to human, animal and plant health and safety. The complete list of agents currently regulated under the Select Agent Program is attached.

These regulations implement the Public Health Security and Bioterrorism Preparedness Response Act of 2002, which became effective February 7, 2003 with full compliance due before November 12, 2003. The rules establish a registration process for facilities possessing select agents and toxins, safety and physical security compliance requirements, exemption criteria, and restrictions upon persons eligible to be granted access to a select agent or toxin in accordance with the US Patriot Act. More information about the Select Agent Program may be found at http://www.cdc.gov/od/sap/.

These Guidelines pertain to toxins on the Select Agent list, which may be exempt from Federal registration due to possession of quantities below federally established thresholds.

2. Requirements

2.1.1 All investigators at the University of Pittsburgh in possession of any select agents (including toxins) must be registered with the Department of Environmental Health and Safety. Please visit http://www.ehs.pitt.edu/biosafety/biochemreg.htm to download this MS Excel-based workbook and follow the associated instructional guide to submit your registration. Upon successful submittal, you will receive an email notification of receipt from EHS.

2.1.2 EHS will coordinate the federal registration with the Select Agent Program for those investigators requiring registration. Federal regulations require the designation of a Responsible Official (RO) for Select Agents in each organization possessing such materials. The RO for the University of Pittsburgh is the University Biosafety Officer in the Department of Environmental Health and Safety. The Alternate RO for the University is Jay Frerotte, Director of Environmental Health and Safety.

2.1.3 All investigators must notify the RO prior to acquiring or purchasing any amount of material on the attached list of select agents, including toxins. The notification must include the identity, quantity and source of the agent and should be submitted via email to biosafe@ehs.pitt.edu No select agents may be transferred to or from the University of Pittsburgh without prior registration with the CDC and with the RO. The RO will coordinate all requests for CDC or USDA approval regarding the procurement, transfer, or destruction of Select Agents.

3. Toxin Exemptions

3.1.1 Under the Regulations, certain listed toxins are exempt from the Select Agent registration with the Federal government provided that the ***principal investigator does not at any time possess more than the following aggregate amount of any toxin*** (in the purified form or in combinations of pure and impure forms):

Abrin ……………………………………………100 mg
Botulinum neurotoxin……………………………0.5 mg
Clostridium perfringens epsilon toxin…………..100 mg
Conotoxins …………………………………...100 mg
Diacetoxyscirpenol……………………………1000 mg
Ricin…………………………………………..100 mg
Saxitoxin ……………………………………...100 mg
Shiga-like ribosome inactivating proteins ………100 mg
Shigatoxin …………………………………….100 mg
Staphylococcal enterotoxin…………………………5 mg
Tetrodotoxin ………………………………….100 mg
T-2 ……………………………………………1,000 mg

3.1.2 Investigators in possession of any the toxins listed above, but in a quantity below the applicable limits are still required to register with EHS.

3.1.3 All principal investigators in possession of any the toxins listed above must sign and date the attached *Toxin Declaration Form.* Completed forms must be returned to the Biosafety Officer, B-50 BenedumHall or faxed to 624-8524.

3.1.4 The Biosafety Officer must be notified prior to each toxin acquisition purchase or transfer, regardless of quantity procured or transferred. The notification must include the identity, quantity and source of the agent and should be submitted via email to biosafe@ehs.pitt.edu The investigator must wait for a response before the acquisition or purchase is initiated.

3.1.5 An inventory log must be kept for each toxin listed above. The inventory log must reflect the date and quantity of each purchase, acquisition or transfer of toxin. The log must also reflect any toxin usage or destruction.

3.1.6 EHS will conduct periodic audits to verify the maintenance of the toxin inventory logs, and to verify appropriate storage and use of the toxin.

3.1.7 The investigator must take precautions to ensure the security of the toxins by limiting access to the toxin storage and use locations.

3.1.8 Investigators must notify EHS if they will no longer be in possession of select agent toxins.

3.1.9 If an investigator seeks to possess more toxin than the exemption quantity, prior approval from University EHS and the Federal Select Agent Program, as coordinated through EHS, must be obtained before acquiring the material.

TOXIN DECLARATION FORM

The University of Pittsburgh requires all investigators in possession of toxins listed in the Select Agent Regulation (42 CFR 73) to complete this form. If the investigator always possesses less than the exemption quantity, no Federal registration is necessary.

By signing below, I indicate the following:

· I am in possession of a toxin(s) found on the attached Select Agent List

· I have registered the toxin(s) in my possession with the University of Pittsburgh Department of Environmental Health and Safety (EHS)

· I understand the quantity exemption limit for the toxin(s) in my possession and **I agree to never exceed the applicable possession limit without prior approval from the Department of Environmental Health and Safety and the Federal government.**

· I understand that failure to abide by these quantity limits for specified toxins will result in a Federal violation of the Select Agent Regulation, which may have serious consequences including criminal penalties.

· I agree to maintain an accurate inventory log for the toxin(s) in my possession

· I agree to notify EHS prior to any new toxin(s) acquisition, purchase or transfer

· I agree to notify EHS when I am no longer in possession of any select agent toxin(s)

________________________________ ____________________________

Signature Date

____

Name (Print)

Return completed forms to the Biosafety Officer, B-50 Benedum Hall or fax to 624-8524. For questions, please call 624-8919

Select Agents and Toxins
Bacteria
§ *Bacillus anthracis*
§ *Brucella abortus*
§ *Brucella melitensis*
§ *Brucella suis*
§ *Burkholderia mallei* (formerly *Pseudomonas mallei*)
§ *Burkholderia pseudomallei* (formerly *Pseudomonas pseudomallei*)
§ Botulinum neurotoxin producing species of *Clostridium*
§ *Coxiella burnetii*
§ Cowdria ruminantium (Heartwater)
§ Francisella tularensis
§ *Liberobacter africanus*
§ *Liberobacter asiaticus*
§ *Mycoplasma capricolum/ M*. F38/*M. mycoides capri* (contagious caprine pleuropneumonia)
§ *Mycoplasma mycoides mycoides* (contagious bovine pleuropneumonia)
§ *Ralstonia solanacearum*, race 3, biovar 2
§ *Rickettsia prowazekii*
§ *Rickettsia rickettsii*
§ *Xanthomonas oryzae* pv. oryzicola
§ *Xylella fastidiosa* (citrus variegated chlorosis strain)
§ *Yersinia pestis*

Toxins (Below quantity in parentheses, toxin is exempt)
§ Abrin (100 mg)
§ Botulinum neurotoxin (0.5 mg)
§ *Clostridium perfringens* epsilon toxin (100 mg)
§ Conotoxins (100 mg)
§ Diacetoxyscirpenol (1 g)
§ Ricin (100 mg)
§ Saxitoxin (100 mg)
§ Shiga-like ribosome inactivating proteins (100 mg)
§ Shigatoxin (100 mg)
§ Staphylococcal enterotoxins (5 mg)
§ T-2 toxin (1 g)
§ Tetrodotoxin (100 mg)

Viruses
§ African horse sickness virus
§ African swine fever virus
§ Akabane virus
§ Avian influenza virus (highly pathogenic)
§ Bluetongue virus (exotic)
§ Camel pox virus
§ Cercopithecine herpesvirus 1 (Herpes B virus)
§ Classical swine fever virus

§ Crimean-Congo haemorrhagic fever virus
§ Eastern Equine Encephalitis virus
§ Ebola viruses
§ Foot-and-mouth disease virus
§ Goat pox virus
§ Hendra virus
§ Japanese encephalitis virus
§ Lassa fever virus
§ Lumpy skin disease virus
§ Malignant catarrhal fever virus (exotic)
§ Marburg virus
§ Menangle virus
§ Monkeypox virus
§ Newcastle disease virus (exotic)
§ Nipah virus
§ Peste des petits ruminants virus
§ Plum pox potyvirus
§ Rift Valley fever virus (Vaccine strain MP-12 exempt)
§ Rinderpest virus
§ Sheep pox virus
§ South American Haemorrhagic Fever viruses [Junin (Candid #1 vaccine strain exempt) Machupo, Sabia, Flexal, Guanarito]
§ Swine vesicular disease virus
§ Tick-borne encephalitis complex (flavi) viruses (Central European Tick-borne encephalitis, Far Eastern Tick-borne encephalitis, Russian Spring and Summer encephalitis, Kyasanur Forest disease, Omsk Hemorrhagic Fever)
§ Variola major virus (Smallpox virus) and Variola minor virus (Alastrim)
§ Venezuelan Equine Encephalitis virus (Vaccine strain TC-83 exempt)
§ Vesicular stomatitis virus (exotic)

Fungi
§ *Coccidioides immitis*
§ *Coccidioides posadasii*
§ *Peronosclerospora philippinensis*
§ *Phakopsora pachyrhizi*
§ *Sclerophthora rayssiae var. zeae*
§ Synchytrium endobioticum

Prions
§ Bovine spongiform encephalopathy agent

Genetic Elements and Recombinant Organisms considered as Select Agents

§ Viruses, bacteria, fungi, and toxins listed that have been genetically modified.
§ Select agent viral nucleic acids (synthetic or naturally derived, contiguous or fragmented, in host chromosomes or in expression vectors) that can encode infectious and/or replication competent forms of any of the select agent viruses.
§ Nucleic acids (synthetic or naturally derived) that encode for the functional form(s) of any of the toxins listed if the nucleic acids
(i) are in a vector or host chromosome,
(ii) can be expressed *in vivo* or *in vitro*, or (iii) are in a vector or host chromosome and can be expressed *in vivo* or *in vitro*.
§ Experiments involving deliberate formation of recombinant DNA containing genes for the biosynthesis of listed toxin lethal for vertebrates at an LD50 <100 ng/kg body weight

Exclusions

§ Any select agent or toxin that is in its naturally occurring environment provided it has not been intentionally introduced,
cultivated, collected, or otherwise extracted from its natural source.
§ Non-viable select agent organisms or nonfunctional toxins.
§ Fixed tissues that bear or contain select agents or toxins.
§ Genetic elements or sub-units of agents or toxins, if the genetic elements or sub-units are not capable of causing disease.

STANDARD OPERATING PROCEDURES (SOP)
SERUM SURVEILLANCE PROGRAM

1. **Scope**

The University of Pittsburgh offers faculty, staff, students and other individuals with potential exposure to specified infectious agents in the research environment the opportunity to obtain information about their serum status upon hire and to voluntarily undergo testing to determine their serum status against certain agents on an ongoing basis at no charge to the individuals.

2. **Purpose**

To provide serologic monitoring for antibodies or to provide other diagnostic tests for specified infectious agents used in the participants laboratory area or research area for which there is a licensed test that is commercially available. Medical monitoring is conducted to provide updated epidemiologic and medical information in conjunction with information on identifying potential worksite exposures to specified agents.

3. **Procedures**

3.1 Agents

3.1.1 Agents for which there is a commercially licensed test and for which there is sufficient risk to warrant testing. The specified agents with a current commercially licensed and available antibody test which are included in this Program are HIV-1, HIV-2, HTLV-1, HTLV-2 and SIV.

3.1.2 To have a potentially infectious agent included in the University of Pittsburgh Serum Surveillance Program a written request should be made to the University Department of Environmental Health and Safety.

3.1.3 All proposed alterations will be forwarded to the University Biohazards Committee for discussion and approval.

3.1.4 Exceptions can be made by the University Biohazards Committee to the requirement that the diagnostic test be licensed and commercially available, if the diagnostic test is conducted by a nationally recognized institution (eg. CDC).

3.2 Individuals at risk

Individuals with significant potential exposure to naturally or experimentally infected laboratory animals, and individuals with significant potential exposure to specified agents in the research environment are eligible. Significant potential exposure is typically defined as manipulation or direct handling of infectious agents, materials or animals.

3.3 Procedures

3.3.1 All principal investigators using infectious agents included in this Program must offer all individuals with significant potential exposure the opportunity to participate in the University's Serum Surveillance Program. Department Directors or Chairmen who have staff members with significant potential exposure to specified agents or research animals known to have been infected with specified agents also must notify staff of the availability of the Serum Surveillance Program.

3.3.2 Notification of this Serum Surveillance Program shall occur upon hire, and with the employee's consent, a voluntary baseline serum sample will be collected and tested. Collection should occur prior to any exposure to the specified agent in the workplaces of the University of Pittsburgh. Testing of the collected sample will occur expeditiously and the University will not retain an individual's serum (serum banking).

3.3.3 Those faculty and staff who work with specified agents for which there is a commercially available test or one which is available from nationally recognized source can voluntarily participate in the Serum Surveillance Program on a semi-annual basis.

3.3.4 All serum samples submitted to the University's Serum Surveillance Program will be encoded with a unique and confidential sample identification number (SID). The linking of the SID with the participant's name can only be performed by the medical director or clinical designee from the University-appointed employee health program. The University strictly protects the privacy of participants by withholding their name and other identifying information from all persons not directly connected with the conduct of the University's Serum Surveillance Program.

3.3.5 Faculty and staff participation in the University Serum Surveillance Program in no way affects or compromises the employee's ability to receive appropriate and prompt post-exposure evaluation, treatment, or if indicated, prophylaxis. Human retrovirus exposure is well defined in the University Bloodborne Pathogen Exposure Control Program and all reported exposures are evaluated and treated at Employee Health Services.

