

Safety Manual Chapter 7

Laboratory Safety - Issue Date 10/07

7-1 Laboratory and Art Studio Safety

- **7-1.1 General** -- These regulations apply to all academic laboratories and art studios.

The University follows the Federal OSHA Chemical Hygiene Standard[29 CFR 1910.1450(e)(i)] to ensure the safety of all personnel in laboratories or art studios.

- **7-1.1-0 Departmental Responsibilities.**

Each department having laboratory or art studio facilities shall draft a "Chemical Hygiene Plan" and implement the same in compliance with the above standard. A generic Chemical Hygiene Plan is attached hereto and may be used as a reference. A copy of the Chemical Hygiene shall be kept in the following locations: (1) The Department office; (2) The Environmental Health & Safety office; and (3) in a location(s) convenient to each laboratory or art studio.

- **7-1.1-01** No students are to be permitted in laboratories or art studios containing hazardous materials until they have completed a laboratory safety training program. Each instructor is responsible to develop his/her own safety training program with the assistance of the departmental safety officer.
- **7-1.1-02** No experiments or projects other than those scheduled for the course may be carried out unless approved beforehand by the instructor in the course.
- **7-1.1-03** The instructional laboratory is "off limits" for eating and drinking.
- **7-1.1-04** Safety goggles shall be worn at all times by all people in the laboratory, including the instructor and visitors.
- **7-1.1-05** Students are advised to wear laboratory coats or laboratory aprons. Open sandals shall not be worn, but shoes must be. Long hair shall be held away from the face by a net or hair clip to minimize being ignited by fire or caught in moving equipment.
- **7-1.1-06** All accidents (cuts, toxic gas inhalation, and other injuries) are to be reported to the Vice President for Business. An "Accident Report" shall be filed by the instructor on all accidents requiring medical attention.
- **7-1.1-07** A hood or suitable aspirating device is required on all reactions giving off noxious vapors.
- **7-1.1-08** There must be two persons in the laboratory/studio and an instructor available on the floor while experimentation is in process. The instructor may be one of the two persons.
- **7-1.1-09** Broken glass, pieces of metals, match sticks, splints, and paper contaminated with chemicals are to be swept up, not picked up, and placed in the stone jars. Paper only is to be placed in the waste paper baskets.
- **7-1.1-10** Anyone who is accidentally sprayed with large quantities of corrosive chemicals should immediately wash it off under the safety shower. Chemicals in or near the eyes should be removed using the eye wash fountain. Medical attention should be given immediately.
- **7-1.1-11** Dangerous materials should be handled only with specific instructions from the instructor.
- **7-1.1-12** All students are to be adequately informed with regard to location and use of the first aid cabinet, fire blanket, fire alarm, and fire extinguishers in each laboratory/studio.
- **7-1.1-13** All students are to be adequately informed on the proper and safe handling of glassware.
- **7-1.1-14** Highly flammable solvents such as ethers and carbon disulfide are not to be used near any flame and should be used with caution, even when hoods or desk aspirators are available.
- **7-1.1-15** Each chemistry laboratory/studio shall have posted, and easily readable, first aid rules for a chemistry laboratory. In addition, a list of common dangerous chemicals and their hazardous properties should be posted.
- **7-1.1-16** All mercury spills shall be cleaned up. Any residue of mercury must be covered with powdered sulfur. (See section on Hazardous Waste Disposal.)
- **7-1.1-17** Following the completion of an experiment, students shall be responsible for minimization of waste, and preparation of the remaining waste for disposal -- including labeling, under the supervision of the instructor.

