

CHEMICAL HYGIENE PLAN

*Know the Choices,
Know the Consequences,
Convince others to Care*

Department of Physical Science and Engineering
Harry S. Truman College
Fall 2006

CONTENTS

1. Scope and Application
2. Definitions
3. Responsibilities
 - 3.1 College/Department of Physical Science and Engineering
 - 3.2 Chemical Hygiene Officer
 - 3.3 Department Safety Committee
 - 3.4 Laboratory Supervisors
 - 3.5 Laboratory Workers
4. Standard Operating Procedures
 - 4.1 General Rules for Safety and Hygiene
 - 4.2 Chemical Storage
 - 4.3 Personal Protective Apparel and Equipment
 - 4.4 Housekeeping, Maintenance, and Inspections
 - 4.5 Chemical Waste Disposal
 - 4.6 Chemical Spills, Accidents, Emergencies
5. Management of Engineering Controls
 - 5.1 Laboratory Fume Hoods
 - 5.2 Chemical Storage Cabinets
 - 5.3 Emergency Equipment
6. Special Precautions for Handling Highly Hazardous Materials
 - 6.1 Prior Approval for Highly Hazardous Work
 - 6.2 Special Procedures for Working with Highly Hazardous Materials
7. Medical Program
 - 7.1 Emergency Cases
 - 7.2 Non-emergency Cases
8. Information and Training Program
 - 8.1 Information
 - 8.2 Training
 - 8.3 Record of Training
9. Recordkeeping
 - 9.1 Inspection/Maintenance Reports
 - 9.2 Accident Reports
 - 9.3 Medical Examination/Evaluation
 - 9.4 Exposure Monitoring
 - 9.5 Training
10. Annual Review of the Chemical Hygiene Plan
11. References
12. Appendices

1. Scope and Application

The Department of Physical Science and Engineering (PSED) and Truman College place a high premium on the safety and health of PSED faculty, staff, students, and the environment. On January 31, 1990, the Occupational Safety and Health Administration (OSHA) promulgated the "Laboratory Standard" to address the most pressing safety needs of the laboratory. It has been designed to protect laboratory workers from hazards associated with exposure to chemicals in laboratories. A major component of the Laboratory Standard is the development and implementation of a Chemical Hygiene Plan (CHP). The CHP provides for procedures, equipment, personal protective equipment, work practices capable of protecting employees from health hazards in the laboratory, and keeping chemical exposures at or below permissible exposure limits. This document is the Chemical Hygiene Plan for the Department of Physical Science and Engineering (PSED CHP).

The PSED CHP shall apply where routine laboratory use of hazardous chemicals, as defined in Section 2 of this document, occurs. Laboratory instructors and supervisors may supplement this plan with more detailed information about additional precautions and proper handling of particular chemicals used in their laboratories. The laboratory instructor/supervisor and Chemical Hygiene Officer (if one is assigned) are responsible for the interpretation and implementation of the standards set forth in the CHP. Authority to enforce adherence to the policies in the CHP rests on the department chair.

2. Definitions

Most of the definitions in this section are lifted from *29 CFR part 1910 subpart Z section 1910.1450*. Others that are used in this document are also listed.

Action level means a concentration designated in *29CFR part 1910* for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure and medical monitoring

Carcinogen (*see select carcinogen*)

Chemical Hygiene Officer (CHO) means an appointed faculty/staff who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold in the department.

Chemical Hygiene Plan (CHP) is this document.

Combustible liquid means any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flashpoints of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Compressed gas means:

- (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or
- (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg. C) regardless of the pressure at 70 deg. F (21.1 deg. C); or
- (iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

Designated area means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity (e.g., entire laboratory or a laboratory hood)

Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite

Hazardous chemical means 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. 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.

(*Note:* Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.)

Laboratory means 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. In the PSED, this CHP uses the term *laboratory* to refer to laboratory teaching classrooms, research laboratories, chemical instrumentation rooms, PSED studio classrooms, and stockrooms where routine laboratory scale chemical procedures occur. This definition includes PSED courses described in the course catalogue as "laboratory."

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances is designed to be easily and safely manipulated by one person.

Laboratory supervisor is a laboratory or course instructor, stockroom/laboratory coordinator, or research director/coordinator.

Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

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

Laboratory worker, for the purposes of this CHP, refers to the a laboratory or course instructor, stockroom/laboratory coordinator, research director/coordinator, laboratory assistant/technician, work study student in the stockroom or laboratory, student ambassador/student services liaison/technology liaison in PSED studio classrooms, or student who works in the laboratory or is enrolled in a laboratory class

Medical consultation means a consultation which takes place between a laboratory worker and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Organic peroxide means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer means a chemical other than a blasting agent or explosive as defined in § 1910.109(a),

that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

PEL, Permissible Exposure Limit is the maximum concentration of an OSHA regulated substance in breathing air to which a laboratory worker may be legally exposed as an 8-hour time-weighted average, usually abbreviated to **TWA**. This means that, for limited periods, a worker may be exposed to concentrations of OSHA regulated substances which are higher than the PEL, so long as the average concentration over eight hours remains lower than the PEL.

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 pyrophoric, unstable (reactive) or water-reactive.

Protective laboratory practices and equipment means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive toxins mean chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Required Respirator is an appropriate respirator (not including a dust mask) that is used properly when the laboratory worker is exposed to contaminants above the PEL and when engineering controls are either not in place or do not adequately lower the exposure concentration

Select carcinogen means any substance which meets one of the following criteria:

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

STEL, Short-Term Exposure Limit is the maximum concentration of an OSHA regulated substance in breathing air to which a laboratory worker may be legally exposed as a time weighted average for a maximum of 15 minutes (for most chemicals).

Unstable (reactive) means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

3. Responsibilities

3.1 College/Department of Physical Science and Engineering

The responsibilities of the college related to this CHP are to be carried out by the PSED.

