



CHEMICAL HYGIENE PLAN

Environmental Health & Safety 

Chemical Hygiene Plan

This Plan Applies to:

Department:

Principal Investigator, Faculty or Lab Supervisor

Building & Room Location(s)

Person Making Amendments

Environmental Health & Safety
122 Grand Ave. Ct.
Ph. 319-335-8501



CHEMICAL HYGIENE PLAN

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CHEMICAL HYGIENE PLAN

PREFACE

The University of Iowa is committed to providing its employees, students and visitors with an environment where the laboratory use of hazardous chemicals is done safely. Attainment of this goal requires the cooperation and commitment of all persons involved.

This generic Chemical Hygiene Plan was written to fulfill uniform requirements applicable to most University labs. The generic CHP must have location specific information, and possibly amendments, added to complete it for the department and lab locations it will apply to. Additional chemical hygiene resources are available at <http://www.uiowa.edu/~hpo/chemsafety/chemsafetyprogram.html>.

This generic Chemical Hygiene Plan supersedes previous University generic chemical hygiene plans.



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Modified May 2009

SPILL RESPONSE INFORMATION

In the event of a small spill, take action as outlined in your lab's spill plan or contact your supervisor.

EMERGENCY & TROUBLE CALLS INFORMATION

Major Chemical Spill

911

Other Emergencies

Public Safety

335-5022 or 911

Ambulance

Break Ins and Illegal Entry

Fire

Personal Injuries

Theft

Building Emergency

FM Work Control Center

335-5071

Elevator Problems

Floods

Heating/AC Problems

Power Outages

Storm Damage

Snow Removal/Roads



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1.0 SCOPE and APPLICATION

The Federal OSHA Lab Standard, 29 CFR 1910.1450, was adopted by the Iowa Occupational Safety and Health Administration (IOSH) and therefore applies to The University of Iowa. It applies to all laboratory employees working on laboratory scale operations involving laboratory use of hazardous chemicals.



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2.0 PURPOSE

The purpose of this document, The University of Iowa Chemical Hygiene Plan (UI CHP), is to protect employees from chemical health hazards and to comply with the OSHA Standard for Occupational Exposures to Hazardous Chemicals in Laboratories, Title 29 Code of Federal Regulations 1910.1450.



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3.0 DEFINITIONS

Action Level

A concentration designated in 29 CFR 1910 for a specific substance, calculated as an 8-hour time weighted average (TWA) which initiates certain required activities to ensure exposure levels are controlled.

Carcinogen

See Select Carcinogen

Chemical Hygiene Plan

A written program developed and implemented which sets forth procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in the laboratory.

Designated Area

Is an area that may be used for work with select carcinogens, reproductive toxins or substances that have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood or glove box.

Employee

Means an individual employed in a laboratory workplace that may be exposed to hazardous chemicals in the course of his or her assignments.

Hazardous Chemical

Is a chemical for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.

Mixtures containing 1% of a hazardous chemical or 0.1% of a carcinogen are also defined as hazardous chemicals. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems and agents which damage the lungs, skin, eyes or mucous membranes.

Laboratory

Is a facility where the laboratory use of hazardous chemicals occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non- production basis. See also laboratory scale and laboratory use definitions.



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3.0 DEFINITIONS - Continued

Laboratory Scale

Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

Laboratory Use of Hazardous Chemicals

Means the handling or use of such chemicals in which all of the following conditions are met:

1. Chemical manipulations are carried out on a laboratory scale.
2. Multiple chemical procedures or chemicals are used.
3. The procedures involved are not part of a production process nor in any way simulate a production process, and
4. Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Physical Hazard

Means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, phrophoric, unstable (reactive) or water-reactive.

Prior Approval

Circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer before implementation. The intent is to ensure individuals have knowledge and procedures in place to safely perform the task.

Reproductive Toxins

Are chemicals, which affect the reproductive capabilities including, damage to chromosomes (mutagens) and effects on fetuses (teratogens).

Select Carcinogen

Any substance which meets one of the following criteria:

1. It is regulated by OSHA as a carcinogen, or
2. It is listed under the category, known to be carcinogens in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest editions), or
3. It is listed under Group 1 (carcinogenic to humans) by the International Agency for Research on Cancer Monographs (IARC) (latest editions), or
4. It is listed in either Group 2A or 2B by IARC or under the category, reasonably anticipated to be carcinogens by NTP, and causes statistically



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3.0 DEFINITIONS - Continued

5. significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - a. After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime, to dosages of less than 10 mg/m³.
 - b. After repeated skin application of less than 300 (mg/kg of body weight) per week.
 - c. After oral dosages of less than 50 mg/kg of body weight per day.



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4.0 POLICY

This University of Iowa Chemical Hygiene Plan contains policies, procedures, and work practices necessary to protect personnel working in laboratories. The intent of this plan is to not exceed legal exposure levels and to maintain exposure to hazardous chemicals at the lowest practical level. The UI CHP must be readily available to employees. Copies of this document are available from the Health Protection Office (EHS) and at <http://www.uiowa.edu/~hpo/>.

If procedures in this generic plan do not adequately address hazards in a particular location or unit, responsible parties in the respective unit must develop specific procedures. Provisions of the UI CHP include:

- Information contained in chemical MSDS Sheets and the results of monitoring will be used to select appropriate control measures designed to accomplish this.
- Medical examinations and consultations will be provided for employees if exposure levels are found to be in excess of legal limits, if employee shows symptoms of overexposure, or if a spill or other event results in the likelihood of overexposure.
- Protective equipment will be provided at no cost to the employee.
- Routine laboratory inspections will be performed to ensure that protective equipment is functioning properly.



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5.0 RESPONSIBILITIES

The University is responsible for providing a safe workplace for employees and complying with OSHA regulations. The University has a designated University Chemical Hygiene Officer who is qualified by education and experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. The University Chemical Hygiene Officer will review this generic plan at least annually and update it as necessary.

DEPARTMENTS

Each department is responsible for implementing this Chemical Hygiene Plan (or its equivalent) within their department. Generally, one or more individuals in the department provide administrative liaison for EHS by serving as the Department Health and Safety Coordinator.

LABORATORY UNITS

Principal Investigators, faculty, and laboratory supervisors are responsible for chemical hygiene in their laboratories and must:

- possess a knowledge of chemical hygiene plan requirements;
- add laboratory-specific concerns to the chemical hygiene plan;
- determine required levels of protective equipment and ensure adequacy of facilities and equipment;
- ensure workers are trained and follow procedures of the plan; and
- perform periodic reviews of their chemical hygiene program and equipment.

LABORATORY EMPLOYEES

Laboratory occupants are responsible for planning and conducting all operations in accordance with the chemical hygiene procedures in their respective Chemical Hygiene Plan. Deviation from these procedures requires prior approval from the lab supervisor.



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6.0 TRAINING and INFORMATION

Everyone who works with or is exposed to potentially hazardous chemicals in a laboratory will receive training on the Occupational Exposure to Hazardous Chemicals in Laboratories Standard. The intent of training is to assure that all individuals are informed about hazards and protection when working in the lab.

REQUIREMENTS

Initial training is required upon assignment to the lab and includes basic orientation for lab chemical safety plus laboratory-unique information and training. Basic lab chemical safety orientation training in classroom or online formats is available through EHS. Training schedules and online training courses are found at <http://www.uiowa.edu/~hpo/training/trainingpage.htm>. For more information contact EHS at 335-8501. Upon completion of EHS training, a record is sent to the employing unit that includes a guide for site-specific topics the lab unit must provide. Other training sources may also be used as long as the training requirements of the standard are met.

