STLCC Meramec Campus
Chemical Hygiene Plan

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1.0 Introduction

St. Louis Community College (STLCC) is committed to providing safe learning, teaching and working environments for students, faculty and employees. The safe storage, use and disposal of chemicals in the laboratory require policies for the protection of students, employees, and the environment. The purpose of this chemical hygiene plan (CHP) is to provide the chemical user with basic safety information regarding the use of chemicals. The guidelines set forth in this chemical hygiene plan form the foundation of the safe use of chemicals in the laboratory.

This chemical hygiene plan applies to St. Louis Community College Meramec Campus.

2.0 Responsibilities

It is the responsibility of all administrators, faculty, staff and students to promote safety in the laboratories.

Academic and Administrative Directors

The Dean and respective Department Chairperson(s) have the primary responsibility for the health and safety of the faculty, staff, and students. Specifically members of Chemical Hygiene Committee (STLCCHC) will be selected by the Dean/Department Chairperson(s) from the staff to review and revise annually a Chemical Hygiene Plan (CHP) that include lab-specific guidelines. These individuals are to serve as the hygiene officers of their respective areas and ensure faculty and staff comply with the Chemical Hygiene Plan.

STLCCHC

The St. Louis Community College Meramec Chemical Hygiene Committee (STLCCHC) is responsible for recommending to the Dean the minimum requirements of the CHP that all laboratories must follow. This committee is to be made up of at least one member from each department covered by the plan. Members of the committee will be appointed for two years. This committee will meet at least once a semester, or more frequently, to: review lab incidents, approve permits to use particularly hazardous substances, and collaboratively suggest annual revisions to the CHP. The STLCCHC will review the CHP at least annually.

Faculty and Staff

Faculty and staff in charge of supervising laboratories (referred to as Laboratory Supervisors or instructors throughout this document) are responsible for maintaining compliance with the CHP and each laboratory instructor has the overall responsibility for compliance with the CHP in his or her laboratory. This responsibility may not be shifted to inexperienced or untrained personnel.

Each instructor must assure that anyone entering the laboratory during their lab time: knows and follows the chemical hygiene rules, wears appropriate protective equipment, has been appropriately trained, and unsafe acts, conditions or inadequate facilities are reported. Each laboratory instructor will train lab students in laboratory safety during their first lab class and have each student sign a laboratory accident prevention contract. Individual laboratory users are responsible for planning and conducting each laboratory module in accordance with the standard procedures outlined in this CHP, wearing safety glasses in the laboratory when appropriate, developing good laboratory hygiene habits and reporting unsafe acts or conditions.

Instructors must be in the vicinity of the laboratory while students are working in the lab.

Environmental, Health, and Safety (EHS) Specialist

The EHS Specialist is a resource responsible for working with faculty, staff, students, and others to develop and implement appropriate chemical hygiene practices and procedures. The EHS Specialist will also establish procedures to monitor use and disposal of chemicals used in laboratories, to assure, on a periodic basis that appropriate laboratory chemical hygiene practices are conducted and that records are maintained, help laboratory instructors develop precautions and adequate facilities in addition to knowing the current legal requirements for hazardous materials.

Laboratory Technicians

Laboratory technicians are to: receive and inventory all chemicals entering the storeroom. This group ensures that wastes generated in the laboratory are secured, for safety reasons, in the storeroom each day. They monitor procurement of extremely hazardous and less hazardous bulk volume chemicals used in the labs and provide information to the Chemical Hygiene Committee (STLCCHC) as requested.

These employees: flush eyewash stations once per week, ensure spill kits are available, and maintain a log of usage. Laboratory technicians also maintain the following records: updated records of chemicals stored in the lab including amounts and dates of procurement, waste inventories,(M)SDS for incoming chemicals, and peroxide tests of hazardous peroxide-forming materials.

Physical Plant (Maintenance)

In general, lab employees are responsible for the daily maintenance of their areas. Maintenance workers are not expected to be present in lab areas on a daily basis. Maintain records on, repair, and inspect the following safety equipment: Fume hoods, Eyewash stations, Safety showers, Fire Blankets, and Fire extinguishers. A week notice, when possible, of non-emergency water, steam, and electrical outages needs to be arranged.

The scope of cleaning by custodial workers should be limited to floors, windows, blackboards / dry erase boards, and the removal of non-hazardous trash. Cleaning of counters and shelves should be conducted by lab employees.

Departments, the Environmental Health and Safety Specialist, and the employees are all responsible for the safety of outsiders in the lab areas. Lab Supervisors shall assure that contractors are informed of the hazards in the lab and that precautions have been taken to protect the contractors against any hazards present.

Students

Students must: follow all health and safety standards and rules set forth by this Chemical Hygiene plan and the Laboratory Supervisors. Students are to:

- *Wear or use prescribed protective eq*uipment;
- Report any lab-related injuries or illness to the Laboratory Supervisor and seek treatment immediately by contacting Campus Police;
- Refrain from the operation of any equipment or instrumentation without proper instruction and/or authorization;
- Request information and training when unsure how to handle a hazardous chemical or procedure; and,
- Indicate by their signature that they have read and understood the Chemical Hygiene Plan and are willing to comply with its tenets to the best of their ability.

3.0 Standard Operating Procedures

Below are rules and procedures for chemical and physical hazards commonly found in St. Louis Community College Meramec laboratories. These procedures define the minimum prudent handling and use rules permitted at the College. Adherence to the procedures by all St. Louis Community College lab users is mandatory. It is the responsibility of the laboratory instructor of each laboratory to review the procedures and assure that the protective equipment and procedures outlined are in place.

3.1 General Rules and Procedures

- Minimize all chemical exposures
- Potential hazardous reactions caused by mixing chemicals in laboratory modules will minimally be checked against either: the reactivity chart in Appendix C, *Bretherick's Handbook of Reactive Chemical Hazards,* or against an electronic database such as Cameo Chemicals (**http://cameochemicals.noaa.gov**/). Safeguards against reactions must be in place prior to performing the module.
- Lab coats are not to be worn outside of the laboratories to prevent the chance of contaminating non-lab areas
- Skin contact with chemicals should be avoided
- Wear appropriate eye protection at all times. Safety glasses must be worn any time chemicals, glassware or heat are used in the laboratory
- Promptly clean up small spills (less than 100 ml) using appropriate protective apparel and equipment
- Never allow practical jokes or other behavior which might confuse, startle or distract another person
- Do not leave operations unattended
- As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of 50 ppm or less
- Ensure floors are clean and dry
- Keep all aisles, hallways, and stairs, and exits free of obstructions.
- Access to emergency equipment, utility controls, showers, eyewashes and exits should never be blocked
- Wastes and broken glassware should be kept in appropriate containers and labeled properly.
- Any unlabeled container must be labeled if it is not under direct supervision
- Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made; keep materials stored in hoods to a minimum and do not place materials along the back along the baffles
- Do not discharge to the sewer anything without a permit- Check with EHS Specialist about what is permitted to be discharged to the sewer
- Never use flammable or combustible materials near any source of ignition, spark or open flame.
- Never perform a first-time chemical demonstration in front of your class. Always perform first-time demonstrations in front of other instructors to evaluate the safety of the demonstration
- Only allow authorized personnel in the chemical/biological storeroom.
- Know the locations for all personal safety and emergency equipment, eye wash, shower, fire extinguisher and spill control materials
- Train all students on how to use all safety devices in the laboratory (i.e. eyewash, shower, etc.) and teach all students and employees to find the safety devices quickly in an emergency
- Do not smell or taste chemicals
- Read all chemical labels prior to use
- Know and understand the hazards of the chemical as stated in the (M)SDS and other references
- Know how to properly store all chemicals in their compatible chemical families
- Know proper disposal procedures for chemicals

- Use hazardous chemicals and all laboratory equipment only as directed or for their intended purpose
- Inspect equipment, apparatus, personal protective equipment, etc. for integrity or proper functioning before use. Do not use damaged equipment. Malfunctioning laboratory equipment should be labeled or tagged “out of service” so that others will not inadvertently use it before repairs are made
- Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur

3.2 Personal Hygiene Guidelines

- Remove contaminated clothing and gloves before leaving the laboratory
- Wash hands before leaving the laboratory
- Avoid direct contact with any chemical. Keep chemicals off your hands, face, and clothing, including shoes. Never, smell, inhale or taste a chemical. Wash thoroughly with soap and water after handling any chemical
- Do not eat, drink, chew, or use tobacco or cosmetic products in the laboratory or storeroom.

3.3 Particularly Hazardous Substances

When laboratories require the use of Particularly Hazardous Substances (allergens, embryotoxins, carcinogens, pyrophorics, etc), additional special precautions shall be implemented and documented on a permit as deemed necessary by the Chemical Hygiene Committee. Alternate chemicals should be substituted whenever possible. Faculty will assist in substituting experiments that do not require such chemicals if possible. All questions regarding the use of the permit system should be addressed to the Dean. Minimally the Dean and the committee members of the effected department must sign the permit prior to acquiring the substance.

Particularly hazardous substances are defined to include select carcinogens, reproductive toxins and substances that have a high degree of acute toxicity (such as cyanides and dimethyl mercury).
Select carcinogens include any substance that is included on any of the following lists of carcinogens:

- **OSHA Carcinogen List**
- **Annual Report on Carcinogens** published by the National Toxicology Program (NTP), including all of the substances listed as "known to be carcinogens" and some substances listed as "reasonably anticipated to be carcinogens"
- **International Agency for Research on Cancer** (IARC), including all of Group 1 "carcinogen to humans" and some in Group 2A or 2B, "reasonably anticipated to be carcinogens"
- **Reproductive toxin** includes any chemical that may affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

3.3.1 Working with Allergens and Embyrotoxins (special precautions)

- Suitable gloves to prevent hand contact shall be worn when exposed to allergens or substances of unknown allergen activity
- Women of child-bearing age will handle embryotoxins only in a hood with confirmed satisfactory performance and will use protective equipment to prevent skin contact.
- Embyrotoxins will be stored in adequately ventilated areas in unbreakable secondary containers.
- The EHS Specialist and dean will be notified of spills and other exposure incidents. A physician will be consulted when appropriate.

3.3.2 Working with Chemicals of Moderate Chronic or High Acute Toxicity (special precautions)

- The chemicals and hood shall be labeled with special warning signs.
- Gloves and long sleeves shall be worn. Hands and arms will be washed immediately after working with these chemicals.
- Two people will always be present during work with these chemicals.

3.3.3 Working with Chemicals of High Chronic Toxicity (special precautions)

- All transfer and work with these substances shall be in a designated area.
- Approval of the dean will be obtained before use.
- Any contaminated equipment or glassware will be decontaminated in the hood before removing them from the designated area.
- For powders, a wet mop will be used for cleanup, and all materials used will be disposed of as hazardous waste.
- The designated area will be marked with warning signs while the work is being conducted.
- Containers will be stored in a ventilated, limited access area in labeled, unbreakable, chemically resistant, secondary containers.

3.3.4 Working with Biologicals (Animals) with Chemicals of High Chronic Toxicity (special precautions)

- Large scale studies will not be permitted. Special precautions approved by the Chemical Hygiene Committee will be followed and approved by the Dean.
- The substance being tested will be administered by injection or lavage and not by diet.
- Plastic or rubber gloves and fully buttoned lab coats will be worn while working with live animals.

3.3.5 Working with Highly Reactive Materials: Pyrophoric Substances (special precautions)

Pyrophoric materials are liquids (such as some organometallics) or solids (such as Phosphorus) which ignite spontaneously on contact with air. These chemicals react with oxygen in the air, moisture in the air, or both. Training is the key to safely working safely with these materials. Those using pyrophoric materials must be proficient in their handling and must not work with these materials alone or during off hours.

- Read the relevant Material Safety Data Sheets ((M)SDS) and technical bulletins to understand how to mitigate hazards. The (M)SDS should be reviewed before using an unfamiliar chemical and periodically as a reminder
- Know the location of the eyewash, shower, fire extinguishers, fire alarm pulls, and emergency exits
- Always wear appropriate personal protective equipment. Use a non-combustible lab coat, goggles / face shield, and gloves
- Always minimize the quantities of pyrophoric chemicals stored in the laboratory.
- Be especially vigilant when working with tertiary-butyl lithium, which is extremely pyrophoric
- Pyrophoric materials should be stored under an atmosphere of inert gas or kerosene, as appropriate. Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while the material is stored
- Do not store pyrophoric materials with flammable materials or in a flammable-liquids storage cabinet. A nitrogen-filled dessicator is a suitable storage location
- If pyrophoric materials are received in specially designed containers (such as Sure/Seal™ bottles), ensure that the integrity of the original container is maintained in use and storage

- Remove all excess and nonessential chemicals and equipment from the fume hood where pyrophoric materials will be used. Keep all combustible materials, including paper towels and Kimwipes, away from pyrophoric reagents
- Transfer pyrophoric materials with a glass syringe. After flushing the syringe with inert gas, depress the plunger and insert the syringe into the Sure/Seal™ bottle with the tip of the needle below the level of the liquid
- Secure the syringe so if the plunger blows out of the body, the contents will not impact anyone (aim it toward the back of the hood)
- Insert a needle from an inert gas source carefully keeping the tip of the needle above the level of the liquid
- Gently open the inert gas flow control valve to slowly add inert gas into the Sure/Seal™ bottle. This will allow the liquid to slowly fill the syringe (pulling the plunger causes gas bubbles). It is better to do multiple transfers of small volumes than attempt to handle larger quantities
- Let inert gas pressure push the plunger to reduce bubbles. Excess chemical and entrained bubbles mat then be forced back into the reagent bottle
- The desired volume of reagent in the syringe should then be transferred to the reaction apparatus
- Never return excess material to the original container. Small amounts of impurities may be introduced into the container and cause a fire or explosion.

Failure to follow proper handling procedures can result in fire or explosion, leading to serious injuries/death or significant damage to facilities. Good technical guidance can be found in Aldrich Technical Bulletins AL-134 and AL-164.

