CHEMICAL HYGIENE PLAN

COLLEGE OF SCIENCE AND ENGINEERING
UNIVERSITY OF SOUTHERN INDIANA

DEVELOPED 9/5/07

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DISCLAIMER

THIS PLAN IS DESIGNED FOR USE IN ANY GENERAL LABORATORY SETTING THAT IS ENCLOSED IN THE UNIVERSITY.

THE GUIDELINES IN THE PLAN ARE MEANT TO BE THE GENERAL REQUIREMENTS TO ENSURE LABORATORY SAFETY, HOWEVER IT MAY BE NECESSARY TO ADD SPECIFICATIONS TO THE PLAN TO FIT THE REQUIREMENTS OF YOUR LABORATORY.

PLEASE REVIEW THE SAFETY REQUIREMENTS NEEDED FOR YOUR LABORATORY AND MAKE THE NECESSARY ADDITIONS TO THIS PLAN BEFORE IMPLEMENTATION.

PLAN REVIEW FORM (TO BE COMPLETED BY INSTRUCTORS OR RESEARCH SUPERVISOR)

LOCATION OF LAB_____

THIS CHEMICAL HYGIENE PLAN WAS REVIEWED AND CONTENTS ACCEPTED FOR THIS LOCATION

NAME OF PERSON POSITION DATE

PLAN TRAINING FORM

TEACHING LAB-SIGN BY ALL LABORATORY INSTRUCTORS

RESEARCH LAB-SIGN BY ALL RESEARCH STUDENTS

THE FOLLOWING HAVE REVIEWED THE CHEMICAL HYGIENE PLAN IN ACCORDANCE TO TRAINING REQUIREMENTS (REFER TO PART VI-EMPLOYEE INFORMATION AND TRAINING)

LOCATION

NAME TITLE DATE

PART I. INTRODUCTION

I. INTRODUCTION

PURPOSE OF THE CHEMICAL HYGIENE PLAN

OSHA (Occupational Safety and Health Administration) has established a standard (29 CFR 1910.1450), which establishes rules designed to protect employees from health hazards associated with hazardous chemicals in the laboratory.

A part of this requirement is the development of a chemical hygiene plan, which shall be readily available to all employees who work in such hazardous environments. This plan contains work practices, procedures, and policies which when followed will provide a safe environment.

This plan must be presented to all employees and provide to OSHA during inspections.

29 CFR 1910.1450 may be found in Appendix 1

PART II DEFINITIONS AND RESPONSIBILITIES OF EMPLOYEES

II. DEFINITIONS AND RESPONSIBILITIES OF EMPLOYEES

DEFINITIONS

"**EMPLOYEE**" REFERS TO IN THIS PLAN AS ANY FACULTY, STAFF MEMBER, OR STUDENT WHO TEACHES OR WORKS IN A LABORATORY ENVIRONMENT AND MAY BE EXPOSED TO CHEMICAL HAZARDS.

"**LABORATORY**" REFERS TO ANY FACILITY WHERE THE LABORATORY USE OF CHEMICALS OCCURS IN A SMALL SCALE QUANTITY ON A NON-PRODUCTION BASIS.

THIS MEANS THAT CHEMICALS ARE BEING HANDLED UNDER THE FOLLOWING CONDITIONS:

1. CHEMICAL MANIPULATIONS CAN SAFELY BE PERFORMED BY ONE PERSON. PROCEDURES INVOLVED ARE NOT PART OF THE PRODUCTION PROCESS NOR IN ANY WAY SIMULATE A PRODUCTION PROCESS.

2. PROTECTIVE LABORATORY PRACTICES AND EQUIPMENT ARE AVAILABLE AND IN COMMON USE TO MINIMIZE THE POTENTIAL FOR EMPLOYEE EXPOSURE TO HAZARDOUS CHEMICALS.

THE FOLLOWING BREAKDOWN IS USED TO DEFINE EMPLOYEE'S RESPONSIBILITIES DIRECTED BY THE CHEMICAL HYGIENE PLAN

CHEMICAL HYGIENE OFFICER RESPONSIBILITY GUIDELINES

- Oversee the procurement, use, and disposal of hazardous substances.
- Assist the lab supervisors in identifying hazardous operations, establishing safe work practices, and selecting protective equipment and other exposure controls.
- Set criteria for evaluating potential exposures, including description of circumstances requiring prior approval for use of hazardous chemicals and/or conduct of hazardous operations.
- Arrange for employee monitoring (as required); inform employee of the results and use the data to aid in the evaluation and maintenance of appropriate laboratory conditions.
- Consult the laboratory staff on health and safety matters.
- Develop the written health and safety plan/chemical hygiene plan to include rules and procedures for safe work practices; review and evaluate the effectiveness of the plan at least annually and update as necessary.
- Coordinate with the lab supervisor to obtain, review, and approve health and safety standard operating procedures (SOP) required for inclusion in the health and safety plan/chemical hygiene plan.
- Ensure the health and safety plan/chemical hygiene plan is available to the lab staff.
- Develop health and safety training plans and programs, conduct training courses, establish safety references, and establish record keeping systems to document training activities.
- Ensure the staff receives instruction and training in safe work practices and in procedures for responding to incidents involving hazardous substances.
- Conduct formal, periodic laboratory inspections to ensure compliance with laboratory policies.

- Interact with the lab supervisor to evaluate and correct deficiencies in the health and safety program.
- Investigate and report (in writing) to lab supervisor and management any significant problems pertaining to the safe operation of equipment and the facility and to the implementation of control practices.
- Support follow-up to accidents and incidents and assist the lab supervisor and other key staff with accident investigation.
- Coordinate with health services to establish a system for provision of medical consultations and examinations.