3.3.6 Test results are sent by the medical director or clinical designee to the faculty or staff member's self-designated address in confidence and in timely fashion (no more than three weeks).

3.3.7 Failure to consent to a baseline serum sample or to annual serum surveillance shall have no consequence on the employee's standing or function at the University of Pittsburgh.

3.3.8 All participants are advised prior to consent that under State of Pennsylvania Law, the credentialed physician (i.e. University Medical Director) is required to notify Allegheny County Health Department and the State of Pennsylvania of all participants identified as HIV positive via serum surveillance.

3.3.9 All participants who are notified in confidence of a positive result shall be offered appropriate counsel, evaluation and available treatment through the University-appointed employee health program.

3.3.10 Any positive test result indicating a possible occupational sero-conversion will be reported by the University Employee Medical Director to the Principal Investigator and to EH&S without divulging the employee's name. EH&S in conjunction with the PI will perform a comprehensive review of practice in the laboratory.

3.3.11 All Serum Surveillance Program samples are to be collected, prepared for analysis and reported to faculty and staff by the University-appointed employee health program. The University appointed employee health program is currently managed through;

UPMC Employee Health Services
3708 Fifth Avenue
Medical Arts Building, 5th Floor
Phone: 412-647-3695.

STANDARD OPERATING PROCEDURES (SOP)
MEASLES PROTECTION PROGRAM

1. SCOPE

Measles or rubeola infects human and old and new world non-human primates including macaques, chimpanzees, and owl monkeys. Symptoms of measles include a fever, rash and upper respiratory symptoms. The virus can also cause immunosuppression that can lead to pneumonia, otitis media, conjunctivitis, hepatitis, meningitis and encephalitis. In non-human primates measles has also been associated with endometritis and spontaneous abortion. Macaque to human transmission of measles has been documented. This SOP was designed to establish a system of information and safeguards to be utilized to control the spread of measles infection at the University of Pittsburgh research environments.

2. PROCEDURE

2.1 **Agent**- Measles or rubeola, genus Morbillivirus

2.2 **Employees at risk**- Naturally or experimentally infected laboratory animals are a potential source of infection to exposed unvaccinated laboratory personnel. An additional potential risk to laboratory personnel and animal users is also through the direct contact with material from infected animals or infected human volunteers.

2.3 **Animal populations at risk** – Old and new world non-human primates including macaques, chimpanzees and owl monkeys are susceptible to measles. Distressed animals, infants and juveniles are most susceptible.

2.4 **Laboratory Hazards** - Measles is spread by airborne droplets or fomites. It is highly contagious to unvaccinated individuals and non-human primates.

2.5 **Required Procedures**

2.5.1 All Principle Investigators (PI’s) using virus of the genus Morbillivirus must register their research with the Biosafety Officer/EH&S. A registration document may be obtained from the web site www.ehs.pitt.edu or by calling the Biosafety Officer at 624-8919.

2.5.2 University of Pittsburgh requires measles immunization for all individuals, faculty, staff, and students, who directly contact or manipulate non-human primates, or who utilize measles virus in research.

2.5.2.1 The PI or department director/ supervisor must arrange for all individuals with responsibility for direct handling of non-human primates or the measles virus to be medically evaluated for measles immune status by Employee Health Services.

2.5.2.2 Following this counsel all such individuals must sign a measles immunization acceptance/declination form prior to continued work with non-human primates or measles virus at the University of Pittsburgh. The form will be maintained by Employee Health Services.

2.5.2.3 Individuals refusing vaccination or having medical contra-indication may be prohibited from handling non-human primates or measles virus. This determination is made by an ad hoc panel which includes the University Employee Health Medical Director, University Employee Health Nurse, the University Director of Environmental Health and Safety, Human Resources representation, the Principal Investigator of the involved research, Provost Office representation if faculty are involved, and the Director of the Division of Laboratory Animal Resources, if animals are involved.

2.5.3 **Implementation-** MMR (measles, mumps, rubella) vaccine will be used to vaccinate individuals identified as having insufficient immunity.

2.5.3.1 Anyone having a 0 titer as demonstrated by an ELISA test performed by a qualified diagnostic laboratory will receive two vaccines given 4 weeks apart.

2.5.3.2 Individuals with a titer greater than 0, but less than 1:10 will receive one vaccine booster.

2.5.3.3 Anyone who has never been vaccinated and who is not known to have had measles will receive two vaccines given 4 weeks apart.

2.5.3.4 Even though it is believed that life long immunity results from infection, all employees in the measles protection program will have their titers re-evaluated 10 years after enrollment.

STANDARD OPERATING PROCEDURE (SOP)
TUBERCULOSIS PROTECTION IN RESEARCH ENVIRONMENTS

1. Scope

Tuberculosis is a zoonotic disease which is difficult to detect in nonhuman primates and spreads rapidly in nonhuman primate colonies. Due to the devastating consequences of tuberculosis for old world and new world nonhuman primates and associated research projects, special precautions are taken to reduce the risk that workers involved in the use and care of animals will infect non-human primates with *M. tuberculosis.*

University of Pittsburgh research facilities, which utilize M. tuberculosis organisms, or specimens **known to** contain M. tuberculosis, operate at Biosafety Level 3 (BSL-3) in accordance with current CDC/NIH guidelines published in the latest edition of *Biosafety in Microbiological and Biomedical Laboratories and Recombinant DNA Guidelines*.

2. Procedure

2.1 <u>Agent</u>- Mycobacterium tuberculosis

2.2 <u>Individuals at risk</u>- All individuals (including visitors) entering areas where non-human primates are housed or utilized are at risk of acquiring M. tuberculosis infection and pose a risk of transmitting M. tuberculosis to a non-human primate. All individuals utilizing non-fixed primary tissue from non-human primates and all individuals authorized to enter research facilities that utilize M. tuberculosis or specimens that potentially contain M. tuberculosis are at potential risk for M. tuberculosis infection.

2.3 All participants shall undergo baseline screening for M. tuberculosis exposure upon hire or upon enrollment in the University Animal Exposure Surveillance Program.

2.3.1 If the participant has a history of a previous positive reaction to a tuberculin skin test, further skin testing is not performed.

2.3.1.1 A Tuberculosis Health Questionnaire is administered and the completed form is filed in the employee's medical record.

2.3.1.2 A chest radiograph is obtained if:

a. the employee cannot provide documentation of a normal chest radiograph following the discovery of the positive reaction, or
b. the employee's responses to the questions suggest active pulmonary tuberculosis, or
c. the employee did not receive appropriate chemoprophylaxis or treatment, as determined by the University’s Employee Medical Director.

2.3.1.3 If there is no clinical or radiographic evidence of active pulmonary disease, the employee is medically restricted from entering areas where live nonhuman primates are housed or utilized until there has been a medical evaluation to consider both the likelihood that the reaction indicates a true infection and the estimated risk for progression from latent to active tuberculosis, or appropriate medical treatment has been initiated. While on treatment, the individual will be monitored by Employee Health for adherence to the treatment regimen. These individuals will not be allowed to enter non-human primate areas until cleared by the Employee Medical Director. Consultation with the DLAR director, Principal Investigator, Animal Facility Director and EHS will occur, as necessary, to assist in the evaluation of specific cases. If a consensus cannot be reached among these individuals, the final decision will rest with the Employee Medical Director.

2.3.1.4 If there is clinical or radiographic evidence of active pulmonary tuberculosis, the employee is medically restricted. This restriction is not removed until the individual provides documentation establishing that the clinical or radiographic findings can reasonably be attributed to a condition other than active pulmonary tuberculosis. The worker is not cleared to return to any University work place until the University Employee Medical Director is reasonably convinced that the individual does not represent a health risk.

2.3.2 Participants who do not have a history of a prior positive reaction to a tuberculin skin test will receive a ”two-step” tuberculin skin test (Purified Protein Derivative, PPD test) on enrollment in the Animal Exposure Surveillance Program. The second tuberculin test should be given 1-3 weeks after the first. If the participant has documented negative PPD tests within the previous 12 months, only a single tuberculin skin test is administered. The two-step test is not required for visitors to the facility (i.e. regulatory agencies, unique maintenance, etc). (Note: Persons who have received Bacillus Calmette-Guerin (BCG) immunization will be given PPD tests. Interpretation of a reaction will be based upon the size of the reaction, length of time since BCG administration, and risk of prior exposure to tuberculosis.)

2.3.2.1 If the first tuberculin skin test is positive, a medical history is obtained for symptoms suggestive of active pulmonary tuberculosis and a chest radiograph is obtained. The participant may also be referred to the Allegheny County Health Department for follow-up, per the discretion of the University Employee Medical Director.

a. If there is no clinical or radiographic evidence of active pulmonary disease, the employee is evaluated as described in 2.3.1.3 .

b. If there is clinical or radiographic evidence of active pulmonary tuberculosis, the employee is evaluated as described in 2.3.1.4.

c. If the medical recommendation is that the employee not enter areas with live nonhuman primates or not return to work at the University, the employee, supervisor, and Human Resources are notified the day the decision is reached.

2.3.2.2 If the initial tuberculin skin test is negative and the second test is positive during the 2-step procedure, the response is indicative of a prior infection (booster phenomenon). Such individuals undergo evaluation as indicated under 2.3.1 above

2.3.2.3 If the tuberculin skin tests are both negative and there are no other medical contraindications, the employee is medically cleared for work.

2.4 All participants shall undergo periodic tuberculin skin testing or medical screening for active tuberculosis infection every six months.

2.4.1 If the prior tuberculin skin test was negative, but the current test indicates positive, this is considered a recent conversion and the individual will undergo evaluation as indicated under 2.3.1 above.

2.4.2 If the prior tuberculin skin test was positive, the employee will be sent an informational TB health review with a letter asking the worker if he or she has any symptoms suggestive of active tuberculosis. The form must be completed and signed by the participant and submitted to Employee Health Services every six months.

3. Implementation

Individuals refusing tuberculin skin testing, declining the recommended clinical treatment**,** or failing to submit a completed TB health review form shall be prohibited from entering non-human primate areas or BSL-3 M. tuberculosis research labs.

3.1 The DLAR supervisor, Animal Facility Director, and/or the Principal Investigator's designee are responsible to verify current TB status of all entrants (including all visitors) into non-human primate areas or an M. tuberculosis lab under their control.

3.2 Individuals who manipulate non-fixed primary tissue from non-human primates AND who refuse tuberculin skin testing or fail to submit a completed TB health review form will be reported to the Principal Investigator(s) for the active research protocol. The individual's name will be removed from the protocol or protocol approval/renewal will be denied until compliance is achieved.

STANDARD OPERATING PROCEDURES (SOP)
RABIES PROTECTION PROGRAM

1. SCOPE

Rabies is a virus causing an acute central nervous system infection, which is typically transmitted by introducing the rabies virus into open cuts or wounds, or via percutaneous exposure (i.e. scratches, punctures or bites). An effective rabies virus vaccination is available and is offered free of charge to employees who are determined to have exposure to rabies virus through employment with the University of Pittsburgh. This SOP was designed to establish a system of information and safeguards that should be followed at the University of Pittsburgh when using rabies virus or certain animals in the research environment.

2. PROCEDURE

2.1 AGENT

Rabies virus (prototype of the genus Lyssavirus, family Rhabdoviridea)

2.2 EMPLOYEES AT RISK

Naturally or experimentally infected laboratory animals are a potential source of infection to exposed unvaccinated laboratory personnel. Such personnel are also at risk of acquiring rabies infection when working with rabies virus, having direct contact with quarantined animals potentially infected with rabies, having exposure to potentially infected animal tissues and having responsibility for capturing or destroying wild animals. To further delineate employees at risk, categories of exposure and risk have been developed.

2.2.1 Continuous Risk Category- Potential exposure due to the manipulation of rabies virus in the research environment. This category includes all individuals involved in experiments using rabies virus and all animal care staff handling animals that have been infected with the rabies virus.

2.2.2 Frequent Risk Category- Potential exposure due to the manipulation of wild animal species known to harbor rabies virus, including but not limited to bats, dogs, cats, ferrets, and wild terrestrial carnivores. This category includes veterinarians and animal care staff and other staff who handle wild or pre-quarantined animals whose species is known to harbor rabies virus.

2.2.3 Infrequent Exposure- Exposure to rabies virus is typically episodic with a recognized source but exposure may be unrecognized although very rare. This category includes veterinarians and animal care staff who handle purpose-bred or post-quarantine wild animals that have not been infected with the rabies virus but their species is known to harbor rabies virus, including bats, dogs, cats, ferrets, and wild terrestrial carnivores.

2.2.4 Rare Exposure- Exposure is always episodic from a recognized source. This category would include employees exposed to research animals with negligible rabies rates. It should be noted that small rodents and rabbits have not been known to transmit rabies to humans.

2.3 LABORATORY HAZARDS

Virus-ladened saliva introduced via a bite, scratch or very rarely into a fresh break in the skin or mucous membrane or body fluids from an animal in the research environment is the typical route of transmission,
although very rare instances of transmission have been reported via inhalation or ingestion of very high concentrations of virus.