- **7-1.1-18** No materials shall be flushed down the drain without the permission of the instructor who shall be responsible for the lawful disposal of all materials.
- **7-1.2 Materials and Poisons**
 - **7-1.2-01** Chemicals listed as hazardous will not be allowed to remain in the laboratory any longer than necessary. All flammable solvents shall be stored in safety cans and labeled.
 - **7-1.2-02** Laboratory benches and reagent shelves are to be cleaned up at the end of each laboratory period by the student. Side shelves and hoods are to be cleaned regularly as supervised by the storeroom personnel.
 - **7-1.2-03** There shall be adequate hood ventilation in all laboratories and studios.
 - **7-1.2-04** If an excess of a reagent is removed from a bottle, the reagent should not be returned to the original bottle. The instructor should dispose according to policy.
- **7-1.3 Proper Handling of Glassware**
 - **7-1.3-01** Glass breakage is a common cause of injury producing accidents in laboratories and studios. Only glass in good condition should be used. Discard pieces with chips and cracks.
 - **7-1.3-02** When using glass tubing, all ends should be fire polished.
 - **7-1.3-03** Lubricate tubing with glycerin or water before inserting into rubber stoppers or rubber tubing.
 - **7-1.3-04** Protect hands with gloves or towel when inserting the glass tubing. Hold elbows close to the body to limit movement when handling tubing.
- **7-1.4 Safe Storage of Gases and Liquids**
 - **7-1.4-01** All flammable liquids used in laboratories and studios should be stored in approved safety cans. For those liquids not stored in safety cans, fire resistant and properly ventilated storage shall be provided.
 - **7-1.4-02** Refrigerators and coolers used for storage of flammable liquids shall be used only if they are approved explosive proof.
 - **7-1.4-03** All containers shall be clearly labeled, special chemicals and gases shall be dated and their owner identified so that disposal, if necessary, can be made safely.
 - **7-1.4-04** Quantities of gases and flammable liquids in any laboratory should be strictly controlled.
- **7-1.5 Control of Sources of Ignition**
 - **7-1.5-01** Laboratories and studios will greatly enhance their safety posture when sources of ignition are managed
 - **7-1.5-02** Explosion proof electrical equipment should be provided in all areas where flammable vapors are present or could be produced.
 - **7-1.5-03** Non-explosive proof plugs, switches, motors, and electrical contact shall be removed from areas which are subject to flammable vapors.
 - **7-1.5-04** Separate smoking areas with ash trays should be provided.
 - **7-1.5-05** Smoking shall not be permitted during any operation where flammable vapors are present or may be released.
- **7-1.6 Ventilation**
 - **7-1.6-01** Proper ventilation (see 7-3 Ventilation for definition) is most important in controlling and dissipating concentrates of flammable liquid vapors.
 - **7-1.6-02** Laboratory ventilating hoods should be of adequate size and in proper operating condition.
 - **7-1.6-03** Approved respirators shall be required and used in areas where ventilation is insufficient to dissipate the toxic flammable vapors.
- **7-1.7 Waste Disposal**
 - **7-1.7** Please review the waste disposal plan located at <http://www.eiu.edu/~environ/hazardou.htm> Waste Disposal
- **7-1.8 Chemical Spill Response**
 - **7-1.8-01** Small spills of hazardous or non-hazardous materials may be cleaned up by the department at the discretion of the instructor or other person in charge.
 - **7-1.8-02** Larger spills should be handled in accordance with the University's Chemical Spill Emergency Response Plan. Call the Campus Police [Ext. 3212].
- **7-1.10 Laboratory Safety Instruction**
 - **7-1.10-01** At the beginning of each course of instruction, the instructor shall advise his students of the requirements for safety apparel and accessories; the particular hazards that may be encountered and rules and procedures to prevent or minimize the hazards. Fire and accident first aid procedure, to include location and use of fire extinguishers and safety showers, should be reviewed. A pamphlet published by the Upjohn Company, Kalamazoo, Michigan titled "Safety in the

Laboratory" is an excellent reference publication which would be helpful to all individuals working in laboratories and studios.