1. Maintain records of laboratory worker exposures to hazardous chemicals such as exposure monitoring and up-to-date medical examinations/consultations arising from a chemical exposure.
2. Develop and provide a general safety training and information program for laboratory workers so that they
 - a. understand and are aware of the chemical and physical hazards in the laboratory
 - b. recognize the symptoms related to overexposure to hazardous chemicals and OSHA regulated substances
 - c. are able to use personal protective apparel and equipment correctly
 - d. protect themselves from chemical exposure by developing good laboratory practices
 - e. understand the policies and practices outlined in the CHP
3. Provide laboratory workers access to medical consultation and examination
 - a. if a laboratory worker manifests symptoms of exposure,
 - b. if an action level or PEL is routinely exceeded, or
 - c. if there is a spill, leak or explosion that may raise the level of exposure to an OSHA regulated substance above the PEL

The college shall be responsible for the cost of medical consultation and examination.
4. Provide laboratory workers with adequately maintained personal protective equipment (e.g., eye and face protection, aprons, lab coats, gloves, respiratory protection) as needed.
5. Maintain Material Safety Data Sheets of all hazardous materials in the department
6. Provide access for all laboratory workers to
 - a. exposure records, if any
 - b. MSDS for all hazardous materials
 - c. PEL of hazardous substances used in the laboratory
 - d. their own personal medical records
 - e. this CHP and to the Laboratory Standard
7. Provide continuing support to the PSED CHO (if one is assigned) and to the PSED Safety Committee for departmental chemical hygiene

3.2 Chemical Hygiene Officer

The responsibilities of a CHO (if one is appointed by the district or the college) are:

1. Develop, maintain, and update a college-wide Chemical Hygiene Plan (TR-CHP) or a district-wide Chemical Hygiene Plan (CCC-CHP) that include adequate policies and practices
2. Keep updated on federal, state, and local codes and regulations regarding hazardous materials and issues regarding safety in the workplace
3. Provide expert guidance to college (district) units and individuals to maintain compliance with the TR-CHP (CCC-CHP). This shall include but not be limited to:
 - a. assisting college (district) units in making MSDS available to laboratory workers

- b. assisting college (district) units in developing appropriate labeling practices for chemicals
 - c. assisting college (district) units in determining if an event of possible overexposure needs to be referred for medical consultation
 - d. assisting laboratory instructors/directors/coordinators in selecting the proper personal protective apparel and equipment
 - e. assisting in the determination of the necessity for an “Exposure Assessment” and, if it an “Exposure Assessment” is necessary, conduct or arrange for one
4. Monitor chemical and hazardous waste disposal practices
 5. Conduct regular reviews of chemical inventories of college (district) units
 6. Conduct regular inspections of college (district) units to audit operations and compliance. Recommend appropriate corrective changes, if any, to the responsible individual(s)

3.3 Department Safety Committee

The PSED chair may appoint staff/faculty members of the department to serve as the PSE Safety Committee.

1. The committee shall be composed of the stockroom coordinator, one Physics faculty member, and one Chemistry faculty member
2. The committee shall serve as a consultative body to review PSED laboratory operations that may require approval under this CHP
3. The committee shall serve as a consultative body for the regular annual review of this CHP
4. If a college Chemical Hygiene Officer is not assigned, the additional responsibilities of the committee are:
 - a. Keep updated on federal, state, and local codes and regulations regarding hazardous materials and issues regarding safety in the workplace
 - b. Provide guidance to the PSED to maintain compliance with the college-wide CHP.
 - c. Assist the PSED in making a copy of this CHP and the MSDS accessible to laboratory workers
 - d. Assist the PSED in developing appropriate labeling practices for chemicals
 - e. Assist the PSED in determining if an event of possible overexposure needs to be referred for medical consultation
 - f. Assist laboratory instructors/directors/coordinators in selecting the proper personal protective apparel and equipment
 - g. Assist in the determination of the necessity for an “Exposure Assessment” and, if an “Exposure Assessment” is necessary, conduct or arrange for one
 - h. Monitor chemical and hazardous waste disposal practices
 - i. Conduct regular reviews of chemical inventories of the PSED
 - j. Conduct regular inspections of PSED laboratories and operations. Recommend appropriate corrective changes, if any, to the responsible individual(s).

3.4 Laboratory Supervisors

The laboratory supervisors (department chair, full-time and adjunct faculty, stockroom coordinator) have full responsibility for laboratory operations in their unit (department, instructional laboratory, research laboratory, or stockroom). Their main responsibility is

to implement the policies and practices as set forth in this CHP. Specifically, laboratory supervisors shall:

1. Be familiar and keep current with the policies and practices as set forth in this CHP
2. Be familiar and keep current with the legal requirements of working with hazardous or regulated substances
3. Make sure that all laboratory work is performed in accordance with the policies and practices set forth in the CHP
4. If necessary, develop additional chemical hygiene policies specific for their unit
5. Make sure that adequate training is provided to the laboratory workers in their unit, and, that the laboratory workers know and understand proper chemical hygiene, good safety practices, proper use of protective equipment, and the proper response to accidents that involve hazardous materials. Assist laboratory workers in practicing good personal chemical hygiene
6. Maintain a record of completion of 3.4.5, that may include signed CHP forms, graded safety quizzes, attendance, date, and content of training session
7. With the assistance of the CHO or the Safety Committee, determine the appropriate type of personal protective equipment and apparel for all laboratory work
8. With the assistance of the CHO or the Safety Committee, make sure that proper waste disposal practices are observed
9. With the assistance of the CHO or the Safety Committee, perform regular review of hazardous operations and recommend corrective action, if necessary, in order to remain in compliance with this CHP
10. Provide assistance to the Safety Committee in conducting regular inspection of emergency equipment, engineering controls, conditions and procedures in their unit
11. Monitor the conduct of laboratory workers in order to make sure that correct laboratory techniques are employed, proper personal protective equipment are used, and the prescribed safety precautions are always observed
12. If necessary and with the assistance of the CHO or the Safety Committee, conduct or arrange for the determination of laboratory exposure to OSHA regulated substances, inform laboratory workers of the outcome, and perform necessary corrective measures
13. Investigate accidents in their unit and write a report by filling out the Incident Report Form. Retain a copy and submit another copy to the Safety Committee. Incidents that need to be reported to the Safety Committee or CHO include ones that
 - a. cause the laboratory workers to be exposed to hazardous chemicals via skin contact, eye contact, ingestion, or inhalation and where signs of the exposure are evident or medical treatment is administered;
 - b. pose a clear danger to the environment caused by the spill or release of a hazardous material whose nature is such that a person in the immediate vicinity cannot clean up the spill without increasing the risk of environmental damage or the level of exposure of laboratory workers to the hazard
14. Make sure that the CHP and MSDS are accessible to the laboratory workers

3.5 Laboratory Workers

1. Understand and abide by the policies and procedures outlined in this CHP
2. Understand and abide by the safety precautions that apply to all laboratory work as instructed by the laboratory supervisor

3. Understand and apply all training received
4. Learn how, when, and where to use the appropriate personal protective equipment and clothing
5. Immediately inform the laboratory supervisor any incident related to chemical safety and hygiene that may arise during the performance of routine laboratory work
6. Provide to the laboratory supervisor all factual information relevant to accidents that occur in the laboratory
7. Report to the laboratory supervisor any condition or action that could cause an accident or a release of hazardous substance in the laboratory
8. Ask the laboratory supervisor to clarify if any of the above responsibilities is not completely understood
9. Students enrolled in laboratory classes where hazardous chemicals are used need to obtain or purchase and use a laboratory coat or apron. ANSI Z87.1 rated safety glasses or goggles are provided by PSED.