Additional training is required when a new hazard is introduced or when there is a need. Laboratory supervisors will provide or arrange for the additional training. Examples of a new hazard may be physical or health hazards associated with chemicals, or operations for which prior training was not received. Examples of a need for additional training may be to improve work practices, address measures to prevent a spill or accident from recurring, or to provide training for work with highly hazardous substances. Labs are encouraged to routinely include chemical health and safety topics in lab meetings or other communications with employees. (A specific interval for refresher training is not specified in the Lab Standard.)

Fire extinguisher training is required for employees expected to use fire extinguishers. For training arrangements contact Facilities Services Group at 335-5035.

CONTENT OF REQUIRED TRAINING

1. Provisions of the Laboratory Standard.
2. The location and availability of the Chemical Hygiene Plan.
3. Hazardous chemicals in the work area.
4. Physical and health hazards of the hazardous chemicals in the work area.
5. Protective measures for handling hazardous chemicals used in the work area.
6. Proper chemical handling procedures for all classes of materials used.
7. Labels and hazard warnings.



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6.0 TRAINING and INFORMATION - Continued

CONTENT OF REQUIRED TRAINING - continued

8. How to locate, interpret and use Material Safety Data Sheets.
9. How to detect the presence or release of hazardous chemicals in the work area.
10. Legal and recommended exposure limits.
11. Correct use of engineering controls, personal protective equipment, and any other methods used to reduce or eliminate exposure.
12. Signs and symptoms of overexposure.
13. Medical Services available.
14. A procedure for emergencies, spills and first aid.



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7.0 EXPOSURE ASSESSMENTS and MEDICAL SERVICES

Many hazardous chemicals have defined exposure limits called Permissible Exposure Limits or PELs. These exposure limits can be based on an 8-hour Time Weighted Average (TWA) exposure, a 15 minute Short Term Exposure Limit (STEL), or an upper limit exposure (Ceiling). Where specific limits are given, the lab standard requires employee exposures not exceed these limits. If an overexposure is suspected, an exposure assessment is necessary. If the assessment indicates that an employee could reasonably have been exposed to a hazardous chemical in a manner that might have caused harm, the person is entitled to medical services. Services include a medical consultation and, if determined to also be needed, a medical examination.

7.1 EXPOSURE ASSESSMENTS

The purpose of an assessment is to determine if there was an exposure that might have caused harm to lab employees and to identify the chemical(s) involved. Exposure assessments may include interviews with the affected employee(s) and laboratory staff, air monitoring, evaluation of laboratory controls and protective equipment, and medical consultation and examination.

When to suspect overexposure

- If an employee manifests symptoms such as headache, rash, nausea, coughing, tearing, irritation or redness of the eyes, irritation of the nose or throat, dizziness, loss of motor dexterity or judgement, etc. and:
 1. Some or all of the symptoms disappear when the employee is removed from the exposure area.
 2. The symptoms reappear soon after the employee returns to work with the same hazardous chemicals.
- Two or more persons in the same laboratory work area have similar complaints.
- A hazardous chemical leaked, spilled or was otherwise rapidly released in an uncontrolled manner.
- A laboratory employee had direct skin or eye contact with a hazardous chemical.

Note: Odor is not a means of determining exposure levels. If there is reason to suspect that a chemical exposure limit has been exceeded notify the lab supervisor whether or not a suspicious odor is involved.



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7.0 EXPOSURE ASSESSMENTS and MEDICAL SERVICES - Continued

7.2 AIR MONITORING

Contact the Health Protection Office at 335-8501 to request air monitoring to evaluate chemical exposures. Upon completion of monitoring, employees must be notified of results in writing either individually or by posting, within 15 days, of the receipt of results. Records of monitoring results and employee notification must be kept, transferred, and made available in accordance with 29 CFR 1910.1020. If exposures are found to be over legal limits further action will be required.

7.3 MEDICAL SERVICES

Medical services may consist of a medical consultation, examination, or emergency services. Pre-exposure (baseline) assessment is available upon departmental request at the University Employee Health Clinic. There is no cost to the employee for these services and employees may be medically monitored on an annual basis.

When assessment results indicate that an employee may have been exposed to a hazardous chemical, the employee should obtain a medical consultation from the Workers Health Clinic (356-3632). Consultations and examinations must be under the direct supervision of a licensed physician. The employing lab or department must inform the physician of the identity of the chemical, the conditions of the exposure, and the employee's symptoms. A written opinion must be obtained from the physician. It must be maintained as a part of the employee's record and made readily available to the employee and upon request to his/her designated representative. The written opinion must not reveal findings unrelated to occupational exposure.

The written opinion must include:

1. Follow-up recommendations.
2. Exam and test results.
3. Any medical condition found as a result of the exam that may place the employee at an increased risk as a result of hazardous chemical exposure.
4. A statement that the employee has been informed by the physician of the results of the consultation.

7.4 EXPOSURE AND MEDICAL RECORDS

Records of monitoring measurements or any medical baseline, consultation or examination, including tests or written opinions, must be maintained for each employee for a period of thirty years after retirement or resignation. Records must be kept, transferred and made available IAW 29 CFR.1910.1020.



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8.0 GENERAL SAFETY PRACTICES in LABS

8.1 EXPOSURE CONTROLS

Potential exposure should be maintained at the lowest practical level and must not exceed legal exposure levels. OSHA requires engineering controls as the primary means of worker protection. A common engineering control in the laboratory is the chemical fume hood. Administrative controls such as safe work practices and personal protective equipment are other exposure controls common in labs.

8.2 ROUTINE SAFETY PROCEDURES IN LABS

1. Post entrances with emergency contact information.
2. Be aware of the location and proper operation of laboratory safety equipment.
3. Dress appropriately in the lab. Apparel should include full foot coverings and clothing that covers the skin. Perforated shoes and sandals should not be worn in laboratories. Loose, skimpy or torn clothing should not be worn in laboratories.
4. Wear lab coats and gloves in lab areas only, not in public areas.
5. Do not eat, drink, or apply cosmetics in chemical use areas. Smoking is not allowed in University buildings.
6. Ice, glassware, utensils, ovens, refrigerators, and other equipment used for lab operations should not be used for storage, handling or consumption of food and beverages.
7. Wash hands before using the restrooms and before eating or smoking.
8. Keep access route to exits, emergency equipment and utility controls open and unblocked.
9. Keep lab areas clean and uncluttered to help prevent unnecessary contact or personal injury from breakage and spillage of chemicals.
10. Keep lab doors closed for fire safety and to maintain proper room air pressures.
11. Visitors to the lab are to be escorted by an employee and are the responsibility of that employee.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Proper use of Personal Protective Equipment (PPE) will minimize exposure to hazards associated with many laboratory operations. PPE should satisfy performance requirements such as strength, chemical resistance and thermal resistance without inhibiting flexibility and manual dexterity.



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8.0 GENERAL SAFETY PRACTICES in LABS - Continued

8.3 PERSONAL PROTECTIVE EQUIPMENT - continued

PPE shall be selected, used, and maintained in accordance with applicable IOSH Standards and as described in EHS's "Personal Protective Equipment Procedures." This PPE compliance guide for PPE, available at <http://www.uiowa.edu/~hpo/occsafety/ppeprogram.pdf>, contains resources for completing the required Certification of Hazard Assessment and Training for employees.