3.3.6 Working with Highly Reactive Materials: Water-Reactive Substances (special precautions)

Water-reactive materials are liquids and solids (such as Sodium, Potassium, Calcium, and Lithium metals) which ignite or release gas on contact with water. Training is the key to safely working safely with these materials. Those using highly water-reactive materials must be proficient in their handling and must not work with these materials alone or during off hours. Read the relevant Material Safety Data Sheets (MSDS) and technical bulletins to understand how to mitigate hazards. The (M)SDS should be reviewed before using an unfamiliar chemical and periodically as a reminder.

- Know the location of the eyewash, shower, fire extinguishers, fire alarm pulls, and emergency exits
- Always wear appropriate personal protective equipment. Use a non-combustible lab coat, goggles / face shield, and gloves
- Always minimize the quantities of water-reactive chemicals stored in the laboratory
- Water-reactive materials should be stored under an atmosphere of inert gas or kerosene, as appropriate. Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while the material is stored
- Remove all excess and non-essential chemicals and equipment from the chemical fume hood where water-reactive chemicals will be used. Keep all combustible materials, including paper towels and Kimwipes, away from water-reactive reagents.

3.3 Review of Safety Procedures

Individuals working in the laboratory should not proceed with what seems to be a familiar task. Hazards may exist that are not fully recognized. Certain indicators (procedural changes) should cause the person to stop and review the safety aspects of their procedure. These indicators include:

- A new procedure, process or test, even if it is very similar to older practices.
- A change or substitution of any of the ingredient chemicals in a procedure.
- A substantial change in the amount of chemicals used (scale up of experimental procedures); usually, one should review safety practices if the volume of chemicals used increases by 200%.
- A failure of any of the equipment used in the process, especially safeguards such as chemical hoods.
- Unexpected experimental results (such as a pressure increase, increased reaction rates, unanticipated byproducts). When an experimental result is different from the predicted, a review of how the new result impacts safety practices should be made.
- Chemical odors, illness in the laboratory staff that may be related to chemical exposure or other indicators of a failure in engineered safeguards.

The occurrence of any of these conditions should cause the laboratory employee to pause, evaluate the safety implications of these changes or results, make changes as necessary and proceed cautiously.

3.4 Personal Protective Equipment (PPE) /Clothing

Personal protective devices are to be used only where engineering and administrative controls cannot be used or made adequate, or while controls are being instituted.

Engineering and administrative controls to reduce or eliminate exposures to hazardous chemicals include:

- **substitution** of a less hazardous substance
- **substitution** of less hazardous equipment or process (e.g., safety cans for glass bottles)
- **isolation** of the operator or the process
- **local and general ventilation** (use of fume hoods)

The (M)SDS will list the personal protective equipment recommended for use with the chemical. The MSDS addresses "worst case" conditions. Therefore, not all of the equipment shown may be needed for a specific job.

Personal protective equipment (PPE) should be selected on a task basis and checked to ensure it is in good condition prior to use.

3.4.1 Respirators

Respirators are designed to protect only against specific types of substances and in certain concentration ranges, depending on the type of respirator used. Never use a respirator unless you have been assigned one, have been trained, and fit tested.

Respirator selection is based on the hazard and the protection factor required. Respirators shall be selected and used in accordance with the requirements outlined in 29 CFR 1910.134.

Types of respiratory protective equipment include:

- particle-removing air purifying respirators (N95, N100)
- gas and vapor-removing air purifying respirators
- air supplied respirators

Training is required on the limitations of each type of respiratory protective equipment used and the signals for respirator failure (odor breakthrough, filter clogging, etc.).
Respirators are not to be used except in conjunction with the written respiratory protection program.

3.4.2 Eye Protection

Eye and face protection must be worn whenever its use will reduce or eliminate injury. It is mandatory that eye protection be worn in the laboratory whenever chemicals, heat and/or glassware are in use.
The need for adequate eye protection is fundamental to the use of chemicals, including housekeeping materials such as wax strippers, detergent and toilet bowl cleaners, and operations such as grinding, drilling, and sawing with power tools. Eye protection, and at times face protection, is required wherever the potential for eye injury exists. Areas where eye protection must be worn are laboratories, jewelry and ceramics, and machine shops or any area where active or automated work with chemicals is conducted. Eye protection is required for all personnel and visitors in these areas. No personnel may enter laboratories where chemicals are being handled or automated processes are in operation without eye protection.

Ordinary (street) prescription glasses do not provide adequate protection. (Contrary to popular opinion these glasses cannot pass the rigorous test for industrial safety glasses.) Adequate safety glasses must meet the requirements of the standard Practice for Occupational and Educational Eye and Face Protection (ANSI Z87.1-2003) and must be equipped with side shields.

Safety glasses with side shields do not provide adequate protection from splashes, therefore, when the potential for a splash hazard exists, other eye protection and/or face protection must be worn.
Splash goggles (acid goggles) with splash proof sides or a face shield should be used when protection from a chemical splash is needed.

Face shields afford protection to the face and neck. Face shields should be worn if there is an explosion or implosion (pressure or vacuum) hazard and when transferring cryogenic liquids.
Special eye protection is available for protection against laser, ultraviolet (UV), welding and brazing, or intense light sources.

Eye protection must be made available when the potential for eye injury exists.

3.4.3 Gloves

Before each use, gloves should be checked for integrity. Reusable gloves should be washed prior to removal whenever possible to prevent possible skin contamination.

Disposable nitrile gloves provide adequate protection against accidental hand contact with small quantities of most laboratory chemicals. These gloves provide a non-chemical resistant barrier between the worker's hand and the reagent. Lab workers who contaminate their gloves should immediately remove them, wash their hands and don new gloves. Gloves should not be worn outside of the lab.

The selection of the proper glove requires knowledge of the health and physical hazards of the chemical that is used; familiarity with the glove manufacturer's test data (permeation rate and breakthrough time) and the length of the hand exposure. (See Appendix I)

3.4.4 Aprons/Lab Coats

Chemical resistant aprons are available in various labs. Aprons and lab coats should not be worn outside of the lab.

3.5 Personal Contamination and Injury

General Information
Do what is necessary to protect life. Remain calm. The (M)SDS for the chemical will contain special first aid information.

Do not move an injured person unless they are in further danger. A blanket should be used immediately to protect the victim from shock and exposure. Get medical attention promptly by calling:

- Campus Police 314-984-7667
- 911
- Poison Information Center 1-800-222-1222

For specific instruction regarding personal contamination, contact your supervisor, instructor, or EHS Specialist.

Chemicals Spilled Over a Large Area of the Body
Quickly remove all contaminated clothing, especially the shoes, while using the safety shower or other available source of water. Immediately flood the affected body area in cold water for at least 15 minutes. Wash off chemical with water but do not use neutralizing chemicals, unguents, creams, lotions, or salves.
Get medical attention promptly.

Chemicals on the Skin in Confined Areas
Immediately flush with cold water. If there is no visible burn, scrub area with warm water and soap. Remove all jewelry to facilitate removal of any residual material. If a delayed action is noted (often the next day), report immediately for medical attention and explain carefully what chemicals were involved.
If there is any doubt, seek immediate medical attention.

Chemicals in the Eyes
Irrigate with plenty of cool water for at least 15 minutes. Simultaneously, check for and remove contact lenses.

Smoke and Fumes
Anyone overcome with smoke or chemical fumes should be removed to uncontaminated air and treated for shock. Contact campus police. If trained, begin CPR protocols (Note: Campus police is trained on CPR). Get medical attention promptly.
Do not enter the area if a life threatening condition still exists, such as the presence of:

- oxygen depletion
- explosive vapors
- cyanide gas, hydrogen sulfide
- nitrogen oxides, carbon monoxide

Burning Clothing
Extinguish burning clothing by dousing with cold water, use the safety shower, or the drop-and-roll technique as appropriate. Remove contaminated clothing. If possible, send clothing with the victim. Wrap injured person to prevent shock.
Get medical attention promptly.

Ingestion of Hazardous Chemicals
Identify the chemical ingested and Call 911 and Campus Police (314-984-7667). If instructed by local emergency personnel (911), call poison control 1-800-222-1222. Wrap the injured person to prevent shock.
Provide the ambulance crew and physician the chemical name and any other relevant information.

Chemical Spill and Accident Procedures

General Information
Chemical spills will inevitably occur in the lab and staff should be properly trained to recognize hazards associated with the spill, mitigate the spill within their ability, and to notify response authorities where necessary. Initial response to a spill shall always be to evacuate the immediate area until the scope of the hazard is assessed.

Small spills, less than 100 ml that do not pose a fire, toxic, or reactive hazard, may be cleaned up by laboratory staff. Use an absorbent material that will neutralize the spill if available.

A spill kit should be used and gloves and goggles should be worn during the cleanup. Decontaminate area with soap and water after clean-up. Place residue in a labeled container for waste collection and notify the EHS Specialist.

No staff member shall respond to a chemical spill unless they are properly trained to do so. All lab staff must be trained to recognize hazardous conditions associated with spills in the laboratory.

Hazardous Spills
The following compounds are very hazardous. You should not clean them up yourself.

- aromatic amines
- nitro compounds
- bromine
- mercury
- ethers
- carbon disulfide
- hydrazine
- cyanides
- nitriles
- organic halides

If a large spill of hazardous or unknown material is observed, immediately evacuate the surrounding area and contact a responsible party for your department. If, in the judgment of the individual, the spill may be life threatening, immediately pull a fire alarm to initiate building evacuation and proceed to the nearest safe location and contact campus police via a telephone's PANIC button to advise them of the situation. Campus police will contact the appropriate response authorities.

3.6 Fire and Related Emergencies

If you discover a fire or fire-related emergency, such as abnormal heating of material, hazardous gas leaks, hazardous material or flammable liquid spill, smoke, or odor of burning, immediately follow these procedures: Activate the building alarm (fire pull station);

- Shut down equipment in the immediate area (if possible)
- Close doors to isolate the area and evacuate the building
- Contact campus Police and 911 from a safe location
- Use a portable fire extinguisher to: assist oneself or another to evacuate, or control a small fire, if possible. (Never put oneself in harm's way!)

Identify yourself as the person who notified the authorities and provide the fire and police teams with the details of the problem upon their arrival. Special hazard information you may know is essential. If the fire alarms are ringing in your building:

- Evacuate the building.
- Move away from the building to a designated area/rally point.
- Stay clear of driveways, sidewalks and other means of access to the building.

Do not reenter the building until directed to do so.

3.7 Electrical Safety

The hazards associated with the use of electricity include electrical shock and electrical fires caused by shorts and overloaded circuits or wiring. In addition, sparks from electrical equipment can serve as an ignition source for flammable or explosive vapors or combustible materials. Most incidents are a result of unsafe work practices, improper equipment use, and faulty equipment. Adherence to the following rules and procedures can significantly reduce the electrical hazards one might encounter:

- Never obstruct electrical panels and disconnect switches. These should be clearly labeled to indicate what equipment or power source they control. **A minimum 3-foot clearance must be maintained around electrical panels at all times to permit ready and safe operation and maintenance of such equipment**
- **Do not overload circuits or wiring.** Overloading can lead to overheated wires and arcing, which can cause fires and electrical shock injuries
- Inspect all electrical equipment (hot plates, stirrers, ovens, extension cords, etc.) before use to ensure that cords and plugs are in good condition—not worn, twisted, frayed, abraded, corroded, or with exposed wires or missing ground pins. Live parts must be effectively insulated or physically guarded. Equipment with damaged or defective cords or plugs should be taken out of service immediately and repaired by qualified personnel
- Ensure that all electrical outlets have a grounding connection requiring a three-pronged plug. All electrical equipment should have three-pronged, grounded plugs or be double-insulated
- Electrical outlets, wiring, and other electrical equipment integral to the building may only be serviced and repaired by Facilities Operations qualified trades personnel or other qualified electricians
- Work on electrical equipment must be done only after the power has been disconnected. On cord and plug connected equipment, the power cord must be unplugged and under the exclusive control of the person performing the work so that the equipment cannot be accidentally turned on by someone else. On hard-wired equipment, the main disconnect device or circuit breaker must be shut off and locked and tagged with a special padlock and tag**. Service and/or repair work on hard-wired equipment may only be carried out by authorized individuals who have received Lockout/Tagout training**
- Limit the use of extension cords—they are for temporary, short-term use only. In all other cases, request the installation of a new electrical outlet. Do not use extension cords as substitution for fixed receptacle outlets
- Ensure that all extension cords used are carefully placed, visible, and not subject to damage. Cords must not run across aisles or corridors where they might be damaged or create a tripping hazard. Cords must not run through doors, walls or partitions, under rugs, or above dropped ceilings. They must not be tied in knots, draped overhead, or attached to walls.
- **Ensure that the wire size of an extension cord is adequate for the current to be carried**. Failure to do so can lead to electrical fires. Cords used for 110-120 volt service should be UL listed with a polarized three prong plug. Extension cords must never be linked together—use the proper length extension cord needed for the application
- Keep corrosive chemicals and organic solvents away from electrical cord—these can easily erode the insulation on wires
- Keep electrical equipment away from wet or damp locations or potential water spillage, unless specifically rated for use under such conditions.
- Never handle electrical equipment when hands, feet, or body are wet or perspiring or when standing on a wet floor.
- In an electrical emergency, if a person received an electrical shock, do not touch the equipment, cord or person. **Campus Police so that the Fire Department can be contacted to treat the injured person and evaluate the situation.** If safe and possible, shut down the main power source.

3.8 Chemical Storage Rules and Procedures

3.8.1 General

- Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved. No container should be accepted without an adequate identifying label. All chemicals shall be opened in the chemical storeroom by trained personnel
- When chemicals are hand carried, the container should be placed in an outside container or bucket
- Keep an updated inventory of all chemicals, their amounts and location
- Stored chemicals should be examined annually for replacement, deterioration and chemical integrity
- All chemicals should be stored in chemically compatible families
- Store the minimum amount of chemicals needed
- Store corrosives in appropriate corrosives cabinets
- No flammable materials should be stored outside flammable cabinets unless in safety cans or in explosion proof refrigerators designed for the storage of flammable materials
- Do not store chemicals in fume hoods
- Avoid storing chemicals on shelves above eye level. Corrosives, toxic, and flammable liquids are not to be stored above 4.5'
- The storage area and cabinets should be labeled as to identify the hazardous nature of the products stored within
- Shelving sections should be secured to walls or floor to prevent tipping of entire sections
- Chemicals should not be stored on the floor except in approved shipping containers
- Never store food in a laboratory refrigerator
- Only authorized personnel are allowed in the chemical storage area unless under direct supervision
- Exposure to heat or direct sunlight should be avoided

3.8.2 Labeling

General
A label is any written, printed, or graphic material displayed on, or affixed to, containers of chemicals.
Labels or other forms of hazard warnings, such as tags or placards, provide immediate warning of potential danger. They are used to warn of a variety of potential physical hazards, or health hazards.