4. Standard Operating Procedures

4.1 General Rules for Safety and Hygiene

1. Be aware of chemical and physical hazards in the work area.
2. Only authorized personnel shall be allowed in the stockroom.
3. Limit exposure to chemicals to a minimum at all times.
4. Avoid skin contact and inhalation of chemicals
5. Abide by the personal protective equipment and clothing policy. Laboratory supervisors, laboratory workers, and visitors should wear the prescribed eye protection in the laboratory. Chemical splash goggles must be worn any time chemicals, glassware, or heat are used in the laboratory. Make sure the equipment is in proper working condition and that you know how to use it.
6. Use shields when an implosion or explosion is possible.
7. Read the labels on reagent bottles carefully before use. Make sure that chemicals are in tightly closed containers and the labels are readable and accurate.
8. Read the equipment instructions carefully before use.
9. Work areas should be kept clean and orderly.
10. Keep aisles clear as much as possible.
11. Be familiar with the location and proper use of all safety equipment including the first aid kit, eyewash station, safety shower, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located. Be familiar with emergency procedures.
12. If you have a medical condition (e.g., allergies, pregnancy, etc.), consult with your physician prior to working in lab.
13. Never work alone when using chemicals. No student may work in the laboratory without an authorized supervisor present. Another person who is familiar with the work being performed should always be present.
14. Be alert and cautious at all times. Notify the lab supervisor immediately if any unsafe conditions are observed.
15. Always be prepared by reading the procedure thoroughly before performing laboratory work. Students should pay attention to the pre-laboratory discussion.
16. Always work in a well-ventilated area. Use the fume hood when working with volatile substances or poisonous vapors. Never place your head into the fume hood.
17. When flammable materials are in use, make sure that there are no sources of ignition that may cause a fire or explosion.
18. When using sharp instruments, always carry with tips and points pointing down and away. Always cut away from the body.
19. Never leave an experimental setup unattended. If it is necessary to leave a setup for an extended period of time, make sure that the setup is equipped with automatic shutdown controls and any possible accident that may occur while it is unattended can easily be contained with the applicable engineering controls. Post warning signs for the applicable hazard (chemical, radioactive, explosive, etc.) that the setup may pose.
20. Dispose of all chemical waste properly. Never pour chemicals in sink drains. Only water and aqueous solutions so designated may be poured in the sink. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in the proper solid waste containers. Always double-check the label of all waste containers before disposing chemical waste to the container.

21. Dispose of broken glassware into the box labeled "Broken Glass Disposal," supplied in each laboratory
22. Keep hands away from any part of the body while using chemicals. Wash hands with soap and water after performing all laboratory work.
23. If there is an emergency evacuation, containers must be closed, gas valves turned off, and any electrical equipment turned off.
24. Post emergency contact information in the laboratory door(s). Information should include name of person(s) to contact and telephone number(s).
25. Wash immediately any area of the skin that comes in contact with a chemical
26. Do not touch or taste chemicals. Never smell chemicals directly.
27. Never return unused chemicals to their original containers.
28. Always handle acids with extreme care. You will be instructed on the proper method for diluting strong acids. Always add acid to water. Be cautious of the heat produced, particularly with highly concentrated acids.
29. Never touch any chemical that is spilled. Seek assistance if necessary.
30. If a chemical splashes in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 15 minutes. Notify the instructor immediately.
31. Carry glass tubing in a vertical position to prevent breakage and possible injury.
32. Never handle broken glass with bare hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container.
33. Inserting and removing glass tubing from rubber stoppers can be dangerous. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) before attempting to insert it in a stopper. Oftentimes, distilled water will do the trick. Always protect your hands with towels when inserting glass tubing into, or removing it from, a rubber stopper. If a piece of glassware becomes "frozen" in a stopper, ask for assistance.
34. Keep hands dry when handling electrical equipment. When removing an electrical plug from its socket, grasp the plug, not the electrical cord.
35. Report damaged electrical equipment immediately. Do not attempt to use them.
36. If you do not understand the instructions for equipment use, ask for assistance.
37. Exercise extreme caution when using a gas burner. Take care that anything that can catch fire (e.g., hair, clothing, flammable chemicals, etc.) is kept at a safe distance at all times. Do not put any substance into the flame unless specifically instructed to do so. Never reach over a flame. The instructor will demonstrate how to light a burner.
38. Always turn the burner or hot plate off when not in use.
39. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs or heat-protective gloves if necessary. Do not set hot glassware in cold water or bench top; it may shatter.
40. Never look directly into a container that is being heated.
41. Do not place hot apparatus directly on the bench top. Always use an insulating pad. Allow plenty of time for hot apparatus to cool before touching it.
42. When bending glass, allow time for the glass to cool before further handling. Hot and cold glasses have the same visual appearance. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.
43. Always use a rubber bulb or pipet pump when using pipettes.
44. Do not bring food, tobacco products, beverages, chewing gum, or food containers in the laboratory.
45. Do not eat, drink, chew gum, smoke, bite fingernails, apply cosmetics, or handle contact lenses in the laboratory.

46. Do not store food or beverages in a refrigerator that is used to store chemicals. Do not store chemicals in a refrigerator that is used to store food.
47. Do not use laboratory glassware for drinking.