2.4 PRE-EXPOSURE PROPHYLAXIS

2.4.1 Continuous Risk Category

2.4.1.1 These individuals are required to undergo a primary course of vaccination with serologic levels of rabies antibodies monitored every six months. Vaccination shall be the human diploid cell vaccine (1.0 ml HDCV) given intramuscularly in the deltoid. Vaccine is given on days 0, 7 and 21.

2.4.1.2 Four weeks after vaccine dose 3 at day 21, persons will undergo serological testing by having a serum sample tested for rabies antibody using rapid fluorescent focus inhibition tests (RFFIT). And thereafter, persons in the continuous risk category will undergo serological testing every six months. Booster doses of vaccine are administered to maintain a serum titer corresponding to at least complete neutralization at a 1:5 serum dilution.

2.4.2 Frequent Risk Category

2.4.2.1 These individuals are required to undergo a primary course of vaccination with serologic levels of rabies antibodies monitored every two years.

2.4.2.2 Four weeks after vaccine dose 3 at day 21, persons will undergo serological testing by having a serum sample tested for rabies antibody using rapid fluorescent focus inhibition tests (RFFIT). And thereafter, persons in the continuous risk category will undergo serological testing every two years. Booster doses of vaccine are administered to maintain a serum titer corresponding to at least complete neutralization at a 1:5 serum dilution.

2.4.3 Infrequent Risk Category

2.4.3.1 Animal users as defined in the infrequent risk category are offered rabies vaccination as the primary course is listed above.

2.4.3.2 It is recommended that infrequent risk category persons who elect to be vaccinated have a serum sample tested for rabies antibody according to the frequencies and administrations outlined in 2.4.2.2.

2.4.4 Rare Risk Category- the primary course of rabies vaccination is offered but not recommended for these individuals. If the vaccination is accepted, no ongoing serological testing is required.

2.5 <u>POST EXPOSURE PROPHYLAXIS</u>

2.5.2 The exposed individual should immediately cleanse the wound with soap and water and a virucidal agent, such as a povidone-iodine solution. If the exposed site is the mucous membranes, an irrigation of the site with potable water for 15 minutes is conducted.

2.5.3 The individual should report the exposure to their supervisor and to the appropriate occupational health clinic.

2.5.3.1 The occupational health clinic for the Oakland campus of the University of Pittsburgh is Employee Health Services, 3708 Fifth Ave, Medical Arts Building, Fifth floor, Suite 500.59. Monday through Friday 7:30am – 4pm. Rabies exposures occurring outside these times should proceed to the UPMC Presbyterian Emergency Department for clinical evaluation and treatment.

2.5.3.2 Rabies exposures occurring on the job but outside the Oakland Campus should be treated emergently at the nearest hospital emergency room.

2.5.4 After wound cleansing, a previously vaccinated individual should be injected intramuscularly with 1.0 ml of HDCV. An additional 1.0 ml intramuscular injection of HDCV should be given day 3 post exposure.

2.5.5 After wound cleansing, an unvaccinated individual should receive a dose of human rabies immunoglobulin HRIG (20 IU per kilogram body weight). If anatomically feasible, the full dose should be infiltrated around the wound. Any remaining volume should be administered intramuscularly at an anatomical site distant from the site of subsequent vaccine administration. In addition, intramuscular injections in the deltoid area of 1.0 ml HDCV are to be administered at the time of exposure and post exposure on days 3, 7, 14 and 28.

3. IMPLEMENTATION

3.1 Completion of a vaccination series for rabies virus and documentation of current and adequate immunity to rabies virus is required for all individuals entering spaces or rooms in which rabies infected animals are present and for all individuals whose job duties include anticipated contact with wild animals known to carry rabies virus.

3.2 All principal investigators using rabies virus must enroll all personnel manipulating rabies virus in this Rabies Protection Program. Those individuals with potential exposure to animals which are rabies infected or which belong to species known to carry rabies virus are offered rabies protection upon enrollment in the University of Pittsburgh Animal Exposure Surveillance Program.

3.3 Biosafety Level 2 practices, containment equipment and facilities are required for all activities involving the use or manipulation of rabies virus or rabies infected animals (ABSL-2).

3.4 All laboratories utilizing rabies virus and all ABSL-2 animal housing areas utilizing rabies virus are inspected by the Department of Environmental Health and Safety to verify appropriate containment and practices. Additional primary containment, personnel precautions and personal protective equipment, such as those described for biosafety level 3, may be indicated for activities with a high potential for droplet and aerosol production and for activities involving production quantities or concentrations of rabies virus.

3.5 The University of Pittsburgh Rabies Protection Program is designed to reflect full compliance with the recommendations of the Advisory Committee on Immunization Practices (ACIP) in their document Human Rabies Prevention, published in Morbidity and Mortality Weekly on January 8, 1999 (volume 48 #RR-1).

STANDARD OPERATING PROCEDURES (SOP)
VACCINIA VIRUS USAGE

1. **SCOPE**

Cases of laboratory- associated infections with pox viruses (i.e. smallpox, vaccinia, yaba, tanapox) have been reported. Human poxvirus infection ranges from severe systemic febrile disease to less severe rarely fatal vesicular diseases. This SOP was designed to establish a system of information and safeguards that should be followed at the University of Pittsburgh when using vaccinia virus.

2. PROCEDURE

2.1 **Agent**- Vaccinia virus, human host poxvirus, smallpox vaccine

2.2 **Employees at risk**- Naturally or experimentally infected laboratory animals are a potential source of infection to exposed, unvaccinated laboratory personnel. Genetically engineered recombinant vaccinia viruses pose an additional potential risk to laboratory personnel, through direct contact or contact with clinical materials from infected volunteers or animals.

2.3 **Laboratory hazards**

2.3.1 Ingestion, parenteral inoculation, and droplet or aerosol exposure of mucous membranes or broken skin with infectious fluids or tissues, are the primary hazards to laboratory and animal personnel. The agents may be present in lesion fluids or crusts, respiratory secretions, or tissues of infected hosts. Some poxviruses are stable at ambient temperature when dried and may be transmitted by fomites.

2.3.2 The different strains of vaccinia virus used in the laboratory present different levels of risk to humans. Non-attenuated vaccinia strains, such as WR, NYCBOH, Copenhagen or Lister, present a greater risk to humans based on an increased ability to replicate in human cells. Highly attenuated strains, such as MVA, NYVAC, ALVAC, and TROVAC are unable to replicate or replicate poorly in human cells and do not initiate productive infection in humans. The recommendations for vaccinia immunization differ depending upon the strain of experimental virus and setting in which it will be used in the individual laboratory.

2.4 **Required Procedures**

2.4.1 All Principal Investigators (PI's) using vaccinia virus, recombinant vaccinia virus or any orthopox virus must be registered with the Biosafety Officer/EH&S. A registration document may be obtained from the web site www.ehs.pitt.edu or by calling the Biosafety Officer at 624-8919.

2.4.2 Biosafety Level 2 practices, containment equipment and facilities are required for all activities involving the use or manipulation of vaccinia virus.

2.4.3 Laboratories are inspected by EHS to verify appropriate BSL-2 containment and practices.

2.4.4 All individuals who directly handle a) cultures or b) animals contaminated or infected with non-attenuated vaccinia virus strains or other Orthopoxviruses that infect humans must be medically screened by Employee Health Services for contraindications to vaccinia exposure and will be counseled on the risks and benefits of vaccinia vaccination. These individuals will be offered vaccinia vaccination at no cost (provided no contraindications exist). Following this counsel, all individuals, as previously described, must sign a Vaccinia Vaccination Immunization Acceptance/Declination Form prior to work with vaccinia at the University of Pittsburgh. The original form will be maintained by Employee Health Services and a copy submitted to the Biosafety Officer, B-50 Benedum Hall, will be filed with the PI's registration.

2.4.5 Vaccination is NOT recommended for individuals working only with highly attenuated vaccinia strains, such as MVA, NYVAC, ALVAC, and TROVAC. However, these individuals must be medically screened by Employee Health Services prior to initiating work with these attenuated strains.

2.4.6 It shall be the responsibility of the Principal Investigator to assure that individuals with potential vaccinia virus exposure as described in section 2.4.4 and 2.4.5 are enrolled in the medical screening component of this Procedure prior to initial exposure to vaccinia virus. All individuals with current potential exposure to vaccinia virus will undergo medical screening before January 31, 2004.

2.4.7 Individuals having a medical contraindication to vaccinia exposure as determined by the Employee Health Services will be prohibited from performing tasks with potential vaccinia exposure. The determination of prohibited tasks will be made by the employee's supervisor in consultation with the Department of Environmental Health and Safety, and if necessary, the Office of General Counsel, Office of the Provost (faculty and students), Human Resources (staff), and the University Biohazards Committee.

2.4.8 Laboratory personnel not directly handling or manipulating cultures of vaccinia virus or animals exposed to vaccinia virus, but working in the same lab where non-attenuated vaccinia virus strains are utilized shall be offered medical screening for potential contraindications to vaccinia exposure. It shall be the responsibility of the Principal Investigator to assure that individuals in labs where vaccinia virus is utilized as described in section 2.4.8 are offered medical screening through Employee Health Services.

2.4.9 Non-lab personnel, such as janitors or trades workers, who may enter labs where vaccinia is used, are exempted from the vaccination and medical screening requirements. All work areas must be disinfected prior to their entry. Agents must not be in active use when non-lab personnel are in the lab.

2.4.10 Laboratory personnel must wear personal protective equipment when handling these agents to include at a minimum a lab coat and liquid barrier gloves. Refer to the University of Pittsburgh Safety Manual Section V, Policy 05-003 for more details on Biosafety level 2 requirements.

LASER SAFETY MANUAL
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PAGE

1. INTRODUCTION

A. Purpose

The Laser Safety Program for the University of Pittsburgh provides guidance to faculty, staff and students for the safe use of lasers and laser systems in research, education, and medical science. All individuals utilizing laser-producing equipment should familiarize themselves with this document and with the applicable sections of the ***American National Standard for the Safe Use of Lasers (ANSI Z136.1-2000) and American National Standard for the Safe Use Of Lasers In Educational Institutions*** *(ANSI Z136.5 2000)*.

B. Objectives

The objectives of the University of Pittsburgh Laser Safety Program are to:

- identify potential hazards associated with lasers, laser systems, and laser operations and to prescribe suitable means for the evaluation and control of these hazards,
- investigate all laser accidents and institute immediate corrective action to prevent recurrence,
- provide guidance for compliance with Federal regulations and ANSI Standards.

2. RESPONSIBILITIES

A. University Laser Safety Officer (LSO)

An individual shall be designated as the University Laser Safety Officer (LSO) with the authority and responsibility to monitor and enforce the control of laser hazards, and to effect the evaluation and control of hazards associated with Class 3b or Class 4 lasers or laser systems.

The LSO shall:

- Classify, or verify classifications, of lasers and laser systems.
- Evaluate hazards of laser work areas, including the establishment of Nominal Hazard Zones (NHZ) as defined by ANSI.
- Ensure that the prescribed control measures are in effect, and recommend or approve substitute or alternate control measures .
- Conduct periodic audits to ensure compliance with this Program and applicable standards. (See Appendix D for Audit Form)
- Approve standard operating procedures, alignment procedures, and other procedural control measures, including signage.
- Recommend or approve protective equipment (e.g., eyewear, clothing, barriers, screens) used for personnel safety.
- Approve Class 3b and Class 4 laser installation facilities and laser equipment prior to use. These approval procedures also apply to the modification of existing laser facilities and equipment.
- Ensure that safety education and training is provided to laser area personnel.

B. Department Chairperson

The Department Chairperson has overall responsibility for the implementation of the Laser Safety Program within his/her Department. The Department Chairperson will appoint Department Laser Supervisors as appropriate. The University Laser Safety Officer (LSO) will coordinate efforts with the Department Chairperson or designee to ensure that adequate safety measures are taken and all Class 3b or 4 lasers under his/her control are registered with the LSO.

C. Department Laser Supervisor

The Department Laser Supervisor has responsibility for laser safety procedures within his/her department or laboratory, including:

- meeting with the LSO and the Department Chairperson to design adequate administrative and engineering controls for each laser or laser system,
- submitting to the LSO laser equipment information for design of control measures,
- submitting to the LSO the names of laser users within his/her department. implementing control measures designated by the LSO
- reporting laser-related accidents to the LSO and Department Chairperson,
- preparing standard operating procedures for Class 3b or Class 4 laser or laser system and ensuring that they are implemented by laser users,
- ensuring that all users of lasers within their department have received adequate training.

D. Laser User

The Laser User is responsible for:

- attending required laser safety training programs,
- complying with the safety rules, personal protective equipment requirements, and operating procedures for the laser equipment ,
- reporting any laser-related accident to his/her Department Laser Supervisor

3. LASER SAFETY

A. Classification of lasers and laser systems

To provide a basis for laser safety requirements, all lasers,and laser systems are designated into classes. The manufacturer provides the classification and labeling of commercial lasers or laser systems. The LSO, in cooperation with the Department Laser Supervisor, determines the classification of all lasers and laser systems manufactured or modified for internal use (i.e. research lasers).