LABORATORY SUPERVISOR RESPONSIBILITY GUIDELINES

- Ensure that all work is conducted in accordance to local policies and guidelines, as well as all applicable local, state, and federal regulations.
- Select, with the HSO/CHO, the appropriate control practices for handling test substances, positive controls, and other hazardous substances.
- Coordinate with the HSO/CHO to develop, review, and approve health and safety standard operating procedures required for inclusion in the health and safety plan/chemical hygiene plan.
- Prepare, with the HSO/CHO, procedures for response to accidents/incidents involving hazardous substances that may result in the unexpected exposure of personnel and/or release to the environment.
- Prepare a safety plan for use of unusual substances when this use involves alternate procedures not specified in the health and safety plan/chemical hygiene plan.
- Ensure that required health and safety documents have been prepared and approved, and that corresponding programs have been implemented.
- Report to the HSO/CHO the location of work areas where test substances and other hazardous agents are being used, and ensure that the inventory of test substances is properly maintained.
- Ensure that the MSDS'S and other available additional information for hazardous chemicals and health and safety information documents for each study agent/positive control are obtained and maintained.
- Ensure that workers know and follow safety policies and practices, that workers are properly trained, and that training activities are properly documented.
- Ensure that ventilation systems and other engineering controls are monitored regularly and maintained in sound working conditions.
- Follow recommendations of the HSO/CHO and correct any unsafe laboratory conditions.
- Inform the HSO/CHO of any accidents/incidents involving exposure to hazardous substances.
- Provide and coordinate appropriate follow-up to injuries, illnesses, and incidents, including medical consultation and examination as necessary.
- Conduct regular safety inspections; participate in other audits and evaluation as necessary.

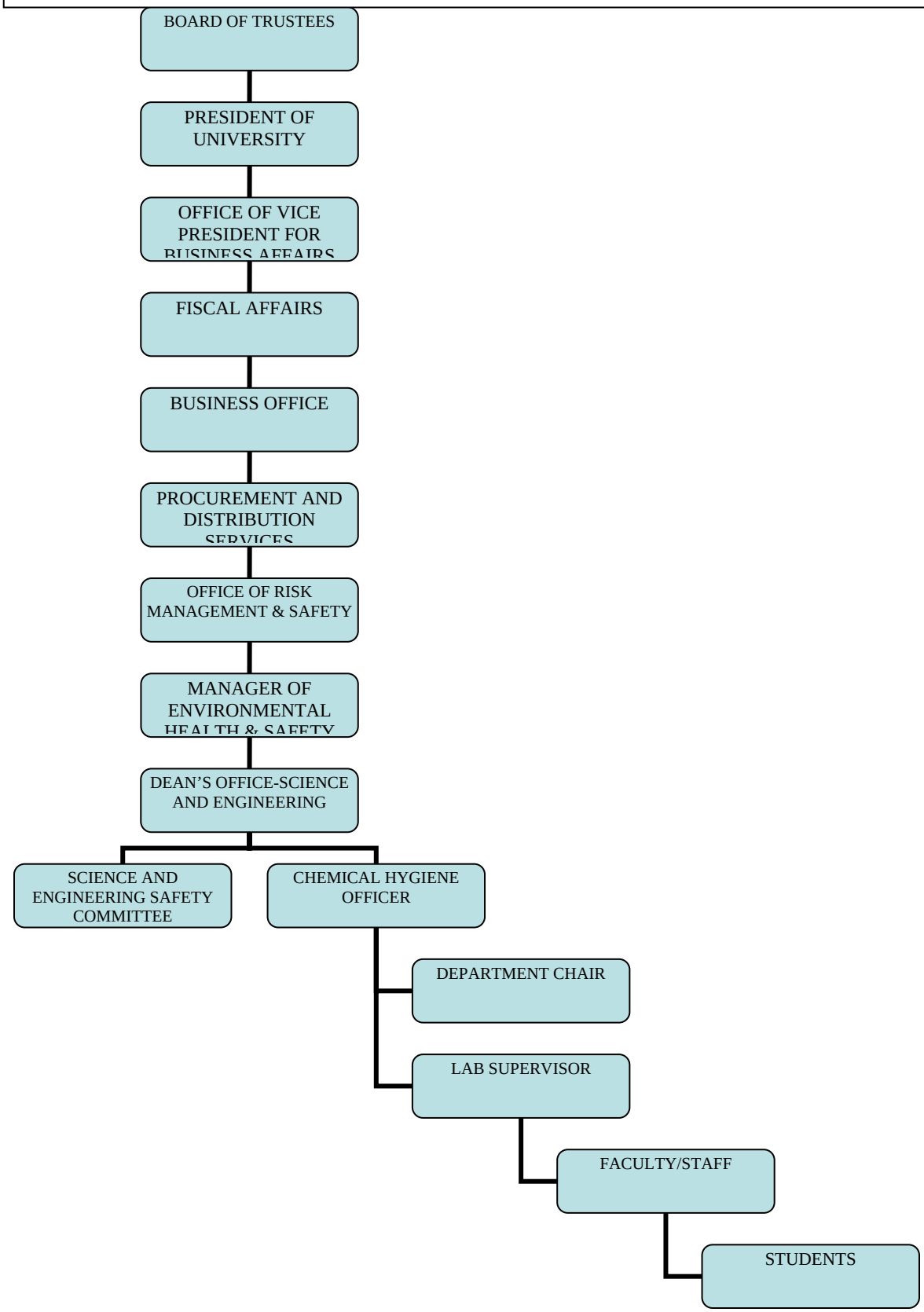
FACULTY AND STAFF

- Understand and act in accordance with the safety requirements established for the laboratory.