- **7-1.11 Laboratory Safety Equipment**
 - **7-1.11-01 Safety Shower**
 - **7-1.11-011** Each laboratory, shop, or studio if appropriate, shall be provided with a safety shower near an exit. Showers in all such equipped rooms shall be tested at least once every 3 years by the Facilities Planning and Management department to assure that the water will flow properly and that the shower will turn off properly.
 - **7-1.11-02 Eye-Wash Stations**
 - **7-1.11-021** Each laboratory, shop, or studio if appropriate, shall be provided with a suitable eye-wash station located in a convenient position in the room. These shall be tested and run for 5 minutes each month to assure that they deliver water and that the water is clean, and adjusted to give proper eye coverage when used. Other type eye wash equipment should be equipped with an appropriate cover to assure that they are dust free.
 - **7-1.11-03 Safety Apparel**
 - **7-1.11-031** It is the instructor's responsibility to ensure that laboratory operations which introduce potential hazards to the well-being of personnel will not commence until all personnel concerned are wearing the appropriate safety apparel. Safety gloves, shoes, glasses, eye shields, aprons, and respirators are examples of safety apparel available. The Campus Safety Officer is prepared to offer assistance and advice in determining the proper apparel needed for a particular operation.
 - **7-1.11-04 Eye Protection**
 - **7-1.11-041** In compliance with the Illinois Revised statutes:
"SECTION 1. All students, teachers and others in attendance at the following courses or laboratories in schools, colleges or universities and exposed to the risks incident to working with the materials, equipment, and/or performing the acts described in Subsection "A" below shall wear eye protective devices of industrial quality: "
 - B. Vocational or industrial arts courses or laboratories using or concerned with:
 - Hot molten metals;
 - Milling, sawing, turning, shaping, cutting, grinding, or stamping of any solid materials;
 - Heat treatment, tempering, or kiln firing of any metal or other materials;
 - Gas or electric welding;
 - Repair or servicing of any vehicle;
 - Caustic or explosive materials;
 - B. Chemical or combined chemical-physical laboratories/studio using caustic or explosive chemicals or hot liquids or solids.
 - **7-1.11-05** Further, in compliance with Illinois Revised statutes:

"SECTION 2. Eye protective devices shall be considered of "industrial quality" when they meet the standards of the American Standards Association Safety Code for Head, Eye, and Respiratory Protection promulgated by the American Standards Association, Inc., or other standards generally recognized by industry."
- **7-1.12 Laboratory Animals**
 - **7-1.12-01** Animal bites on hands are the source of significant laboratory accidents which require medical attention. Gloves should be worn when handling laboratory animals such as dogs, cats, mice, or rats. An accident form should be filled out after each exposure to these types of animals.
- **7-1.13 Other Equipment**
 - **7-1.13-01** Each laboratory shall be equipped with fire blankets and fire extinguishers according to the National Fire Protection. Safety shields for hazardous operations shall be stored and maintained by an appropriate person in each department.
- **7-1.14 Design of Experiments**
 - **7-1.14-01** When designing experiments for either instruction or research, all safety factors should be kept in mind to ensure that the safest possible conditions exist.
- **7-1.15 Inspection**
 - **7-1.15-01** Each instructional laboratory must be inspected for the proper safety equipment and conditions at least at the beginning of all academic terms. Additional inspections may be required by the Safety Officer. Such inspections shall be made by two people. One from the department

under inspection and one from outside that department and designated by the Safety Officer. See additional comments in Chapter 8.

- **7-1.16 Medical Exams/Base Line Screening**
 - **7-1.16-01** All personnel in constant contact with potentially dangerous materials, such as stockroom keepers, shall receive a medical examination (by Health Service) at the start of employment and on a yearly basis thereafter.
 - **7-1.16-02** All instructors associated with known or unknown dangerous materials should receive a medical examination at least once every 5 years.
 - **7-1.16-03** Such exams should search for evidence of cancer, tumors, Dermatitis, heavy metal poisoning, and other such afflictions as deemed necessary by the medical staff of the Health Center.