Existing labels on new containers of chemicals or containers in storage shall not be removed or defaced.

Employees and students should not work with any chemical from an unlabeled container. However portable containers intended for the immediate use, by the employee or student performing the transfer, do not need to be labeled provided the container is in the control of the student or employee throughout the transfer and the material is not stored (Held for more than an 8 hour shift) . The labeling requirement does not apply to students assigned unknown chemicals for analysis however a mark with corresponding hazard information should be provided with all unlabeled chemicals in student laboratories in case of emergency.

Carefully read all the information on the label. If you do not understand something, contact your supervisor or instructor for an explanation or request the (M)SDS.

Follow the rule: **IF YOU MAKE IT, YOU LABEL IT!** Minimum labeling requirements for stock chemicals that will not leave the laboratory include:

- The name of the chemical(s),
- Hazards,
- The preparation date

3.8.3 (MS)DS Sheets

The material safety data sheet (MSDS) is the hazard communication tool that provides details on all important aspects of chemical use, handling, and storage. Review both the appropriate procedure and the MSDS when working with a chemical for the first time or when training staff. The OSHA Hazard Communication standard (29 CFR 1910.1200) requires manufacturers to provide (M)SDSs at no cost.

Safety data sheets that are received with incoming shipments of hazardous chemicals must be retained and be readily accessible to laboratory employees and students.

3.9 Hazardous Chemicals

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.

Acute exposure refers to an intense exposure over a relatively short period of time.

Chronic exposure refers to a prolonged exposure occurring over a period of days, weeks or years.

Routes of Entry into the Body
Route of exposure describes the way the chemical enters the body. Chemicals may have serious effects by one route, and minimal effects by another. Hazardous chemicals may enter the body by:

- ***Inhalation*** - absorption through the respiratory tract
- ***Absorption*** through the skin via dermal contact
- ***Ingestion*** - absorption through the digestive tract - (Ingestion can occur through eating or smoking with contaminated hands or in contaminated work areas)
- ***Injection*** - Introducing the material directly into the bloodstream - (Injection may occur through mechanical injury from "sharps")

In the laboratory the primary routes of chemical exposure is through inhalation and dermal contact. Working in a laboratory with good general ventilation and using a chemical fume hood can prevent inhalation exposures. Wearing appropriate chemical protective clothing prevents dermal contact. Good hygiene habits, such as regular washing your hands, and using tongs or other tools to pick up sharp objects, will prevent exposure through ingestion or injection.

3.9.1 Chemical Toxicology & Symptoms

Some symptoms of chemical toxic exposure include:

- irritation, coughing, choking, tight chest, shortness of breath
- nausea, vomiting, diarrhea
- back pain, urinating more or less than usual
- headache, dizziness, behavior confusion, depression, coma, convulsions
- anemia (tiredness, weakness)
- rashes, itching, redness, swelling or burning sensation

3.9.2 Permissible Exposure Limits (PEL); Threshold Limit Value (TLV)

Permissible Exposure Limits (PEL)
OSHA sets enforceable permissible exposure limits (PELs) to protect workers against the health effects of exposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a substance in the air. They may also contain a skin designation.

PEL may be either a time-weighted-average (TWA) exposure limit (8 hour), a 15 minute short term exposure limit (STEL), or a ceiling (C).

Threshold Limit Value (TLV)
TLVs are airborne concentrations of substances devised by the ACGIH that represents conditions under which it is believed that nearly all workers may be exposed day after day, with no adverse effect. TLVs are advisory exposure guidelines, not legal standards, which are based on evidence from industrial experience, animal studies, or human studies when they exist.

TLV may be either a time-weighted-average (TWA) exposure limit (8 hour), a 15 minute short term exposure limit (STEL), or a ceiling (C).

3.11.3 Toxic Chemicals

- Poisons
- Carcinogens
- Teratogens/Reproductive Hazards
- Heavy Metals
- Mutagens

Generally, when the volatile chemical has a threshold limit value, TLV, or permissible exposure limit, PEL, of 50 ppm or less an approved fume hood or other containment should be used.

3.11.4 Flammable Chemicals

In general, the flammability of a chemical is determined by its ***flash point***, the lowest temperature at which a liquid gives off enough vapor to form an ignitable mixture and burn when a source of ignition (sparks, open flames, cigarettes, etc.) is present.

Flammable substance can fall into one of the following categories:

- Aerosol
- Gas
- Liquid
- Solid

An ***ignitable waste*** is a liquid or compressed gas waste that has a flash point of less than 140^{o}F

A ***combustible liquid*** is defined by the DOT and NFPA, as any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), or liquids that will burn. They do not ignite as easily as flammable liquids. However, combustible liquids can be ignited under certain circumstances, and must be handled with caution. Substances, such as wood, paper, etc., are termed "Ordinary Combustibles".

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.

Some flammable chemicals include organic solvents, alcohols and acetone.

Flammables/Ignitable wastes must be stored in flammable cabinets. Vapors of flammable liquids are heavier than air and can travel along bench tops and down drain troughs. Keep sources of ignition away from any flammables/ignitable and use adequate ventilation. Have a fire extinguisher in the near vicinity.

3.11.5 Reactive Chemicals

Reactivity is a substance's susceptibility to undergoing a chemical reaction or change that may result in dangerous side effects such as explosion, burning, and corrosive or toxic emissions. The conditions that cause the reaction, such as heat, other chemicals and dropping, will usually be specified as "Conditions to Avoid" when a chemical's reactivity is discussed on a (M)SDS.

Some reactive chemicals include organic peroxides, ethers, oxidizers, explosives and water reactive and air sensitive materials. The user should be familiar with the (M)SDS before using the reactive substance. Disposal of reactive chemicals generally requires prior treatment to render the chemical less hazardous. .

Ethers are particularly prone to forming explosive peroxides and must be tested every 6 months. Most manufactures recommend ether's shelf life of not more than one year.

3.11.6 Corrosive Chemicals

A corrosive chemical is a substance that causes visible destruction or permanent changes in human skin tissue at the site of contact or is highly corrosive to steel. Corrosive wastes will; have a PH at or below 2 or at or above 12.5.

Corrosive chemicals include strong acids and bases. Corrosive chemicals can be irritants and allergic sensitizers. Personal protective equipment **MUST** be used when working with corrosive substances to protect skin, eyes and the respiratory tract from vapors. Always add corrosives to water to prevent overheating and spattering. Spills must be cleaned up immediately. Corrosive chemicals shall be neutralized before disposal. Corrosives must be stored in corrosive cabinets, separating acids from bases.

3.11.7 Compressed Gases

Compressed gas cylinders can be extremely hazardous when misused or abused. Compressed gas cylinders can present a variety of hazards due to their pressure and/or content. Without proper use and care compressed gas cylinders can explode or become flying projectiles when cylinder valves are damaged or broken off.

All gas cylinders at St. Louis Community College must:

- Be equipped with the correct regulator
- Secured at all times with appropriate chains or straps (2)
- Segregated in hazard classes while in storage
- Oxygen separated from flammable gases
- Empty cylinders isolated from filled cylinders
- Protective cap on cylinder when being transported

3.12 Chemical Waste Disposal Program

General Information, Responsibility and Liability

The Resource Conservation and Recovery Act (RCRA) establishes a "cradle to grave" hazardous waste management system, which is administered by the U.S. Environmental Protection Agency (EPA). This system provides for managing, tracking, and regulating wastes at each step of the way, from generation to final disposal. The regulations by the EPA/MO DNR apply to those who generate, transport, treat, and

dispose of hazardous wastes. It is the responsibility of each person on campus, generating hazardous waste to fully understand and comply with the College's Hazardous Waste Management Program.

3.12.1 General

A general guide when using chemicals is to reduce, reuse and recycle. Each laboratory employee should contact the EHS Specialist to find out how to dispose of particular chemicals in their lab. Chemicals are not to be disposed of through the sewer system unless allowed by permit issued by MSD (Metropolitan Sewer District).

3.12.2 Hazardous Waste

St. Louis Community College Meramec is considered a Small Quantity Generator (SQG) which produces more than 220 pounds (100 kg) of non-acute hazardous waste within any calendar month or no more than 2.2 pounds of acute hazardous waste in any month.

St. Louis Community College is dedicated to disposing of chemicals in a safe and environmentally conscious way. Any waste material that may, upon contact, present a hazard to one's health or surrounding environment should be treated as a potentially hazardous waste. This includes spent or unused chemicals, cleaning solutions, oils, etc.

A chemical waste lab management plan under 40 CFR 262 Subpart K has been prepared. Waste in laboratories are to be labeled and disposed of to this plan.

3.12.3 Biological, Pathological and Medical Waste Management

St. Louis Community College produce biological, pathological, or medical waste. Protocols outlined in the College Blood borne Pathogen Exposure Control Plan must be followed to safely dispose of biological or blood borne pathogens and sharps. The following procedures will be followed for packaging biological, pathological and medical waste disposal:

Sharps

- All sharps, including but not limited to needles, syringe, lancets and blades, shall be disposed of in one time use sharps containers
- When a sharps container is full it shall be placed in the MedAssure Package

Red Biohazard Bags

- Biohazards such as blood or bodily fluids cleaned up by the custodial staff shall be placed in a red biohazard bag
- All biohazard bags shall be placed in the MedAssure Package

Medical Waste

- All medical waste shall be placed in red biohazard bags
- All biohazard bags shall be placed in the MedAssure Package

These wastes are regulated by the Department of Transportation as UN3291 Regulated Medical Waste. This waste is picked up through Med Assure. Follow the package instructions for filling the Med Assure tub. If DOT certified, function specific Regulated Medical Waste, you may sign for the pick-up of these materials. Access to the electronic manifest system will be requested after completion of DOT training.

3.13 Laboratory Facility

Each laboratory facility shall have the following:

- An appropriate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air
- Fire extinguishers
- Laboratory hoods and sinks where applicable
- Safety equipment including eyewash fountains and safety showers where applicable
- Spill control equipment

3.14 Room Signs

Prominent signs and labels of the following types should be posted:

- Emergency telephone numbers of emergency personnel/facilities
- Location signs for safety showers, eyewash stations, spill equipment, and other safety and first aid equipment
- Warnings at areas or equipment where special or unusual hazards exist

3.15 Safety Equipment Inspection

Fume hoods, eyewashes and safety shower/drenches, fire extinguishers and other safety equipment shall be inspected on a routine basis. Fire extinguishers shall be inspected by STLCC Facilities Maintenance personnel who shall maintain inspection and service records.

Fume hoods
Capture velocity will be tested every 12 months by a qualified person using appropriate test methods. The minimum average capture velocity for fume hoods shall be an average of 80 linear feet per minute at the face of the hood with the sash at the operating height using at least three measurements. Certification of hood velocity and the height the sash was tested at will be posted on each hood. The flow alarm, if present on the hood, will be inspected and calibrated by a qualified person on the frequency specified by the manufacture or at least biennially whichever is sooner. At least every 2 years; the sash counterweight system, and baffle control system will be inspected.

Safety Showers and Eye Washes
Emergency eyewash stations will be flushed for operability by the laboratory technicians at least weekly. Safety showers will be flushed monthly by facilities staff. Facilities will inspect the mechanical components at least every six months. Any repairs will be made under facilities work order.

Spill Kits
Spill kits will be inspected for missing supplies and degrading PPE at least once a semester before students are allowed to perform experiments in the lab by the laboratory technicians.

First Aid Kits
First aid kits will be inspected for missing supplies and expired supplies at least once a semester before students are allowed to perform experiments in the lab by the laboratory technicians.

Fire Extinguishers and Blankets
Fire extinguishers will be inspected for pulled pins, pressure, corrosion, and blocked nozzles monthly by facilities personnel. A qualified contractor will also inspect the extinguishers annually. The inspections will be documented on the fire extinguisher tag.

3.16 Recordkeeping

- Incident records should be written and retained by the EHS specialists
- The EHS specialist shall establish and maintain an accurate record of any measurements taken to monitor employee exposure to hazardous chemicals in the laboratory
- Medical records shall be maintained by the Human Resources Department Workers Compensation representative for at least the duration of employment plus thirty (30) years, for each employee with occupational exposure
- Training records shall include the dates of the training sessions and contents (or a summary) of the training. The training records shall be maintained for three (3) years from the date on which the training occurred. These files will be maintained by the EHS specialist.

4.0 Employee Training and Information

Faculty and staff shall provide employees and students with information and training to ensure that they are apprised of the hazards of chemicals present in the laboratory area.

Such information shall be provided at the time of an initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations.

Employees and students shall be informed of:

- The contents of this CHP
- The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory
- The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

Training shall include:

- Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.)
- The physical and health hazards of chemicals in the work area
- The measures to take in order to protect themselves from these hazards, including specific procedures implemented to protect from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used
- The applicable details of the employer's written Chemical Hygiene Plan

4.1 Notice to Employees

Employee Rights
Employees who may be exposed to hazardous chemicals have access to the following information where appropriate:

- chemical exposure information
- workplace chemical lists
- material safety data sheets

In addition, employees and students shall receive training on the hazards of chemicals and on the measures, they can take to protect themselves from those hazards.

Protective Equipment
The employer must assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment. The EHS Specialist fulfills this responsibility by completing a Safety Audit annually.

The Laboratory Supervisor is responsible to select and provide employees with routine personal protective equipment appropriate for laboratory work (e.g. disposable gloves, safety glasses, face shields and other similar items).

Laboratory Supervisors shall assure that training in the use of routine laboratory personal protective equipment is provided.