4.2 Chemical Storage

1. General

- a. A separate, secure, and locked area should be designated for chemical storage.
- b. All incoming shipments of chemicals should be opened only by qualified PSED faculty/staff. MSDS sheets that accompany the chemicals should be filed.
- c. Maintain an updated inventory of all chemicals. Information in the chemicals database should include but not be limited to identity, quantity, hazards, location, and date acquired.
- d. Inspect stored chemicals regularly for deterioration and chemical integrity.
- e. Update the chemical inventory by regularly updating the quantity of each stored chemical as it is used or found to have deteriorated.
- f. All chemicals should be properly labeled with the chemical name, physical state, hazard information, and purchase date.
- g. Label all prepared solutions with the chemical name and concentration, hazard information, name of preparer, and date of preparation.
- h. Store all chemicals in chemically compatible families. (*Refer to the Flinn Scientific Catalog/Reference Manual for guidance.*) Chemicals that react with each other or create a hazardous condition should be separated with enough distance such that any chemical spill or release would not cause any mixing or create a hazardous condition.
- i. Store flammable materials in approved flammables storage cabinets.
- j. Store corrosives in appropriate corrosives cabinets.
- k. Do not store chemicals under a fume hood.
- l. Maintain only the quantity of chemicals that is necessary for three (3) years of instruction and/or research.
- m. Label storage areas and cabinets as to the hazards of the chemicals stored in them.
- n. Do not store chemicals, glassware, or loose equipment on shelves above sinks or any work area.
- o. Secure shelves to walls or the floor to prevent tipping.
- p. Equip shelves with lips to prevent containers from rolling off.
- q. Do not store chemicals on the floor unless they are in approved shipping containers.
- r. The chemical storage area should be ventilated by at least four changes of air per hour. Isolate the chemical storage exhaust from the general ventilation system. This storage exhaust system should be able to draw vapors from the floor.
- s. Chemical storage areas should have a chemical spill kit. This kit should include
 - an absorbent such as sand, sponge, spill-specific absorbents
 - personal protective equipment (splash goggles, rubber gloves)
 - plastic sweep and pan
 - plastic bags for waste absorbents

- labeling pen
- t. Do not store food or beverages in a refrigerator that is used to store chemicals. Post a “No Food or Drink” sign. Do not store chemicals in a refrigerator that is used to store food.
- u. Store all poisons in a locked cabinet.
- v. Do not allow students in the chemical storage area(s). Only authorized PSED personnel should be allowed in these area(s).
- w. Do not expose stored chemicals to heat or direct sunlight.

2. Compressed Gases

- a. Regard compressed gases as potential explosives.
- b. Secure each gas cylinder in place with a chain that is securely fastened to a wall.
- c. Label gas cylinders with identity of content and as empty or full.
- d. Protect the cylinder valve stem at all times.
- e. Do not lubricate, force, or tamper with a cylinder valve.
- f. Do not expose gas cylinders to heat or direct sunlight.
- g. Work with cylinders of reactive, flammable, or toxic gases only under a fume hood.
- h. Shut off the gas before extinguishing a flame. Otherwise, the gas can reignite and possibly cause an explosion.

3. Flammable Chemicals

- a. Store all flammable chemicals in a designated cabinet.
- b. Always keep the temperature in the flammable storage area at 55 °F - 80 °F.
- c. Keep all sources of ignition away from flammable materials.
- d. Keep all oxidizers away from flammable and combustible materials.
- e. Keep all flammable materials away from direct sunlight.
- f. If flammable chemicals need to be stored in a refrigerator, make sure that the refrigerator is explosion proof.
- g. Dispense flammable chemicals from a fume hood
- h. Always have an ABC fire extinguisher available in areas where flammable chemicals are stored or used

4. Corrosives

- a. Store all corrosives in a designated corrosives cabinet.
- b. Wear chemical splash goggles or face shield when handling corrosive materials.
- c. Inspect the corrosives cabinets every three (3) months for signs of rusting.
- d. Do not store glacial acetic acid and nitric acid together.
- e. Label acid solutions properly (see **4.2a6** above) before storing.
- f. Use rubber bottle carriers or carts if transporting acids from one work area to another.
- g. Always dispense concentrated acids from under a fume hood.

5. Highly Hazardous Chemicals

- a. Avoid the use of highly hazardous chemicals unless their use is for educational purposes. Use alternative materials whenever possible.
- b. Use a fume hood if, based on the MSDS, the PEL for a chemical is less than 50 ppm.

- c. Always use a fume hood when handling carcinogens, mutagens, teratogens, and allergens.
- d. Always use a fume hood when handling toxic, corrosive, flammable, and noxious chemicals.
- e. Do not use flammable materials near sources of ignition such as an open flame, sparks or heat unless laboratory conditions are carefully, strictly controlled.
- f. Highly reactive solids such as sodium, potassium, or lithium metal should be handled only in small quantities. Protect yourself with a safety shield when igniting flammable solids.
- g. Exercise extreme caution when handling finely divided hazardous solids. These may form explosive mixtures with air.
- h. Open cans of diethyl ether should be disposed of properly after use. Store only if necessary. Date containers upon receipt and upon opening.
- i. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.

4.3 Personal Protective Apparel and Equipment

1. All personal protective equipment must always be fully functional and in good working condition.
2. Each laboratory must have eyewashes/shower, fire extinguisher, safety goggles or glasses. Protective eyewear must meet the requirements of the American National Standards Institute (ANSI Standard Z87.1). Safety glasses do not provide sufficient protection against liquid splash. Safety goggles that meet the ANSI Z87.1 standard do. Always keep protective eyewear clean.
3. Fire extinguishers must be dry chemical ABC and must be regularly inspected.
4. Eyewashes must be flushed at least once month.
5. Showers must be tested at least twice a year.
6. Wear gloves and a lab coat or an apron impermeable to specific hazardous chemicals that are to be used in a laboratory activity. These protective apparels are typically made of rubber or plastic.
7. Protect as much skin as possible with adequate clothing and footwear. Do not wear short skirts or shorts in the laboratory.
8. Long hair must be tied back and dangling jewelry must be secured. Avoid loose clothing as they can be a hazard. Always wear closed footwear to protect your feet.

4.4 Housekeeping, Maintenance, and Inspection

1. Secure access to the chemical storage and preparation areas. Return all chemicals used in instructional laboratories to their proper storage locations at the end of each day's laboratory classes. Transport of these chemicals must be done using carts.
2. Maintain proper containers and labels for waste materials. Make sure the labels remain readable, fastened to the container, and in good condition.
3. Avoid using the fume hood as storage. This reduces the efficiency of the fume hood and serves as a possible fire hazard.
4. Chemical spills should be cleaned up properly and promptly.
5. Clean floors and benches regularly. Keep these areas free of clutter such as book bags, purses, bike helmets, etc. Bench tops should be wiped clean at the end of a laboratory activity or experiment, or at the end of the day.
6. The contents of all unlabeled containers are considered hazardous waste unless the contents are known.
7. Provide clear access to all exits, safety and emergency equipment, and master utility controls.