7-2 Storage and Handling of Gases and Liquids

- **7-2.1 Gases**
 - **7-2.1-1** Compressed Air
 - **7-2.1-2** Use compressed air only for the purposes designated by your supervisor.
 - **7-2.1-3** Compressed air used for cleaning shall be regulated at 35 psi and so designated by an appropriate sign.
 - **7-2.1-4** Do not point a compressed air hose at yourself or at anyone else. The sixty-pound blast of compressed air can easily burst an eardrum, put out an eye, or pierce the skin. Compressed air hoses pointed carelessly, or in fun, have caused severe injuries.
 - **7-2.1-5** Use a brush to clean machinery, the floor, and your clothes; never use compressed air. Particles of dust carried by a compressed air blast may lodge under the skin unnoticed for several days, then become infected. Only machinery that cannot be cleaned in any other way, as designated by your supervisor, should be cleaned by compressed air and then only when other personnel are cleared away. Never use compressed air to clean equipment or parts which are contaminated with toxic materials.
 - **7-2.1-6** Wear eye protection when you must use compressed air, and make sure that people working around you are protected from your air blast and flying chips.
 - **7-2.1-7** Special safety nozzles which reduce the pressure or deflect the air blast are available. Information may be obtained from the Safety Officer.
- **7-2.2 Compressed Gas Cylinders**
 - **7-2.2-1** Serious accidents may result from the misuse, abuse, or mishandling of compressed gas cylinders. Workers assigned to the handling of cylinders under pressure should be carefully trained and should work only under competent supervision. Observance of the following rules will help control hazards in the handling of compressed gas cylinders.
 - **7-2.2-2** Compressed gases are defined by the Interstate Commerce Commission as any materials or mixtures in containers having an absolute sure in excess of 40 psi at 70o 11F or in excess of 104 psi at 130oF
 - **7-2.2-3** Color-coding of cylinders for identification of the gas is not universal; therefore, do not rely on color codes for identification. The cylinder should be marked by stenciling, stamping, or labeling with at least the chemical or commonly accepted name of the gas.
 - **7-2.2-4** Do not destroy the identification tags or labels.
- **7-2.3 Safety Devices**
 - **7-2.3-1** Most I.C.C. cylinders are equipped with fragile discs, fusible plugs, relief valves, or combinations of these devices to prevent explosion of normally charged cylinders when involved in fire. Cylinders containing toxic or poisonous gases do not have such relief devices. Never tamper with these devices in any way.
- **7-2.4 Storage**
 - **7-2.4-1** Main storage of compressed gas cylinders should be in a level, fire-resistive area which is well ventilated and located away from sources of ignition or excessive heat (Air temperature around cylinders should not exceed 125o F). Separate oxygen from flammable gases by 50 feet or by a 2.5 hour fire rate wall.
 - **7-2.4-2** Cylinders shall be chained or strapped in place at all times to prevent them from falling over. The protection cap should be in place when the cylinder is not in use. Cylinders should be labeled Full, In Use, or Empty.
 - **7-2.4-3** Store empty cylinders separately from full cylinders.

- **7-2.4-4** Flammable substances such as oil and volatile liquid should not be stored in the same area.
 - **7-2.4-5** Smoking is PROHIBITED in gas cylinder storage areas or public buildings.
- **7-2.5 Handling**
 - **7-2.5-1** Keep the protective metal cap securely in place to protect the valve when the cylinder is being transported or is not in use.
 - **7-2.5-2** Do not tamper with safety devices in valves on cylinders.
 - **7-2.5-3** Use a hand truck to transport cylinders. When one is not available, roll the cylinder on its bottom edge. Never drag a cylinder, as damage to the cylinder and sparks may occur.
 - **7-2.5-4** Never drop a cylinder or permit cylinders to strike each other violently.
 - **7-2.5-5** Do not remove or change numbers on any cylinder.
 - **7-2.5-6** Never mix gases in a cylinder. The next person who draws from it may unknowingly cause an explosion.
- **7-2.6 Use and Operation**
 - **7-2.6-1** Cylinders of liquefied gases should be used in an upright position, and be secured against being accidentally knocked over.
 - Attach the proper regulator designed for use with that particular gas.
 - Never use a cylinder of compressed gas without a pressure reducing regulator attached to the cylinder valve, except where cylinders are attached to a manifold.
 - Before you remove the regulator make sure that the cylinder valve is closed.
 - Never use oil or grease on valves intended for oxygen cylinders. An explosion could result.
 - When opening cylinder valves, be sure the outlet is not pointing towards anyone. Crack the valve to remove foreign particles. Never crack a fuel cylinder near a welding operation, flames, sparks, or other source of ignition.
 - Secure all hose connections with clamps.
 - Prevent contamination by placing a trap check valve or vacuum break between the regulator valve and the reactor vessel. Do not empty to less than 25 psi to prevent suck-back. Notify supplier if it is known that foreign material has entered a cylinder.
 - Ground all cylinders and piping containing flammable gases.
 - If a cylinder of noxious or combustible gas is leaking, close the valve if possible and remove the cylinder to a well ventilated area, outdoors if possible. Check for leaks with a soap solution. Never use a flame. Contact the supplier if leaks are found in the cylinder valve.
 - Wear appropriate personal protective equipment.
 - If a cylinder containing a toxic gas should fail in an unventilated area evacuate the area and call the University Police immediately.
 - When your work is finished, turn off the cylinder valve and then the regulator valve. The pressure gauges should be brought back to zero.
 - Turn out secondary pressure control before opening cylinder valve to prevent damage to the regulator.
 - Slowly open cylinder valve.
 - Adjust desired pressure with secondary pressure control on regulator. Do not use cylinder valve to dispense gas.
 - Install protective cap after regulator has been removed.
- **7-2.7 Flammable Liquids**
 - **7-2.7-1** All liquids should be stored in a cool, constant temperature room. This is to prevent "breathing," which is associated with or results from temperature variations and causes gradual loss of the liquid which contaminates the room air.
 - **7-2.7-2** Materials which react with atmospheric moisture to release noxious gases should be stored in a hood.
 - **7-2.7-3** Volatile materials (those prone to evaporation) should be stored in a special area, commonly called a "volatile solvents room", which is equipped with explosion or spark proof electrical equipment complying with Article 500 of the National Electric Code. Metal containers used for dispensing should be bonded to a low resistance ground. The room should have two exits if possible.
 - **7-2.7-4** Adequate ventilation should be provided. If dispensing is to be performed, mechanical ventilation of six changes per hour should be provided. For dispensing noxious materials, an adequate hood should be provided.