Laser and Laser System Hazard Classification Definitions

Lasers and laser systems are classified on the power or energy output and potential for causing biological or physical damage to the eye or skin during intended use.

1. Class 1 Lasers and Laser Systems

Class 1 lasers or laser systems are considered incapable of producing damaging levels of emissions. Most lasers in this class maintain an enclosure, which, by virtue of design, prohibits access to laser radiation. These lasers are safe under reasonably foreseeable conditions of operation. These lasers are exempt from control measures. This exemption applies only to emitted laser radiation hazards and not to other potential non-beam hazards.

2. Class 2 Lasers and Laser Systems

Visible lasers or laser systems which are not capable of emitting accessible laser radiation greater than the Class 1 accessible emission limit (AEL) not exceeding a duration of .25 seconds and an average radiant power of 1mW.

3. Class 3a and Class 3b Lasers and Laser Systems

a. Class 3a Lasers

Class 3A lasers and laser systems are normally not hazardous when viewed momentarily with the naked eye, but pose severe eye hazards when viewed through optical instruments that collect and focus the laser onto the eye or skin. These emit visible or invisible light with a power of 1-5 mW.

b. Class 3b Lasers

Class 3B lasers or laser system will cause injury upon direct viewing of the beam and specular reflections. The shortest intrabeam exposure can cause injury. The power output of Class 3B lasers is 5-500 mW for continuous wave lasers, or less than 10 J cm^{-2} for a .25 second pulsed system. Hazard control measures mentioned in Section 5 of this manual must be implemented.

4. Class 4 Lasers and Laser Systems

Class 4 laser and laser systems produce a hazardous direct or specular reflected beam and may be a fire hazard. Class 4 lasers may also produce a diffuse reflection hazard. For Class 4 Lasers, the emitted power exceeds 500 mW.

5. Embedded Lasers

Lasers or laser systems (of higher classes) which are intended for a specific use may be designated Class 1 by the LSO on the basis that use for a limiting exposure duration of less than 30,000 sec will be incapable of producing damaging levels of emissions. A Class 2, Class 3, or Class 4 laser or laser system contained in a protective housing ("embedded") and operated in a lower classification (Class 1, Class 2, or Class 3) shall require specific control measures to maintain the lower classification.

4. Hazard Assessment

Four aspects of the application of a laser or laser system influence the total hazard evaluation and , thereby, influence the application of control measures:

- Capability of the laser or laser system for injuring personnel,
- Environment in which the laser is used,
- Personnel who may be exposed to laser radiation,
- Non-beam hazards associated with the laser or laser system.

1. Laser Characteristics

The capability of the laser or laser system for injuring personnel is characterized primarily by the class of the laser.

In addition to the laser classification, the nominal hazard zone (NHZ) associated with Class 3b and Class 4 lasers and laser systems must be determined. The NHZ describes the space within which the level of direct, reflected, or scattered radiation during normal operation exceeds the appropriate Maximum Permissible Exposure(MPE), and is determined from the following characteristics of the laser:

- power (continuous wave, repetitively-pulsed lasers) or energy (pulsed lasers) output,
- beam diameter,
- beam divergence,
- pulse repetition frequency,
- wavelength,
- beam path (including reflections),
- beam profile,
- maximum anticipated exposure duration.

2. Environment

It is extremely important to consider the operating environment of the laser to determine the appropriate control measures. As a minimum, consider the:

- number of lasers or laser systems,
- degree of isolation of laser (laboratory, operating room),
- probability of the presence of uninformed, unprotected, transient personnel,
- permanence of beam path(s),
- permanence of specular reflecting objects in or near the beam path,
- the use of optics (e.g., lenses, microscopes, optical fibers).

3. Personnel

The personnel who may be in the vicinity of a laser and its emitted beam influence the total hazard evaluation, and in some cases may warrant additional control measures.

An Authorized employee is one who is approved by the Department Chairperson, Department Laser Supervisor, or designee to install, operate or service laser equipment.

The following are considered when qualifying Authorized Personnel:

- maturity of judgment and reliability of the laser user(s),
- general level of training and experience of the laser user(s), e.g., whether the users are students, scientists, service personnel,
- awareness of spectators that potentially hazardous laser radiation may be present, and of relevant safety precautions,
- number and location of individuals relative to the primary beam or reflections, and the potential for accidental exposure,
- other non-beam hazards which may cause the individuals to react unexpectedly, or which influence the choice of protective equipment for personnel.

4. Non-Beam Hazards

In addition to direct hazards to the eyes and skin associated with exposure to the laser beam, it is important to address other hazards associated with the use of lasers, such as:

a. Laser generated airborne contaminants
b. Fire and Explosion Hazards
c. Collateral and ''plasma'' Radiation Hazards
d. Electrical Hazards
e. Compressed gases
f. Chemical hazards of laser dyes
g. Noise

5. CONTROL MEASURES

Control measures are implemented to reduce the possibility of human exposure to laser radiation and associated hazards.

For all lasers and laser systems use, it is recommended that:

- the minimum laser radiation required for the application be used,
- the beam height be maintained at a level other than the normal position of the eye of a person in the standing or seated position.

A distinction needs to be made between operation, maintenance and service when considering control measures as each poses unique hazards.

Engineering Controls

Although commercial laser products will be certified by the manufacturer and will incorporate some engineering controls, the use of additional controls shall be considered in order to reduce the potential for hazard associated with some lasers and laser systems. Potential controls could include:

- Protective housings,
- Controls for laser operation without protective housings,
  - access restriction,
  - eye protection or other types of Personal Protective Equipment(PPE),
  - area controls,
  - barriers, shrouds, beam stops, etc., to block or sufficiently attenuate a beam to below the MPE,
  - administrative and procedural controls,
  - education and training.
- Interlocks on removable protective housings,
- Cover windows leaving the Laser Controlled Area with non-reflective or diffuse reflective material.
- Service access panels (require special tool for entry or interlocked),
- Key control,
- Viewing portals, display screens, and collecting optics,
- Beam Paths,
  - Totally unenclosed beam path controls,
  - Limited open beam path controls,
  - Enclosed beam path control
  - Not directed toward any doors
  - Not directed upward at any time during alignment or operation
- Remote interlock connector,
- Beam stop or attenuator,
- Laser activation warning systems,
- Emission delay systems,
- Indoor laser controlled area,
- Remote laser firing and monitoring,
- Equipment labels,
- Area posting signs.

Administrative and Procedural Controls

Administrative and procedural controls are methods or instructions which specify rules, work practices, or both, which implement or supplement engineering controls. The specified engineering control measures for Class 3b and 4 laser systems, upon review and approval by the LSO, may be replaced by procedural, administrative or other alternate engineering controls which provide equivalent protection. Unless otherwise specified, administrative and procedural controls shall apply only to Class 3b and 4 lasers and laser systems.

a. Standard Operating Procedures (SOP) (Class 3b, Class 4)

A written SOP is required for each Class 3b or Class 4 laser system. These SOP's shall be maintained with the laser equipment for reference by the operator and maintenance or service personnel. All information from the laser manufacturer must be available with the SOP.

b. Output Emission Limitations (Class 3a, Class 3b, Class 4)
If, in the opinion of the LSO, excessive power or radiant energy is accessible during operation or maintenance of a Class 3a, Class 3b or Class 4 laser, the LSO shall take action to reduce the levels of accessible power or radiant energy to that which is commensurate with the required laser application.

c. Education and Training (Class 2, Class 3a, Class 3b, Class 4)
Education and training shall be provided for University operators, maintenance, and service personnel of Class 2, Class 3, and Class 4 lasers or laser systems. The level of training shall be commensurate with the level of potential hazard. Personnel must be trained on the SOP for the specific laser(s) they will be using.

d. Authorized Personnel (Class 3b, Class 4)
Class 3b or Class 4 lasers or laser systems shall be operated at all times under the direct supervision of an experienced, trained operator who shall maintain visual surveillance of conditions and terminate laser emission in the event of equipment malfunction or any other condition of unsafe use. These systems shall be maintained or serviced only by authorized personnel. The supervisor of the laser or laser system shall determine and post the list of authorized University personnel outside of the laser laboratory.

e. Alignment Procedures (Class 2, Class 3a, Class 3b, Class 4)
Beam alignment poses the highest potential for injury. Alignment of Class 2, 3a, 3b, or Class 4 laser optical systems shall be performed in such a manner that the primary beam, or a specular or diffuse reflection of a beam, does not expose the eye to a level above the applicable MPE. Written SOP's outlining alignment methods shall be approved for Class 3b and Class 4 laser systems. The use of low power visible lasers (Class 1 or Class 2) for path simulation of higher power visible or invisible lasers (Class 3b or Class 4) is recommended.

f. Protective Equipment (Class 3b, Class 4)
Protective equipment (protective eyewear, barriers, windows, clothing and gloves) specifically selected for suitable protection against laser radiation may be required when other control measures are inadequate to eliminate potential exposure in excess of the applicable MPE. This equipment will be provided by the University.

g. Spectators (Class 3b, Class 4)
Spectators shall not be permitted within a laser controlled area which contains a Class 3b or Class 4 laser or laser system unless:

- appropriate approval from the Department Laser Supervisor or Department Chairperson has been obtained,
- the degree of hazard and avoidance procedure has been explained,

- appropriate protective measures are taken.

h. Service Personnel (All laser classes)
During periods of service or maintenance, control measures appropriate to the class of the embedded laser shall be implemented when the beam enclosures are removed and beam access is possible. A temporary laser controlled area shall be established by service personnel that provides safety requirements for all personnel both within and outside of the area appropriate to the laser or laser system. A notice sign shall be posted outside the temporary laser controlled area to warn of the potential hazard.

Protective Equipment
Enclosure of the laser equipment or beam path is the preferred method of control. However, when these control measures do not provide adequate means to prevent access to direct or reflected beams at levels above the MPE, it may be necessary to use personal protective equipment.

1. Protective Eyewear
Eye protection devices which are specifically designed for protection against radiation from Class 3b or Class 4 lasers shall be required and their use enforced by the supervisor of the laser equipment when controls are inadequate to eliminate potential exposure in excess of the applicable MPE.
Laser eye protection attenuates the amount of light reaching the eye. In many research and laboratory situations there may be times when complete engineering controls may not be possible. In these situations, laser eye protection has shown to be a successful defense against eye injury.
When selecting the appropriate eyewear, beam wavelength, power, optical density, maximum permissible exposure and nominal hazard zones, must all be taken into consideration. Use **ANSI Z136.1 (Table 4b - Simplified method for choosing laser eye protection)** to determine Optical Density requirements for laser eye protection. Since exposure may include direct or diffusely scattered laser beam emissions, it will be important to choose eyewear appropriate to the parameters of the laser system.

In general, eye protection will afford adequate protection against medium power, Class 3 lasers but will seldom provide sufficient protection against direct beam viewing of CW lasers exceeding 10 W in power or pulsed lasers exceeding 10 to 100 J in output energy.
One pair of laser eyewear may not provide adequate protection from multiple wavelengths produced by a laser. The laser user must be conscious of which type of eye protection is appropriate for each different wavelength which may be used in the operation of the laser.

2. Laser Protective Equipment

Protective equipment shall be chosen which reduces any transmitted laser radiation to levels below the applicable MPE level.

- Laser Protective Windows: reduce any transmitted laser radiation through protective window to levels below the applicable MPE.
- Laser Protective Barrier and Curtains: block or prevent the laser light from exiting the area at levels above the applicable MPE level.
- Skin Protection: opaque gloves, tightly woven fabrics, etc. protect skin from laser burns or injury.

Laser Safety Control Measures

	LASER CLASSIFICATION				
CONTROLS FOR LASER SYSTEMS	I	II	IIIa	IIIb	IV
1. Classify	X	X	X	X	X
2. Warning Label			X	X	X
3. Precautions for maintenance, repair or modifications	X	X	X	X	X
4. Primary beam precautions		X	X	X	X
5. LSO Notification				X	X
6. Laser Safety Training		R	R	X	X
7. Controlled Area				X	X
8. Entryway Safety Controls				R	X
9. Warning signs		R	X	X	X
10. Area supervised by a Laser System Supervisor, Authorized Laser Operators assigned			R	R	X
11. Readily visible indication(light) that laser is in operation				R	X
12. Beam stop or attenuator				R	X
13. Protective eye wear				R*	X
14. Startup warning				R	X
15. Alignment procedures		X	X	X	X
16. SOP			X**	X	X
17. Locks/ Remote Interlock connector				R	X

R = Recommended X = Mandatory * Mandatory if MPE is exceeded ** If laser produces a beam invisible to the eye or a CW beam with greater than 15mW power.

6. LASER SAFETY TRAINING PROGRAMS

Laser safety training is required for all users working with Class 3b and Class 4 lasers and laser systems containing embedded class 4 lasers. Laser safety training is highly recommended for users working with Class 1, Class 2, and Class 3a lasers and laser systems. Users shall include University faculty, staff and students working with lasers and laser systems as operators, technicians, engineers, maintenance and service personnel. A guide for the organization of a training program is outlined below. The supervisor of the laser or laser system is responsible for ensuring that all users are properly trained. Training assistance is available for the University LSO and the Department of Environmental Health and Safety.