Training Programs
St. Louis Community College will provide a training program for employees using or handling chemicals. Additional instruction is required whenever the potential for exposure to hazardous chemicals is altered or whenever new information concerning a chemical is received. New or newly assigned employees must be provided training before working with, or in a work area containing hazardous chemicals. For students, training may be required for each course. Training programs shall include, as appropriate, the following:

- interpreting labels and MSDSs
- location of hazardous chemicals
- a description of the acute and chronic effects of chemicals
- safe handling procedures
- personal protective equipment
- cleanup procedures
- waste disposal

In an area or laboratory where a large variety of hazardous chemicals are stored or used, St. Louis Community College may substitute generic training for chemical specific training. The contents of this manual meet the requirements of 29 CFR 1910.1450.

St. Louis Community College is required to keep a record of training sessions provided.

5.0 Chemical Exposure Assessment

Exposure to any substance regulated by a standard which requires monitoring, if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL), must be monitored. At lab scale unless a substance is left open for over three days outside of a hood, it is not reasonable to assume the PEL will be exceeded. Substance monitoring may be performed in response to concerns raised by staff and students.

If the initial monitoring discloses exposure over the action level (or in the absence of an action level, the PEL), additional exposure monitoring will be performed in accordance with the provisions of the relevant standard.

Monitoring may be terminated when exposure fall below the action levels.

Within 15 working days after the receipt of any monitoring results, the individual will be notified of these results in writing. If area monitoring was performed the results will be posted in an appropriate location that is accessible to employees.

6.0 Medical Evaluations

Medical consultation means a consultation which takes place between an employee 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.

The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

- Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.
- Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
- Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.
- All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

The employer shall provide the following information to the physician:

- The identity of the hazardous chemical(s) to which the employee may have been exposed
- A description of the conditions under which the exposure occurred including quantitative exposure data, if available
- A description of the signs and symptoms of exposure that the employee is experiencing, if any

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

- Any recommendation for further medical follow-up
- The results of the medical examination and any associated tests
- Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace
- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

7.0 Incident Investigation

Reporting
Incidents involving laboratories are to be reported immediately. Campus Police is to be notified for any laboratory accidents that involves fire, spill (greater than 100 ml), or injury.

Investigation
The EHS Specialist will initiate investigations on reported accidents involving injury. The hygiene committee will participate in the investigation of all reports. The purpose of the investigation will be to determine opportunities to prevent future incidents.

Chemical Hygiene Plan updates

Post investigation the chemical hygiene plan will be updated with recommendations to changes to practices from the investigation. If no incidents occurred within the year the hygiene committee will review the procedures in the chemical hygiene plan to ensure they are still applicable and revise the plan as needed. If no revisions are required, a note to file, signed by the committee, will be kept on file that the plan was reviewed and no revisions were required.

Appendix A
Laboratory Inventory

Appendix B
Laboratory Accident Prevention Contract

STLCC Laboratory Accident Prevention Contract

The following rules are designed for your safety in the laboratory and to prevent accidents. The course instructor has complete authority for enforcement of these rules and any other procedures, as is seen fit to ensure safe practices in carrying out the laboratory work. Violations of these rules are grounds for expulsion from the laboratory area.

1) **Be properly prepared to do the experiment before you enter the lab.** Read the instructions in advance and understand what you are being asked to do. Be aware of all the potential hazards of the experiment ahead of time.
2) **Perform all experiments as directed by the lab instructions and your instructor.** Do not do anything that is not part of your instructions, unless your laboratory instructor gives you approval. If any part of the experiment is unclear to you, stop to read the instructions again, then ask your instructor for help before continuing.
3) **Act appropriately at all times.** No horseplay or carelessness is permitted in the lab. You are responsible for the safety of yourself and your classmates.
4) **Always be prepared for an accident.** Be ready for the unexpected at all times, even in apparently safe situations. Learn the locations and operation of the emergency equipment. This includes the eyewash, safety shower, fire extinguisher, fire blanket, and sinks. First aid protocol for acid or base in the eyes is to wash with water using the eyewash station for a minimum of 15 minutes. First aid protocol for acid or base on skin or clothes is to wash thoroughly with water, or emergency shower if appropriate. Removal of contaminated clothing may be necessary. Washing with water should be followed by application of a solution of sodium bicarbonate for acid burns or a solution of boric acid for base burns.
5) **Report all accidents, injuries, explosions, or fires immediately to campus police.**
6) **Read chemical labels carefully.** Read them both before and after use. Review (M)SDS's for any needed information about the chemicals that will be used. Treat all chemicals with the respect they deserve.
7) **Wear appropriate protective equipment.** ANSI approved eyewear should be worn at all times. Goggles must be worn in the appropriate manner rather than on your forehead or around your neck, as one of the main reasons for their use is chemical splash protection. Safety glasses are only permitted if there is no possibility for chemical splashes. Nitrile gloves will be provided for student protection.
8) **Wear appropriate clothing in the lab.** Clothing and shoes should appropriate to the lab as per instructor direction. Closed toes shoes are to be worn in the laboratory at all times. Clothing should not be loose and baggy, especially if you are wearing long sleeves.
9) **Confine long hair.** Hair can catch on fire while using open flames or can touch chemicals if not tied back.
10) **Never taste a chemical or place your nose directly above a chemical container.** This includes a ban of mouth suction to fill pipettes. Check odors by gently wafting chemical vapors toward your nose with your hand.
11) **Use the fume hoods when necessary.** All operations in which noxious, poisonous, or otherwise harmful gases are used or produced must be carried out with proper

ventilation.

12) **Never eat or drink in the laboratory.** Do not bring any food items into the laboratory classroom. This includes candy, cough drops, and gum.
13) **Avoid all chemical contamination.** Never return unused reagents to the reagent bottle. Be careful to take only what you actually need. It is easier and less expensive to go back for more reagent rather than disposing of excess reagent.
14) **Dispose of chemicals properly.** Containers will be available for waste chemicals and for contaminated paper towels and gloves. Although you should not dispose of anything incorrectly.
15) **Clean up all spills.** This includes water. Broken glass goes in special receptacles and not in trash cans. Clean up immediately while exercising the appropriate care to protect yourself from skin contact with the substance. Clean off your lab space before leaving the laboratory.
16) **Never take chemicals, supplies, or equipment out of the laboratory.** When any container is moved over any distance, it must be capped, corked, etc. in order to prevent spills.
17) **Special health consideration.** If you are aware that you have a special health condition such as asthma, pregnancy, or any other health concerns, you may want to consult your doctor before taking science lab. Please feel free to discuss any questions or concerns with your instructor.
18) **You must sign a copy of this Safety Sheet before you may work in the lab.** Direct any questions toward your instructor.

I,_____have read, understand, and agree to follow these safety rules and procedures. In addition, I have paid close attention to the safety orientation provided to me by my instructor. I agree to conduct myself in a manner that insures my safety and that of my classmates at all times while working in the lab. I understand that failure to behave in such a manner may result in my removal from the lab and a failing grade for the lab exercise. I agree to abide by any additional instructions, whether written or verbal, provided by my instructor.

Student Signature Date Instructor/ Course and Section CRN

Appendix C
Chemical Reaction Chart

CODE	Potential Reaction
H	Heat Generation
F G	Fire
GT	Innocuous and non-flammable gas generation Toxic Gas formation
GF	Flammable Gas formation Explosion
E P	Violent Polymerization
S	Solubilization of toxic substance May be hazardous, but
U	Unknown

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	101	102	103	104	105	106
1	Acids, Mineral, Non-oxidizing																																								
2	Acids, Mineral, Oxidizing		G																																						
3	Acids, Organic		H																																						
4	Alcohols and Glycols	H	F	P																																					
5	Aldehydes	H	F	P																																					
6	Amides	H	GT																																						
7	Amines, Aliphatic and Aromatic	H	GT	H		H																																		
8	Azo Compounds, Diazo Compounds and Hydrazines	H G	H GT	H G	H G	H																																		
9	Carbamates	H G	H GT						G H																																
10	Caustics	H	H	H		H				H G																															
11	Cyanides	GT GF	GT GF	GT GF					G																																
12	Dithiocarbamates	H,F GF	H,F GF	H,GT GF		GF GT		U	H G																																
13	Esters	H	H F						H G		H																														
14	Ethers	H	H F																																						
15	Fluorides, Inorganic	GT	GT	GT																																					
16	Hydrocarbons, Aromatic		H F																																						
17	Halogenated Organics	H GT	H,F GT					H GT	H G		H GF	H																														
18	Isocyanates	H G	H,F GT	H G	H P			H P	H G		H,P G	H G	U																													
19	Ketones	H	H F						H G		H	H																														
20	Mercaptans and Other Organic Sulfides	GT GF	H,F GT						H G										H	H	H	20																			
21	Metals, Alkali and Alkaline Earth, Elemental	H,F GF	H,F GF	H,F GF	H,F GF	H,F GF	GF H	GF H	GF H	GF H	GF H	GF H	GF,H GT		GF H				H E	GF H	GF H	GF H	21																	
22	Metals, Other Elemental & Alloys as Powders, Vapors, or Sponges	H,F GF	H,F GF	G F					H,F GT	U	GF H								H E	GF H		H,F GF		22																	
23	Metals, Other Elemental & Alloys as Sheets, Rods, Drops, etc.	H,F GF	H,F GF						H,F G										H F						23																
24	Metals and Metal Compounds, Toxic	S	S	S			S	S			S															24															
25	Nitrides	GF HF	H,F E	H GF	H,E GF	GF H			U	H G	U	GF H	GF H		GF H				GF H	U	GF H	GF H	E				25														
26	Nitriles	H,GT GF	H,F GT	H							U												H P			S	GF H	26													
27	Nitro Compounds, Organic		H,F GT			H					H E												H,E GF				H,E GF		27											
28	Hydrocarbons, Aliphatic, Unsaturated	H	H F			H																		H E					28										
29	Hydrocarbons, Aliphatic, Saturated		H F																											29										
30	Peroxides and Hydroperoxides, Organic	H G	H E		H F	H G		H GT	H,F E	H,F GT		H,E GT	H,F GT						H E	H	E	H,F GT	H E	H G		H G	H,E GF	H,P GT		H P		30								
31	Phenols and Cresols	H	H F						H G											H P			GF H				GF H					H	31							
32	Organophosphates, Phosphothioates, Phosphodithioates	H GT	H GT						U		H E												H									U		32						
33	Sulfides, Inorganic	GT GF	HF GF	GT		H			E											H												H GT			33					
34	Epoxides	H P	H P	H P	H P	U		H P	H P		H P	H P	U									H P	H P	H P		H P	H P					H P	H P	U	H P	34				
101	Combustible and Flammable Materials, Miscellaneous	H G	H,F GT								H												H,F G				H,F GF					H,F GT				101				
102	Explosives	H E	H E	H E					H E		H E				H E								H E	H E	H E	E	E					H E	H E		H E	H E	H E	102			
103	Polymerizable Compounds	P H	P H	P H					P H		P H	P H	U										P H	P H	P H	P H	P H					P H	P H		P H			H E	103		
104	Oxidizing Agents, Strong	H GT		H GT	H F	H F	H,F GT	H,F GT	H E	H,F GT		H,E GT	H,F	GT	H F	H F		H F	H GT	H,F GT	H F	H,F GT	H,F E	H,F E	H F		H,F E	H,F GT	H E	H F	H F	H G	H F	H,F GT	H,F GT	H,F G	H,F G	H E	H,F GT	104	
105	Reducing Agents, Strong	H GF	H,F GT	H GF	H,F GF	H,F GF	H GF	H G			H GT	H	F				H,F E	H E	H GF	H GF	H GF	H GF						H GF	H E				H E	H GF	H,GT GF		H	H GF	H E	H,P GF	H,F E	105	
106	Water and Mixtures Containing Water	H	H						G										H G			H GF	H GF		S	H GF								GT GF					GF GT	106
107	Water Reactive Substances	<---EXTREMELY REACTIVE! DO NOT MIX WITH ANY CHEMICAL OR WASTE MATERIAL! EXTREMELY REACTIVE!--->																																						

Appendix D
Particularly Hazardous Substances

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Androgenic hormones	NA				
Arsenic & compounds	NA		X	X	
Arsenic, elemental/inorganic cmpds; except arsine	NA	X			
Beryllium and Beryllium Cmpds	NA		X		
cadmium compounds	NA		X		
Chlorobiphenyls	NA				X
Chromium (VI) compounds, insoluble NOC	NA		X		
Chromium (VI) compounds, water soluble NOC	NA		X		
Coumarin anticoagulants	NA				X
Cyanides (soluble cyanide salts); NOC	NA				
Endrin; & metabolites	NA				
Estrogens; conjugated	NA	X			
Mercury; organic	NA				X
Methoxsalen w/ultraviolet A therapy	NA	X			
Methyl mercury substances	NA				X
Mineral oils; untreated & mildly treated	NA		X		
MOPP; specified combined therapies	NA		X		
Nickel compounds, essentially sulfate & sulfide	NA		X		
Nicotine; & salts	NA				
Oestrogens; nonsteriodal	NA		X		
Oestrogens; steriodal (not all in group)	NA		X		
Oestrone replacement therapy	NA		X		
Oral contraceptives; combined & sequential	NA		X		
Panfuran S; containing dihydroxymethylfuratrizine	NA		X		
Toxoplasmosis	NA				X
Aziridine	99932-76-0	X	X	X	
Valproate; see valproic acid	99-66-1				X
Valproic acid	99-66-1				X
Benzotrichloride	98-07-7	X			
Aminoazotoluene; o-	97-56-3	X			
Ethylene thiourea	96-45-7	X	X		
Dibromo-3-chloropropane; 1, 2	96-12-8	X	X		
Styrene oxide	96-09-3		X		
Chloro-o-phenylenediamine; 4	95-83-0	X	X		
Diaminotoluene; 2 4	95-80-7	X	X		
Chloro-o-toluidine; p-; & its salts	95-69-2		X		
Toluidine; o-	95-53-4	X	X		
Safrole	94-59-7	X	X		
Nitrosopyrrolidine; n-	930-55-2	X	X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Nitrosodi-n-butylamine; n-	924-16-3	X	X		
Polybrominated biphenyls	922-66-0	X			
Nitrodiphenyl; 4	92-93-3			X	
Benzidine	92-87-5	X	X		X
Aminobiphenyl; 4	92-67-1	X	X		
Dichlorobenzidine salts; 3, 3'	91-94-1			X	
Dichlorobenzidine; 3, 3'	91-94-1	X	X	X	
Naphthylamine; beta	91-59-8	X	X	X	
Iron dextran complex	9004-66-4	X	X		
Ammonium picrate	88-89-1				
picric acid	88-89-1				
Dinoseb	88-85-7				
Trichlorophenol; 2, 4, 6	88-06-2	X			
toluene diisocyanate (mixture of isomers)	86-91-9				X
ANTU, see Naphthylthiourea	86-88-4				
Naphthylthiourea; alpha-	86-88-4				
Amino-2-methyl-anthraquinone; 1	82-28-0	X		X	
Cyclosporin	79217-60-0		X		
Nitropropane; 2	79-46-9	X	X		
Dimethylcarbamoyl chloride	79-44-7	X	X		
peracetic acid	79-21-0				
Trichloromethanethiol	79-20-9				
Hydrazinecarbothioamide	79-19-6				
Thiosemicarbazide	79-19-6				
chloroacetic acid	79-11-8				
acrylamide	79-06-1				
trichloroethylene	79-01-6		X		X
hydrazine hydrate	7803-57-8				X
Ammonium vanadate	7803-55-6				
phosphine	7803-51-2				
Tetraethyl lead	78-00-2				
cadmium bromide	7789-42-6		X	X	
Strontium chromate	6/2/7789	X			
Beryllium sulphate tetrahydrate	7787-56-6	X			
Beryllium fluoride	7787-49-7	X			
Beryllium chloride	7787-47-	X			