- **7-2.7-5** Containers for use of flammable liquids (use of glass containers for storing flammable liquids shall be eliminated) shall be kept in approved safety cans. Screw-type cap cans should not be considered adequate because they are not designed to relieve pressure. All such cans shall be painted red, and clearly labeled as to their contents.
- **7-2.7-6** Highly volatile material or those which decompose at room temperature should be stored in an explosion proof refrigerator.
- **7-2.7-7** A dry chemical or carbon dioxide portable fire extinguisher shall be located near the exit of the storage room or area.
- **7-2.7-8** The quantities of flammable liquids stored in general use laboratories/studios (used for research and instruction) shall be based upon OSHA Standards. OSHA has classified flammable liquids in the following manner:

Flammable Liquids

- Class IA** Flashpoints below 73°F
Boiling point below 100°F
- Class IB** Flashpoints below 73°F
Boiling point at or above 100°F

Combustible Liquids

- Class II** Flashpoint at or above 100°F and below 140°F
- Class III** Flashpoint at or above 140°F

- **Maximum Container Size Permitted by OSH**

Class	Glass or Plastic	Metal	Safety Can
Class 1A	1 pint	1 gal.	2 gal.
Class 1B	1 pint	5 gal.	5 gal.
Class 1C	1 gal.	5 gal.	5 gal.
Class II & Class III	1 gal.	5 gal.	5 gal.

- **7-2.79** Personnel handling flammable liquids shall always know the locations of the nearest exit, safety shower, fire blanket, portable fire extinguishers, and fire alarm box.
- **7-2.8 Labeling Hazardous Chemicals and Flammable Liquids**
 - **7-2.8-01** Complete eye and/or face protection shall be used at all times when handling liquids. Clothing and shoes saturated with flammable liquids must be removed immediately and not reworn unless complete decontamination can be provided. Respiratory protection, where required, must be kept clean and in perfect functional condition. Such equipment should bear Bureau of Mines approval and should be specifically suited to the type of exposure. "Chemical Safety Data Sheets" of the Manufacturing Chemists Association should be consulted.
 - **7-2.8-2** All chemicals and flammable liquids which are used all labs or workplaces be labeled according to: National Fire Protection Association hazardous chemicals data #49 and fire hazard properties of flammable liquids, gases and volatile solids #325M.
 - **7-2.8-3 Handbook**
 - **7-2.8-4** National Fire Protection Association "Hazardous Materials" current edition shall be used as the handbook for such regulations. This handbook contains the regulations for:
Flashpoint index of trade name liquids NFPA 325A
Fire hazard properties of flammable liquids, gases, volatile solids NFPA 325M
Hazardous chemicals data NFPA 49
Manual of Hazardous Chemical Reactions NFPA 491M