Laser Safety Training Program Outline

Only qualified and authorized personnel are permitted to operate a Class 3b or 4 laser. The Department Laser Supervisor must determine the employee's/student's operational qualifications. Each person who operates a laser must receive laboratory/laser system-specific training and general laser safety training. The Department Laser Supervisor or his/her designee who is familiar with the laser/laser system, must provide the laboratory/laser system specific training prior to that worker using that laser.

This training must be documented and consist of:
- Description of the laser system,
- Review of operating procedures and emergency procedures,
- Review of the SOP for use and set-up and alignment, if applicable,
- Selection and use of personal protective equipment, if required
- Identification and proper use of engineering controls,
- Identification of administrative controls, including warning signs and lights,
- Identification of non-laser safety hazards associated with the laser system.

General Laser safety training should consist of:
- Laser Bioeffects
- Eye Hazards
- Skin Hazards
- Non-beam hazards from high power lasers
- Laser safety standards and hazard classifications
- Safety procedures and control measures for each laser classification

7. LASER SAFETY AUDITS AND INVESTIGATIONS

Incident and Accident Investigations

Authorized laser supervisors and operators must report all laser incidents or accidents to the Laser Safety Officer (4-9505) immediately. An investigation will be conducted to identify the root cause and contributing factors to the incident , to estimate employee exposures, and to identify corrective action(s) to prevent recurrence.

All laser supervisors and operators are expected to review their open beam laser system(s) and experimental layout(s) before each use to verify that all safety controls, components, and equipment operate properly, and to confirm the equipment and components have not been modified. All malfunctioning equipment shall be repaired and laser system modifications corrected before energizing the laser.

The Laser Safety Officer conducts laser safety audits with the authorized laser supervisor or one of their designated operators to assess compliance with hazard control strategies. The Laser Safety Officer will issue a written report of findings to the authorized laser supervisor.

Audits are performed for all newly acquired lasers, new laser laboratories, or other lasers that have not been evaluated by the Laser Safety Officer. These initial laser safety audits collect information about personnel and equipment, evaluate administrative, engineering, and non-beam hazard controls, and assesses available and required personal protective equipment.

Periodic laser safety audits are performed on class 3b and 4 open beam systems to ensure compliance with the Laser Safety Program.

Laser Safety Self-Audit Checklist

Building __________________ Room ___________ Principal Investigator _____________________________
Audit Performed by _______________________________ Date _____________________________________

	Y	N	NA	COMMENTS
A. Administrative				
1. Lasers are classified appropriately (2, 3a, 3b, 4)				
2. Standard operating procedures are available				
3. Alignment procedures are available				
4. Viewing cards are used for alignment				
5. Laser users attended appropriate training				
6. Lasers are included in inventory				
B. Labeling and Posting				
1. Certification label present				
2. Class designation and appropriate warning label present				
3. Radiation output information on label				
4. Aperture label present				
5. Appropriate warning/danger sign at entrance to laser area				
6. Warning posted for invisible radiation				
C. Control Measures				
1. Protective housing present and in good condition				
2. Beam attenuator present				
3. Laser table below eye level				
4. Beam is enclosed as much as possible				
5. Beam not directed toward doors or windows				
6. Beams are terminated with fire-resistant beam stops				
7. Surfaces minimize specular reflections				
8. Controls are located so that the operator is not exposed to beam hazards				
D. Personal Protective Equipment				
1. Eye protection is appropriate for wavelength				
2. Eye protection has adequate OD				
3. Warning/indicator lights can be seen through protective filters				

E. Class 3b and 4 Lasers				
1. Interlocks on protective housing				
2. Service access panel present				
3. Limited access to spectators				
4. Nominal hazard zone determined				
5. Operators do not wear watches or reflective jewelry while laser is operating				
6. Viewing portals present where MPE is exceeded				
F. Class 4 Lasers				
1. Failsafe interlocks at entry to controlled area				
2. Area restricted to authorized personnel				
3. Laser may be fired remotely				
4. If present, curtains are fire-resistant				
5. Area designed to allow rapid emergency egress				
6. **Pulsed –** interlocks designed to prevent firing of the laser by dumping the stored energy into a dummy load				
7. **CW –** interlocks designed to turn off power supply or interrupt the beam by means of shutters				
8. Operators know not to wear ties around the laser				
G. Non-Beam Hazards				
1. High voltage equipment appropriately grounded				
2. High voltage equipment located away from wet surfaces or water sources				
3. High voltage warning label in place				
4. Compressed gases secured				

A. Administrative

1. Lasers are classified by the manufacturer, but must be reclassified by the LSO and principal investigator if the system is altered or constructed in the laboratory. Class 2 designates lasers in the visible range (400-700 nm) where radiant power does not exceed 1 mW. Class 3a designates visible lasers with 1 – 5 mW radiant power. Class 3b designates lasers with radiant power ranging 5 mW – 500 mW. Class 4 lasers have radiant power exceeding 500 mW.

2. Self-explanatory

3. Self-explanatory

4. Self-explanatory

5. All faculty, staff and students operating Class 3 or 4 lasers must attend training.

6. All lasers must be included in the University laser inventory maintained by EH&S. Any new laser system must be reported to EHS at 624-9505.

B. Labeling and Posting

1. The manufacturer's certification label must be affixed to the laser housing.

2. The laser housing must bear a sticker which includes the class designation and appropriate warnings.

3. The laser labeling must include the output radiant energy or power.

4. Self-explanatory.

5. At the entrance to the room, the following signage is necessary:

   Class 2: CAUTION, Laser Radiation (or laser symbol), Do Not Stare Into Beam

   Class 3a: DANGER, Laser Radiation (or laser symbol), Avoid Direct Eye Exposure

   Class 3b: DANGER, Laser Radiation (or laser symbol), Avoid Direct Exposure To Beam

   Class 4: DANGER, Laser Radiation (or laser symbol), Avoid Eye or Skin Exposure to Direct or Scattered Radiation

6. If laser is not visible range (e.g., not 400-700 nm), warning sign should be posted stating that the beam is not visible.

C. Control Measures

1. Self-explanatory

2. Self-explanatory Laser table should be set up such that the beam is below eye level when sitting or standing.

3. Self-explanatory

4. Self-explanatory

5. Self-explanatory

6. Self-explanatory

7. Self-explanatory

8. Self-explanatory

D. Personal Protective Equipment

1. Eye protection should bear markings indicating the optical density and wavelength that the eyewear protects

2. Optical density must be appropriate for the laser system.

   $OD = \log_{10}$ (anticipated worst case exposure in W/cm^2 or J/cm^2)/MPE

3. Self-explanatory

E. Class 3b and 4 Lasers

1. Interlocks must be provided on removable parts of the housing.

2. Service access panels should be interlocked or require a tool for removal.

3. Spectators must be provided appropriate personal protection and be warned of the associated hazards of the laser.

4. The Nominal Hazard Zone must be calculated and marked to warn individuals within the NHZ that protective equipment is needed.

5. Watches and reflective jewelry may create hazardous specular reflections.

6. Recommended.

F. Class 4 Lasers

1. It is strongly recommended that interlocks be placed at entryways to the controlled area such that the laser system shuts down upon entry of unauthorized personnel.

2. Self-explanatory. Visitors or spectators must be warned of hazards and given protective equipment.

3. It is strongly recommended that the laser be monitored and fired remotely.

4. Self-explanatory.

5. Self-explanatory.

6. Self-explanatory

7. Self-explanatory

8. Ties may accidentally get into the path of the beam

G. Non-Beam Hazards

1. Self-explanatory.

2. Self-explanatory. Operators should take care not to handle electrically charged equipment when hands are wet or sweaty.

3. Self-explanatory.

4. Cylinders should be secured to the wall or to a stationary object to avoid tipping or falling.

8. Laser Warning Signs and Labels

Sign dimensions (letter size, color, etc.) shall be in accordance with ***applicable standards.*** Figures 1 to 7 show signs for entryways to laser areas or laboratories. Figure 8 shows a sample sign for a temporary laser controlled area.

Where multiple lasers exist in the same room, rather than utilizing multiple warning signs, the owner may affix a single sign corresponding to the laser with the highest hazard potential to the entrance doors.

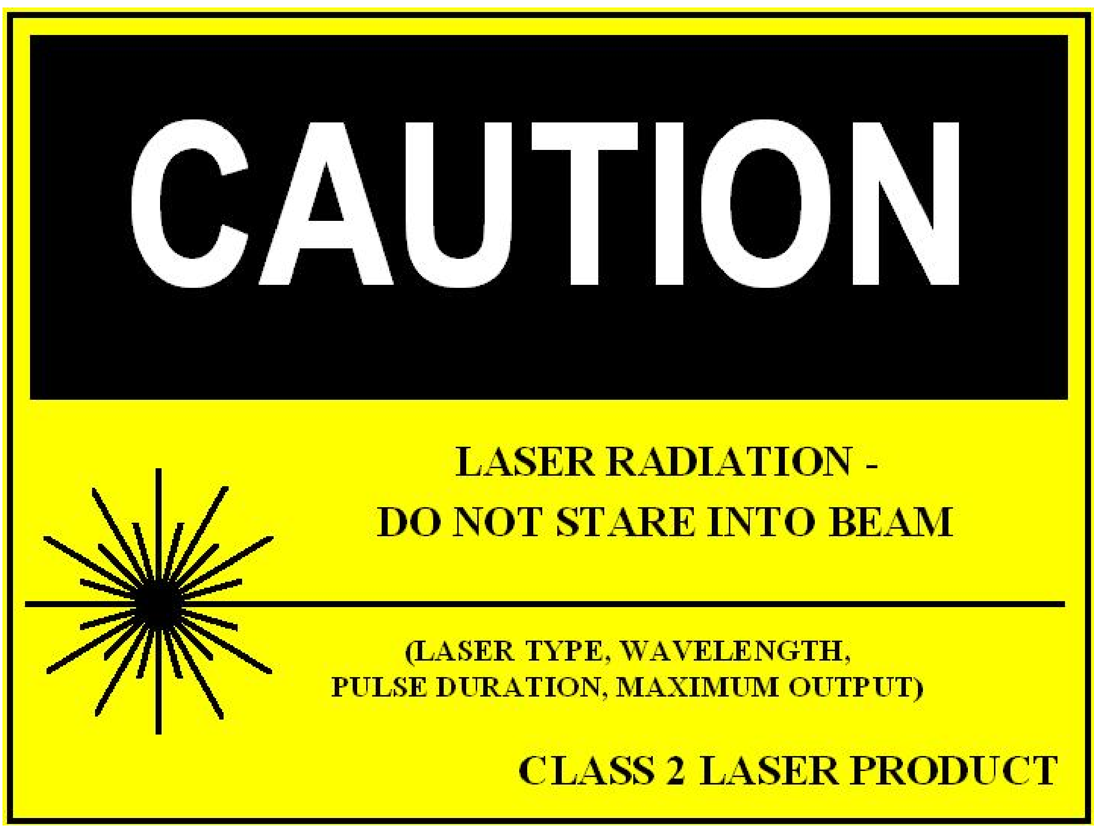

Figure 1
Sample Warning Sign for Class 2 lasers

Figure 2

Sample Warning Sign for Class 3a lasers (below MPE)

Figure 3
Sample Warning Sign for Class 3a lasers (above MPE)

Figure 4
Sample Warning Sign for Class 3b lasers

Figure 5
Sample Warning Sign for Class 4 lasers

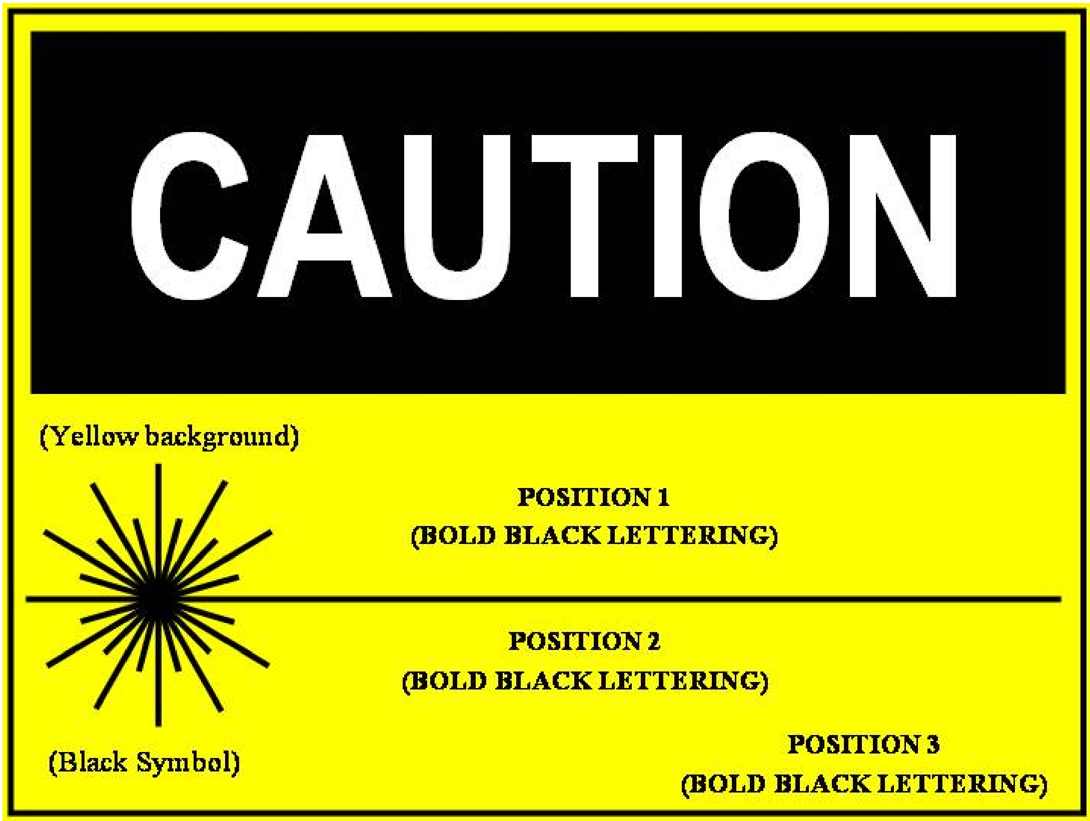

Figure 6
Blank template for "CAUTION" laser warning signs

Position 1: Special Precautionary instructions or protective action that may be applicable (Invisible Laser Radiation; Knock Before Entering; Do Not Enter When Light is On; Restricted Area, etc.)