8. Fume hoods should be tested every six months.
9. Fire extinguishers must be dry chemical ABC and must be regularly inspected quarterly or more frequently.
10. Always keep protective eyewear clean.
11. Eyewashes must be flushed at least once month.
12. Showers must be tested at least twice a year.
13. Any safety equipment failing a regular inspection or found to be out of order needs to be repaired or replaced as soon as possible. Always keep a record of these inspections as to their nature, the dates, and name(s) of inspector(s).

4.5 Chemical Waste Disposal

1. Chemicals that show the following indications may need to be disposed:
 - a. liquids that have become cloudy
 - b. chemicals that are changing color
 - c. spotting on solids
 - d. caking of anhydrous materials
 - e. existence of solids in liquids or liquids in solids
 - f. pressure buildup in bottles
 - g. evidence of reaction with water
 - h. damage to the container
2. Maintain proper containers and labels for proper classification of chemical waste. Make sure the labels remain readable, fastened to the container, and in good condition. The labels should:
 - a. include the words, "HAZARDOUS WASTE;"
 - b. indicate the type of waste (i.e., CORROSIVE, IGNITABLE, TOXIC, REACTIVE);
 - c. indicate the physical state of the contents (i.e., SOLID or LIQUID)
 - d. indicate the DATE when waste is first added to the container
 - e. NAME and SOURCE of the waste generator (e.g., TRUMAN PSED/ROOM 3831)
3. All chemical wastes must be kept in closed, properly maintained waste containers.
4. Chemical waste must be removed by a licensed chemical disposal company at least once a year.

4.6 Chemical Spill/Release, Accidents, Emergencies

1. Notify fellow laboratory workers and clear the immediate vicinity of the spill
2. Identify the spilled material and the extent of the spill
3. Follow proper containment procedures for the particular chemical spill
4. Responding to a **minor chemical spill** (release of hazardous material that a laboratory worker is capable of handling safely)
 - a. Turn off all possible sources of ignition if the spilled material is ignitable.
 - b. Use appropriate personal protective equipment/apparel to avoid spilled material from touching your skin or clothing.
 - c. Avoid inhalation of fumes or dust from spilled material
 - d. Clean up spill immediately and thoroughly
 - e. Use absorbent for liquid spills. See appendix for list of common absorbents for hazardous materials clean up. If applicable and safe to do, neutralize the spilled liquid with the appropriate neutralizing agent (e.g., baking soda for minor acid spills). Work from the outer edge of the spill toward the center and allow the spilled liquid to be completely absorbed or neutralized.

- f. Use 100% wool fire blanket to contain the spill and its vapors if no other containment materials are available.
- g. Gather all contaminated clean-up materials (absorbent, gloves, rinse water, clothing, etc.) in an appropriate bag and treat as hazardous waste.
- h. Fill out a detailed accident report after the spill has been cleaned up.

5. Responding to a **major chemical spill** (release of hazardous material that a laboratory worker cannot handle safely without the aid of safety or emergency personnel). Remember **NEAR**.

Notify the laboratory supervisor and fellow laboratory workers immediately. The laboratory supervisor notifies the CHO and calls emergency assistance (911). Turn off all sources of ignition, if possible and safe to do so.

Evacuate everyone in the vicinity to a safe location and attend to injured or exposed individual(s) without putting anyone in further danger. Contain exposure by closing the door to the affected area, if possible and safe to do so. If evacuating the building becomes necessary, sound the fire alarm.

Assemble and account for all the evacuated laboratory workers. The laboratory supervisor and/or a laboratory worker familiar with the incident should be near the affected area to provide assistance to emergency personnel and to prevent others from going in the affected area.

Report the incident promptly. Fill out a detailed accident report for this type of emergency once the incident is over.

6. Fire Emergencies

- a. Notify everyone in the room or laboratory immediately.
- b. **Evacuate the room or laboratory immediately but calmly.**
- c. Activate the nearest fire alarm.
- d. Trained personnel may use fire extinguishers in case of small fires.
- e. Follow Truman College's fire evacuation procedures.
- f. Prepare a detailed accident report once the emergency is over.

7. Medical Emergencies

- a. In cases when a laboratory worker is injured or shows signs or symptoms of overexposure to a particular chemical and it appears that the attention of a medical professional is necessary, dial 911.
- b. At the same time, initiate action to minimize the effects of overexposure. For burns or chemical contact with the skin, flush the affected area with water for **15 minutes**. Use a safety shower if necessary.
- c. Prepare a detailed report of any incident requiring medical attention using the standard form used by PSED. See appendix.
- d. Whenever there is a high probability for serious harm to occur, it is always good policy to have available (1) a staff member who is qualified to administer basic first aid or cardiopulmonary resuscitation (CPR); and (2) basic first aid kit or equipment.

5. Management of Engineering Controls

5.1 Laboratory Fume Hoods

1. The PSED Laboratory Safety Committee shall coordinate with the appropriate college or district unit the inspection and maintenance of all laboratory fume hoods (or hoods) in PSED.
2. The hoods shall be inspected at least twice a year or at the beginning of every term to confirm adequate air flow. Necessary repair shall be ordered or performed whenever adequate air flow is not consistently achieved. An improperly functioning hood cannot be used until the necessary repair work is done.
3. Copies of the inspection and maintenance reports shall be maintained by the PSED laboratory safety committee.
4. The hoods shall always be on. A device that indicates that the hood is on and working properly must be installed.

5.2 Chemical Storage Cabinets

1. Cabinets for flammable and hazardous chemicals shall be ventilated as necessary.
2. These cabinets shall be equipped such that they are capable of containing accidental spills.

5.3 Emergency Equipment

1. Eye washes shall be flushed at least once a month by the PSED laboratory coordinator or by designated lab workers.
2. Safety showers shall be flushed at least every three months
3. The PSED Laboratory Safety Committee shall coordinate with the appropriate college or district unit the annual inspection of fire extinguishers in PSED.