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
	5				
Sodium arsenite	7784-46-5	X			
arsine	7784-42-1		X	X	
Potassium arsenate	7784-41-0	X			
Lead arsenate	7784-40-9	X			
hydrogen sulfide	6/4/7783				
chlorine	7782-50-5				
fluorine	7782-41-4				
Calcium arsenate	7778-44-1	X			X
Arsenic acid H3AsO4	7778-39-4		X		
Lead chromate	7758-97-6	X			
Asbestos anthopyllite	77536-67-5	X	X		
phosphorus	7723-14-0				
Dimethyl sulphate	77-78-1	X	X		
Sulfuric acid; occupational exp., inorg mists	7664-93-9		X		
ammonia (anhydrous)	7664-41-7	X	X		
hydrofluoric acid	7664-39-3				
hydrochloric acid	7647-01-0				
Sodium arsenate	7631-89-2	X			
Heptachlor & heptachlor epoxide	76-44-8				
Nitroso-n-ethylurea; n-	759-73-9	X	X		
Hexaethyl tetraphosphate	757-58-4				
Acetone cyanohydrin	75-86-5				
chlorotrimethylsilane	75-77-4				
Epoxypropane; 1, 2; see Propylene oxide	75-56-9				
Propylene oxide	75-56-9	X	X		
Propylene imine	75-55-8				
phosgene	75-44-5				

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
bromodichloromethane	75-27-4	X	X		
Ethylene oxide	75-21-8	X	X		
carbon disulfide	75-15-0				
formamide	75-12-7		X		
dichloromethane	75-09-2				X
acetaldehyde	75-07-0	X	X		
Selenium sulfide	7446-34-6	X			
Lead phosphate	7446-27-7	X			
Thallium(I) sulfate	7446-18-6				
sulfur trioxide	########				
sulfur dioxide	9/5/7446				
Chromium III (Chromic Acid)	7440-47-3	X	X		
cadmium	7440-43-9	X	X		
beryllium	7440-41-7	X			
Beryllium powder	7440-41-7				
arsenic	7440-38-2	X			
Lithium	7439-93-2				X
lead and its inorganic compounds (Dust/ground)	7439-92-1		X		X
Hydrogen cyanide	74-90-8				
Estrogens (not conjugated); mestranol	72-33-3	X			
Endrin	72-20-8				
Benzene	71-43-2	X	X		
Methyl-N'-nitro-N-nitrosoguanidine; n-; (MNNG)	70-25-7		X		
Arsonous dichloride; phenyl-	696-28-6		X	X	
Dichlorophenylarsine	696-28-6				
Diethylarsine	692-42-2				
Methyl-N-nitrosourea; N-	684-93-5		X		
Nitroso-n-methylurea; n-	684-93-5	X			
MeA-a-C(2-amino-3-methyl-9H-pyrido[2,3-b]indole	68006-83-7		X		
Hexamethyl phosphoramide	680-31-9	X	X		
Hexachloroethane	67-72-1	X			
chloroform	67-66-3	X	X		X

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Trichloromethane; see chloroform	67-66-3				
Erionite	66733-21-9	X	X		
Uracil mustard	66-75-1		X		
Coal tar pitch	65996-93-2		X		
Dimetilan	644-64-4				
(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone; 4	64091-91-4	X	X		
Fluoroacetamide	640-19-7				
Colchicine	64-86-8				
Tetracycline hydrochloride; internal use	64-75-5				X
Diethyl sulfate	64-67-5	X	X		
Cumenyl methylcarbamate; m-	64-00-6				
Isopropylphenyl N-methylcarbamate; 3	64-00-6				
Toluidine hydrochloride; o-	636-21-5	X			
Azathioprine	6336-41-0		X		
Selenourea	630-10-4				
carbon monoxide	630-08-0				X
Phenoxybenzamine hrdrochloride	63-92-3	X	X		
Mercury fulminate	628-86-4				
Methyl isocyanate	624-83-9				
Nitrosodi-n-propylamine; n-	621-64-7	X	X		
Methanamine; N-methyl-N-nitroso-	62-75-9				
Nitrosodimethylamine; n-	62-75-9	X	X		
Sodium fluoroacetate	62-74-8				
Thiourea	62-56-6	X	X		
Thioacetamide	62-55-5	X	X		
aniline	62-53-3				X
Ethyl methanesulphonate	62-50-0	X	X		
Phenacetin	62-44-2		X		
Phenacetin, analgesic mixtures containing	62-44-2	X	X		
Phenylmercury acetate	62-38-4				
Diacetylbenzidine; N,N'-	613-35-4		X		
Dichlorobenzidine dihydrochloriode; 3, 3'	612-83-9	X			
Amino-1,2,4-triazole; 3; see amitrole	61-82-5				
Amitrole	61-82-5				
Hexachlorocyclohexane	608-73-1	X			
Dieldrin	60-57-1				
Methimazole	60-56-0				X
Tetracycline; internal use	60-54-8				X
Dimethoate	60-51-5				

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Methyl hydrazine	60-34-4				
Monomethyl hydrazine; see methyl hydrazine	60-34-4				
Dimethylaminoazo-benzene; 4	60-11-7	X		X	
bromoacetone	598-31-2				
Dimethylmercury	593-74-8				X
Vinyl bromide	593-60-2		X		
Calcium cyanide	592-01-8				
Acetamide; N-(aminothioxomethyl)-	591-08-2	X	X		X
Nitrosomorpholine; n-	59-89-2	X	X		
5-Bromo-2′-deoxyuridine	59-14-3	X			X
Hexachlorocyclohexane; gamma; see lindane	58-89-9				
Lindane	58-89-9	X			
Progesterone	57-83-0	X			
Chlordane	57-74-9		X		
Physostigmine salicylate	57-64-7				
Estrogens (not conjugated); ethinylestradiol	57-63-6	X			
Propriolactone; beta	57-57-8	X	X	X	
Physostigmine	57-47-6				
Phenytoin	57-41-0	X	X		X
Pentobarbital sodium	57-33-0				X
Strychnine	57-24-9				
Dimethylhydrazine; 1, 1	57-14-7	X	X		
Chloro-2-methylpropene; 3	563-47-3	X			
Chloramphenicol	56-75-7		X		
Benzanthracene	56-55-3	X	X		
Diethylstilbestrol	56-53-1	X	X		X
Parathion	56-38-2				
carbon tetrachloride	56-23-5	X	X		
Tetrachloromethane; see carbon tetrachloride	56-23-5	X	X		X
Trans-2-[(dimethylamino)methylamino]-5-[2-(5-ni…	55738-54-0		X		
Nickel cyanide	557-19-7				
Epoxy-1-propanol; 2, 3; see Glycidol	556-52-5				
Glycidol	556-52-5	X			
Carbosulfan	55285-14-8				
Busulfan; see 1,4-butanediol dimethylsulfonate	55-98-1				
Butanediol dimethanesulfonate; 1,4	55-98-1	X	X		X
Myleran, see 1,4-Butanediol dimethanesulfonate	55-98-1				
Phosphorofluoridic acid; bis(1-methylethyl) ester	55-91-4				
Nitroglycerine	55-63-0				
Nitrosodiethylamine; n-	55-18-5	X	X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Chlorozotocin	54749-90-5		X		
Copper cyanide	544-92-3				
Etretinate	54350-48-0				X
Bis (chloromethyl) ether	542-88-1	X	X	X	
Chloropropionitrile; 3	542-76-7				
Dichloropropene; 1, 3; technical grade	542-75-6	X	X		
Barium cyanide	542-62-1			X	
Dithiobiuret	541-53-7				
Thioimidodicarbonic diamide [(H2N)C(S)]2NH	541-53-7				
Aminopterin	54-62-6	X	X	X	
Pyridine; 3-(1-methyl-2-pyrrolidinyl)-; (S)-...	54-11-5				
Thiourea; (2-chlorophenyl)-	5344-82-1				
Dinitro-o-cresol; & salts	534-52-1				
Acetylaminofluorene; 2	53-96-3				
Dibenz(a,h)anthracene	53-70-3	X			
Dibenzanthracene	53-70-3		X		
Estrogens (not conjugated); estrone	53-16-7	X			
Calcium arsenite	52740-16-6	X			
Famphur	52-85-7				
Penicillamine	52-67-5				X
Thiotepa; see tris (1-aziridinyl) phosphine sul...	52-24-4				
Tris (1-aziridinyl) phosphine sulfide	52-24-4	X	X		
Dimethylvinyl chloride	513-37-1	X			
Urethane	51-79-6	X	X		
Mechlorethamine; see nitrogen mustard	51-75-2				
Nitrogen mustard	51-75-2		X		
Propylthiouracil	51-52-5	X	X		
Epinephrine	51-43-4				
Dinitrophenol; 2, 4	51-28-5				
Fluorouracil; 5	51-21-8				X
Tetranitromethane	509-14-8	X			
Cyanogen chloride	506-77-4				
cyanogen bromide	506-68-3				
Silver cyanide	506-64-9				
Potassium dicyanoargentate	506-61-6				
Potassium silver cyanide	506-61-6				
Mustard gas	505-60-2	X	X		
Aminopyridine; 4	504-24-5				X
5-fluoro- deoxyuridine	50-91-9	X			X
Actinomycin D	50-76-0	X	X		X

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Reserpine	50-55-5	X			
Thalidomide	50-35-1				X
Benzopyrene	50-32-8	X	X		
DDT (Dichlorodiphenyl trichloroethane)	50-29-3	X	X		
Estrogens (not conjugated); estradiol-17 beta	50-28-2	X			
Cyclophosphamide; anhydrous	50-18-0	X	X		X
Phenobarbital	50-06-6		X		
Formaldehyde	50-00-0		X		X
Methoxypsoralen; 5	484-20-8		X		
Cis-retinoic acid; 13	4759-48-2				X
Dimethanonaphthalene; 1,2,3,4,10,10-...	465-73-6				
Isodrin	465-73-6				
Cyanogen	460-19-5				
Ethanedinitrile	460-19-5				
Nitrosomethylvinylamine; n-	4549-40-0	X	X		
Dacabarzine	3/4/4342	X	X		
Oxymetholone	434-07-1	X	X		
Beryllium zinc silicate	39413-47-3	X			
Thiofanox	39196-18-4				
Diaminoanisole sulfate; 2 4	39156-41-7	X			
Methyl chrysene; 5	3697-24-3	X			
Procarbazine hydrochloride	366-70-1	X	X		
fluoroacetylchloride	359-06-8				
Brucine	357-57-3				
Diazomethane	334-88-3				
Azacitidine	320-67-2	X			
Hexachlorocyclohexane; beta	319-85-7	X			
Hexachlorocyclohexane; alpha	319-84-6	X			
Mexacarbamate	315-18-4				
Diethyl-p-nitrophenyl phosphate	311-45-5				
Aldrin	309-00-2				
paraformaldehyde	30525-89-4				
Chlorambucil	305-03-3	X	X		
Hydrazine	302-01-2	X	X		
Lead acetate	301-04-2	X			
Treosulphan	299-75-2		X		
Methoxypsoralen; 8; plus ultra violet radiation	298-81-7		X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Disulfoton	298-04-4				
Phorate	298-02-2				
Methyl parathion	298-00-0				
Diethyl O-pyrazinyl phosphorothioate; o o	297-97-2				
Dibenzo(c,g)carbazole	28641-62-5	X			
(Aminomethyl)-3-isoxazolol; 5	2763-96-4	X	X		
Calcium arsenite	27152-57-4	X			
sodium azide (Na(N3))	26628-22-8				
toluene diisocyanate	26471-62-5	X			
Dithiolane-2-carboxaldehyde; 2, 4-dimethyl-...	26419-73-8				
Tirpate	26419-73-8				
Promecarb	2631-37-0				
Direct Blue #6	2602-46-2	X	X		
Azoxymethane	25843-45-2	X	X		
Kanechlor 500	25429-29-2	X			
Hydroxyanisole; butylated	25013-16-5	X	X		
Captafol	6/1/2425		X		
Mirex	2385-85-5		X		
Formetanate hydrochloride.	23422-53-9				
Adriamycin	23214-92-8	X	X		
Oxamyl	23135-22-0				
Dibenz(a,h)acridine	226-36-8	X	X		
Dibenz(a,j)acridine	224-42-0	X	X		
Aluminum phosphide	20859-73-8				
Osmium tetroxide	20816-12-0				
Benzo(k)fluoranthene	207-08-9	X	X		
Benzo(b)fluoranthene	205-99-2	X	X	X	
Benzo(j)fluoranthene	205-82-3	X	X		
Dimethoxybenzidine dihydrochloride; 3, 3'	20325-40-0	X			
Methiocarb	2032-65-7				
Direct Black #38	1937-37-	X	X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
	7				
Indeno (1,2,3 cd) pyrene	193-39-5	X	X		
diborane (gas)	19287-45-7				
Dibenzo(a,e)pyrene	192-65-4	X	X		
Dibenzo(a,l)pyrene	191-30-0	X	X		
Dibenzo(a,h)pyrene	189-64-0	X	X		
Dibenzo(a,i)pyrene	189-55-9	X	X		
Nitrofen	1836-75-5	X			
Benzopyran-2-one; 4-hydroxy-3-(3-oxo-1-…	181-81-2				
Formparanate.	17702-57-7				
Tetrachlorodibenzo-p-dioxin (TCDD); 2, 3, 7, 8	1746-01-6	X	X		
Dimethanonaphth [2,3-b]oxirene…	172-20-8				
tetrafluoroboric acid	16872-11-0				
Methomyl	16752-77-5				
Chlorinated camphene	165820-10-0	X	X		
Toxaphene; see chlorinated camphene	165820-10-0				
Nitrosonornicotine; n-	16543-55-8	X	X		
Aldicarb sulfone	1646-88-4				
Direct Brown #95	16071-86-6		X		
Cisplatin	15663-27-1	X	X		
Carbofuran	1563-66-2				
BCNU; see bis chloroethyl nitrosourea	154-93-8				
Bis chloroethyl nitrosourea	154-93-8	X	X		
Manganese dimethyldithiocarbamate.	15339-36-3				
Manganese; bis(dimethylcarbamodithioato-S,S')-...	15339-36-3				
Octamethylpyrophosphoramide	152-16-9				
Calcium arsenite	15194-98-6	X			
Potassium cyanide	151-50-8				
Silica; crystalline; quartz; respirable	14808-60-7	X	X		
Tridymite; see silica	14808-60-7				
Diepoxybutane	1464-53-5	X	X		
Endothall	145-73-3				
Silica; crystalline; cristobalite (Suspended in dust)	14464-46-1		X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
sodium cyanide (Na(CN))	144-33-9				
Kepone	143-50-0		X		
Aflatoxins	1402-68-2	X	X		
Ethyl acrylate	140-88-5	X	X		
CCNU; methyl	13909-09-6	X	X		
Calcium chromate	13765-19-0	X			
Phenazopyridine hydrochloride	136-40-3	X	X		
Beryllium phosphate	13598-15-7	X			
Beryllium sulphate	13510-49-1	X			
Cupferron	135-20-6	X			
Potassium arsenite	13464-35-2	X			
Nickel carbonyl	13463-39-3				
gallium trichloride	13450-90-3				
Naphthylamine; alpha	134-32-7			X	
Anisidene hydrochloride; o-	134-29-2	X			
Polychlorinated biphenyls	1336-36-3	X	X		
ammonium hydroxide	1336-21-6	X	X		
chromium trioxide	1333-82-0	X			
Beryllium hydroxide	13327-32-7	X			
Asbestos	1332-21-4				
Talc; containing asbestos; see asbestos 1	1332-21-4		X		
Tremolite; asbestiform; see asbestos	1332-21-4				
Arsenic trioxide	1327-53-3	X			
arsenous oxide	1327-53-3	X			
Nitrososarcosine	13256-22-9	X	X		
Silica; crystalline; tripoli	1317-95-9		X		
Vanadium oxide V2O5	1314-62-1				