Identification system fire hazards of materials NFPA 704M
(NFPA, 470 Atlantic Ave., Boston, Mass. 02210)

- **7-2.8-5 Labeling**
 - **7-2.8-5/01** * Glass or plastic containers approved up to one gallon for Class IA and Class IB. Flammable liquids if the liquid is contaminated by or cause corrosion and leakage of metal containers. (Ref. Section 1910.106 Fed. Reg. 10/18/72.) (NFPA 30 Storage Flammable and Combustible Code.)
- **7-2.8-6** All materials stored or used in any laboratory shall be labeled in accordance with NFPA standards. All materials stored in "Volatile Storage Rooms" shall be labeled in accordance with NFPA standards. All materials stored in general stockroom areas listed in NFPA 49 shall be labeled.
- **7-2.8-7 Labels**
- **7-2.9 Identification System**
 - **7-2.9-1** A diamond-shaped diagram label gives a general idea of the inherent hazards of the chemicals and the order of severity of these hazards under conditions of spills, leaks, or fires. The diagram identifies a.) health, b.) flammability, and c.) reactivity, and indicates the order of severity on a numerical rating of five (5) gradings.

Health (Blue)

- 4--Could cause death. Need special protective clothing.
- 3--Extremely hazardous to health. Full protective clothing.
- 2--Hazardous to health. Use self-contained breathing apparatus.
- 1--Slightly hazardous. Desirable to use self-contained breathing apparatus.
- 0--No health hazard beyond that of ordinary combustible material.

Flammability (Red)

- 4--Very volatile flammable liquids.
- 3--Liquids can be ignited under all normal temperatures.
- 2--Liquids must be heated. Solids that readily give off flammable vapors.
- 1--Material must be pre-heated before ignition.
- 0--Materials will not burn.

Reactivity (Yellow)

- 4--Capable of detonation or explosive reaction at normal temperatures.
- 3--Capable of detonation or explosive reaction, but requires initiating source or heated under confinement.
- 2--Materials unstable and undergo violent chemical changes.
- 1--Materials normally stable. Protect from high temperatures and pressures.
- 0--Normal. Stable under fire exposure conditions.

Water (White)

- Identifies unusual reactivity with water=
- Radiation Hazard=
- Oxidizing Chemicals=OXY

7-3 Ventilation

- **7-3.1 Conditions**
 - **7-3.1-1** Adequate ventilation should be provided whenever materials are being handled that can permeate the atmosphere shared by personnel. These materials include all gases, small solids that can form dusts, and all liquids and solutions since even with aqueous solutions can produce "mists" which would contain the material dissolved in the water. Certain pieces of equipment that are capable of forming dusts, mists, and/or gases should be enclosed or covered with a hood with proper capacity. These operations typically involve the heating of materials such as in ovens or kilns, the grinding and mixing of materials and spraying operations as in painting and cleaning. The ventilation system should prevent escape of materials into the room occupied by personnel.
- **7-3.2 Equipment**
 - **7-3.2-1** Normally, a ventilation system or hood providing an opening of approximately 2 feet by 5 feet should provide a face velocity of from 100 to 150 FPM depending upon the application. Generally suitable equipment is available commercially.