Eye and Face Protection

Eye and face protection shall be required where there is a reasonable probability that injury could be prevented by such protection. PPE shall be selected in accordance with IOSH 1910.133 "Eye and Face Protection" and shall meet requirements specified in American National Standards Institute, Z87.1, "Practice for Occupational and Educational Eye and Face Protection". Eye and face protection can be purchased from laboratory and safety catalogs and University Stores. Prescription safety glasses are purchased from the University's vendor, McDonald Optical, with a green safety requisition. Eye examinations and associated costs are the responsibility of the employee.

Note: Protective equipment related to lasers, X-rays, gamma rays, and microwaves, etc. are not covered by the Z87.1 standard. Departments or the user should contact the manufacturer and EHS's Radiation Protection Section (335-8501) for proper selection.

General eyewear requirements

1. Safety glasses with permanently attached side shields are required where there is a potential of being struck by projectile objects.
2. Chemical splash goggles are required in chemical handling operations where protection is needed against mists, aerosols and sprays.
3. Face shields are required where facial skin protection is needed for chemical or physical agents. Where both eye and face protection is needed, the face shield is used in addition to the safety glasses or goggles.

Hand Protection

Skin contact is a potential source of exposure to toxic materials. Check the Material Safety Data Sheet for substances that can create exposure routes by skin absorption. Appropriate gloves may be selected based on the requirements listed on the next page and can be purchased from laboratory and safety supply catalogs.



CHEMICAL HYGIENE PLAN

8.0 GENERAL SAFETY PRACTICES in LABS - Continued

8.3 PERSONAL PROTECTIVE EQUIPMENT – continued

Hand Protection - continued

General glove requirements

1. Gloves should be worn whenever there is potential for contact with corrosive or toxic materials, or materials of unknown toxicity.
2. Gloves should be selected based on test data from the glove manufacturer.
3. Chemicals eventually permeate gloves; however, they can be used safely for limited time periods if specific use and glove characteristics, i.e., thickness, permeation rate and time, are known.
4. Gloves should be replaced periodically depending on frequency of use and permeability to the substance(s) handled.

8.4 INHALATION PROTECTION

When a chemical is used in a way that may present an inhalation hazard, measures must be taken to control exposure. This is primarily accomplished in the laboratory through proper use of a chemical fume hood. When procedures cannot be performed in a fume hood or ventilation is not adequate to provide protection against inhalation hazards, respiratory protective equipment may be necessary. Respirators should be the last option chosen for controlling inhalation hazards.

8.5 RESPIRATORS

Departments or laboratories that issue, recommend or provide respirators for employee protection are required to implement a respiratory protection program in accordance with OSHA Standard 1910.134. The Health Protection Office or other qualified industrial hygiene services should be contacted for assistance in determining the need for implementation of a respirator program. Respirator program components include hazard evaluations, annual medical evaluations, fit-tests and training for individuals using respirators, and written programs including record keeping and annual reviews.



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9.0 FACILITY and EQUIPMENT SAFETY

Chemical safety is achieved with continual awareness of chemical hazards and keeping chemicals under control by using precautions including engineering safeguards. All engineering safeguards, equipment and controls must be properly maintained, inspected on a regular basis, and never overloaded beyond their design limits. Laboratory supervisors should be alert to detect malfunction of these controls.

9.1 VENTILATION

General lab ventilation shall provide airflow into the laboratory from non-laboratory areas and out to the exterior of the building. Laboratory doors should remain closed except for egress and entrance.

Local Exhaust Ventilation equipment is a commonly used engineering control in the lab. Usually this is a chemical fume hood but also includes ventilated bench top cabinets, spot exhaust devices, and filtered cabinets for using hazardous solids.

9.2 CHEMICAL FUME HOODS

A fume hood is a local exhaust device whose primary purpose is to protect laboratory workers from hazards of airborne chemical contaminants. The secondary purpose is to protect people and property against small fires and explosions. The fume hood must be used properly to allow it to function properly and remove contaminants from the breathing area of the user.

- Use chemicals in the hood that may generate contaminants near or above exposure limits.
- Do not have sources of ignition inside the hood when flammable liquids or gases are present.
- Visually inspect the device (and flow monitor) daily or before each use.
- Keep all items 6 inches back from the front edge of the hood to avoid blocking the airflow path.
- Keep slot openings at the back of the hood free from blockage with large objects or numerous containers.
- Elevate large objects 2 inches off the floor of the hood so air can pass under the object and out the back slots in the hood.
- Close the sash when the hood is not in use
- During hood use, lower the sash to the sash arrow sticker, below the chin and more if possible.
- Lower and use the sash as a safety shield when working with reactive materials or materials that may splatter.
- Do not store chemicals in hoods.



CHEMICAL HYGIENE PLAN

9.0 FACILITY and EQUIPMENT SAFETY - Continued

9.1 MAINTENANCE AND INSPECTIONS OF FUME HOODS

Operators should check the hood area daily for visible blockage of airflow, e.g., large items or numerous containers blocking the lower slot opening in the rear of the hood. Airflow monitor devices should be observed before each use to check that the hood is functioning. If the hood does not have a monitor, place a tissue paper strip at the opening to observe inward directional airflow. Users should keep interior hood surfaces in a clean condition.

EHS checks fume hood airflow performance annually to confirm that:

- airflow into the hood is not compromised by cross drafts;
- airflow into the hood has a uniform inward pattern; and
- average velocity of air moving into the hood is within acceptable range.

Guidelines and results are noted on the hood sticker placed on the front of the hood. If results are not acceptable a notice will be placed on the hood sash and repair request sent to Facilities Service Group.

A yellow sash arrow sticker indicates maximum sash height at which acceptable airflow performance results were checked. The sash sticker indicates the maximum sash opening for hood use. In the event a hood lacks a hood or sash sticker or the test date is older than one year, contact EHS.

Facilities Services Group periodically inspects and maintains the hood system components such as lights, fans, and motors. Equipment failures or problems should be reported to the Work Control Center at 335-5071.

9.4 VENTILATION FAILURE PROCEDURES

In the event of a ventilation failure or recurring low flow alarm on the monitor occupants should contact the Work Control Center in Facilities Services Group (319-335-5071, 24 hours, 7 days). Occupants should place lids on open containers, lower the fume hood sash, and shut down equipment and secure reactions that may be generating hazardous emissions.

9.5 REFRIGERATORS

Individuals and/or departments purchasing refrigerators for laboratory use are expected to follow university procedures that are in accordance with requirements of NFPA 45 (National Fire Protection Association), "Standard on Fire Protection for Laboratories Using Chemicals." If flammable solvents need to be refrigerated an explosion-safe refrigerator must be purchased. In nearly all situations this type of unit is necessary for lab use.



CHEMICAL HYGIENE PLAN

9.0 FACILITY and EQUIPMENT SAFETY - Continued

9.5 REFRIGERATORS - continued

Explosion-safe refrigerators are designed to eliminate ignition of flammable vapors inside the storage compartment. A domestic refrigerator must not be used to store flammables because they contain ignition sources that can set off explosive concentrations of flammable vapor. Vapors from a leaky stopper or a cracked container can build up to explosive concentrations and be ignited by the light switch or thermostat. Domestic refrigerators located in labs must be labeled "**Do Not Store Flammables in This Refrigerator.**"

9.6 BODY SHOWERS AND EYEWASH STATIONS

IOSH requires this equipment be provided in work areas where any person's eyes or body may be exposed to corrosive materials. The American National Standard Institute (ANSI) Standard Z358.1-1998 "Emergency Eyewash & Shower Equipment" provides the specific requirements. These requirements are rather extensive. Facilities Services Group address construction and renovation requirements. EHS may also be contacted for additional information.