6. Special Precautions for Working with Highly Hazardous Chemicals

6.1 Prior Approval for Highly Hazardous Work

1. Laboratory workers must seek written permission from the laboratory supervisor or the chair of the laboratory safety committee before performing work that involves using highly hazardous materials and potentially hazardous procedures. Highly hazardous materials include select carcinogens, reproductive toxins, biohazards, and substances that have a high degree of toxicity.
2. Prior approval is necessary if at least one of the following conditions exists
 - a. A procedure is likely to exceed the PEL for one or more substance
 - b. A new procedure is used, even if it is similar to an existing or older one
 - c. A modified procedure is used, even if it is similar to existing or older one
 - d. Working after hours in the laboratory
 - e. Working alone in the laboratory
 - f. Leaving laboratory operations unattended (e.g., continuous instrument operation or overnight reactions); Unattended operations must satisfy the following:
 - A permit must be posted near the setup
 - Signs that an operation is ongoing must be posted at all entrances to the work area; this should include contact information in case of an emergency
 - Lights must be turned on in the laboratory.
 - Automatic shut-off mechanisms should be in place in case of an emergency, including loss of utility service (i.e., water, electricity)
3. All new procedures must be reviewed by the laboratory safety committee to make sure that all necessary safety considerations have been explored and are in place before implementation

6.2 Special Procedures for Working with Highly Hazardous Materials

1. Plan the laboratory operation carefully.
2. Write a clear experimental protocol that includes all safety precautions that must be observed and engineering controls that must be in place before performing the operation. This should address proper handling of the hazardous materials from the moment they are acquired to waste disposal. In cases where the PEL could be exceeded, procedures for continuous monitoring of the work area must be included in the protocol.
3. Consider the toxicity and other physical properties of the materials to be used, the extent that workers might be exposed, and the effects of such exposure
4. Consider using less hazardous alternative materials.
5. Consider using the minimum amount of materials that will give the desired result.
6. Consider the worst when planning for possible accidents and spills. Keep a spill kit close to the designated area. Make sure there is a secondary containment device (e.g., an impermeable tray or absorbent mat) that can keep any spilled material from contaminating a wider area.
7. Working with highly hazardous materials or procedures must be done in a designated space such as a room or laboratory with controlled access, a fume hood, glove box, or a biosafety cabinet. Operations that may generate vapors, aerosols, or dust must be done in a properly functioning fume hood, biosafety cabinet, or glove box. When using the fume hood, the sash must be pulled down as much as possible.
8. Maintain a log of laboratory workers that access the designated work area. Laboratory workers properly trained in handling highly hazardous materials must be

the only ones allowed access to the designated area. They must sign the log prior to gaining access and upon leaving.

9. Laboratory workers must wear appropriate protective equipment and clothing and observe proper laboratory hygiene. Gloves that are impervious to the hazardous materials being used must be worn. Face shields must be used to provide additional protection from liquid splash, aerosols, and dust. Explosion shields must be in place if there is an explosion hazard.
10. Laboratory workers must observe proper laboratory hygiene. Hands, arms, neck, and face must be thoroughly washed after working with highly hazardous materials. Laboratory equipment and re-usable personal protective equipment must be decontaminated properly before being transported out of the designated area.
11. MSDS and other information for the highly hazardous materials used in a particular operation should be close by.
12. Warning signs related to the highly hazardous operation must be posted near the designated area.
13. Highly hazardous materials must be transported in sturdy secondary containers outside the designated area.
14. Waste disposal must be guided by Section 4.5 of this CHP.

7. Medical Program

7.1 Emergency Cases

Incidents that require the immediate aid of a medical professional shall be treated as a medical emergency. Dial 911. Refer to Section 4.6 of this CHP.

7.2 Non-emergency Cases

1. Laboratory workers employed by Truman College who are injured or may have been exposed to hazardous chemicals but are not showing symptoms or do not need the aid of a medical professional may obtain a medical examination or evaluation related to this incident at no cost.
2. The medical examination or evaluation must be performed by a licensed physician recommended and approved by the college.
3. For the purposes of the medical examination, the PSED will provide the following information:
 - The nature and identity of the hazardous material to which the laboratory worker may have been exposed
 - The description of the symptoms, if any, that the laboratory worker may be experiencing
 - The description of the incident that may have caused the exposure
4. After the medical examination, the physician must provide the PSED a written report of the findings addressing the following:
 - The results of the examination
 - The results of any and all medical tests associated with the examination except findings not related to the exposure
 - Recommendation for follow-up examinations or medical check-up, if necessary
 - An acknowledgement that the laboratory worker has been informed of the results of the examination and the possibility or necessity of follow-up examinations or treatment.

8. Information and Training Program

8.1 Information

1. PSED, the laboratory safety committee, and the laboratory supervisor shall provide laboratory workers access to information and training concerning the hazards of working with the materials and procedures in the departmental laboratories and work areas.
2. Resources that are available either in print or through links on the department/college/course webpage include:
 - The OSHA Laboratory Standard
 - The PSED Chemical Hygiene Plan (or the Truman or district-wide CHP, if available)
 - The list of OSHA regulated substances with the corresponding PEL
 - Material Safety Data Sheets (MSDS) for the chemicals and materials used in the PSED laboratories

8.2 Training

1. Laboratory supervisors (instructors and laboratory coordinator for work-study student assistants) are responsible for providing training to laboratory workers concerning the hazards of working with the chemicals and procedures in the PSED laboratories and work areas.
2. Training shall include the following topics:
 - The content and location of the printed form of the PSED CHP (this document), including the standard operating procedures outlined in it.
 - Good laboratory practices (e.g., proper chemical hygiene, techniques to avoid or minimize personal exposure to hazardous materials, managing physical hazards, etc.)
 - Categories or classifications of hazardous materials in the PSED laboratories. Students must be reminded of special hazards as they apply in particular laboratory activities
 - Methods of detecting presence or release of hazardous materials
 - Recognizing symptoms associated with exposure to hazardous materials
 - Proper response for specific situations such as an accidental spill or leak, injury, exposure above PEL, or other emergency.
 - Material Safety Data Sheets (MSDS) and the information contained therein
 - Other sources of information concerning hazardous materials (e.g., manufacturers' catalogs, container labels, OSHA or EPA websites, or other resources available in PSED or online).

8.3 Record of Training

1. A record of all training sessions shall be maintained by the PSED laboratory safety committee.
2. The document shall include the following information
 - The duration and date(s) on which the training was conducted
 - A record of the attendance (names and signatures, student or employee ID)
 - A summary of the topics covered in the training
 - A copy of documents used to assess the participants' understanding of the content and the results of such assessment

9. Recordkeeping

9.1 Inspection/Maintenance Reports

A copy of the record of equipment inspection and maintenance shall be kept by PSED for not less than five (5) years. Record of laboratory inspections shall be submitted by laboratory supervisors to the PSED laboratory safety committee and will be retained for not less than five (5) years.