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
phosphorus pentoxide	1314-56-3				
Thallic oxide	1314-32-5				
Thorium dioxide	1314-20-1	X			
potassium hydroxide	1310-58-3				
Cyclohexyl-4;6-dinitrophenol; 2	131-89-5				
Phenol; 2-cyclohexyl-4, 6-dinitro-	131-89-5				
Cadmium sulphide	1306-23-6	X			
cadmium oxide	1306-19-0	X			
Beryllium oxide	1304-56-9	X			
Arsenic pentoxide	1303-28-2				
CCNU	13010-47-4	X	X		
chromium hexacarbonyl	13007-92-6	X		X	
Saccharin	128-44-9	X	X		
Beryllium-alluminum alloy	12770-50-2	X			
Trimethadione	127-48-0				X
Perchloroethylene	127-18-4	X	X		
Tetrachloroethylene, see perchloroethylene	127-18-4				
Tris (2;3-dibromopropyl) phosphate	126-72-7	X	X		
ethidium bromide	1239-45-8				
Dioxane	123-91-1	X			
Hydrazobenzene	122-66-7	X			
Phenyl glycidyl ether (PGE)	122-60-1		X		
Dimethylphenethylamine; alpha, alpha	122-09-8				
Asbestos, amosite	12172-73-5	X			
Thallium(I) selenite	12039-52-0				
Asbestos, chrysotile	12001-29-5	X			
Asbestos, crocidolite	12001-28-4	X			
Cresidine; p-	120-71-8	X	X		
Dimethylbenzidene; 3, 3'	119-93-7	X	X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Dimethoxybenzidine; 3, 3'	119-90-4	X	X		
Isolan	119-38-0				
Hexachlorobenzene	118-74-1	X	X		
Di-sec octyl phthalate	117-81-7	X	X		
Aminoanthraquinone; 2	117-79-3	X			
Anisindione	117-37-3	X			
Aldicarb	116-06-3	X	X		
Endosulfan	115-29-7				
Chlorendic acid	115-28-6	X	X		
Metolcarb	1129-41-5				
Propane sultone; 1, 3	1120-71-4	X	X		
Nitrosodiethanolamine; n-	1116-54-7	X	X		
Glutaraldehyde	111-30-8				
Aroclor 1254	11097-69-1				
Aroclor 1260	11096-82-5	X			
tetramethyl ethylenediamine	110-18-9				
butyl lithium	109-72-8				
Chlorinated paraffins; certain	108171-26-2	X	X		
Phenyl mercaptan	108-98-5				
Thiophenol; see phenyl mercaptan	108-98-5				
Toluene	108-88-3				X
Tetraethyl pyrophosphate	107-49-3				
chloromethyl ether	107-30-2	X	X	X	
Chloroacetaldehyde	107-20-0				
Propargyl alcohol	107-19-7				
Allyl alcohol	107-18-6				
ethylene diamine	107-15-3				
Acrylonitrile	107-13-1	X	X		X
Propanenitrile	107-12-0				
Ethylene dichloride	107-06-2	X			
Acrolein	107-02-8	X		X	
trimethylin chloride	1066-45-1				
Butadiene; 1,3	106-99-0	X	X		
Butadine; see 1,3 butadine	106-99-0				
Dibromoethane; 1, 2; see ethylene dibromide	106-93-4	X	X		X
Ethylene dibromide	106-93-4	X	X		

Chemical Name	CAS NO.	CARC NTP	CARC IARC	CARC OSHA	REPRO Hazard
Chloro-2,3-epoxypropane; 1; see epichlorohydrin	106-89-8				
Epichlorohydrin	106-89-8	X	X		
Dichlorobenzene; p-	106-46-7	X	X		
Phenylthiourea	103-85-5				
boron tribromide	10294-33-4				
cobalt carbonyl	10210-68-1				
Cadmium sulphate	10124-36-4	X			
cadmium chloride	10108-64-2	X			
Nitrogen dioxide	10102-44-0				
Nitric oxide	10102-43-9				
Diglycidyl resorcinol ether	101-90-6	X	X		
Oxydianiline; 4, 4'	101-80-4	X	X		
Methylene-bis(2-chloroaniline) MOCA; 4, 4'	101-14-4		X		
Disodium hydrogen arsenate	10048-95-0	X			
Hydrazine sulfate	100-93-2	X			
Nitrosopiperidine; n-	100-75-4	X	X		
Benzyl chloride	100-44-7				
Vinyl benzene; see stryene	100-42-5				
Nitroaniline; p-	100-01-6				

Appendix E
Particularly Hazardous Substances Permit

Particularly Hazardous Substance (PHS) Safety Permit Form

Instructions:

- Each Laboratory is responsible for the completion of its own PHS forms. EHS may be contacted for supplemental information or in the event of any questions regarding the form
- Each approved **USER** of the PHS **must** complete a copy of page nine of this form and submit it to the chemical hygiene committee
- Retain this form and the approval pages in your laboratory
- Refer to the Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS) for assistance in the completion of this form.
- Use as much space in the response boxes as you need…

*****Attach the MSDS or SDS to this form*****

Chemical Identification:

Chemical Name:						
CAS #						
Synonyms:						
Physical State: (mark with an "X")		Solid		Liquid		Gas

Hazard Identification:

Indicate *why* this is a PHS (there may be more than one category):

	Select Carcinogen		Reproductive Toxin
	Water Reactive		Pyrophoric
	Acutely Toxic		Other

Indicate other hazards:

	Flammable		Corrosive		Oxidizer
	Reactive		Temperature sensitive		Sensitizer
	Other (specify				

Identify any incompatible materials or conditions:

Indicate possible routes of exposure from this material

☐ Inhalation ☐ Skin contact ☐ Accidental ingestion

Indicate the effects of overexposure to this material:

Exposure Controls:

1. Personal Protective Equipment

Indicate the items of PPE required for the use of this material, and the steps where they are required:

Type	*Specific item needed*	*Step(s) when required for use*
Eye Protection		
Skin Protection		
Hand Protection		
Respiratory Protection[1]		
Other (Specify)		

[1] All use of respiratory protection must be approved by EHS, in advance of use.

2. Ventilation Controls

Item	y/n	*Step(s) when required for use*
Fume Hood Required?		
Glove Box Required?		
Other ventilation needed?		

3. Designated Area

All PHS materials must be stored and used in a designated work area. (You MAY designate your entire lab.) Indicate the area designated for PHS use and how it will be posted:

4. Waste Disposal

Indicate details of disposal for the PHS and any subsequent materials where it is present (such as glassware, sample containers, etc.):

Emergency Response:

Indicate response actions for exposures to the PHS

Indicate response actions for a spill of the PHS:

Describe how the PHS will be used:

Permit Approval

Employee Name	
PHS being used	
Maximum quantity of PHS approved for use	
Location of use of material (building and room)	
Other restrictions to this material's use (i.e. working alone)	

Employee declaration:

I declare that I have read and I understand this PHS Protocol Form for this material (noted above). I agree to follow all procedures in this form and all applicable procedures in the Chemical Hygiene Plan.

Signature: _____ Date:_____

Committee Approval (Sign and date):

Dean: _____ Date:_____

Hygiene Committee Representative: _____ Date:_____

Hygiene Committee Representative: _____ Date:_____

Hygiene Committee Representative: _____ Date:_____

Appendix F
Lab Incident Report

Lab Incident Report

Incident and Safety Concern Memorandum

This memorandum form should be used to document incidents that occur in laboratories or to report safety concerns associated with the operation of laboratories.

Note: Injuries are to be reported to Campus Police

1. Give a description of the safety incident including time, date, and location.

Name of person Filing Report: _____

Date of Report: _____

RETURN THIS MEMORANDUM TO THE ENVIRONMENTAL HEALTH AND SAFETY SPECIALIST

To be filled out by the chemical hygiene committee.

1. Describe what changes to the policy and procedures in the hygiene plan or laboratory that would mitigate or prevent future incidents. Include an anticipated due date:

Committee Approval (Sign and date):

Dean: _____ Date:_____

Hygiene Committee Representative: _____ Date:_____

Hygiene Committee Representative: _____ Date:_____

Hygiene Committee Representative: _____ Date:_____

FILE THE COMPLETED MEMORANDUM FORM WITH THE CHEMICAL HYGIENE PLAN

Appendix G
TEST PROCEDURE FOR PEROXIDES

TEST PROCEDURE FOR PEROXIDES

Ethers (particularly cyclic ethers and those synthesized from primary or secondary alcohols (such as tetrahydrofuran, diethyl ether and diisopropyl ether) form peroxides. Aldehydes, alkenes that have allylic hydrogen atoms (cyclohexene), compounds having benzylic hydrogens on a tertiary carbon atom (such as isopropyl benzene) and vinyl compounds (vinyl acetate) may also form peroxides. Although peroxides are not powerful explosives, they are extremely sensitive to shock, sparks, light, heat, friction, and impact. When peroxide-forming compounds are distilled, the peroxide has a higher boiling point than the parent compound and remains in the distilling flask as a residue that can become overheated and explode. **Thus, NEVER distill any compound that may contain peroxide impurities to dryness to avoid explosion.**
Peroxide formation often occurs in stored ethers. Since ethers are frequently used solvents and form peroxides easily, the solvent container should be dated when opened. **If not used within one month, the container must be tested for peroxide formation. DO NOT test an uninhibited ether, which has been opened for more than SIX months, or an inhibited ether, which has been opened and stored more than ONE year.**

Peroxide Detection
Add 1 ml of the liquid suspected of containing peroxide to a solution of 0.1 g sodium iodide in 1 mL of glacial acetic acid. If the mixture turns brown, a high concentration of peroxide is present; whereas a yellow solution indicates that a low level of peroxide exists in the solution.

Peroxide Removal
The solvent containing peroxides should be poured through a column of basic activated alumina, which will simultaneously remove peroxide and dry the solvent. During peroxide removal, do not let the column dry out. Be sure to test the solvent again to determine if peroxide is still present. When the alumina column no longer removes peroxide, wash the column with 5 % aqueous ferrous sulfate and discard the material as chemical waste.
Adapted from Organic Experiments, Sixth Edition, authored by L. F. Fieser and K. L.Williamson, D. C. Heath and Company, 1987.