7-4 Waste Disposal

- **7-4.1 Biohazard Solid Wastes**
 - **7-4.1-1** To avoid exposure to unknowing persons, place all soiled materials into a red Biohazard bag. Bag shall display the Biohazard warning label.
 - **7-4.1-2** Disposal of Red Bag Biohazard waste -- call Environmental Health and Safety Department for disposal of waste.
- **7-4.2 Hypodermic Needles and Syringes**
 - **7-4.2-1** Disposal of used syringes and needles into conventional trash containers presents the possibility that unknowing persons might accidentally be inoculated with viruses, bacteria, toxic, or other hazardous chemicals and drugs. Further, it presents a psychological hazard for those persons who may later come into contact with the materials, in that they may fear that they have been exposed to a blood borne pathogen such as HIV or HBV.
 - **7-4.2-2** To avoid this situation, syringes and needles, before or after sterilization or autoclaving, should be put in special, marked containers which are designed for that purpose. The containers should be marked "biohazard" and then disposed of in accordance with the University's Biohazard waste procedures. Call the Environmental Health and Safety Department for disposal of waste.
 - **7-4.2-3** Contrary to prior practice, syringes and needles should not be broken before placing in the disposal container.
 - **7-4.2-4** Syringes and needles used with radioactive materials must be disposed of in accordance with the procedure set forth in Chapter 11.
- **7-4.3 Broken Glass**
 - **7-4.3-1** All waste glass shall be placed in a properly labeled container in each lab. Broken glass in a wastepaper basket could result in severe cuts to unsuspecting persons.
- **7-4.4 Chemical Recycling/Waste Minimization and Disposal Policy**

It is the policy of this University that the minimum amount of chemicals necessary to perform the job or experiment be purchased. Instructors and employees have the responsibility for recycling and minimizing waste. Once it has been determined that a material is waste, then the instructor or employee has the responsibility for disposing of the waste in a manner consistent with the laws of the State of Illinois and the United States. All hazardous waste must be disposed of in accordance with RCRA.

- **7-4.4-1 Disposal of Common Non-Hazardous Chemicals**
- **7-4.4-2** Small quantities of ordinary solids may be safely disposed of in the earthenware containers provided by the academic department. Larger quantities may be either added to the liquid wastes container or placed in a labeled container to be handled separately by the Building janitorial staff and placed in the commercial disposal containers, provided that they are not hazardous materials. Liquid wastes are usually not a problem except for the organic materials and these should be placed in properly labeled containers kept in the hoods or other well ventilated area. These waste containers should be kept closed but not sealed in case a gas develops. When full, the contents may be disposed of either by burning or by mixing with a large quantity of dry ordinary municipal wastes and buried in a landfill, provided that it is non-hazardous.
- **7-4.5 Minimization/Disposal of Less Common, Toxic or Hazardous Materials**
 - **7-4.5-1** Instructions for minimization of less common, toxic, or hazardous materials are included in many publications. Consult with the departmental safety committee, the Campus Safety Officer for further information.
- **7-4.6 Radioactive Wastes**
 - **7-4.6-1** These should be disposed of as outlined by the Radiation Safety Officer.

7-5 Safety Apparel

- **7-5.1** Remember that elimination of a hazard is the primary protection for personnel and that protective equipment is a second line of defense appropriate only when the hazard cannot be eliminated or avoided. The purpose of protective equipment is to lessen the severity of an injury or save a vital function such as eyesight or hearing.
 - **7-5.1-1** No single item is capable of protecting an individual from all hazards which he may encounter, but personal protective equipment is available to provide head-to-toe protection from a great variety of hazards. The following is a brief summary of the major categories of available equipment.

- **7-5.1-2** Head protection is designed to protect the head from falling objects and bumps, to prevent catching the hair in machinery, and to protect from fire. Hat materials most common are plastic, fiberglass, aluminum, and fabric.
- **7-5.1-3** Eye and face protection is available, with or without prescriptions, in spectacles, goggles, helmets, and face shields, in glass or plastic.
- **7-5.1-4** Special shades should be used to protect against glare, ultraviolet radiation, and laser energy and in other special applications.
- **7-5.1-5** Hearing protection can be afforded in high noise level areas by proper insulation or by use of ear plugs or ear muffs. The Campus Safety Officer is equipped to evaluate such exposures and recommend proper controls to be used.
- **7-5.1-6** Respiratory protection can be provided by use of respirators equipped with proper cartridges, gas masks, air-line-supplied masks, and self-contained breathing apparatus. To be effective, such equipment must be of the approved type and be fitted properly.
- **7-5.1-7** Body protection against environmental hazards may take many forms, from simple aprons to complete enclosure of the body. Specially resistant materials may be required in some cases.
- **7-5.1-8** Hand or finger protection in the form of gloves may be required for many operations to protect against heat, cuts, abrasion, chemicals, cold, and dermatitis.
- **7-5.1-9** Foot protection in the form of steel capped safety shoes may be required for certain operations.
- **7-5.2** Laboratory supply rooms shall normally carry a stock of safety devices and protective equipment and clothing.
 - **7-5.2-1** The Campus Safety Officer is available to assist the department in the evaluation of hazards and recommending the proper equipment.