9.2 Accident Reports

Accident reports shall be written and submitted to the laboratory safety committee as soon as possible. Copies of records of accident investigations shall be kept by PSED for not less than five (5) years.

9.3 Medical Examination/Evaluation

Copies of results of medical examinations or evaluations shall be retained by the PSED for the duration of stay of the laboratory worker at Truman College plus thirty (30) years as required by OSHA.

9.4 Exposure Monitoring

Copies of records of exposure evaluation conducted by PSED shall be kept for the duration of stay of the laboratory worker at Truman College plus thirty (30) years.

9.5 Training

Training documentation shall be kept by PSED for not less than five (5) years. Training records for an individual laboratory worker shall be kept in the individual's PSED file for not less than five (5) years.

10. Annual Review of the Chemical Hygiene Plan

The PSED laboratory safety committee shall review the PSED Chemical Hygiene Plan annually, before the start of spring semester. Recommendations shall be submitted to the Truman or district-wide CHO, if there is one so designated. Any deficiency noted shall be corrected by the appropriate laboratory instructor or supervisor within the time prescribed according to the type and extent of the deficiency.

11. References

11.1 Literature References

American Chemical Society (ACS) Committee on Chemical Safety, *Safety in Academic Chemistry Laboratories Vol. 1: Accident Prevention for College and University Students*, 7th ed., ACS, Washington, D.C., 2003.

American Chemical Society (ACS) Committee on Chemical Safety, *Safety in Academic Chemistry Laboratories Vol. 1: Accident Prevention for Faculty and Administrators*, 7th ed., ACS, Washington, D.C., 2003.

Code of Federal Regulations, 29 CFR Part 1910 Subpart Z Section 191.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories*, 1990.

Flinn Scientific, Inc., *Chemical Hygiene Plan: Generic Plan for Schools*, Batavia, IL, 2004.

Flinn Scientific, Inc., *Student Safety Contract*, Batavia, IL, 2004.

Flinn Scientific, Inc., *Scientific Safety Seminar Workbook: Practical Solutions to Laboratory Safety Problems*, Batavia, IL, 2004.

National Research Council, *Prudent Practices in the Laboratory: Handling and Disposing of Chemicals*, National Academies Press, Washington, D.C., 1995.

OSHA, U.S. Department of Labor, *Best Practices Guide: Fundamentals of a Workplace First Aid Program*, Washington, D.C., 2006.

11.2 Internet Resources

U.S. Department of Labor, Occupational Safety and Health Administration
<http://www.osha.gov>

University of Vermont Environmental Safety Facility
<http://esf.uvm.edu>

California Polytechnic University Chemical Hygiene Plan
<http://www.afd.calpoly.edu/Risk/pdf/chp98.pdf>

The University of Illinois Division of Research and Safety
<http://www.ehs.uiuc.edu/index.aspx>

Princeton University Environmental Health and Safety
<http://web.princeton.edu/sites/ehs/index.html>

The Laboratory Safety Institute
<http://www.labsafety.org/>

12. Appendices

- 12.1 Student Laboratory Safety Contract**
- 12.2 Safety Inspection Checklist**
- 12.3 Prior Approval Form**
- 12.4 Safety Training Record**
- 12.5 Sample Laboratory Safety Quiz**

TRUMAN COLLEGE
DEPARTMENT OF PHYSICAL SCIENCE AND ENGINEERING

STUDENT SAFETY CONTRACT

Chemistry is an experimental science. Students in this course will be performing various laboratory activities that may require the use of hazardous chemicals. Truman College places a high priority on the safety of the students, faculty, and staff in its chemical laboratories. To ensure safe laboratories, a list of rules has been developed and provided to you in this safety contract. Your conduct must be guided by these rules at all times. You need to sign two copies before you can participate in the laboratory. One copy will be collected by your instructor for filing. Keep the second copy in your laboratory notebook as a constant reminder of these rules.

GENERAL RULES

1. Always be prepared by reading the procedure thoroughly before coming to the laboratory. Pay attention to the pre-laboratory discussion.
2. Follow all instructions carefully. Ask the instructor if you do not understand a direction or part of a procedure.
3. No student may work in the laboratory without an authorized supervisor present.
3. Do not touch any equipment, chemicals, or other materials in the laboratory area until instructed to do so.
4. Do not eat food, drink beverages, or chew gum in the laboratory.
5. Be familiar with the location and proper use of all safety equipment including the first aid kit, eyewash station, safety shower, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located.
6. Perform authorized experiments only.
7. Horseplay, practical jokes, and pranks are dangerous and prohibited.
8. Work areas should be kept clean and orderly. Bring only your laboratory manual and notebook to your lab station.
9. Keep aisles clear as much as possible.
10. Always work in a well-ventilated area. Use the fume hood when working with volatile substances or poisonous vapors. Never place your head into the fume hood.
11. Be alert and cautious at all times. Notify the instructor immediately if you observe any unsafe conditions.
12. Dispose of all chemical waste properly or as instructed. Never pour chemicals in sink drains. Only water and aqueous solutions designated by the instructor may be poured in the sink. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in the proper solid waste containers. Always double-check the label of all waste containers before disposing your chemical waste to the container.
13. Read the labels on reagent bottles carefully before use.
14. Read the equipment instructions carefully before use.
15. Keep hands away from any part of your body while using chemicals. Wash your hands with soap and water after performing all experiments.
16. Clean and wipe all work surfaces, equipment, and apparatus at the end of the experiment. All borrowed equipment must be returned on the cart.
17. Never leave an experimental setup unattended.
18. Keep out of the stockroom unless given permission by the instructor. The stockroom attendant will provide assistance.
19. If there is an emergency evacuation during the laboratory period, containers must be closed, gas valves turned off, and any electrical equipment turned off.

20. When using sharp instruments, always carry with tips and points pointing down and away. Always cut away from your body.
21. If you have a medical condition (e.g., allergies, pregnancy, etc.), consult with your physician prior to working in lab.

USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

22. Use a laboratory coat, apron or other personal protective equipment when instructed to do so.
23. Whenever chemicals, heat, or glassware are used in the laboratory, you need to wear your safety goggles.
24. Do not wear contact lenses in the laboratory. The instructor may permit contact lenses for certain activities.
25. Wear appropriate clothing in the laboratory. Long hair must be tied back and dangling jewelry must be secured. Avoid loose clothing as they can be a hazard. Always wear closed footwear to protect your feet.