- Wear and properly maintain the personal protective equipment necessary to perform each task to which he/she is assigned.
- Use engineering controls and safety equipment properly and according to laboratory requirements.
- Follow good industrial and chemical hygiene practices.
- Participate in all required training programs.
- Read, understand, and sign off on health and safety SOP's and other program documents.
- Report to the supervisor or the HSO/CHO all facts pertaining to accidents that result in injury or exposure to hazardous substances and any action or condition that may result in an accident (AKA-near miss).
- Assist with the medical consultation/examination process by providing required information to the examining physician.

SOURCE Stricoff and Walters, Handbook of Laboratory Health and Safety 2nd ed.,

CHAIN OF RESPONSIBILITY IN REGARDS TO THE CHEMICAL HYGIENE PLAN



PART III. STANDARD OPERATING PROCEDURES

III STANDARD OPERATING PROCEDURES

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THE CHEMICAL HYGIENE PLAN COVERS THE FOLLOWING FACILITIES:

ALL LABORATORIES ENCLOSED WITHIN THE FOLLOWING DEPARTMENTS

BIOLOGY

CHEMISTRY

PHYSICS

GEOLOGY

ENGINEERING

SECTION A-GENERAL GUIDELINES FOR WORKING IN A LABORATORY

1. PERSONAL PROTECTIVE EQUIPMENT
   Protect yourself from potential injury by choosing appropriate personal protective equipment for the task. The following list will detail personal protective equipment available in the laboratory.

   a. EYE PROTECTION
      1.) Safety glasses

      At a minimum, safety glasses meeting ANSI standard Z87.1 (APPENDIX II) must be worn AT ALL TIMES while you are in a lab area where eye hazards are a possibility.

      Prescription eye glasses and contact lenses
      Prescription eyeglasses are NOT ACCEPTABLE as a form of eye protection. While they may meet FDA accepted guidelines for eye protection, they do not provide the side shield protection required in the laboratory. Safety glasses or goggles must be worn over eyeglasses.
      Contact lenses are allowed in the laboratory however be aware that some organic solvents will react with the lens and can cause serious eye damage. Safety glasses or splash goggles must be worn with contact lenses since contact lenses are not an adequate form of eye protection. It is also recommended that you let your co-workers know that you are wearing contact lenses so that proper safety measures can be taken in case of emergency.

      2.) Chemical Splash Goggles

      These are designed for additional eye protection especially when working with hazardous liquids (example, corrosives) or anything where a splashing hazard is present. These goggles should be splash proof goggles and not industrial or garden goggles where materials can spill into them.

      3.) Complete Face Shield or Blast Shield

      These are designed for highly hazardous or explosive materials. The ideal shield will be one that covers the face down to the neck. You must wear either safety glasses or chemical goggles in addition to the face shield. It is also advisable that any procedure that involves the use of a face shield be carried out with the use of an additional barrier or contained environment.

      4.) Safety Glasses for Optical Light Hazards
      When working with optical light hazards, use eye protection that has wavelength protection corresponding with the light. An example is the use of plastic safety glasses when working with UV light. The plastic will provide moderate UV protection since the plastic cuts off light at longer wavelengths.

b. SKIN PROTECTION

1.) Appropriate Clothing and Attire
When chemicals or hazardous materials are being used, proper attire in the laboratory provides some protection to the body and may prove to be the difference from keeping a minor injury from becoming a major one. No loose clothing is to be worn because it can come into contact with instrumentation or chemicals. Long hair must be tied back for the same reason.

Shoes must be made of leather or equivalent material and should cover the feet completely. Sandals or flip-flops are not allowed. Shoes that are made of canvas are not recommended because the chemical can transfer through the fabric and stay trapped to the skin.

2). Gloves

a.) Chemical Hazards
Always wear protective gloves when working with chemical hazards. A chemical resistance chart is given in Appendix III. In general, nitrile gloves provide the best all around protective. Latex gloves will provide minimal coverage and are not recommended for chemical handling. Make sure when wearing gloves not to contaminate water/utility/door handles or other surfaces likely to be touched by bare hands. Be sure to inspect the gloves for punctures or tears before wearing them. Wash or decontaminate the gloves before removing them.

Please note that the best source for determining what glove to wear is to consult the manufacturers chart as far as what materials their products are meant to handle.

If you have any questions, consult with your lab supervisor.

b.) Broken Glassware/Glassware under strain
Always wear leather gloves when working with either broken glassware and or glassware that are under strain. Be advised that leather gloves do not provide protection from chemicals.

c.) Temperature Extremes
Use an appropriate insulated glove when working with temperature extremes. As with leather gloves, these gloves do not provide protection from chemicals.

2. INGESTION/INHALATION HAZARDS

a. Smoking, Food, and Drink Policy

Smoking, eating, and drinking are forbidden in the laboratory. Airborne powders/sprays/vapors, as well as residues on surfaces, can contaminate food and drink.

Application of cosmetics is forbidden in areas where hazardous chemicals are used and shall be done only in well-defined designated non-chemical areas.

If food is to be used as part of an experiment it must be labeled for such purposes when stored. Under no circumstance is this food to be consumed by anyone.