Appendix H
Laboratory Inspection Self Checklist

Safety Self-Inspection Checklist
Science Laboratory / Classroom Area

Department: _____ Building /Room: _____ Supervisor: _____
Inspection Date: _____ Inspection Performed by: _____
Contact Phone: _____

Check **NA** if not applicable to your area. Check **OK** for acceptable items. Check **X** for items needing repair and describe the situation in the **Comments** section below – identify the issue by item#

OK NA X **Laboratory Equipment**	OK NA X **Laboratory Waste**
[ ] [ ] [ ] Fume hood used as designed; only essential items	[ ] [ ] [ ] No leaking containers
[ ] [ ] [ ] Fume hood sash pulled down as far as practicable and unobstructed	[ ] [ ] [ ] Containers closed unless receiving waste
[ ] [ ] [ ] Fume hood working	[ ] [ ] [ ] Containers labeled with the word "waste" and their specific chemical contents
[ ] [ ] [ ] Fume hood tested within past year	[ ] [ ] [ ] Containers have secondary containment
[ ] [ ] [ ] Freezer/refrigerator approved for content	**Classroom/Lab. Facilities**
[ ] [ ] [ ] Bunsen burner shut off valves operable	[ ] [ ] [ ] No overhead hazards present
[ ] [ ] [ ] Centrifuge operable	[ ] [ ] [ ] Emergency exit unobstructed
[ ] [ ] [ ] Fan(s) guarded	[ ] [ ] [ ] Emergency exit posted
[ ] [ ] [ ] Safety shower/eye wash operable	[ ] [ ] [ ] Emergency procedures/contacts posted
[ ] [ ] [ ] Appropriate spill kit(s) present	[ ] [ ] [ ] No eating/food storage policy observed
[ ] [ ] [ ] First aid kit present	[ ] [ ] [ ] Electrical cords in good condition
[ ] [ ] [ ] Fire extinguisher(s)/blanket present	[ ] [ ] [ ] No electrical/extension cords run across floor, above
[ ] [ ] [ ] Appropriate PPE present	**Biological/Chemical Safety**
[ ] [ ] [ ] Appropriate PPE being worn	[ ] [ ] [ ] Chemical containers closed
[ ] [ ] [ ] No inappropriate attire	[ ] [ ] [ ] Containers labeled with contents
[ ] [ ] [ ] (M)SDS available or readily accessible	[ ] [ ] [ ] Chemicals stored by hazard class, e.g., flammables,
[ ] [ ] [ ] Gas cylinders labeled, secured, capped	[ ] [ ] [ ] Biohazardous materials properly labeled
Comments	[ ] [ ] [ ] Biohazardous materials properly stored
	[ ] [ ] [ ] Biohazardous materials properly stored
	[ ] [ ] [ ] Biohazardous materials properly stored

It is recommended that inspections be conducted monthly at a *minimum*.

Forward completed form to supervisor and EHS specialist for review to ensure awareness and corrective action and filing.

Appendix I
Glove Permeability Chart

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
Acetaldehyde	4	2	2	N	3	U001, D001	A	4	>360	10.2
AceticAcid	2	2	0	N	8	D002	Co-Ac	5	>480	360
AceticAnhydride	2	2	1	N	8	D002	Co		>480	210
Acetone	3	1	0		3	U002, F003, D001	A	3	1440	2.4
Acetonitrile (MethylCyanide)	3	3	0	N	3	D001	B	<5	1440	<10.8
Acetophenone	2	1	0	N		U004	A		>480	
AcetylChloride	3	3	2	WR	3	U006, D001, D002, D003	FI			
Acrolein	3	3	3	N	6.1	P003, D001	FI	4.2	>480	
Acrylamide	2	3	2	N	6.1	U007	P		>240	
AcrylicAcid	2	3	2	N	8	U008, D001	FI		>240	70
Acrylonitrile	3	4	2	N	3	U009, D001	FI	<5	>480	
Aldehyde					3	D001	A	4	>360	
AllylAlcohol	3	3	1	N	6.1	P005	FI			94.8
Allylamine	3	3	1	N	6.1	D001	FI		15	
AllylChloride	3	3	1	N	3	D001	FI		>240	
Ammonia	1	3	0	N	2.3	D002	Co-Ba		110	
AmmoniumFluoride	0	3	0	N	6.1		Co	>360	>240	>360
AmmoniumHydroxide	1	3	0	N	2.3	D002	Co-Ba	360		360
AmylAcetate (IsoamylAcetate)	3	1	0	N	3	D001	A	<5		5.4
AmylAlcohol	3	1	0	N	3	D001	A	30		321
AmylNitrile	2	2	0	Ox	3			175.8		46.8
Aniline	2	3	0	N	6.1	U012	B	18	>1440	30
Benomyl						U271	P		>240	
Benzaldehyde	2	2	0	N	9		A	<5	>480	39
Benzene	3	2	0	N	3	U019, D001, F005, D018	A	4.2	480	1.2
BenzenesulfonicAcid							NR		>240	>1200
BenzethoniumChloride							NR			>480
Benzonitrile (PhenylCyanide)	2	3	0	N	6.1		NR			
BenzophenoneTetracarboxylicDianhydride							NR		>240	
BenzoylChloride	2	3	2	WR	8	D002	FI			15

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
BenzylAlcohol	1	2	0	N			A		>480	
BenzylCyanide	1	2	0	N			FI		>240	
Benzyldimethylamine (Dimethylbenzylamine)	2	2	0	N	8	D002	FI		>240	
BispenoldiglycidylEther									>480	
Bisphthalate								259.8		120
BoricAcid	0	0	0	N			NR	>480		>480
Bromine	0	3	0	Ox	8	D002	Co			
Bromoacetonitrile										
Bromobenzene	2	2	0	N	3	D001	C	13.2		
Bromoethanol										
Bromoethylethylcarbonate									>240	
Bromofluorobenzen							C			
Bromopropanol							Co			>480
BromopropionicAcid							Co-Ac			180
Butadiene	4	2	2	N	2.1	D001	Hood			46.8
ButanediolDiglycidylEther							Co		>240	
Butanol (Isobutanol)	3	1	0	N	3	D001, U031, F003	A	30	>480	10
ButylAcetate	3	1	0	N	3	D001	A	<5	>480	3.6
ButylAcrylate	2	2	2	N	3	D001	FI	67.8	>480	
Butylamine	3	3	0	N	3	D001	B	19.8		12
ButylCellosolve (Butoxyethanol)	2	2	0	N		D001	A	9		90
ButylChloride (Chlorobutane)	3	2	0	N	3	D001	C	12		
Butylfluazifop									>480	
ButylGlycol									>240	
ButylHydroperoxide	4	1	4	Ox	N	D001, D003	OP		>240	
ButylNitrite	3	1	3	N	3	D001, D003	OP	97.8		
Butyltoluene	2	1	0	N	6.1		A	>360	>480	73.2
Butyraldehyde	3	2	2	N	3	D001	A		>480	25.2
Butyrolactone	1	0	0	N			A		>480	10
CarbonDisulfide	4	2	0	N	3	P022, D001, F005	FI	1	1440	2
CarbonTetrachloride	0	3	0	N	6.1	U211, D019	C	5	>480	4.8
Cellosolve (Ethoxyethanol)	2	2	0	N		D001, F005, U359	A		>360	45
CellosolveAcetate (EthoxyethylAcetate)	2	2	0	N		D001	A	<5		25
Chlorine	0	3	0	Ox	2.3		Hood		>240	>480
ChloroaceticAcid	1	3	0	N	6.1	D002	Co-Ac			

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
Chloroacetone	2	3	2	N	6.1	D001	FI		>240	
Chloroacetonitrile										
Chloroaniline					6.1		C			
Chlorobenzene	3	2	0	N	3	U037, D021, D001, F002	C	<5		10.8
Chlorobutadiene (Chlorophrene)	3	2	0	N		D001	C	3.6		3
Chloroethanol (EthyleneChlorohydrin)	2	3	0	N	6.1	D001	Hood		>240	298.8
Chloroform	0	2	0	N	6.1	U044, D022	C	2.4	10	0.6
ChloromethylMethylEther	3	4	3	WR		U046	FI			
Chloronaphthalene	1	1	0	N		U047	P	174	>480	
Chloronitropropane	2	0	3	N						
Chloropropanol										
Chloropropene	4	2	2	N	3	D001	C		>240	
ChlorosulfonicAcid	0	3	2	WR	8		NR			
Chlorotoluene (BenzylChloride)	2	2	1	N	3	P028	FI	15	>480	
ChromicAcid	0	3	1	Ox	8	D001, D002, D007	Ox	240	>240	75
CitricAcid	1	2	0	N		N	Keep			>360
CleaningAgent	2	0	0	N					>480	
Copper	0	2	0	N						>360
Creosote	2	2	0	N		U051	FI		>240	270
Cresol	2	3	0	N	6.1	U052 D026 F004	FI	<5	>240	>60
Crotonaldehyde	3	3	2	N	6.1	D001, U053	FI			21
Cyclohexane	3	1	0	N	3	U056, D001	A	360	>480	6
Cyclohexanol	2	1	0	N			A	360	>480	150
Cyclohexanone	2	1	0	N	3	U051, D001, F003	A	<5	>480	
Cyclohexylamine	3	2	0	N	8	D001	B		>240	36
Cyclopentanone	3	2	0	N	3	D001	A		>240	
Cypermethrin							NR		>240	
Decanal (DecylAldehyde)							NR			240
DeepWoodsOff (R)									>240	
DiacetoneAlcohol (HydroxyMethylPentanone)	2	1	0	N	3	D001	A		>240	300
Diaminodiphenylmethane (Methylenedianiline)	1	3	0	N	6.1		NR		>1440	
Diamylamine	2	3	0	N		D001	B	>480		129

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
Dibromoethane (EthyleneDibromide)	0	3	0	N	6.1	U067	FI	27	>480	4.8
Dibutylamine	2	3	0	N		D001	B	>480		
DibutylEther (ButylEther)	3	2	1	N	3	D001	A		>480	
DibutylPhthalate (ButylPhthalate)	1	0	0	N			A	30	>480	120
Dichloroaniline	1	3	0	N	6.1		NR			
Dichlorobenzene	2	2	0	N	6.1	D027, U072, F002, U070, U071	P	<5	>240	
Dichlorobutene					8	D001	C	2.4	>240	10.2
Dichloroethane (EthyleneDichloride)	3	2	0	N	3	D028, U076, D001, U077	C	2.4	144	1.8
Dichloroethylene	3	2	2	N	3	D001, D029, U078	C	7.2	>420	
Dichloromethane	1	2	0	N	6.1	U080, F002	C	6	>480	6
Dichloropropene	3	3	0	N	3	D001	C			
Diesel	2	0	0	N	3	D001	A	>240		
Diethanolamine	1	1	0	N			B	>480	>240	>480
Diethylacetamide							NR		>480	
Diethylamine	3	3	0	N	3	D001	B	<5	60	34
Diethylaminoethanol	2	3	0	WR	3	D001	B	>480		
Diethylenedioxide (Dioxane)	3	2	1	N	3	D001, U108	A	<5	>480	6.4
Diethylenetriamine	1	3	0	N	8		B		>240	>480
Diethylnitrosoamine							NR		>240	
Diethylphthalate						U088	A		>240	
Diisobutylamine					3	D001	B	>480		52.2
DiisobutylKetone	2	1	0	N	3	D001	A	120	>360	15
Diisopropylamine	3	3	0	N	3	D001	B	195		40.2
Dimercaptothiodiazole									>240	
Dimethylacetamide	2	2	0	N			B	<5	>240	
Dimethylamine	4	3	0	N	2.1	D001	Hood			>480
Dimethylaminopropylamine						D001	B			28.8
Dimethylaniline	1	3	0	N	6.1		B		>240	
Dimethylbutylamine					3			81		
Dimethylcyclohexylamine					8	D001	B		>480	
Dimethylethanolamine (Dimethylaminoethanol)	2	2	0	N	8	D001	B	>480	350	235.2
Dimethylethylamine									9	
Dimethylformamide	2	1	0	N	3	D001	B	<5	1440	1.2

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
Dimethylhydrazine	3	3	1	N	6.1	D001, U099, U098	FI	6		37.8
Dimethylmercury									60	
DimethylSulfate	2	4	0	N		U103	FI		>240	
Dimethylsulfoxide	1	1	0	N		U103	FI	28.2	>480	60
Dimethylvinylchloride								9		
Dinol									>240	
Dinoseb						P020	P		>240	
Dioctylphthalate	1	0	0	N		U107	A			>360
Dipentene					3	D001	A		>480	
Diphenylcyclopropenone									>240	
DiphenylmethaneDiisocyanate	1	2	0	N	6.1		NR			
Diphthalate									>240	
DiquatDibromide							NR		>240	
Divinylbenzene	2	2	2	N			FI	60	>480	
Dodecane	2	0	0	N			A		>480	
Dynasylan									>480	
Epichlorohydrin	3	3	2	N	6.1	U041, D001	FI	19.8	>240	15
Epoxybutane (ButyleneOxide)	3	2	1	N	3	D001	A			4.2
Ethanol	3	0	0	N	3	D001	A	240	>480	49.2
Ethanolamine	2	2	0	N	8		B	360	>480	360
Ether (EthylEther, DiethylEther)	4	2	1	N	3	U117, F003, D001	A	13.8	>480	10
EthidiumBromide							NR		>480	
Ethoxypropanol									>240	
EthylAcetate	3	1	0	N	3	U112, D001, F003	A	<5	1440	12
EthylAcrylate	3	2	2	N	3	U113, D001	FI		>240	48
Ethylamine					2.1	D001	B	66	28.2	
Ethylbenzene	3	2	0	N	3	F003, D001	A	<5	>480	
Ethylbromide					6.1	D001	C			4.2
Ethylbutylamine						D001	B			73.2
EthylCellosolve (Ethoxyethanol)								91.8	>240	244.8
EthylCellosolveAcetate										
EthylCyanide										
Ethylenediamine	3	3	0	N		D001	B		92	399
EthyleneGlycol							A	360	>240	360
Ethyleneimine					6.1	P054, D001	FI			<4.8
EthyleneOxide	4	2	3	N	2.3	U115, D001	FI		>240	
Ethylglycol									>240	