Laboratory occupants should ensure that access routes to body showers and eyewash stations are free of obstructions. Laboratory occupants should activate water flow in eye wash stations periodically. If problems are noted with water flow contact the Work Control Center at Facilities Services Group (335-5071). Body showers are checked and maintained by the Facilities Services Group.

9.7 ELECTRICAL EXTENSION CORDS

The National Electrical Code and the State Fire Marshal's Office prohibit use of extension cords as a substitute for permanent wiring. Multiple plug outlet adapters are also prohibited. If additional electrical outlets are needed in a work area, one of two possible solutions could be used to rectify the problem.

1. The department can pay FSG to install additional outlets.
2. The department can complete a "Building Repairs Request" form and forward it to Facilities Planning. This option is contingent upon availability of funding.

The only exception granted is that the State Fire Marshal's Office will allow the University to use electrical power strips for personal computers and their components only in older and existing building operations. Remodeling and new construction must provide additional outlets for computers. These UL listed powerstrips come with a cord and an outlet box that has a 15-amp circuit breaker. These units should be purchased at General Stores.



CHEMICAL HYGIENE PLAN

9.0 FACILITY and EQUIPMENT SAFETY - Continued

9.8 FLAMMABLE LIQUID STORAGE CABINETS

When purchasing flammable liquid storage cabinets the following specifications must be met.

1. Cabinets must comply with NFPA and IOSH Standards.
2. Cabinets must have self-closing door(s), with red lettering stating "**Flammable Keep Fire Away**".
3. Two doors are required on all cabinets except 10 and 20-gallon sizes where one door is required. Where two doors are required, they may be either bifolding or hinged on each side.
4. Cabinets must be of approved metal construction and meet minimum construction requirements:
 - Bottom, top, sides and door(s) of cabinet shall be at least No.18 gauge sheet metal and double walled 1 1/2-inch air space.
 - Joints must be riveted, welded or made liquid tight by some equally effective means.
5. Door must be provided with three-point latch arrangement and the doorsill shall be raised at least two inches above bottom of the cabinet to retain spilled liquid within the cabinet.

9.9 GUARDING

All mechanical equipment should be adequately furnished with guards that prevent access to electrical connections or moving parts; e.g., belts and pulleys of a vacuum pump. Each laboratory worker should inspect equipment before using it to ensure that the guards are in place and functions. Careful design of guards is vital. An ineffective guard can be worse than none at all, because it can give a false sense of security. Emergency shutoff devices may be needed in addition to electrical and mechanical guarding.

9.10 SHIELDING

Safety shielding should be used for any operation having the potential for explosion and must be placed so that all personnel in the area are protected from hazard, such as whenever:

1. A reaction is attempted for the first time (small quantities of reactants should be used to minimize hazards).
2. A familiar reaction is carried out on a larger than usual scale (5-10 times more material).
3. An operation is carried out under non-ambient conditions.



CHEMICAL HYGIENE PLAN

9.0 FACILITY and EQUIPMENT SAFETY - Continued

9.11 GAS HOSE CONNECTORS

As per the National Fuel Gas Code, NFPA 54 Section 5.5.2, gas hose connectors i.e., hoses connecting a gas source to an appliance or equipment, are allowed to be used for laboratory equipment such as Bunsen burners provided that all the following items are met:

1. A shut off valve must be installed where the connector is attached.
2. The connector shall not exceed 6 feet.
3. The connector shall not be concealed nor shall it pass from room to room or through walls, ceilings, or floors.
4. Only listed gas hose connectors can be used.

Note: This code specifically disallows use of latex tubing as a connector between a gas source and a Bunsen burner



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES

General procedures should be followed for handling all chemicals in addition to specific procedures for chemical hazard groups (toxins, flammables, etc.).

10.1 ALL CHEMICALS

General Handling Procedures

1. Obtain and review Material Safety Data Sheets (MSDS) before ordering and using chemicals. Ensure that the material can be safely procured, stored, used, and disposed of.
2. Know the hazards associated with materials you are using.
3. Be prepared for emergencies and know what action to take. Assure that necessary supplies and equipment are available for handling small spills.
4. Know the location of safety equipment such as emergency shower, eyewash, fire extinguisher, fire alarm, and emergency telephone numbers.
5. Do not work alone in the laboratory if you are working with chemicals.
6. Purchase minimum amounts of hazardous materials necessary to accomplish work and dispense only amounts necessary for immediate use.
7. Use hazardous materials only as directed and for their intended purpose.
8. Never smell or taste a hazardous chemical.
9. Avoid direct contact with any chemical, use protective equipment to avoid exposure, and review MSDS for specific recommendations for each chemical used.
10. Smoking, drinking, eating and the application of cosmetics is forbidden in areas where hazardous chemicals are in use.
11. Ensure emergency contact information is posted at the lab entrance.
12. Ensure all containers are labeled.
13. Label all secondary containers with chemical name and hazard information.
14. Assure ventilation is adequate for the materials you are using. Where possible, handle all materials in a chemical fume hood.
15. Electrically ground and bond conductive containers using approved methods before transferring or dispensing a flammable liquid from a large container.



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.1 ALL CHEMICALS - continued

General Handling Procedures - continued

16. Store chemical in compatible categories.
17. Only permit reactions to run unattended when the reaction is well understood, provisions are in place to contain toxic substances in the event of a utility failure, and emergency contact information is posted on the door.
18. Dispose of waste properly according to EHS's "Waste Management Guidelines and Procedures Manual."
19. When transporting chemicals outside the lab, use precautions to avoid dropping or spilling chemicals. Use bottle carriers for glass containers and use carts with edges to prevent containers from falling off the cart and breaking.

10.2 TOXINS

Hazards

The effects of exposures to toxic chemicals are either acute or chronic. Acute effects are characterized by prompt or slightly delayed health effects, such as burns, allergic reactions, immediate damage to organs such as eyes. Chronic effects occur over a long periods of time and are characterized by cumulative damage to organs including carcinogenic effects.

Minimizing or eliminating exposure provides protection from toxic hazards. To minimize exposure it is necessary to determine the route by which exposure may occur, i.e., inhalation, skin contact, ingestion, and injection or puncture.

Precautions

1. Know the hazards of the material you are using. Review MSDS sheet and do additional research if necessary. Use less toxic materials if possible.
2. Use and store toxic chemicals in established areas and in the smallest possible amounts.
3. Store and transport toxic chemicals in secondary containment trays.
4. Use these materials in containment devices such as fume hoods and



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.2 TOXINS - continued

5. glove boxes.
6. Use appropriate protective equipment.

Precautions - continued

7. Be prepared for spills and know when to take emergency action.
8. Wash hands and arms immediately after working with toxic materials.
9. Never eat, drink, smoke, apply cosmetics, or store food in areas where toxic substances are being used. Never smell or taste a hazardous chemical.
10. Dispose of wastes in accordance with procedures in the EHS Manual Guidelines and Management of Hazardous Waste. As appropriate, perform chemical decontamination of washes and materials from experiments.
11. Consider whether additional precautions are needed for substances with high toxicity. See also "Carcinogens, Reproductive Toxins and Highly Toxic Chemicals: Chemical Handling Procedures."