If an experiment is designed that involves consumption of food, it is the job of the experimenter, instructor, and lab supervisor to develop appropriate protocols for handling of this material.

b. Pipetting Regulations
Never pipette by mouth. Always use a pipette bulb or other means as appropriate.

c. If any situation occurs in which you have to smell a chemical, waft the sample with your hand rather than directly smelling the substance.

d. Personal Hygiene
Hands should be washed frequently throughout the day, especially after working with chemicals. If wearing gloves, do not leave the room or interact with anything that may come in contact with someone and possibly subject the person to exposure.

3. GOOD PERCEPTION OF SURROUNDINGS
A good perception of your surroundings is very important. Watch out for yourself and your coworkers. If you are unsure of what you are doing, ask! Don't feel embarrassed to ask even the simplest question. Please understand that others use common laboratory equipment (the balances, melting point apparatus, hot plates, etc.). Take care of the equipment and clean up all messes.

4. GOOD HOUSEKEEPING RULES

a. Label all containers
Any sample that is transferred to a secondary container should be labeled as follow:

Name of chemical spelled out. Chemical formula if possible.
Concentration of Material
Date Produced
Class
Hazard description along with target sites if possible.

Student submitted samples should be labeled as follows:

Name of chemical spelled out. Chemical formula if possible.
Concentration of material
Date Produced
Name of Student and Class Student is in

b. Wipe up all spills.
If you spill anything on the balances, or on the bench tops, or in the hood, clean it up immediately. If unsure of how to clean up the spill, consult your instructor or lab supervisor.

c. Maintain your bench tops and hoods free of clutter.
Personal belongings should be kept in the designated area or not brought at all into the laboratory.

d. Chemical hazards should be kept at least 2" from the edge of bench tops.

e. Maintain exits, aisles and safety equipment free of all obstructions.

Aisles within the laboratory should be at least 36 inches in clear width. Doors which are not in use but which are accessible from a corridor or adjacent room should be appropriately labeled if they are blocked on the interior of the room. Hallways are not to be used as storage areas. Work areas and floors are not to be used for excessive storage.

5. Safety Facilities and Procedures
Familiarize yourself with the safety facilities and procedures in the lab. Everyone is expected to know the location of all emergency equipment, alarms, spill kits, and emergency exits.

6. Proper Conduct
Horseplay is strictly forbidden in lab. Anyone caught doing this will be removed from the lab and disciplined accordingly.

7. Unattended Experiments
   Do not leave experiment unattended without proper fail-safes installed. Use caution and adequate labeling which includes the name of the material being used as well as contact information for you and your instructor in case of emergencies. Experiments requiring heat should be under supervision at all times unless proper precautions have been taken.
8. Sinks
   Do not pour reactions down the drain unless you have received approval from instructor or lab supervisor. Use proper waste disposal techniques as needed.
9. Transfer of Chemicals
   Never pour chemicals directly from storage containers into your reaction vessel. Use a beaker or flask to pour solution into, and then add appropriately to your reaction vessel.
10. Flammable Liquids and Open Flames
    Use extreme caution when using an open flame in the vicinity of flammable liquids. If possible, substitute a hot plate or heating mantle when heating flammable liquids.

    Note about the use of hot plates: Be aware that the hot plates are a spark hazard and should be used as a *last resort* if heating mantles or water baths cannot be used to heat flammables.
11. Unauthorized Personal
    Children and unauthorized persons are not permitted in the laboratory where hazardous substances are present.
12. Signage
    Laboratories should be equipped with necessary signage to indicate types of hazards present in the area. Safety equipment should be clearly marked as well along with emergency contact information. Consult Lab Supervisors for more information

SECTION B. GUIDELINES FOR HANDLING EQUIPMENT AND APPARATUS

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1. Good Condition

   Use proper equipment that is in good condition. Never used cracked or chipped glassware. Replace tubing that has dry-rotted or cracked.

2. Secured

   All apparatuses should be securely mounted for any task that requires it. Heating devices should be readily and quickly removable in case of adverse reaction. All power cords and anything flammable should be kept at a safe distance from any hot surface.

3. Catch Pans

   When possible, catch pans should be placed under reaction systems so that if a reaction should get out of control or the container accidentally breaks, the reactants and solvents are contained and reaction materials may be easily recovered and work resumed.

4. Compressed Gas Cylinders

NOTE: ANY TASK THAT INVOLVES THE MOVEMENT OF A CYLINDER OUT OF OR INTO THE LABORATORY NEEDS TO BE CLEARED THROUGH THE EQUIPMENT TECHNICIAN

Compressed gas cylinders can pinwheel or rocket through masonry walls if the regulator valves are broken off and can explode if substantially weakened structurally. Precautions

to prevent injury when working with compressed cylinders included: Cylinders should be firmly secured at all times with a belt or chain. An appropriate hand cart with a strap should be used for moving cylinders

Moving and storing cylinders

a. Cylinders must be capped during movement
b. Cylinders should be kept away from sources of heat or ignition.
c. Cylinders should be stored with their protected caps on and the cylinder secured (strapped or chained down) to reduce the chance of the cylinder being knocked over. Storage of large quantities of cylinders must be done in an approved gas cylinder storage area.

Any questions concerning the use of gas cylinders should be directed to the equipment technician.

5. Dewar Flasks

All Dewar Flasks must be handled carefully. They represent an implosion/explosion hazard with the potential of abruptly releasing glass shrapnel and the contents of the container.