Position 2: Type of Laser (Nd:YAG, Helium-Neon, etc.), emitted wavelength, pulse duration, and maximum output.

Position 3: The class of the laser or laser system.

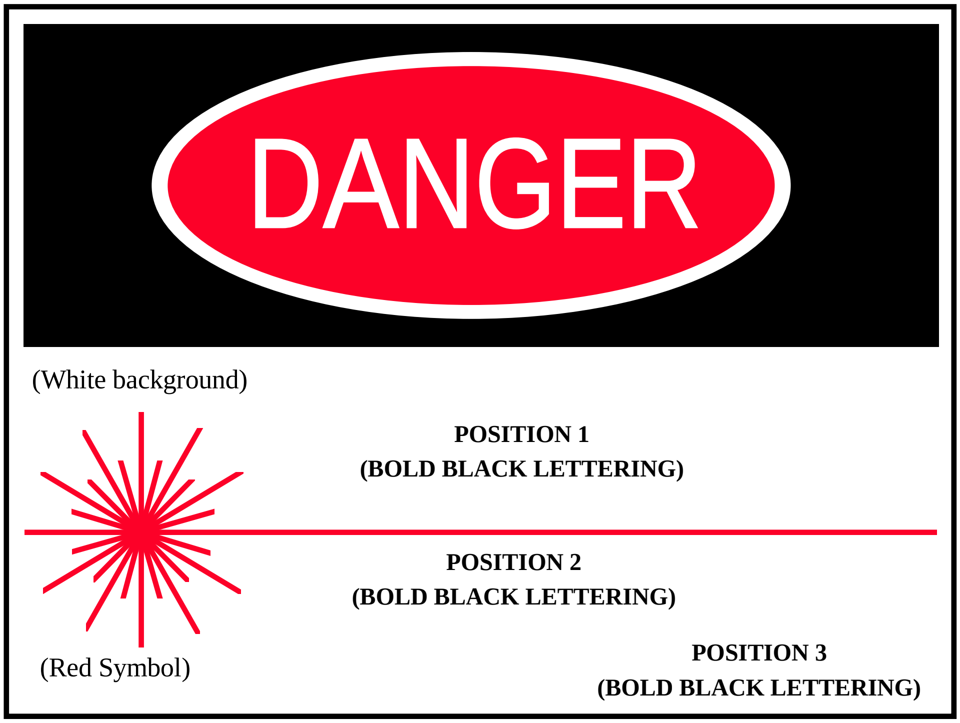

Figure 7
Blank template for "DANGER" laser warning signs

Position 1: Special Precautionary instructions or protective action that may be applicable (Invisible Laser Radiation; Knock Before Entering; Do Not Enter When Light is On; Restricted Area, etc.)

Position 2: Type of Laser (Nd:YAG, Helium-Neon, etc.), emitted wavelength, pulse duration, and maximum output.

Position 3: The class of the laser or laser system.

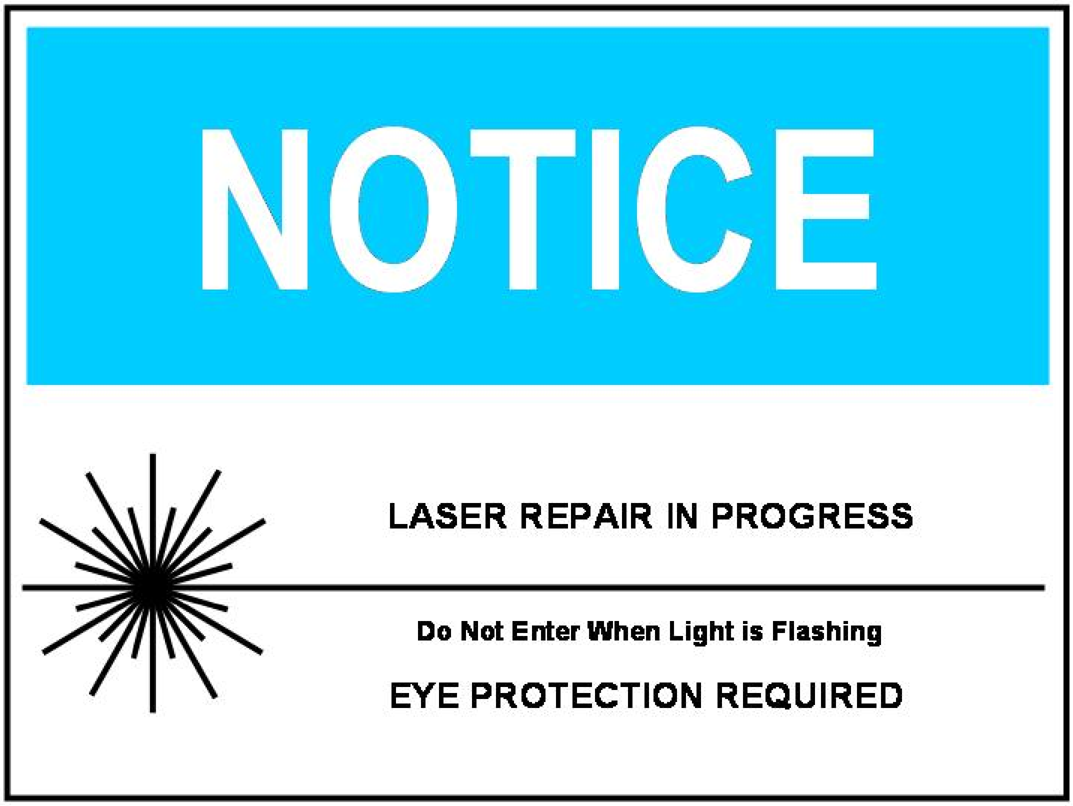

Figure 8
Sample Warning Sign for Temporary Controlled Area

RESPIRATORY PROTECTION PROGRAM THE UNIVERSITY OF PITTSBURGH

1. PURPOSE

Faculty and staff at the University of Pittsburgh must be protected from inhaling atmospheres that exceed hazardous concentrations of dusts, fumes, mists, vapors, gases and microorganisms. This University of Pittsburgh Respirator Program contains guidelines for administering an effective respiratory protection program and provides the information, training, and equipment necessary for proper selection, use and maintenance of respirators. The Program is updated annually to address the changing needs of the University.

This document serves as a standard operating procedure (SOP) for faculty and staff who are required to wear a respirator during work assignments. The University shall take prudent measures to implement engineering or work practice controls to eliminate hazardous conditions. Where such controls are inadequate or prove ineffective, respiratory protection may be required. These guidelines permit some exemptions from requirements for respirator use during emergencies or for respirators worn on a voluntarily basis. These exemptions are subject to the discretion of the Department of Environmental Health & Safety (EH&S).

2. REFERENCES

1998 OSHA Respiratory Protection Standard (29 CFR Part 1910.134)

3. RESPIRATOR USE

The University of Pittsburgh will provide appropriate respiratory protection when it is necessary to protect the health of an employee. The procedure to be followed to obtain a respiratory is detailed in Appendix A. Respiratory protection shall be used:

1. For non-routine operations involving exposures to air contaminants above OSHA permissible exposure limits.
2. For emergency operations involving air contaminant exposures that may be above allowable limits during a spill or the investigation of a possible terrorist act..
3. As a temporary measure to reduce employee exposures to air contaminants until engineering or work practice controls can be implemented.
4. For permanent exposure control when engineering controls are not feasible.
5. As a precaution to prevent exposures, such as during asbestos abatement, lead abatement, chemical spill cleanup, or tuberculosis exposure.

4. MEDICAL EVALUATIONS

Prior to assigning respirators to workers, a determination must be made to assure that employees are physically able to perform the work while wearing the equipment. This medical evaluation will be initiated by having each potential respirator wearer complete the Respiratory Protection Medical Form (Appendix B). This confidential questionnaire is reviewed by a licensed health care provider who determines if the employee has sufficient health status to safely wear respiratory protection or if additional medical examination is needed. The initial medical evaluation and subsequent medical exams deemed necessary by the University's designated clinicians are provided at no cost to the employee.

5. RESPONSIBILITIES

A. Deans, Directors, and Department Chairpersons have overall responsibility for implementation of the Respiratory Protection Program within their departments.

B. The employee's immediate supervisor is responsible for arranging and enforcing the use of respiratory protection. The supervisor is also responsible to:

1. Consider engineering or administrative controls that would eliminate the need for respiratory protection in the department.
2. Work with EH&S to implement the Respiratory Protection Program if engineering or work practice controls are determined to be infeasible.
3. Develop Standard Operating Procedures (SOPs) for department activities that require respirator use.
4. Report any accidents, injury or illness that may be related to the use of respiratory protection.

C. Department Chemical Hygiene Officers (CHOs) may serve as a liaison between the department and EH&S for the dissemination of information or resolution of concerns.

D. Department of Environmental Health and Safety is responsible to:

1. This Program and the associated technical and administrative decisions necessary for program implementation.
2. Monitoring the workplace to determine employee exposures and the need for respiratory protection
3. Consulting with the CHO or department supervision to select the best type of respirator for their purpose.
4. Performing respirator fit tests on respirator wearers.
5. Training employees required to wear respirators.
6. Conducting respirator audits to determine program effectiveness.

E. Employees are responsible to:

1. Use only respirators issued or approved by EH&S in accordance with the training and fit testing received. Employees who wear respirators on a voluntary basis must abide by Appendix D of this Program.
2. Wear respirators only as required for designated tasks and in specified locations.
3. Check the face piece seal of the mask each time the respirator is worn.
4. Guard against damage to the respirators and report any malfunction to their supervisors.

5. Be clean-shaven in the area between the sealing surface of the respirator and the face. Facial hair must not interfere with operation of inhalation and exhalation valves.
6. Wear corrective lenses with fullface respirators that use special eyeglass frames designed to fit inside the facepiece.

6. SELECTION AND USE OF RESPIRATORS

A. All respirators used at the University of Pittsburgh shall be certified by the National Institute for Occupational Safety and Health (NIOSH).

B. All respirators shall be used and maintained in accordance with manufacturer's instructions.

C. The selection of respirators depends upon the concentration of airborne contaminants likely to be encountered and the NIOSH protection factor assigned to each type of respirator as shown below:

<u>NIOSH RESPIRATOR TYPE AND PROTECTION FACTORS</u>

Filtering Face Piece Dust Mask	10x TLV or PEL
Half-Mask, Air-Purifying Respirator	10x TLV or PEL
Loose-Fitting PAPR's or Air-line Hoods or Helmets	25x TLV or PEL
Full-Face (FF), Air Purifying	50x TLV or PEL
FF, Powered-Air Purifying with H-filter	50x TLV or PEL
FF, Continuous-Flow or Demand	50x TLV or PEL
Full-face, Supplied Air, Pressure Demand Mode	2,000x TLV or PEL
Self Contained Breathing Apparatus (SCBA) or FF Airline Mask with SCBA in Pressure Demand Mode	10,000x TLV or PEL

Respirators meeting the above minimum protection factor requirements shall be used whenever the Threshold Limit Value (TLV) is exceeded.

C. Procedures for Wearing Respirators
   1. Only clean, sanitized, and inspected respirators shall be worn by the individual for whom they were fitted and approved.
   2. A positive and negative pressure sealing check shall be performed on all tight fitting respirators.
   3. If the fit "check" is successful, any remaining clothing and equipment can be donned, and the worker can proceed to the duties.

4. If not successful, the worker will contact the job supervisor. A respirator fit "test" should be performed several times during the shift to re-check the fit of a respirator.
5. Each time an employee exits the work area, the respirator should be removed and washed before being placed into storage.

7. LIMITATIONS OF RESPIRATORS

A. Air-purifying and powered air purifying respirators (PAPR) shall only be used in atmospheres that are not oxygen-deficient, not Immediately Dangerous to Life or Health (IDLH), or in atmospheres that do not exceed the protection factors listed above.