HANDLING CHEMICALS AND EQUIPMENT

26. Do not touch, taste, or smell any chemicals unless instructed to do so. The proper technique for safely handling specific chemicals will be demonstrated by your instructor.
27. Double-check the label on reagent bottles carefully before removing any of the contents. Take only as much chemical as you need. The instructor will demonstrate the proper technique for transferring small quantities of chemicals.
28. Never return unused chemicals to their original containers.
29. Use a rubber bulb or pipet pump when you need to fill a pipet.
30. Always handle acids with extreme care. You will be instructed on the proper method for diluting strong acids. Always add acid to water. Be cautious of the heat produced, particularly with highly concentrated acids.
31. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.
32. Never bring reagent bottles and chemicals to your lab station. These must remain in the fume hood or the counter at all times.
33. Be extremely careful when transporting acids and other chemicals. Keep the containers secure and walk carefully.
34. Never touch any chemical that is spilled. Notify the instructor immediately.
35. If a chemical splashes in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 15 minutes. Notify the instructor immediately.
36. Carry glass tubing in a vertical position to prevent breakage and possible injury.
37. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container.
38. Inserting and removing glass tubing from rubber stoppers can be dangerous. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) before attempting to insert it in a stopper. Oftentimes, distilled water will do the trick. Always protect your hands with towels when inserting glass tubing into, or removing it from, a rubber stopper. If a piece of glassware becomes “frozen” in a stopper, ask for assistance.
39. Always make sure that you are using clean glassware. Double-check to make sure that there is no crack or chip.
40. Fill wash bottles only with distilled water.
41. Keep your hands dry when handling electrical equipment. When removing an electrical plug from its socket, grasp the plug, not the electrical cord.
42. Report damaged electrical equipment immediately. Do not attempt to use them.

43. If you do not understand the instructions for equipment use, ask for assistance.
44. Exercise extreme caution when using a gas burner. Take care that anything that can catch fire (e.g., hair, clothing, flammable chemicals, etc.) is kept at a safe distance at all times. Do not put any substance into the flame unless specifically instructed to do so. Never reach over a flame. The instructor will demonstrate how to light a burner.
45. Always turn the burner or hot plate off when not in use.
46. The instructor will demonstrate the proper method of heating and boiling liquids in test tubes. Make sure to point the open end of a test tube being heated away from anyone.
47. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs or heat-protective gloves if necessary. Do not set hot glassware in cold water or bench top; it may shatter.
48. Never look directly into a container that is being heated.
49. Do not place hot apparatus directly on the bench top. Always use an insulating pad. Allow plenty of time for hot apparatus to cool before touching it.
50. When bending glass, allow time for the glass to cool before further handling. Hot and cold glasses have the same visual appearance. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.
51. Notify the instructor immediately in the event of an accident or injury, no matter how trivial it may appear.
52. If you or your lab partner is hurt, immediately get the instructor's attention.

PERSON TO CONTACT IN CASE OF EMERGENCY

NAME _____ TEL. NO. _____

RELATIONSHIP _____

ADDRESS _____

Do you have any allergies? If so, list specific allergies _____

AGREEMENT

I, _____, (student's name) have read and agree to abide by all the safety rules listed in this contract. I understand that I must obey these rules at all times to ensure my and that of my fellow students' and instructor's safety. I will cooperate to the fullest extent with my instructor and fellow students to maintain a safe laboratory environment. I will also carefully follow the verbal and written instructions provided by the instructor. I am aware that any violation of this safety contract that results in unsafe conduct in the laboratory or misbehavior on my part, may result in being removed from the laboratory, receiving a failing grade, and/or dismissal from the course.

Student Signature

Date

New/Hazardous Procedure Approval Form

Submitted by: _____

Lab/Room Number: _____

Lab Supervisor: _____

GENERAL DESCRIPTION OF EXPERIMENT

1. Description of procedure and potential hazards involved (continue on back of form if needed):

2. Hazardous Chemicals Involved:

Can less hazardous or non-hazardous chemicals be substituted? _____

ACTIONS TO ENSURE SAFE OPERATION

1. List all MSDS that have been acquired, reviewed and understood:

2. List personal protective equipment needed for experiment:

3. List specific operational items (good safety practices):

SAFETY PROCEDURES REVIEWED AND APPROVED BY

Staff/Student Signature: _____

Date: _____

Supervisor/Instructor Signature: _____

Date: _____

Department Head Signature: _____

Date: _____

Sample Laboratory Safety Quiz

1. ____ What device should be used if a student pours acid into a beaker and it splashes into their eyes?
A. fume hood B. fire extinguisher C. eye wash station D. fire blanket
2. ____ What safety equipment should the student have used to avoid the accident mentioned in #1 above?
A. eye wash station B. goggles C. safety shower D. fire blanket
3. ____ What piece of equipment should be used when dealing with chemicals that generate dangerous fumes?
A. fume hood B. fire extinguisher C. eye wash station D. fire blanket
4. ____ A student working beside you accidentally gets your notebook on fire. What piece of equipment should you reach for?
A. fume hood B. fire extinguisher C. eye wash station D. fire blanket
5. ____ While trying to put out the fire your sweater catches on fire. What item should your partner use to save you?
A. fume hood B. goggles C. eye wash station D. fire blanket
6. ____ You are safe, but still in a slight state of shock. You knock an entire beaker of acid onto your laboratory partner's pants. What item can be used to save the jeans?
A. safety shower B. goggles C. eye wash station D. fire blanket
7. One of the rules in the laboratory prevents you from wearing loose clothing or jewelry. Why do you think this matters? _____
8. Certain things are never allowed in the laboratory. Check all that are not allowed.

____ Food	____ Laboratory coats	____ Goggles
____ Beverages	____ Horseplay	____ Candy
9. ____ You see on your table an unlabeled beaker filled with clear liquid. This liquid
A. is definitely water, go ahead and drink it.
B. is probably water, drink it anyway. What's the worst that could happen?
C. is a really strong acid. Pour it on your desk and see if it burns through.
D. is unknown. Leave it alone and inform your instructor.
10. ____ The most important thing to have in a laboratory setting
A. is your iPod nano.
B. are beakers and flasks.
C. are Bunsen burners
D. common sense and maturity