6. Electrical Equipment

Access to electrical shut-offs (plugs, switches, and electrical panels) must be maintained free from obstructions to allow immediate access in case of emergency. All receptacle outlets in laboratory spaces shall be the polarized grounding type.

a.) Repairs

Safe procedures to use in repairing electrical equipment are: 1.) Turn off the equipment but leave it plugged in for a few seconds so that the internal capacitor have time to discharge to ground potential. 2) Unplug. 3) If unsure for any reason on repairs, contact equipment technician for repair. 4) Do not replace blown fuses with fuses of higher ratings. 5) If you are working on any apparatus that is or was capable of producing high currents or high voltages, assume that the voltage is still resident within the device when probing for problems. Never have more than one hand in the apparatus, keeping the other hand in your pocket. 6) Do not use a standard voltmeter with standard leads to measure high voltages because the voltmeter could explode.

b.) Extension Cords

All electrical extension cords used shall be visible and inspected on a periodic basis for damage and or defects. Cords may not run through doors, walls or partitions, under rugs or above dropped ceilings. They may not be wrapped around fixtures, tied in knots, or draped over pipes, lights, and ventilation ductwork. Cords may not run down aisles or corridors where it could reasonably be expected they would be damaged or create a tripping hazard.

Electrical extension cords may not be used to supply equipment that is frequently moved. Extension cords may not be used as a substitution for fixed receptacles. Electrical extension cords should not power a device for over 24 hours. Anything requiring that should be connected to a fixed receptacle. Cords used for 110-120 volt service shall be UL listed standard heavy-duty three wire equipped with a polarized three-prong plug. One of the wires shall be an equipment-grounding conductor. In no case shall a two-wire type extension cord be used. Use of a two-wire type extension cord should be avoided.

Frayed cords must be replaced.

Extension cords must be of appropriate length. Excessive lengths or inadequate conductor sizing causes resistive heating, creating a fire hazard.

Power strips should not be plugged into another power strip.

7. Vacuum systems

Evacuated glassware poses a significant implosion hazard, potentially releasing glass shrapnel and the contents of the container.

a.) Desiccators

Caution must be given when evacuating desiccators. Inspect for defects/cracks. Implosion protection should be provided without impairing visual inspection. This is often accompanied by wrapping tape in a grid pattern that leaves the contents visible while guarding against flying glass should the vessel implode.

b.) Flasks

Never evacuate ordinary flasks with flat surfaces. Always use a round bottom flask or flask designed for use with a vacuum.

c.) Rotovaps

The body of a rotary evaporator needs to be implosion protected. A one-liter flask is the largest that can be used with most rotary evaporators.

d.) Water Aspirators

Glassware evacuated using water aspirators poses a significant implosion hazard. Aspirators are a good vacuum source relative to atmospheric pressure and care should be taken when evacuating glassware with water aspirators.

8. Flooding

Flooding from laboratory sinks and service connectors has caused major damage to research equipment, furniture, and project records on both the flooded floor and floors below. In addition to physical damage, the standing water creates significant electrical shock and slip hazards. The following measures can be taken to minimize the chance of flooding.

a.) Sink and Hood Gutter Drains

Maintain sink drains open. Make sure there are no objects or debris in the sinks or hood gutters that could restrict flow down the drain.

b.) Water Regulators

If available, use a water line with a regulator on it for all unattended water use. Water regulators in the lab reduce the chance of flooding because they maintain a steady flow of water regardless of changes in water pressure in the building. To insure regulators will work properly:

1). Make sure valves in line with the regulator are fully open
2). Flush out debris from the regulator by momentarily increasing flow through them.

c.) Tubing

Replace tubing before it becomes too decomposed or brittle

d.) Bench top vessels

When filling bench top vessels, such as water baths from the sink, consider placing the receiving container into a sink-drained secondary container or tray.

9. Laboratory Chemical Hoods (Fume Hoods) (consult part V of this plan for hood inspection parameters)

a.) Usage

Laboratory chemical hoods should be used when chemicals being used have high sufficient volatility to be hazardous or offensive if vented to the laboratory atmosphere. These chemicals include but are not limited to volatile organics, corrosives, highly exothermic when mixed, and solutions that give off hazardous vapor when prepared (ex, sodium hydroxide added to water). Highly toxic chemicals should only be used under a hood. Highly toxic chemicals are those with a PEL (Permissible exposure limits) of 50 ppm or less. Additional considerations include chemical toxicity, flash point, flammability, and odor.

b.) Sash

If possible, position the sash so that work is performed by extending the arms under or around the sash, placing the head in front of the sash, and keeping the glass between the worker and chemical source. The worker will view the work through the sash that will serve as a barrier if a spill, splash, or explosion should occur. Maintain the sash at the lowest comfortable level to serve as a safety shield but not as a hindrance to the work being performed.

Periodically, check to make sure the sash is operating properly. If the sash feels too loose or too tight, do not use the hood. Contact physical plant for repairs. This problem means that the sash is ready to fail and will potentially fall down causing serious injury.

c.) Appropriate Working Space and Usage

1) Six inches back

Maintain all items in the hood at least six inches behind the sash opening to minimize turbulence that would degrade the operation of the hood.

2) Placement of equipment

Place equipment as far to the back of the hood as possible without blocking the bottom baffle.

Hoods are not designed for Large Equipment

It is recommended that large equipment not be used in fume hoods, as this tends to cause dead space in the airflow and reduce the efficiency of the hood. However, if it is necessary to place large equipment in a hood, the equipment

can be placed on legs or blocks (min. of 2 inches high) to allow the proper flow of air under and around the equipment.

3) Hoods are not intended for storage

Avoid using hood for storage. If storage is necessary, locate material so as to minimize air flow disturbances. Use of blocks to elevate equipment above the lower baffle air intake can improve the hood's airflow.