10.3 CARCINOGENS, REPRODUCTIVE TOXINS and HIGHLY TOXIC CHEMICALS

OSHA defines certain carcinogens, reproductive toxins, and substances with high acute toxicity as Particularly Hazardous Substances (PHS) and requires that employers consider the need for precautions in addition to those for handling toxic substances.

Check the MSDS to see if materials meet definitions below. The Hazardous Chemical PHS List available at <http://www.uiowa.edu/~hpo/> contains more common lab substances that meet these definitions.

Definitions

Select Carcinogen – Any substance that meets one of the following criteria:

1. It is regulated by OSHA as a carcinogen, or
2. It is listed under the category, known to be carcinogens in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest editions), or
3. It is listed under Group 1 (carcinogenic to humans) by the International Agency for Research on Cancer Monographs (IARC) (latest editions),
or



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.3 CARCINOGENS, REPRODUCTIVE TOXINS and HIGHLY TOXIC CHEMICALS - Continued

Definitions

Select Carcinogen – continued

4. It is listed in either Group 2A or 2B by IARC or under the category, reasonably anticipated to be carcinogens by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - a. After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime, to dosages of less than 10 mg/m³.
 - b. After repeated skin application of less than 300 (mg/kg of body weight) per week, or
 - c. After oral dosages of less than 50 mg/kg of body weight per day.

Reproductive Toxins - include substances that can affect reproductive capabilities such as mutagens, which cause chromosome damage, and teratogens, which cause harm to the fetus, and reproductive hazards, that may affect female or male reproductive health.

Highly Toxic Chemicals - a substance (poison) that falls within any of the following categories:

1. Median lethal dose (LD₅₀) administered orally is ≤50 mg.
2. LD₅₀ administered by continuous contact is ≤200 mg.
3. Median lethal concentration administered by inhalation is ≤200 ppm
4. Any chemical whose properties are unknown.

Precautions

1. As a minimum, follow precautions section 10.2 of this guide.
2. Determine whether additional precautions are needed for PHS materials.
3. Amend or add procedures as needed.
4. Post the area for use. Inform lab occupants of designated areas. Sample posting available at <http://www.uiowa.edu/~hpo/>.



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.3 CARCINOGENS, REPRODUCTIVE TOXINS and HIGHLY TOXIC CHEMICALS - Continued

Precautions – Continued

5. Consider factors such as potency, concentration, quantity, physical properties and conditions surrounding the use of the substances. Specifically consider if additional precautions are needed for:
 - Areas to be designated for use and posted, e.g., fume hood, glove box, or entire room.
 - Containment devices (e.g., fume hood or glove box).
 - Procedures for decontamination and waste disposal.
 - Additional training or personal protective equipment for material users.
6. List designated areas where additional precautions are needed.
Chemical or Substance
Building/Room
Area Designated for Use

10.4 FLAMMABLES AND COMBUSTIBLES

Flammable/combustible materials can generate sufficient vapor to cause a fire in the presence of an ignition source. They are categorized based on flash point--the minimum temperature at which a liquid gives off vapor in sufficient concentrations to allow the substance to ignite.

Flammable materials can generate sufficient vapors to ignite at temperatures below 100°Fahrenheit.

Combustible materials can generate sufficient vapors to ignite at temperatures at or above 100° Fahrenheit.

Hazards

The liquid does not itself burn; it is vapors from the liquid that burn. The rate of vapor generation depends upon the liquid's vapor pressure, which increases with temperature. The degree of fire hazard depends upon the ability of vapors to mix with air to form combustible or explosive mixtures and the ease of ignition of these mixtures.

Flammables are more hazardous because they are more volatile than combustibles. Safe handling procedures are based upon controlling one or



CHEMICAL HYGIENE PLAN

CHEMICAL HANDLING PROCEDURES - Continued

10.4 FLAMMABLES AND COMBUSTIBLES - Continued

more of the elements necessary to initiate a fire: fuel, ignition source, and oxygen.

Precautions

1. Eliminate ignition sources such as open flames, smoking materials, hot surfaces, sparks from welding or cutting, operation of electrical equipment, and static electricity.
2. Minimize the quantity kept in work area.
3. Store in approved flammable liquid containers (safety cans) and storage cabinets or in a special storage room designed for that purpose. Store away from oxidizers.
4. Flammable liquids stored in glass containers shall not exceed one quart unless chemical purity must be protected. In that case one gallon is permissible.
5. Refrigerators and freezers used for storage of flammables shall be explosion safe and labeled as such.
6. Assure proper bonding and grounding when transferring or dispensing flammable liquid from a large container.
7. Assure appropriate sprinkler and or fire extinguishers are in the area.

10.5 CORROSIVES

A corrosive chemical is one that causes visible destruction or irreversible alterations of living tissue by chemical action at the site of contact. They can be in solid, liquid or gaseous form and act on body tissues by direct contact, inhalation or ingestion. Corrosives can be categorized as strong acid, strong base, dehydrating agent, oxidizing agent, or water-reactive. Corrosive liquids are responsible for most corrosive-based injuries. Corrosive gases are the most serious because they can be readily absorbed into the body by dissolution with skin moisture and by inhalation.

Precautions

1. Eye protection and gloves should always be worn when handling corrosive materials. A faceshield, rubber apron, and rubber boots may also be appropriate; depending upon work performed (check material safety data sheet for personal protective equipment requirements).
2. Always add acid to water. Dehydrating agents such as sulfuric acid, sodium hydroxide, phosphorus pentoxide, and calcium oxide should



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.5 CORROSIVES - Continued

Precautions - continued

be mixed with water by adding the agent to water to avoid violent reaction and splattering.

3. An eyewash and safety shower must be readily accessible to areas where corrosives are used and stored as specified in OSHA 1910.151(c). In the event of skin or eye contact with corrosives, immediately flush the area of contact with cool water for 15 minutes and remove all affected clothing. Get medical help immediately.
4. Strong oxidizing agents such as chromic and perchloric acids should be stored and used in glass or other inert containers (preferably unbreakable); corks and rubber stoppers should not be used.
5. Safety rubber bottle carriers or non-breakable bottles (PVC-coated) should be used for the transport of strong acids and bases from one location to another.

Storage

1. Containers and equipment used for storage should be corrosion resistant.
2. Acids and bases should be stored separately. Strong oxidizing acids should be stored separately from other acids and bases.

10.5 COMPRESSED GASES

Definition

"Compressed Gas" is a generic term for three different types of gas products, compressed gases, liquefied compressed gases, and cryogenic liquefied gases. A compressed gas is either:

1. A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 pounds per square inch (psi) at 70° F;
2. A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 F regardless of the pressure at 70° F; or
3. A liquid having a vapor pressure exceeding 40 psi at 100° F as determined by ASTM D-323-72.

Hazards

Compressed gases may be grouped into different hazard categories based upon their physical or health properties, or both. Any gas could be placed

10.0 CHEMICAL HANDLING PROCEDURES - Continued



CHEMICAL HYGIENE PLAN

10.5 COMPRESSED GASES - Continued

into more than one category. A gas could be corrosive, flammable, toxic, an oxidizer, or act as an asphyxiant by displacing oxygen. An additional hazard is due to the fact that gases are stored under high pressure.

Cryogenics create unique hazards including fire, pressure, embrittlement of materials, and skin or eye burns upon contact with the liquid. Cryogenics condense oxygen from air creating an oxygen rich atmosphere and increasing potential for fire if flammable or combustible materials and an ignition source are present. Pressure is a hazard because of the large expansion ratio from liquid to gas, causing pressure build up in containers. Many materials become brittle at extremely low temperatures. Brief bodily contact with materials at extremely low temperatures can cause burns similar to thermal burns.