7-6 Cryogenics

- **7-6.1** Extreme cold is the principal hazard involved in the use of cryogenic systems and liquefied gases. Temperatures involved are in the range from minus 100 F to minus 460o F (absolute zero). Prolonged contact with the skin may cause burns similar to those resulting from contact with extreme heat.
- **7-6.2 Personal Protection**
 - **7-6.2-1** Eye protection should be worn at all times while handling these fluids.
 - **7-6.2-2** Gloves should not be worn. A spill or overflow can get inside a glove, freezing the material to the skin. If insulation for handling cold containers or metal parts is required, a pad used as a potholder is preferable.
- **7-6.3 Handling and Use**
 - **7-6.3-1** Glass containers shall have exposed glass areas taped to prevent the spattering of broken glass, should the high vacuum cause the container to explode.
 - **7-6.3-2** Extreme care should be observed when moving storage containers, since they are fragile and expensive. Avoid rolling them by holding the neck. The neck is the main support for the inner portion of the container and is very susceptible to damage. Rolling containers by holding the neck is dangerous; always use the dollies available when moving cryogenic containers.
 - **7-6.3-3** Avoid all contact of moisture with storage containers and equipment. Small amounts of moisture can freeze openings and safety relief valves, causing pressure build-up and possible explosion.
 - **7-6.3-4** Select materials with great care, because the extreme cold drastically alters the basic properties of many materials.
 - **7-6.3-5** Equipment and systems must be kept scrupulously clean to avoid contaminating materials which may create hazardous conditions upon contact with the cryogenic fluids or gases. This is particularly important when working with liquid or gaseous oxygen.
 - **7-6.3-6** Ream out the neck of liquid helium or hydrogen storage containers frequently to prevent the formation of ice plugs which create dangerous internal pressures. Ream at least before and after each use, and keep protective safety caps in place.
 - **7-6.3-7** Experiments should not be lowered into storage dewars. The equipment may freeze in the narrow neck, causing dangerous internal pressures to develop.
 - **7-6.3-8** Mixtures of gases or fluids should be strictly controlled to prevent the formation of flammable or explosive mixtures. Extreme care should be taken to avoid contamination of a fuel with an oxidant or an oxidant with a fuel. This is the first line of defense against fire or explosions.

- **7-6.3-9** When flammable gases are being used, potential ignition sources must be carefully controlled.
- **7-6.4** Use caution when handling liquid hydrogen, helium, nitrogen, etc., to prevent it from escaping and producing an oxygen deficient atmosphere.

7-7 Carcinogenic Chemical Agents

- **7-7.1** The Occupational Safety and Health Act (OSHA) defines and lists all carcinogenic agents (see Federal Register). Lists can be obtained through the National Institute on Safety and Health (NIOSH) or The Campus Safety Officer.
 - **7-7.1-1** Carcinogenics shall be stored in a separate area under lock and key to provide maximum control.
 - **7-7.1-2** Storage area or cabinet shall have a sign posted "Warning-Cancer Causing Agents."
 - **7-7.1-3** A label on each container shall clearly identify contents and carry a label "Warning--Cancer Causing Agents."
 - **7-7.1-4** A register shall be maintained specifically for carcinogenics containing the name of agent, quantity on hand, signature of person using it, amount used, date removed and date returned, and how the quantity was disposed. Such records shall be held on file for a period of ten years.
 - **7-7.1-5** The person who signs out for any agents and quantities shall be responsible for reporting to stock room attendant the names of all persons (students/faculty, etc.) who were exposed to the agent.
 - **7-7.1-6** Medical surveillance shall be required of all persons exposed as determined by the Director of Health Services.
 - **7-7.1-8** Prior to the use of such classified agents the person shall submit outlines of project requirements, giving full details to the Department Chairman. Department Chairman shall approve or disapprove the project.