4) Tampering with Hood Not Permitted.

Do not modify hood in any way that adversely affects the hood's performance. If hood modifications are needed, consult laboratory supervisor. Proper hood airflow must be verified following any modification.

5) Hood not Intended for Waste

Do not intentionally utilize a hood for waste disposal. Waste may be temporarily collected in a fume hood. Consult lab supervisor or chemical hygiene officer with questions.

6) Hood Malfunctions

If for any reason a hood is not operating properly contact lab supervisor immediately. Clearly label the hood as out of order and problem associated with hood.

7) Keep Hood Closed

Keep the hood sash closed when you are not actively working in the hood area.

d. Hood Performance

Laboratory fume hoods should be designed to attain a face velocity of 100 ft/min. They should be capable of maintaining a minimum average face velocity of 80 ft/min with a sash open to approximately 18 inches. Typically a range of 80-120 ft/min is acceptable for most uses.

1) Air Flow

Always verify airflow PRIOR to starting experiments or commencing work. Check air flow visually to assure the hood is functioning adequately. Air flow may be checked visually including:

Simple tell-tale device such as a Kim wipe, tinsel, or a ribbon attached to the sash.
Installed hood monitors
Anemometer may be borrowed from Chemistry Laboratory Supervisor.

2) Turbulence

Avoid opening and closing the hood sash rapidly as well as swift arm and body movements in front of or inside the hood. These actions may increase turbulence and reduce the effectiveness of hood containment.

3) Cross Drafts

Check room condition in front of the hood prior to use. Any cross drafts present may seriously degrade the performance of the hood. Minimize cross drafts from open windows or people passing by.

4) Alarms

Do not disable alarms. Know what they mean, act on what they indicate, and report the discrepancy for corrective maintenance.

5) Exhaust fan

The hoods exhaust fans should remain on. Also remember that the hood doors should always be kept closed when you are not actively working in the hood area.

10. Glassware

a. Glass Containers

Glass containers are easily broken, resulting in a significant threat to life and property depending upon the contents, quantity, and location. To minimize the chance of breaking glass bottles, store them properly and well protected if on the floor. Transport them safely using a bottle carrier when transporting glass containers in the halls, stairwells, and elevators. If a bottle carrier is not available, use a cart to transport. Place the bottle in a plastic container and then set the container on the cart. Minimize the size of your working containers. Use proper protective gloves that do not hamper dexterity.

b. Glass Tubing and Thermometers

When cutting, inserting, or removing glass tubes or thermometers into/from corks, rubber stoppers or hoses, always use protective gloves or wraps. Lubricate glass with glycerin or soap. Moisten TYGON® tubing with acetone. All glass tubing should be fire polished at both ends. When pushing glass tubing through a cork or stopper, lubricate the glass with glycerin, then grasp the glass with a wad, cloth, or paper toweling at a point near the end to be inserted. DO NOT FORCE IT! Enlarge the hole with a cork borer if needed.

c. Damaged Glassware

Do not use cracked or chipped glassware. Examine your glassware for star cracks. Broken glassware should be replaced immediately. When dealing with broken glassware, be sure to use leather gloves and protective eyewear. Do not handle broken glassware directly, but sweep into a dust pan or similar equipment. See table below for specific information.

TYPE OF GLASSWARE	TYPE OF PACKAGING	DISPOSAL
Non contaminated lab glass	Glass Disposal Box	Contact Supervisor when full
Chemically Contaminated Lab Glass	Glass Disposal Box	Contact Supervisor when full
Biologically Contaminated Lab Glass	Biohazardous Sharps Container	Contact Biology Supervisor when full.

11. Heating Cautions

    a. Closed Systems

    Never heat a closed system! Always use a boiling chip when heating any liquid, even water. When heating a test tube, never point it at yourself or at anyone else.

    b. Flammable Solvents

    When possible, use a hot plate or heating mantle when heating flammable solvents. Avoid using a Bunsen burner around flammable solvents. If using a Bunsen burner, first be sure that none of your neighbors are using flammable solvents. Light the match first, then turn on the gas supply by using the gas valve on the counter and then using the regulator on the burner while holding the match close to the top of the burner. Long hair must be kept tied back and do not wear garments with floppy sleeves or loose wrist cuffs when using a burner. When finished, turn off the regulator valve of the burner and then turn off the gas valve on the counter. Do not blow the flame out. If the flame should happen to go out, immediately shut off the gas valve on the counter.

12. Heating Mantles

    Heating mantles are ok for heating flammable solvents. They are not suitable for heating highly flammable solvents or reactions where you wish to control the temperature carefully because they form hot spots that can result in intense localized heating and or fire. A stirred fluid bath with temperature control would be better in these situations. Regardless of either means, use an appropriate size mantle or bath for the reaction vessel. Also avoid overheating.

13. High Voltage and/or High Current Equipment

    Equipment that produces high current or high voltage is a special problem in many analytical labs.

    a. Warning Signs

    As a general warning of the dangers, equipment using high currents or high voltages must be clearly marked.

    b. Precautions

    Grounding- Use a 3-prong plug for proper grounding unless other grounding provisions are made and checked. OSHA REQUIREMENT

    Safe Territory- Avoid becoming grounded by staying at least 6 feet away from all metal materials including walls and water.

    One Hand Rule- Work with only one hand keeping the other hand at your side/in your pocket and away from all conducting materials. This prevents accidents resulting in current passing through the chest cavity.