B. Cartridge or canister respirators for gases and vapors may only be used when the airborne hazard has a physical warning such as odor or if the cartridge has a color "end of service life indicator" (ESLI) which demonstrates chemical saturation. A "Respirator Change Schedule" shall be established for each type of gas or vapor cartridge or canister used, based on the concentration of air contaminants present, the temperature and humidity in the work area, and the exertion level of employees. Contact EH&S for help in determining respirator service life.

C. Airline respirators shall be used only with EH&S approval.

D. SCBAs shall be worn for all entry into IDLH atmospheres. Entry shall be restricted for emergency rescue only by trained and qualified personnel. Efforts must be made to clear the confined space to eliminate IDLH atmospheres prior to entry.

8. INSPECTING & DONNING THE RESPIRATOR

A. Air-Purifying Respirators:

1. Prior to donning the respirator, the wearer must check to ensure that all required parts are present and intact, and that the respirator is clean.

2. The respirator is donned by:
   a. Placing the device over the face by first fitting the chin into the respirator and pulling the facepiece to the face;
   b. Positioning the headbands around the crown of the head and the back of the neck;
   c. Adjusting the headbands, beginning with the lowest ones, until a tight, but comfortable fit is obtained; and
   d. Performing a positive and negative pressure check.

3. Positive fit "check" - Place the palm of the hand or the thumb over the exhalation valve cover and press lightly. Exhale slightly to create a positive pressure inside the

facepiece. If no air escapes, proceed with the job duties. If air escapes, readjust the respirator and repeat check.

4. Negative fit "check" - Place the palms of the hands over each filter to seal off the inhalation valves. Inhale slightly to create a negative pressure inside the facepiece. If no air enters, proceed with the job duties. If air enters, readjust the respirator and repeat check.

B. Powered-Air Purifying Respirators:

1. Prior to donning the respirator, the wearer must ensure that all required parts are present and intact; that the device is clean; and the battery is charged.

2. The respirator is donned by:
    a. Placing the device over the face by first fitting the chin into the respirator and pulling the facepiece to the face;
    b. Positioning the headbands around the crown of the head and the back of the neck;
    c. Adjusting the headbands, beginning with the lowest ones, until a tight, but comfortable fit is obtained.
    d. Performing a negative pressure check each time respirator is donned as discussed previously by closing off the breathing tube and then,
    e. Connecting the breathing tube to the respirator and the motor to a fully charged battery pack, and the belt pack is fastened to the small of the back.

C. Airline Respirators and SCBA's:
1. Components of the respirator and air regulators are inspected.
2. The facepiece is placed over the head and fit checked.
3. The airline is connected to the regulator and airflow started prior to entering the hazard area.

D. Helmet or Hood Type Respirators:
1. Prior to donning the respirator, the wearer must ensure all required parts are present and intact; the device is clean, and there is sufficient airflow to the respirator hood or helmet.

2. The respirator is donned by:
    a. Fitting the filter unit and/or power pack around the waist.
    b. After adjusting the helmet to fit snugly on the head, the helmet is placed on the head and the chinstrap tightened under the chin.
    c. The face shield or hood is snapped down into position, with the chin protector fitting under the chin and covering any facial hair.
    d. The power is turned on prior to entering the hazard area.

E. Disposable respirators (filtering facepieces):
   1. Disposable respirators or dust masks should not be used in situations that require protection from hazardous dust or chemicals unless fit tested to an individual.
   2. Disposable respirators shall be NIOSH approved as N-95 or better.
   3. Disposable respirators must be fitted and in place prior to entering the work area.
   4. Employees who wear dust masks on a voluntary basis are not generally included in the University's Respiratory Protection Program, however, EH&S approval to verify adequate protection and effective use is necessary.

9. FIT TESTING

A. EH&S will perform qualitative fit testing for filtering facepiece, air-purifying respirators following protocols outlined in Appendix A of the OSHA standard (1910.134).

B. EH&S also uses an OHD Fit Tester 3000 to check the fit of most mandatory use respirators with sealing face pieces.

C. The following exercises will be performed while the face-piece seal is being tested. Each exercise is performed for approximately one minute:
   1. normal breathing;
   2. deep breathing (deep and regular);
   3. turning head from side-to-side, while inhaling;
   4. nodding head up-and-down, while inhaling;
   5. talking aloud and slowly for several minutes, counting to 100, or reading the 'Rainbow Passage.'

D. Fit testing will be conducted prior to issuing a respirator and annually thereafter for mandatory respirator users.

10. CLEANING, MAINTENANCE AND STORAGE PROCEDURES

The cleaning, inspection and storage of respirators at the University of Pittsburgh is the responsibility of employees wearing the respirators. SCBAs and other emergency use respirators are maintained by EH&S. Employees shall not attempt to repair respirators.

A. Cleaning:
   1. The facepiece components are disassembled and soaked in warm soapy water, and visible residue is removed with a brush.
   2. Parts are rinsed in clean water and allowed to air-dry.

B. Inspection and Storage:
   1. All respirator parts are inspected for dirt, residue, and pliability of rubber or elastic straps, deterioration, cracks, tears, and holes prior to storage and donning. Respirators with missing or defective parts must not be used and should be replaced.

2. All cleaned and inspected respirators should be placed in an airtight container such as plastic bags in a hazard-free area and stored in a position that does not distort the facepiece.

11. SPECIAL PROCEDURES FOR AIRLINE RESPIRATORS AND SCBAs

A. Airline Respirators and SCBAs can be used only with approval by EH&S.

B. Air pumps or compressors used for airline respirators must have their intakes located in a temperature controlled clean air environment.

C. The quality of compressed breathing air should be tested periodically. It must meet OSHA and Compressed Gas Association's criteria for Grade D breathing air as follows;
1. Oxygen, 19-23%
2. Carbon Monoxide, less than 20 PPM
3. Hydrocarbon, less than 5 mg/m3
4. Carbon Dioxide, less than 1,000 PPM

D. Inspection
1. All respirator parts are inspected for dirt, distortion, residue, and pliability of rubber or elastic straps, deterioration, cracks, tears, and holes.
2. Check air supply to assure it meets Grade D or better breathing air quality.
3. Check for breaks or kinks in the supply hoses.
4. Check hose coupling attachments and quick disconnect tightness.
5. Review manufacturer's recommendations for proper setting of regulators and valves.
6. Check that couplings are compatible with other breathing air couplings used on the site and not compatible with other compressed gas fittings.
7. Check the air purifying elements, carbon monoxide alarm, and high temperature shut-off valves on the air compressor.
8. Emergency respirators should be inspected once each month to ensure readiness.
9. Records of these monthly inspections should be kept in a logbook, on a computer database or on a punch tag kept with the respirator.

12. TRAINING

A. Department supervisors are trained in:

1. The capability and limitations of respiratory protection.
2. Selection and use of respirators for airborne contaminant protection.
3. Determining the nature of the hazards to which workers are exposed.
4. Their role in the University's "Respiratory Protection Program."

B. Employees are trained in:

1. Rationale for respiratory protection requirements for a particular job.
2. The respirator's ability to protect them from exposure.
3. The capabilities and limitations of the respirator selected.
4. How to put on the respirator, adjust it for proper fit and check the facepiece seal.
5. Determining when and how to change the filters or chemical cartridges.
6. Recognizing signs or symptoms that may limit or prevent effective use.
7. Proper care, maintenance and storage of their respirator,

Voluntary respirator users are given a copy of Appendix D from the OSHA Standard or this document.

13. PROGRAM EVALUATION

Regular inspections and evaluations should be conducted by department supervisors to determine the continued effectiveness of the respirator program and to ensure that respirators are properly selected, cleaned, issued, and maintained. EH&S will complete a review of the written respirator program each year to determine the need for changes.

Appendix: A

Procedures For Obtaining Respiratory Protection Equipment

1. **Employee or Supervisor should contact EH&S (412-624-9505) to request an evaluation of exposure and the need for respiratory protection. (See Appendix F)**

2. **EH&S personnel will determine if the use of a respirator is necessary by evaluating the work process. This may be evaluated by one or a combination of the following methods:**
   - **Consulting with the supervisor.**
   - **Interviewing the employee.**
   - **Observing the work operation.**
   - **Collecting air samples during the work process to assess airborne exposure.**
   - **Evaluating existing or alternative engineering or administrative controls.**

3. **Upon recommendations of EH&S for respiratory protection, the employee will be required to fill out a Medical History Questionnaire (Appendix B). This form can be obtained from Employee Health Services on the 5th floor of the Medical Arts Building 4708 Fifth Avenue or by calling 412-647-3695. The completed form is sent to the Employee Health Services for medical evaluation. If the reviewing physician deems necessary, you may be asked to undergo a medical exam, pulmonary function test and/or other tests.**

4. **Upon receiving medical clearance from the employee health physician, the employee must attend "Respiratory Protection Training" from the Department of Environmental Health and Safety. This training informs the user of the limitations, use, and care of the respirator.**

5. **EH&S will qualitatively or quantitatively fit test the employee for a respirator when all the above requirements have been met. The supervisor (with consultation from EH&S if necessary) will issue a respirator that provides the best comfort and fit upon completion of these requirements.**

6. **Respirator users must update medical information and fit testing qualifications annually or as needed.**

Appendix B
Medical History Questionnaires

EMPLOYEE HEALTH SERVICES -PARTICULATE FILTERING RESPIRATOR MEDICAL EVALUATION - PART ONE

This questionnaire is used in determining whether or not you have a medical condition that may affect your ability to safely wear a respirator. Fit testing is also required and is done separately. All medical information is confidential.

The following information must be provided by every employee who has been selected to use any type of respirator (PLEASE PRINT).

Date:		**Name:**	**Social Security Number:**
Job Title:		**Department:**	**Work Phone Number:**
Age (to nearest year)	**Sex** (circle one): **Male Female**	**Height in feet/inches**	**Weight in pounds**

Has your employer told you how to contact the health care professional who will review this questionnaire? (circle one): **Yes No**

Check the type of respirator you will use (you can check more than one category):

____ **N,R, or P disposable respirator** (filter mask)

____ **Other type** (if you use (or plan to use) half or full face, or self-contained breathing apparatus, contact Employee Health Services for respirator questionnaire supplement)

The following information must be provided to the health care professional before he/she makes a recommendation concerning your ability to use a respirator:

1. **Duration and frequency of respirator use:** ______________________________
2. **Expected physical work effort:** ______________________________
3. **Additional protective clothing and equipment to be worn:** ______________________________

Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "Y" or "N").

1. Do you currently smoke tobacco, or have you smoked tobacco in the last month?	**Y**	**N**
2. Have you ever had any of the following conditions?		
a. Seizures (fits)	**Y**	**N**
b. Diabetes (sugar disease)	**Y**	**N**
c. Allergic reactions that interfere with your breathing	**Y**	**N**
d. Claustrophobia (fear of closed-in places)		
e. Trouble smelling odors	**Y**	**N**
	Y	**N**
3. Have you ever had any of the following pulmonary or lung problems?		
a. Asbestosis	**Y**	**N**
b. Asthma	**Y**	**N**
c. Chronic Bronchitis	**Y**	**N**
d. Emphysema	**Y**	**N**
e. Pneumonia	**Y**	**N**
f. Tuberculosis	**Y**	**N**
g. Silicosis	**Y**	**N**
h. Pneumothorax (collapsed lung)	**Y**	**N**
i. Lung Cancer	**Y**	**N**
j. Broken Ribs	**Y**	**N**
k. Any chest injuries or surgeries	**Y**	**N**
l. Any other lung problem that you have been told about	**Y**	**N**

5. Have you ever had any of the following cardiovascular or heart problems?	
a. Heart Attack	**Y**
b. Stroke	**Y**
c. Heart Failure	**Y**
d. Swelling in your legs/ feet (not caused by walking)	**Y**
e. Hearth arrhythmia (heart beating irregularly)	**Y**
f. High blood pressure	**Y**
g. Any other heart problem that you have been told about	**Y**
6. Have you ever had any of the following cardiovascular or heart problems?	
a. Frequent pain or tightness in your chest	**Y**
b. Pain or tightness in your chest during physical activity	**Y**
c. Pain or tightness in your chest that interferes with your job	**Y**
d. In the past 2 years, have you noticed your heart skipping or missing a beat	**Y**
e. Heartburn or indigestion that is not related to eating	
f. Any other symptoms that you think might be related to heart or circulation problems	**Y**
	Y

4. Do you currently have any of the following symptoms of pulmonary or lung illness?

a. Shortness of breath	Y	N
b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline	Y	N
c. Shortness of breath when walking with other people at an ordinary pace on level ground	Y	N
d. Have to stop for breath when walking at your own pace on level ground	Y	N
e. Shortness of breath when washing or dressing yourself	Y	N
f. Shortness of breath that interferes with your job		
g. Coughing that produces phlegm (thick sputum)	Y	N
h. Coughing that wakes you early in the morning	Y	N
i. Coughing that occurs mostly when you are lying down	Y	N
j. Coughing up blood in the last month	Y	N
k. Wheezing		
l. Wheezing that interferes with your job		
m. Chest pain when you breath deeply		
n. Any other symptoms that you think may be related to lung problems	Y	N
	Y	N
	Y	N
	Y	N
	Y	N

7. Do you currently take medication for any of the following problems?

a. Breathing or lung problems	Y
b. Heart trouble	Y
c. Blood Pressure	Y
d. Seizures (fits)	Y

8. If you've used a respirator, have you ever had any of the following problems?

a. Eye Irritation	Y
b. Skin Allergies or Rashes	Y
c. Anxiety	Y
d. General Weakness or Fatigue	Y
e. Any other problem that interferes with your use of a respirator	Y

9. Would you like to talk to the health care professional who will review this questionnaire about your answers on this questionnaire? Y

Employee Signature **Date**

μ **Approved** μ **Denied** μ **Approved w/restrictions** μ **More information needed**

Remarks:

Physician/Nurse Signature **Date**

EMPLOYEE HEALTH SERVICES RESPIRATOR QUESTIONNAIRE SUPPLEMENT –FOR ALL BUT FILTERING FACE PIECE RESPIRATORS - PART TWO

This questionnaire is used in determining whether or not you have a medical condition that may affect your ability to safely wear a respirator. Fit testing is also required and is done separately. All medical information is confidential.