Precautions

1. Never drop cylinders or permit them to strike each other violently.
2. The valve-protection cap should be left on each cylinder until it has been secured against a wall, bench, or placed in a stand and is ready to be used.
3. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a cylinder hand truck to move them.
4. Never tamper with safety devices in valves or cylinders.
5. No part of a cylinder should be subjected to temperatures higher than 125° F. A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
6. Do not store full and empty cylinders together. Serious suck-back can occur when an empty cylinder is attached to a pressurized system.
7. Bond and ground all cylinder, lines, and equipment used with flammable compressed gases.
8. Use compressed gases only in well-ventilated areas. Toxic, flammable, and corrosive gases should be handled in a hood. Only small cylinders of toxic gases should be used.
9. When discharging gas into a liquid, a trap or suitable check valve should be used to prevent liquid from getting back into the cylinder or regulator.
10. When returning empty cylinders, close the valve before shipment, leaving some positive pressure in the cylinder. Replace any valve outlet and protective caps originally shipped with cylinder. Mark or



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

COMPRESSED GASES – Continued

label cylinder "empty" and store in a designated area for return.

Precautions - continued

11. Before using cylinders, read all label information and material safety data sheets associated with the gas being used. Check the MSDS for required personal protective equipment and hazard information before use.
12. For flammable cryogenics the precautions detailed in Procedures for Handling Flammable and Combustibles should be followed.
13. When handling cryogenics always wear safety goggles. If there is a splash or spray hazard, personnel protective clothing should also include a face shield, impervious apron or coat, trousers without cuffs, and shoes that cover the foot. Gloves should be impervious.
14. Containers and systems containing cryogenics should have pressure relief mechanisms.
15. Containers and systems should be capable of withstanding extreme cold without becoming brittle.

10.7 PEROXIDE FORMERS

Definition

Peroxide formers, or peroxidizables, are materials which react with oxygen to form peroxides which can explode with impact, heat, or friction.

Hazard Categories

Peroxide-forming compounds can be divided into three hazard categories. Storage times are based on time after opening container.

1. **Compounds forming peroxides that can spontaneously decompose during storage.** Maximum storage time is 3 months. *Examples include divinyl acetylene, isopropyl ether, potassium metal, sodium amide, vinylidene chloride.*
2. **Compounds forming peroxides that require the addition of a certain amount of energy (distillation, shock) to explosively decompose.** Maximum storage time is 12 months. *Examples include acetyl, cyclohexene, diacetylene, dicyclopentadiene, diethyl ether, dioxane, 1,2-dimethoxyethane, methyl acetylene, methyl cyclopentane, methyl isobutylketone, tetrahydrofuran, vinyl ethers, tetrahydronaphthalene.*



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

Hazard Categories - continued

3. **Compounds that have the potential to form peroxide polymers, a highly dangerous form of peroxide which precipitate from solution easily and are extremely heat and shock-sensitive.**
Maximum storage time is 12 months. *Examples include acrylic acid, acrylonitrile, butadiene, chloroprene, chlorotrifluoroethylene, methyl methacrylate, styrene, tetrafluoroethylene, vinyl acetate, vinyl chloride, vinyl pyridine.*

Precautions

1. Date all peroxidizables upon receipt and opening. Unless the manufacturer has added an inhibitor, materials should be disposed of in a timely manner.
2. Do not open any container that has obvious crystal formation around the lid.
3. Other precautions are similar to those used for flammables.
4. Hazards of peroxide formation can be minimized by adding oxidation inhibiting compounds, and testing for peroxide concentration.

10.8 REACTIVES

Definition and Hazards

The category "Reactive" is a term given to a chemical class that displays a broad range of reactions. This category includes explosives, oxidizers, reducers, water sensitive, acid sensitive, air sensitive and unstable chemicals. These substances are capable of producing toxic gases, explosive mixtures, being explosive, reacting with water violently, or they may contain cyanide or sulfide. Reactive chemicals exhibit moderate to extremely rapid reaction rates and include materials capable of rapid release of energy by themselves (self-reaction or polymerization), and/or rates of reaction that may be increased by heat or pressure or by contact with incompatible substances.

Reactives may be broadly classified into two groups: those that may explode and those that do not. Reactivity of individual chemicals in specific chemical classes (e.g., alkali metals) varies considerably. This rate of activity may also vary as a result of aging or contamination. Reactives may be further subdivided and placed into eight classes based upon their chemical behavior.



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.8 REACTIVES - Continued

Class I

Chemicals normally unstable that readily undergo violent change without detonating.

Properties -

1. Pyrophorics--spontaneous ignition in contact with air. Examples: metal alkyls, phosphorus, finely divided metal powders such as magnesium, aluminum, and zinc. Prevent contact with air or water - use and store in inert environments.
2. Polymerizables--spontaneous polymerization in contact with air. Examples: divinyl benzene. Keep cool and avoid contact with water.
3. Oxidizers--violent reaction in contact with organic materials or strong reducing agents. Examples: perchloric, chromic and fuming nitric acid. Use minimum amounts for procedure; do not keep excessive amounts of material in the vicinity of process; store properly, away from organic materials, flammable materials and reducers.

Class II

Chemicals that react violently with water.

Properties –

Causes large evolution of heat in contact with water, decomposes in moist air, and violently decomposes with liquid water. Examples: Sulfuric acid, chlorosulfonic acid, oleum, phosphorous trioxide and pentoxide, acetyl halides, phosphorus halides, titanium tetrachloride, glyoxal.

Precautions

1. Handle materials like corrosives. Use protective acid resistant rubber or plastic clothing with gloves and face shield.
2. Keep away from moisture.
3. Handle materials in fume hood since fuming in moist air can result in exposure to corrosive and/or toxic gases.



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.8 REACTIVES - Continued

Class III

Chemicals that form potentially explosive mixtures with water.

Properties –

Chemicals decompose violently in water with evolution of heat and flammable gases, which may ignite if exposed to ignition source. Evolution of heat with water may be sufficient to cause auto-ignition (and explosion). Examples: alkaline metals, alkaline earth metals, alkaline metal hydrides, alkaline metal nitrides.

Precautions

1. Provide ventilation to disperse flammable gases.
2. Use dry sand to smother materials - use of water as a fire extinguisher may aggravate fire.
3. Avoid contact with and handle away from water sources.

Class IV

Chemicals that, when mixed with water, generate toxic gases, vapors or fumes in quantity sufficient to present a danger to human health or the environment.

Properties –

Reacts rapidly with water with the production of gases or vapors, which are acutely toxic to human health. Examples: alkaline metal phosphides, phosphorus halides, aluminum phosphide toluene diisocyanate.

Precautions

1. Provide adequate ventilation when handling.
2. Keep containers sealed.
3. Do not handle near water.

Class V

Cyanide or sulfide bearing chemicals.

Properties –

Acid sensitive cyanides and sulfides that produce extremely toxic hydrogen cyanide or hydrogen sulfide gases on contact with acids or materials which



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.8 REACTIVES - Continued

Class V - continued

Properties - continued

form acids in the presence of moisture or liquid water.

Examples: metal cyanide salts, organic cyanide compounds, metal sulfide salts, organic sulfides and mercaptans.

Precautions

1. Do not store in cabinets with acids and oxidizers.
2. Isolate from other reactive chemicals.
3. Protect sulfide salts from moisture.
4. Provide adequate ventilation due to severe inhalation hazard of hydrogen cyanide and hydrogen sulfide and acute toxic effects from skin contact with hydrogen cyanide.