14. Lasers

a. Knowledge of Hazards

Know the hazards associated with the particular laser(s) with which you are working.

b. Warning Signs

It is important to have warning signs for optical light hazards at all the entrance doorways. Not all potentially dangerous light can be seen by the human eye.

c. Light Paths

Mark paths of intensive laser light. Before adding or removing optical components anticipate and examine projected light paths.

d. Eye/Skin Protection

Always wear specially designed protective glasses or goggles. You must protect your eyes and skin when operating open UV light sources (including UV absorbance, LC detector, and hollow cathode lamps).

e. Reflective Jewelry

Remove all reflective jewelry before working with lasers. (A laser reflected off a ring can permanently blind you.)

f. Height of Laser Beam

Ensure to keep laser beams at or below chest height.

SECTION C-GUIDELINES FOR HAZARDOUS MATERIAL HANDLING AND STORAGE (REFER TO APPENDIX VI FOR DETAILED CHEMICAL INFORMATION, APPENDIX V FOR INFORMATION PERTINANT TO THIS LAB)

Hazards associated with various chemicals and gases vary widely. Understanding the hazards associated with a compound and prudent use and storage of these materials will decrease the chance of injury.

1. Hazardous Materials

When working with hazardous materials, it is advisable to have a second person present, or at a minimum, maintain surveillance via telephone contact. You should never work alone when you are working with high-energy materials, high pressures, quick-acting/highly toxic materials, or transfer of flammable materials (except in small quantities), and when previous experience indicates the need for assistance.

2. Labels

Make sure all labels are legible. Read the label carefully and make note of all hazards associated with the chemical. All secondary containers should be labeled as follows:

Name of chemical, spelled out. Chemical formula if possible.
Concentration of Material
Date Produced
Class
Hazard description along with target sites if possible
Expiration date of all peroxides and other chemicals that may become unstable over time

3. Dry Ice Baths

An appropriate liquid for dry ice cooling baths is isopropyl alcohol, being less flammable and not as prone to froth as acetone.

4. Drying Ethers

Use of sodium/benzophenone is an acceptable means of drying ethers. Lithium aluminum hydride (LAH) while used in the past should not be used to dry ethers because LAH is a serious fire hazard. LAH decomposes at 125^{o} C which can easily be reached at a flask's surface in a heating mantle. LAH's decomposition products can be quite explosive, especially when combined with CO_2. Therefore do not use CO_2 extinguishers with fires involving LAH.

5. Mercury

Mercury vapor is highly toxic. Since mercury has a low vapor pressure, the evolution of mercury vapors is only a concern when the mercury is heated. Mercury spills are very difficult to clean up because mercury splashes into microscopic balls, which roll into cracks and crevices where they cannot be easily seen or removed.

To reduce the chance of mercury spills, use a catch pan of appropriate size and depth under all mercury-containing equipment. If possible, use non-mercury equipment. Never use a mercury thermometer in a heated oven.

If in the event of a mercury spill, obtain a mercury cleanup kit from SC 2226 unless a kit is located in your lab. Follow the printed instructions on the kit carefully. Contact lab supervisor to arrange for pickup of disposal materials or help with cleanup.

6. Peroxide Formers

Minimize the hazards associated with peroxidizable compounds. Commonly used solvents such as ether, dioxane, and THF can form explosive peroxides after exposure to air. It is highly recommended that it is labeled with the date when the container is initially opened. Store the compounds in an obvious location where they will not be forgotten. Check peroxide formers for peroxides after six months from opening for presence of peroxides. Test strips may be obtained from the Chemical Distribution Center (SC 2226) or can be purchased through lab supervisor. Solutions should be discarded a year from opened date. It is also recommended that these substances be tested for peroxides prior to performing distillations or evaporations.

7. Mal-Odorous compounds

Precautions should be taken when working with mal-odorous compounds. Minimize the quantity of material and time the container is open. Maintain the chemical and contaminated material in a sealed container. Be advised that mercaptans have an odor similar the additive in natural gas. If

working with these compounds, let people in the area know so they do not suspect a gas leak has occurred.

8. Noxious Gases

The internal pressure in laboratories is generally less than the outside pressure. Since the drainage system is vented to the atmosphere on the roof, it is easy for odors and noxious gases to be swept back into the lab through open sink drains. Two things can be done to avoid this:

a. Keep all sink traps filled with water by running water (a gallon or so) down the drain at least monthly.
b. Do NOT utilize the sinks for waste disposal.

TIP! -If you are performing shower inspections, you can pour the water from the trap bucket down the drain and resolve the matter before it even becomes a problem.

9. Chemical Hazards

Many of the chemicals used in the laboratory will be new to you. IT IS HIGHLY IMPORTANT THAT YOU ARE AWARE OF THE SPECIFIC HAZARDS ASSOCIATED WITH THE CHEMICAL AND THE EQUIPMENT THAT YOU ARE WORKING WITH. You should also be aware of all the properties associated with that chemical as well. An MSDS is a good starting base but should not be the only reference in understanding the chemical. The Merck Index, The CRC, compatibility charts and other reference books should be consulted as well. Be sure to read the label on the bottle as well. If still unsure, consult your lab supervisor, faculty or coworker for more information. Overall, it is your responsibility to understand everything you need to know about the chemical.

All chemicals should be treated as though they were toxic. Compounds can enter the body by being absorbed through the skin, inhaled, or ingested.

a. Hazard Awareness

1) Terminology

Whenever you encounter a key word describing a chemical hazard and are unsure as to the meaning of the term, you must refer to a dictionary, reference book, coworkers, etc., to understand what it means.