The following information must be provided by every employee who has been selected to use SCBA/full-face respirator equipment (PLEASE PRINT).

Date:	**Name:**	**Social Security Number:**
Job Title:	**Department:**	**Work Phone Number:**

Questions 1 through 24 must be answered by every employee who has been selected to use SCBA/full-face respirator equipment (please circle "Y" or "N").

1. Have you ever lost vision in either eye (temporarily or permanently)?	Y
2. Do you currently have any of the following vision problem?	
a. Wear Contact Lenses	Y
b. Wear Glasses	Y
c. Color Blindness	Y
d. Any other eye or vision problem	Y
3. Have you ever had an injury to your ears, including a broken ear drum?	Y
4. Do you currently have any of the following hearing problems?	
a. Difficulty hearing	Y
b. Wear a hearing aid	Y
c. Any other hearing or ear problem	Y
5. Have you ever had a back injury?	Y
6. Do you currently have any of the following musculoskeletal problems?	
a. Weakness in your arms, hands, legs or feet	Y
b. Back pain	Y
c. Difficulty fully moving your arms and/or legs	Y
d. Pain or stiffness when you lean forward or backward at the waist	Y
e. Difficulty fully moving your head up or down	Y
f. Difficulty fully moving your head side to side	Y
g. Difficulty bending at your knees	Y
h. Difficulty squatting to the ground	Y
i. Climbing a flight of stairs or a ladder carrying more than 25 lb.	Y
j. Any other muscle or skeletal problem that interferes with using a respirator	Y
7. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen?	Y
If "Yes", do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these Conditions?	Y
8. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust) or have you come into skin contact with hazardous chemicals?	Y
If "Yes", name the chemicals (if you know them): ______________________________	
9. Have you ever worked with any of the materials, or under any of the conditions, listed below?	Y
a. Asbestos	Y
b. Silica (e.g. in sandblasting)	Y
c. Tungsten/cobalt (e.g. grinding or welding this material)	Y
d. Beryllium	Y
e. Aluminum	Y
f. Coal (for example, mining)	Y
g. Iron	Y
h. Tin	Y
i. Dusty environments	Y
j. Any other hazardous exposures	Y
If "Yes" describe these exposures: ______________________________	

10. List any second jobs or side businesses you have:	
11. List your previous occupations:	
12. List your current and previous hobbies:	
13. Have you been in the military services? If "Yes" were you exposed to biological or chemical agents (either in training or combat)?	Y Y
14. Have you ever worked on a HAZMAT team?	Y
15. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in the Particulate Respirator Medical Evaluation questionnaire, are you taking any other medications for any reason (including over-the-counter medications)? If "Yes" name the medications (if you know them): ____	Y
16. How often are you expected to use the respirator(s) (circle Y or N for all answers that apply to you)? a. Escape only (no rescue) b. Emergency rescue only c. Less than 5 hours per week d. Less than 2 hours per day e. 2-4 hours per day f. Over 4 hours per day	 Y Y Y Y Y Y
17. During the period you are using the respirator(s), is your work effort: a. **LIGHT (less than 200 kcal per hour)** If "Yes" how long does this period last during the average shift: ________ hours _______ minutes Examples of a light work effort are <u>sitting</u> while writing, typing, drafting, or performing light assembly work; or <u>standing</u> while operating a drill press (1-3 lb) or controlling machines. b. **MODERATE (200 to 350 kcal per hour)** If "Yes" how long does this period last during the average shift: ________ hours _______ minutes Examples of moderate work effort are <u>sitting</u> while nailing or filing; <u>driving</u> a truck or bus in urban traffic; <u>standing</u> while drilling, nailing, Performing assembly work, or transferring a moderate load (about 35 lb) at trunk level; <u>walking</u> on a level surface about 2 mph or down a 5-degree grade about 3 mph; or <u>pushing</u> a wheelbarrow with a heavy load (about 100 lb) on a level surface. c. **HEAVY (above 350 kcal per hour)** If "Yes" how long does this period last during the average shift: ________ hours _______ minutes Examples of heavy work are <u>lifting</u> a heavy load (about 50 lb) from the floor to your waist or shoulder; working on a loading dock; <u>shoveling; standing</u> while bricklaying or chipping castings; <u>walking</u> up an 8-degree grade about 2mph; climbing stairs with a heavy load (about 50 lb).	 Y Y Y
18. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator? If "Yes" describe this protective clothing and/or equipment: ____	Y
19. Will you be working under hot conditions (temperature exceeding 77 degrees F)?	Y
20. Will you be working under humid conditions?	Y
21. Describe the work you'll be doing while you're using your respirator: ____	
22. Describe any special or hazardous conditions you might encounter when you're using your respirator(s). (Example: confined space, life-threatening gases): ____	

23. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):
   a. Name of the first toxic substance: ______________________________
      Estimated maximum exposure level per shift:: _________________________ Duration of exposure per shift: ___________________________
   b. Name of the second toxic substance: ______________________________
      Estimated maximum exposure level per shift:: _________________________ Duration of exposure per shift: ___________________________
   c. Name of the third toxic substance: ______________________________
      Estimated maximum exposure level per shift:: _________________________ Duration of exposure per shift: ___________________________
   d. The name of any other toxic substances that you'll be exposed to while using your respirator: ____
      ____

24. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others. (Example: rescue, security):
____
____
____

Employee Signature	**Date**

µ **Approved**	µ **Denied**	µ **Approved w/restrictions**	µ **More information needed**
Remarks:			
Physician/Nurse Signature			**Date**

Appendix D

Employee Voluntary Use of Respirators

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards.

If you voluntarily elect to wear respiratory protection, you must do the following:

1. Read and follow all instructions provided by the manufacturer on use, maintenance, cleaning limitations regarding the respirator.

2. Choose respirators certified by NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

5. Complete and submit the following form to EH&S

UNIVERSITY OF PITTSBURGH
VOLUNTARY RESPIRATOR USER REGISTRATION

EMPLOYEE NAME (PRINT)
____

Pitt ID #   2P ____

JOB FUNCTION/TITLE
____

DEPARTMENT
____

BUILDING __________________________ **WORK PHONE NO**.
____

E-MAIL ADDRESS
____

RESPIRATOR USED: MANUFACTURER____
TYPE ____
SIZE ____
FREQUENCY OF USE ____________________________________

AIR CONTAMINANT(S) EXPOSED TO OR REASON FOR USE:
____
____
____

HAVE YOU BEEN TRAINED OR FIT-TESTED FOR THIS RESPIRATOR? YES__NO__

DID YOU COMPLETE AND SUBMIT YOUR MEDICAL EVALUATION FORM? YES___ NO____

Completed forms or questions should be sent by fax, e-mail or campus mail to:

Department of Environmental Health and Safety
B-50 Benedum Hall
3700 O’Hara Street
Pittsburgh, PA. 15261
FAX: 412-624-8524   E-Mail: fpokrywka@ehs.pitt.edu

Appendix E

UNIVERSITY OF PITTSBURGH
ENVIRONMENTAL HEALTH AND SAFETY DEPARTMENT
RESPIRATOR FIT TEST RECORD

EMPLOYEE NAME (PRINT) ____

EMPLOYEE (SIGNATURE) ____

Pitt ID Number 2P ____

JOB FUNCTION/TITLE ____

WORK DEPARTMENT ____

BUILDING __________________________ **WORK PHONE NO**. ________________________

DATE OF FIT TEST _________________________ **DATE OF TRAINING** _______________________

RESPIRATOR: MANUFACTURE ____
TYPE ____
SIZE ____
FREQUENCY OF USE ____

UNUSUAL CONTITIONS:
FACIAL HAIR ____
SCARS/MOLES ____
WRINKLES ____
GLASSES ____
MUSTACHE ____
BEARD GROWTH ____
OTHERS ____

SACCHARIN SENSITIVITY: PASS ______ FAIL ______ DID NOT RUN ______

IA / BIT SENSITIVITY TEST: PASS ______ FAIL _____ _ DID NOT RUN ______

SMOKE SENSITIVITY TEST: PASS ______ FAIL ______ DID NOT RUN ______

QUALITATAIVE TEST:	(PASS)	(FAILED)	(DID NOT RUN)
(PP) = POSITIVE PRESSURE	_______	________	________________
(NP) = NEGATIVE PRESSURE	_______	________	________________
(SA) = SACCHARIN	_______	________	________________
(BIT)= BITREX	_______	________	________________
(IA) = ISOAMYL ACETATE	_______	________	________________
(IS) = IRRITANT SMOKE	_______	________	________________

QUANITIATIVE TEST (DNI -Nevada) PASS ______ FAIL ______ DID NOT RUN ______

Equivalent Fit Factor __________ Average % Leakage ___________

PERFORMED BY (SIGNATURE) ____

Appendix F

INSTRUCTIONS FOR COMPLETING THE RESPIRATORY PROTECTION HAZARD ASSESSMENT FORM

In accordance with the OSHA Respiratory Protection Standard (29 CFR 1910.134) the University of Pittsburgh is required to evaluate each use of respirators to assure that an appropriate level of protection is provided for the exposure hazard. To assist in that task, the attached "Respiratory Protection Hazard Assessment Form" has been developed. EH&S requests that each Department complete one of the forms for each protocol or procedure where respirators are used. The OSHA regulation and the University's Respiratory Protection Program addresses both the voluntary and mandatory use of respirators.

Completed forms should be sent to:

Department of Environmental Health and Safety
B-50 Benedum Hall
Pittsburgh, PA. 15261

Questions or concerns about completing the evaluation form can be addressed to EH&S:

Telephone: (412) 624-8641
E-mail: safety@ehs.pitt.edu
Fax: (412) 624-8524

UNIVERSITY OF PITTSBURGH
RESPIRATORY PROTECTION HAZARD ASSESSMENT FORM

DEPARTMENT NAME	
HAZARD EVALUATION DATE	
LAB PI / SUPERVISOR'S NAME	
NAME OF PROCEDURE REQUIRING RESPIRATOR USE	
EMPLOYEE JOB TITLE / DUTIES	
RESPIRATOR MANUFACTURER & STYLE	
FREQUENCY OF USE	
DURATION OF RESPIRATOR USE (HOW LONG EACH DAY)	
AIR CONTAMINANT EXPOSED TO	
STATE OF MATTER DUST /GAS /VAPOR /MIST /FUME	
TYPE OF CHEMICAL CARTRIDGE OR CANISTER USED	
ANY SKIN, NOSE, THROAT OR EYE IRRITATION EXPERIENCED	
MEASURED AIR CONCENTRATION (IF KNOWN)	
PERMISSIBLE EXPOSURE LIMIT (IF KNOWN)	
RESPIRATOR TRAINING DATE	
FIT TESTING DATE	
MEDICAL EVALUATION DATE	
CLEANING & MAINTENANCE PROGRAM IN EFFECT	
ARE ENGINEERING CONTROLS IN EFFECT	

Appendix G

Color Coded Respirator Cartridge & Canister Selection

Atmospheric Contaminants	Colors Assigned (1)
Acid gases	White Cartridge & Canister.
Hydrocyanic acid gas	White with 1/2-inch green stripe completely around the canister near the bottom.
Chlorine gas	White with 1/2-inch yellow stripe completely around the canister near the bottom.
Organic vapors	Black Cartridge & Canister.
Ammonia gas	Green Cartridge & Canister.
Acid gases and ammonia gases	Green with 1/2-inch white stripe completely around the canister near the bottom.
Carbon Monoxide	Blue Canister.
Acid gases and organic vapors	Yellow Cartridge & Canister.
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2-inch blue stripe completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases	Brown Canister.
Organic vapors & Formaldehyde	Olive Green Cartridge
Radioactive materials, excepting tritium and noble gases	Purple (Magenta) Cartridge & Canister.
P-100 or High Efficiency Particulate Air (HEPA) for toxic dust, fumes & mists	Purple (Magenta) Cartridge & Canister.
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors	Magenta for particulate plus color as designated above,