Class VI

Chemicals capable of detonating or exploding if subjected to a strong initiating source or if heated under confinement.

Properties –

Detonation or explosion can occur if heated above ambient temperature; or if exposed to an initiating source such as shock, mechanical shock, spark or flame, or a catalyst that accelerates decomposition. Examples: lead amide, sodium amide, thallos nitride, metal azides, brominated organic compounds, benzene diazonium salts, ammonium picrate, ammonium tetrachromate, metal periodates, organic perchlorates, isoamyl nitrite, ammonium nitrate & chlorate.

Precautions

1. Protect containers from physical damage, heat and incompatible chemicals.
2. Chemicals in this class exhibit a wide range of other properties, i.e., flammability, acid or water or light sensitivity. Know the properties of the materials being worked with.
3. Check MSDS for information on incompatibles when storing.



CHEMICAL HYGIENE PLAN

10.0 CHEMICAL HANDLING PROCEDURES - Continued

10.8 REACTIVES - Continued

Class VII

Chemicals readily capable of detonation, explosive decomposition, or reaction at standard temperature and pressure.

Properties –

Chemicals capable of detonation or explosive decomposition under ambient temperature and pressure without any external initiating source. Examples: ammonium chlorate, organic azides, metal azides, benzoyl peroxide, peroxidized ethers.

Precautions

1. Materials should only be handled by knowledgeable and trained individuals.
2. Evaluate chemicals periodically to determine whether deterioration has occurred. If so, dispose of properly by contacting the Health Protection Office.
3. Check the MSDS for information on incompatibles for storage and chemical properties of materials handled.
4. Follow recommendations on MSDS for personal protective equipment.

Class VIII

Forbidden explosives, Class A explosives, and Class B explosives as defined [in 49 CFR 173](#).

Properties –

Forbidden Explosives are capable of detonation or explosive decomposition under ambient conditions, considered too dangerous for transportation. Examples: Forbidden explosives: diethylene glycol dinitrate, unstabilized nitroglycerine, nitrocellulose. Class A Explosives: TNT, mercury fulminate, diazo-dinitrophenol, lead 2,4-dinitroresorcinate. Class B. Explosives: stabilized nitrocellulose, stabilized nitroglycerin.

Precautions

Materials should only be handled by experienced and properly equipped persons.



CHEMICAL HYGIENE PLAN

11.0 STORAGE PROCEDURES FOR HAZARDOUS CHEMICALS

Proper storage of chemicals is important to reduce hazards of chemical reactions that may create hazardous exposure situations, cause fires, or damage equipment and property. The laboratory should select a storage scheme that achieves segregation of incompatible materials. Sample storage schemes that may be used for inventory quantities that are light, light to moderate, and moderate to heavy are available at <http://www.uiowa.edu/~hpo>. Storage guidance may also be found in laboratory and safety catalogs, Material Safety Data Sheets and container labels.

11.1 GENERAL PRECAUTIONS

1. Maintain a list of hazardous chemicals used or stored.
2. Assure all containers are in good condition and properly labeled.
3. Review stored items at least yearly, more frequently for age sensitive materials. Ensure containers and caps are in good condition. Ensure materials are stable.
4. Do not store chemicals in alphabetical order unless they are already segregated by hazard category.
5. Do not store incompatible chemicals in close proximity to each other.
6. Avoid floor chemical storage.
7. Provide anti-roll lips on shelves.
8. Provide shelving that can be cleaned and won't soak up spilled chemicals.
9. Store chemicals below eye level.
10. Do not store chemicals on top of shelving units or on top of flammable storage cabinets.
11. Avoid use of adjustable supports with clips.
12. Store severe poisons in a dedicated cabinet.
13. Store oxidizing acids in secondary containers.
14. Label storage areas by chemical group.
15. Store flammable liquid quantities over 10 gallons in flammable storage cabinets. See also storage procedures for flammable and combustible liquids.



CHEMICAL HYGIENE PLAN

11.0 STORAGE PROCEDURES for HAZARDOUS CHEMICALS - Continued

11.2 STORAGE PROCEDURES for FLAMMABLE and COMBUSTIBLE LIQUIDS

The following is a summary of storage requirements for ignitable liquids taken from OSHA 1910.106 and NFPA Standards 30, 45 and 704.

Definitions

Storage limitations of liquids are based on the following classifications.

Term	Class	Flash Point	Boiling Point	NFPA Rating
Flammable	IA	<73° F	<100° F	4
Flammable	IB	<73° F	≥100° F	3
Flammable	IC	73° F - <100° F		3
Combustible	II	100° F - <40° F		2
Combustible	IIIA	140° F - <200° F		2
Combustible	IIIB	≥200° F		1

Procedures

The following storage requirements apply to most university academic and research buildings. For flammable storage vaults, warehouses, and industrial operations, contact the Health Protection Office (335-8501) as other requirements may apply.

Whenever possible, flammable liquids should be placed in storage cabinets.

1. Maximum storage in a fire area (room with approved walls and doors) **outside** of approved storage cabinets: 10 gallons of Class I and II liquids combined or 25 gallons of Class I and II liquids in safety cans; and 60 gallons of Class IIIA liquids.
2. Maximum storage **inside** approved storage cabinet. 120 gallons of Class I, II, and IIIA liquids of which not more than 60 gallons may be of Class I and II liquids.
3. No more than three flammable storage cabinets may be located in a single fire area.
4. Class I liquids may not be stored in basement areas.



CHEMICAL HYGIENE PLAN

12.0 WASTE DISPOSAL PROCEDURES

Laboratory personnel are responsible for determining if their wastes are hazardous and for properly labeling and packaging them so they may be disposed of in a manner that is safe for the environment and for other personnel handling the waste. Detailed waste disposal instructions are found in the EHS Waste Management Guidelines and Procedures available at <http://www.uiowa.edu/~hpo> or by calling 335-8501.



CHEMICAL HYGIENE PLAN

13.0 SPILL AND EMERGENCY PLANS

This section focuses on planning and response for spills or releases of chemicals and hazardous materials.

A spill is the release of a hazardous material to an undesired location, resulting in increased hazard or potential hazard to people, property or environment. When a spill occurs or is discovered, action appropriate for the circumstances must be initiated.

Note: University-wide emergency procedures are addressed in the University of Iowa Critical Incident Management Plan (CIMP) which applies to all University units. Units should supplement the plan if/as needed to address individual needs of the unit while remaining in compliance with the plan. The plan is available at <http://www.uiowa.edu/~pubsfty/>.

13.1 Basic Steps for Emergencies, Major Spills, and Other Problems

- **Any Emergency – Call 911**
Fire, Explosion, Police, Ambulance, Rescue, Evacuation

- **Major Spill - Call 911**
A major spill is one that is spreading rapidly presents inhalation or fire hazards, has entered the environment, or exceeds the capability of the user to respond.
 - Alert others to leave spill area.
 - Remove ignition sources, shut down equipment, close fume hood sash, open windows, as appropriate.
 - Close doors to room.
 - Assemble at a safe distance and location.
 - Wait and provide information to Emergency Responders.

- **Personal Injury**
Body or Eye Splashes
 - Assist person with use of body shower and/or eye wash equipment.
 - Flush body and/or eyes with water for at least 15 minutes.
 - Remove contaminated clothing while under body shower.
 - Wash skin with mild soap and water - do not use neutralizing agents, creams, lotions or salve.
 - Seek medical attention.