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
EthylglycolAcetate									>240	
EthylglycolEther										45
EthylhexanoicAcid							NR	>240		>240
Ethylhexanol							A			>480
EthylMethacrylate						U118, D001	FI	22.8		
Fluorobenzene					3	D001	C			
FluoroboricAcid	0	3	0	N	8	D002	Co-Ac		>240	
Formaldehyde	4	3	0	N	8	U122	A	>1260	>360	120
FormicAcid	2	3	0	N	8	D002	Co-Ac	5	120	>360
Freon (Dichlorodifluoromethane)					2.2	U075	C	10.2	>240	3
Furaldehyde (Furfural)	2	2	0	N	3	D001, U125	FI	<5	>480	19.8
FurfurylAlcohol					6.1	D001	A	28	>480	
Gasohol					3	D001	A			
Gasoline					3	D001	A	30	>240	
Glutaraldehyde							A	>240	>240	>480
Glycerol (Glycerin)							NR		>240	
Glycerolmonothioglycolate									>240	
Glycerolpropoxytriacrylate									>240	
Glyphosatisopropylamine									>240	
Heptane					3	D001	A	360	>480	45
Hexachlorocyclopentadiene					6.1	U130	FI	>480		
Hexamethyldisilazane	3	2	1	N		D001	FI		>240	50
HexamethyleneDiisocyanate					6.1		FI			
Hexamethylphosphoramide							NR	90		
Hexane					3	D001	A	78.6	1440	3.6
HydraulicFluid						N	MP	>240	>480	
Hydrazine	3	3	3	N	8	U133, D001	FI	>480	126	>960
HydrochloricAcid (MuriaticAcid)					8	D002	Co-Ac	360	>360	360
HydrocyanicAcid (HydrogenCyanide)	4	4	2	N	6.1	P063	Hood		>240	
HydrofluoricAcid					8	U134, D002	Co-Ac	120	15	60
HydrogenChloride	0	3	0	N	2.3	D002	Hood			
HydrogenPeroxide	0	2	3	Ox	5.1	D001	Ox	>360	>240	4.8
HydrogenPhosphide						P096	Hood			10.2
Hydroquinone					6.1		NR	>360	>240	>360
Hydroxyethylacrylate									>240	
HydroxyethyltrimethylammoniumHydroxide									>240	

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
Hydroxymethacrylate									>240	
Iminobispropylamine							B			>480
Isophorone	2	2	0	N					>240	
Isoprene	4	2	2	N	3			52.2		16.2
JetFuel					3	D001	A		>240	
Kerosene					3	D001	A	>360		>360
LacticAcid						D002	Co-Ac	>360		>360
LauricAcid							NR	>360		>360
Limonene						D001	A			64.8
LubricationOil						N	MP		>240	
Malathion							NR		>240	
MaleicAcid	1	3	1	N	8		NR	>360		>360
Mercaptoethanol						D001	Hood		>240	
MercuricChloride					6.1	D009	P-Hg			
Mercury					8	U151, D009	P-Hg		>480	
MethacrylicAcid	2	3	2	N	8		NR	10.2	>480	
Methacrylonitrile					3	U152, D001	FI	7		
MethanesulfonicAcid						D002	Co-Ac			>240
Methanol					3	D001, F003, U154	A	10.8	>480	15
Methoxyethanol									>240	
MethoxyethylAcetate									>240	
Methoxymethylpentanone					3		A			99
Methoxypropanol					3	D001	A		>240	
Methoxypropylacetate									>240	
MethylAcetate					3	D001	A		>480	
MethylAcrylate	3	2	2	N	3	D001	FI			15
Methylamine	4	3	0	N	2.1	D001	Hood	>480	114	270
Methylaminopropylamine										63
MethylBromide	1	3	0	N	2.3	U029	Hood			
MethylButylEther					3	D001	A	5	>480	
MethylCellosolve						D001	A	40.2	>240	25
MethylChloride	4	2	0	N	2.1	U045, D001	C			
MethylChloroacetate					6.1		C			
Methylenabls										
Methylenebis									>240	
MethylenebisDiphenylmethaneDiisocyanate							NR		>480	
MethyleneDichloride (MethyleneChloride)	1	2	0	N		F002, U080	C	1.8	114	0.6
Methylethanolamine							B			>480

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
MethylEthylKetone					3	D035, D001, F005, U159		3.6	>1440	2.4
MethylEthylKetonePeroxide					N	U160, D001, D003	OP			>240
Methylethylketoxime										
MethylGlycolEther										25
Methylhexanone (MethylIsoamylKetone)					3	D001	A	<5	>480	
MethylIodide					6.1		C	0.6	123	0.6
MethylIsobutylKetone					3	U061, D001, F003	A	12		15
MethylIsocyanate					6.1	P064, D001	FI			0.6
MethylMercaptan					2.3	U153, D001	Hood			
MethylMethacrylate	3	2	2	N	3	D001, U062	FI	<5	>480	
MethylNorborneneDicarboxylicAnhydride (MemtetrahydrophthalicAnhydride)					8		NR		>240	
MethylPentylKetone									>240	
Methylpyrrolidone							B	<5	>240	
Methyltrichlorosilane	3	3	2	WR	3	D001	FI		>240	
MineralOil						N	MP	>240		
MineralSpirits						D001	A	>360		90
Monoethanolamine	2	2	0	N	8			360	>480	360
Monoethylamine	4	3	0	N	2.1			66	28.2	
Morpholine	3	2	0	N	3	D002	B	<5	>480	
MustardGas (DichlorodiethylSulfide)							P		>240	
Naphathalene	2	2	0	N	4.1	U165	FI		>240	
Naphtha					3	D001	A	>360	>480	15
Naphthylamine					6.1	U167, U168	P		>240	
Nickel										>360
Nicotine					6.1	P075	P		>240	
Ninhydrin							NR		>240	
NitricAcid	0	3	1	Ox	8	D002, D001	Co-Ac	5	34.8	79.8
Nitrobenzene	2	3	1	N	6.1	F004, D036, U169	B	<5	1440	40.2
Nitrodiphenylamine							NR		>240	
Nitroethane	3	1	3	N	3	D001	B		>480	49.2

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
NitrogenTetroxide (NitrogenDioxide)					2.3	D002	Ox			
Nitroglycerol (Nitroglycerin)					1.1	P081, D003	Ex		>240	
Nitroglycol									>240	
NitrohydrochloricAcid (AquaRegia)					8	D002	Co-Ac			45
Nitromethane	3	1	4	N	3	D001	B	30	>480	60
Nitropropane	3	1	2	N	3	U171, D001	Fl	12	>480	5
Nonylphenol							NR			>1200
Octane (Isoctane)					3	D001	A	360		60
Octanol							A	360		360
OleicAcid							NR	>360		60
OrthoToluidin									>480	
OsmiumTetroxide					6.1	P087	Hood			
OxalicAcid	1	2	0	N			NR	360	>480	360
PalmiticAcid							NR	30		>360
Parathion					6.1	P089	P		>240	
Pentachlorophenol	0	3	0	N	6.1	F027	P	>780	>480	6
Pentane					3	D001	A	1.8	>480	6.6
Pentylalcohol									176	
PerchloricAcid	0	3	3	Ox	5.1	D001, D002	Ox	360	>240	360
Perchloroethylene					6.1				>480	
PetroleumEther						D001	A	>240	>480	
Phenol	2	3	0	N	6.1	U188	A	31.8	130	40.2
Phenolphthalein							NR	>480		>480
PhosphoricAcid	0	3	0	N	8	D002	Co-Ac	360	>240	360
PhosphorusOxychloride	0	3	2	WR	8	D002, D003	Co		>240	<0.6
PhosphorusTrichloride	0	3	2	WR	8	D002, D003	Co			
PhthalicAcid					8		NR		>240	
PicolyChlorideHydrochloride									>240	
PicricAcid	4	3	4	N	1.1	D001	Fl			150
PolychlorinatedBiphenyl	1	2	0	N	9	PCB, PCB1, PCB2	P		>480	1440
PolyethyleneGlycol							NR		>480	
Polyol							NR		>480	
PotassiumAcetate							NR			
PotassiumChromate						D001, D007	Ox			
PotassiumHydroxide	0	3	1	N	8	D002	Co-Ba	360	>240	180
PotassiumPermanganate					5.1	D001	Ox		>240	
PromethazineHydrochloride							NR	>480		
Propanol					3	D001	A	30	>480	90

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
(Isopropanol)										
Propanolamine (Monoisopropanolamine)										>480
Propiolactone										
Propionaldehyde	3	2	2	N	3	D001	A			12
Propiophenone							A		>240	
Propylacetate					3	D001	A	16.8	>480	
Propylamine	3	3	0	N	3	U194, D001	B			13.8
Propylenediamine (Diaminopropane)	3	2	0	N		D001	B			271.9
Propyleneglycol							NR		>240	
Propyleneglycolmonoethyletheracetate									>240	
PropyleneOxide	2	4	2	N	3	D001	A		>240	
PropylEther (IsopropylEther)					3	D001		>60		42.6
Propylmethacrylate								60		
PropylNitrate	3	2	3	Ox		D001, D003	OP		>240	
Propyzamide									>240	
Pyridine	3	2	0	N	3	U196, F005, D038	B	5.4	>480	1.8
Pyrrolidine					3	D001	B			
Quinoline					6.1		NR		>240	
Roundup (R) (Glycophase)							NR		>240	
RubberSolvent					3					30
SiliconEtch										>360
SilverCyanide					6.1	D003, D011, P104	P-Cn		>240	
SodiumCyanide	0	3	0	N	6.1	D003, P106	P-Cn			
SodiumHydroxide	0	3	1	N	8	D002	Co-Ba	360	>480	360
SodiumHypochlorite					5.1	D001	Ox	360	>240	360
StoddardSolvent	2	0	0	N		D001	A	>240		180
Stripper									132	
Styrene	3	2	2	N	3	D001	FI	30	>1440	12
SulfurDioxide	0	3	0	N	2.3	D001	Ox			
SulfuricAcid (Oleum)	0	3	2	WR	8	D002	Co-Ac	5	120	70.2
TannicAcid							NR	>360		>360
Tetrachloroethane					6.1	U208, U209	C	13.2		5.4
Tetrachloroethylene	0	2	0	N	6.1	U210, F002, D039	C	5	1440	6
Tetraethylenepentamine					8		NR			>480

Chemical	NFPA 704				DOT Class	Waste Codes	Category	Gloves		
	Fire	Health	Reactivity	Other				Nitrile	4-H / Silver Shield	Neoprene
Tetraethylorthosilicate					3				>480	
TetrafluoroboricAcid									>240	
Tetrafluoroethylene	4	2	3	N	2.1	D001	Hood			>480
Tetrahydrofuran	3	2	1	N	3	D001, U213	A	0.6	>480	1.2
TetramethylammoniumHydroxide					8		NR		>240	
Tetramethylenediamine							NR	108		
Thinner						D001	A		>240	
ThioglycolicAcid (MercaptoaceticAcid)					8	D002	Hood		>240	
Thiophene					3	D001	Hood		>360	
Thiourea						U219	P		>240	
Toluene	3	2	0	N	3	D001, F005, U220	A	<5	1440	1.2
TolueneDiisocyanate	1	3	2	N	6.1	U223	P	222	>480	
ToluenesulfonicAcid					8		NR			>480
Toluidine	2	3	0	N	6.1	U328, U053	P			
TransmissionOil						N	MP		>240	
Triallylamine					3	D001	B	>480		63
Tributylphosphate							NR		>240	
Trichloroacetonitrile							C			67.2
Trichlorobenzene					6.1		C	<5		60
Trichloroethane	1	3	0	N	6.1	U227, F002, U226	C	1.8	>480	2.4
Trichloroethanol							C			
Trichloroethylene	2	2	0	N	6.1	U228, D040, F002	C	<5	>1440	1.8
Trichloropropane							C	21		
Tricresylphosphate					6.1		NR	60		>360
Triethanolamine							B	>480	>240	>360
Triethylamine	3	2	0	N	3	U404, D001	B	>480		37.2
TriethyleneDiamine							NR		>240	
TriethyleneTetramine					8		B	>480	>240	>480
TrifluoroaceticAcid					8	D002	Co-Ac		>240	
Trifluoroethanol								7.2		>60
Tripropylamine					3	D001	B	>480		>480
TripropyleneGlycolDiacrylate									>240	
Turpentine					3	D001	A	30		
Valeronitrile										40.8
VinylAcetate	3	2	2	N	3	D001	FI		>480	
VinylChloride	4	2	2	N	2.1	D001, D043	Hood	342	>480	
Vinylcyclohexane						D001	FI	391.8		

Chemical	NFPA 704 Fire	Health	Reactivity	Other	DOT Class	Waste Codes	Category	Gloves Nitrile	4-H / Silver Shield	Neoprene
Vinylidenefluoride						D001	Hood			<1.2
Vinylpyrrolidone							NR		>240	
Xylene	3	2	0	N	3	U239, D001, F003	A	<5	>1440	3

Explosive 1.1	1.1
Explosive 1.2	1.2
Explosive 1.3	1.3
Explosive 1.4	1.4
Explosive 1.5	1.5
Explosive 1.6	1.6
Flammable Gas	2.1
Nonflammable Gas	2.2
Poison Gas/Toxic Gas	2.3
Flammable Liquid	3
Flammable Solid	4.1
Spontaneously Combustible	4.2
Dangerous when Wet	4.3
Oxidizer	5.1
Organic Peroxide	5.2
Poison/Toxic	6.1
Infectious Substance	6.2
Radioactive Material	7
Corrosive Material	8
Misc Hazardous Materials	9

Mixed CHO Compounds	A
Acid - Heavy Metal	Ac-HM
Nitrogenated Hydrocarbons	B
Halogenated Hydrocarbons	C
Corrosive	Co
Corrosive - Acidic	Co-Ac
Corrosive - Basic	Co-Ba
Explosive	Ex
Flammable	Fl
Keep under Fume Hood	Hood
Keep for other uses	Keep
Motor Pool Recycling	MP
None	N
Non-Regulated	NR
Organic Peroxide	OP
Oxidizer	Ox
Poison	P
Poison - Cyanide	P - Cn
Poison - Mercury	P - Hg
Poison - Heavy Metal	P - HM

Appendix J
References

Prudent Practices in the Laboratory (2011):
http://www.nap.edu/read/12654/chapter/1

NIOSH Pocket Guide to Chemical Hazards:
http://www.cdc.gov/niosh/npg/

Safe Science: Promoting a Culture of Safety in Academic Chemical Research (2014):
http://www.nap.edu/catalog/18706/safe-science-promoting-a-culture-of-safety-in-academic-chemical

13th Report on Carcinogens - National Toxicology Program:
http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html

Air Products SafetyGrams on Compressed Gases:
http://www.airproducts.com/company/Sustainability/environment-health-and-safety/product-safety-safetygrams.aspx

OSHA Lab Standard:
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106