CHEMICAL HYGIENE PLAN

13.0 SPILL AND EMERGENCY PLANS - Continued

- **Medical Treatment Needs**

Emergencies

Report to UIHC Emergency Treatment Center (24 hours, 7 days).

Vehicle Transport Assistance

If needed, call Department of Public Safety, 335-5022.

Non-emergency work-related needs

During normal business hours, call or check with the Workers Health Clinic, 353-8653 located in Boyd Tower, UIHC.

- **Inhalation Hazards**

Rescue or Evacuation

Call 911

Non-emergency evacuation

Call 335-5022, Department of Public Safety

Non-emergency technical assistance

Call 335-8501, Health Protection Office.

- **Radioactive Materials Notification**

Notify EHS of all radioactive materials spills and instances of personal contamination without delay. During normal business hours call 335-8501. After hours call Department of Public Safety at 335-5022.

Note: Radioactive materials spill response procedures must be developed and readily available to personnel. Consult The University of Iowa's "Radiation Protection Guide for Radioactive Materials Use in the Basic Sciences" or contact EHS when developing radioactive materials emergency and spill response information pertinent to your lab, The guide is available at <http://www.uiowa.edu/~hpo/radiation/rpg.pdf> or by calling 335-8501.

- **Environmental Release and Oil Spill Notifications**

For suspect or known s to the environment (air, water, land, drains) notify the Health Protection Office or Environmental Compliance Manager during regular business hours. After hours call Department of Public Safety at 335-5022 for non-emergencies or 911 for emergencies. Notifications must be made to regulatory agencies immediately and not later than six hours for actual or suspect environmental releases.



CHEMICAL HYGIENE PLAN

13.0 SPILL AND EMERGENCY PLANS - Continued

- **Power Outages**
 - Contact Work Control Center 335-5071 (24 hours/7 days)
 - Place lids on open containers of volatile chemicals.
 - Lower the sash on chemical fume hoods.
 - Turn off ignition sources.
 - Shut down equipment (leave cooling water, purge gases on as necessary).
 - Secure or isolate reactions that are underway (boiling liquids, distillations).

13.2 Preparing Spill Plans

- Review your Chemical List to identify hazards of chemicals used and stored in your area.
- Purchase or assemble a spill kit appropriate for your chemicals. Consider special needs for air and water reactives, poisons, and hydrofluoric acid.
- Post Emergency Contact Information or call lists at the entrance to the area.
- Post the Hazardous Materials Spill Guide at an easily accessible location in the work area, e.g., near the telephone.
- Train lab occupants on area spill procedures.

13.3 Spill Kit Supplies

See <http://www.uiowa.edu/~hpo> for a list of spill supplies available at University stores. Supplies are also available from lab and safety catalogs.

Basic Kit Supplies:

Chemical Resistant Container for Kit
Universal Absorbents
Goggles, Gloves
Disposable Coverall or Apron
Shoe Covers
Dust Pan and Whisk Broom for Solids
Hazardous Waste Labels



CHEMICAL HYGIENE PLAN

13.0 SPILL AND EMERGENCY PLANS - Continued

13.3 Spill Kit Supplies - continued

Add as needed in your area:

Personal Protective Equipment such as face shields, aprons, boots.

General neutralizing agents such as sodium bicarbonate for acids, and citric acid or sodium bisulfate for bases.

Agent specific neutralizers available for acids, bases, formaldehyde and solvents.

Mercury collection sponges.

Specialized supplies for air or water reactive chemicals and Hydrofluoric Acid.

Only add respirators if additional training and program requirements have been met.

13.4 Spill Training

Spill Training for your area should include:

Recognition (sight, smell, alarms, etc.)

First aid for chemical injuries that may occur in your area

Handling emergencies (notification, action)

Prevention/Containment (secondary containment, spill limitation)

Clean-up (personal protection, use of equipment, preventing damage, etc.)

Packaging and handling of residue

13.5 How to Minimize Spills

- Store hazardous liquid containers in a pan or tray big enough to hold the contents if the container breaks or leaks.
- Buy liquids in plastic coated bottles.
- Use bottle carriers for protection and containment.
- Put pans under experiments.
- Use traps on vacuum lines.
- Use carts designed to prevent materials from sliding off the cart.
- Have sink stoppers and drain covers handy to prevent material from entering drains.



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13.0 SPILL AND EMERGENCY PLANS - Continued

13.6 Spill Clean-up Procedures

- **Small, Simple Spills**

A simple spill is not spreading rapidly, does not endanger people or property except by direct contact, and does not endanger the environment outside of the building. Users of chemicals are able to neutralize, absorb or otherwise manage small spills. If there are questions about safe or appropriate clean up measures check first with your supervisor or the Health Protection Office.

General Clean Up Procedures

1. Refer to the Hazardous Material Spill Response Guide if needed.
2. Always wear eye and hand protection and choose additional protective equipment appropriate for the situation.
3. Contain the spill. Gently apply absorbent from the outer edge of the spill in.
4. For solids gently brush particles into a container or dustpan. If spill is not water reactive material, wet wipe the area.
5. Deposit hazardous debris in a rigid non-reactive container with a lid.
6. If debris may off gas, place the container in a chemical fume hood. Open the lid slightly to avoid pressure buildup or container rupture.
7. Complete hazardous waste label and request container pickup.

- **Mercury**

For small spills such as a thermometer use an aspirator bulb, suction device or mercury sponge. Place debris in a sealed rigid container, not a plastic bag. If vapor inhalation is a potential problem, i.e., larger spills, spills in small unventilated spaces, or spills in ovens or heating baths, contact the Health Protection Office.

- **Acid Chlorides**

Avoid water and sodium bicarbonate. Use dry sand, Oil-Dri, or an equivalent product.

- **Alkali Metals**

Do not use water. Smother in dry sand and place debris in a hood.

- **Highly Hazardous or Toxic Materials**

Select substances such as hydrofluoric acid or extremely poisonous substances may necessitate having special clean up supplies or antidotes in the work area.



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14.0 ACCIDENT REPORTING

Refer to Section 34.2 of the University Operations Manual found online at <http://www.uiowa.edu/~our/opmanual/> for the complete policy. The main requirements are:

- All injuries must be reported immediately by the injured employee to his/her supervisor.
- The supervisor must submit the First Report of Injury Form within 24 hours. This form is available at <http://www.uiowa.edu/hr/benefits/wc/forms.html>. Late forms are assessed penalty charges which are passed back to the department in which the incident occurred. Questions on the form or claim should be directed to Staff Benefits Office.

Supervisors and/or departments should investigate the cause or causes of incidents to prevent reoccurrence. Contact the Health Protection Office for assistance if needed. Follow-up should be done by the department to ensure that corrective action has been taken.

Departments may request an accident/incident summary for their area from the Health Protection Office. This summary includes the incident date, type and description, name, occupation, and days lost.



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15.0 RECORD KEEPING REQUIREMENTS

Records of monitoring measurements or any medical consultation or examinations, including tests or written opinions, must be maintained for each employee. Such records must be kept, transferred, and made available in accordance with 29 CFR 1910.1020 and, as applicable, record requirements in other select OSHA standards.



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16.0 REFERENCE MATERIALS

Reference materials are provided in the work area, and Chemical Hygiene Resources at <http://www.uiowa.edu/~hpo>. Numerous resources are also available at University libraries and online locations. If any assistance is needed contact the lab supervisor or the Health Protection Office.