2) Material Safety Data Sheets

Review the MSDS if unfamiliar with the specific hazards. MSDS forms are located with the Biology supervisor (SC 1264) and in the Chemical Distribution Center (SC 2226). They may also be looked up online through the vendor of the chemical and also found online at http://msdssearch.com/.

b. Personal Protective Equipment

Identify and use the proper personal protective equipment for the task.

c. Housekeeping

Utilize good housekeeping techniques such as:

-Keep aisles clear
-Clean up all spills
-Clean up all glassware
-Wipe down counters and all areas you worked in

d. Dilution of Acids

To dilute acids remember “AA”, add acid. Carefully and slowly add the concentrated acid to water and never the other way around. This avoids dangerous splattering. Another thing to remember is that this is an exothermic process (Heat is given off). When diluting nitric and sulfuric acids, it is a good idea to set the mixing container in a tub of ice to keep the solution cool.

e. Synthesis of a New Compound

If you are synthesizing a new compound, or have a compound for which an MSDS is not available, review MSDS for similar compounds to obtain further information regarding possible hazards. It is best to develop a protocol for the process and keep on file in the lab as well as keep a record of all MSDS pertaining to the synthesis of the material.

10. Minimization of Hazardous Waste

Minimizing wastes also minimizes safety hazards. The following procedures will help to reduce hazardous waste.

a. Minimize

Minimize the amount of required materials. If possible, use miniscale or microscale procedures.

b. Substitute

If possible, use a less hazardous material in your experiment.

c. Inspect

Periodically inspect the inventory of chemicals and dispose of unwanted or unusable items.

d. Avoid
Avoid purchasing of larger quantities than needed. Even though it may be cheaper to order a larger quantity, you will have to turn around and pay that savings and most of the times more than what you saved to dispose of it.

e. Check

Before ordering from an outside vendor, check your supplies, or consult with another department to see if they could supply you the amount.

f. Treat Small Amounts of Reactive Waste Materials

Treat small amounts of reactive waste materials/toxic chemicals in lab to minimize handling hazards and need for disposal.

g. Eliminate

Eliminate thermometers/reagents that contain mercury. Avoid using chromic acid cleaning solutions. Use of hazardous materials such as heavy metals and halogenated solvents should also be eliminated or reduced, where possible.

h. Inform yourself

Questions concerning waste disposal may be directed to either the Environmental Hygiene Manager, the Chemical Hygiene Officer, or to the lab supervisors for your department. Consult appendix IV for reference materials.

11. Chemical Storage

a. To avoid unwanted reactions, keep chemicals separated by hazard class whenever possible. Use the following hazard classes when separating chemicals.

1) Acids
2) Bases
3) Flammables
4) Oxidizers
5) Reactives

Laboratories that contain large amounts of chemicals may choose to further segregate mineral/organic acids, unstable compounds, heat sensitive compounds, gases, etc.

b. Solvent Storage

Solvent storage in a laboratory is limited. Use proper storage containment for solvents. The hoods are only to be used for short-term storage only.

c. Chemical Containers

Check the integrity of containers. Observer compatibilities at all times, for example hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

d. Volatile Toxic Substances

Volatile toxic substances shall be stored in volatile storage cabinets adequate to the purpose, or in/below hoods when cabinets are unavailable. Flammable materials must be stored in appropriate labeled containers, in safety cans, or in Department of Transportation (DOT) approved containers. Waste halogenated solvents may not be stored in metal cans due to corrosion. When volatile compounds must be stored in a cooled atmosphere, explosion proof refrigeration must be used.

12. Chemical Waste Disposals.

Guidance or advice concerning disposal of waste, INCLUDING unlabeled chemicals in your laboratory may be obtained through your lab supervisor, chemical hygiene officer, or environmental hygiene manager.

a. Regulations

The Environmental Protection Agency and the Resource Conservation Recovery Act (RCRA) as well as the Indiana Department of Emergency Management (IDEM) regulations mandate that hazardous waste be properly and clearly labeled, maintained closed when not in use, and properly disposed of in a timely manner.

b. Chemical Waste

Discard waste chemicals into labeled, closable (screw cap for liquids), waste containers located in the hoods. Solid and liquid wastes should be kept in separate containers and wastes should be further separated by their compatibility (i.e. oxidizers, acids, bases, solvents, halogenated solvents, etc.). Labels should clearly identify the following and include the word "waste":

Name of substances in container
Date of when substances first collected
Any additional information as necessary (class, room, experiment)

If a generic label is used such as "Waste Halogenated Solvents", a log must be kept of the contents of the container.

Arrange pickup of waste through your lab supervisor. Disposals should be arranged to be picked up approximately every 6 months. Chemical Hygiene Officer will keep all final copies of waste disposals.

c. Solvent Waste

1) Disposal

Halogenated and non-halogenated solvents should be collected in separate containers. Please note that aqueous wastes or wastes containing heavy metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium or silver) should not be mixed with solvent wastes. Collect them in a separate container and contact your lab supervisor to arrange for disposal.

2) Solvent wastes should

a) Have a pH between 2 and 12.5 with minimal content of solids and water.
b) Be inventoried properly and transferred safely to avert spills and compatibility concerns.
c) Be discarded promptly.
d) Contain no radioactive, highly carcinogenic, or highly toxic substances.
e) Maintain non-halogenated wastes free of halogenated wastes.

3) Solvent waste Containers

Solvent waste containers must be clearly labeled with its contents and capped when not in use.
Proper labeling includes Name of materials, Concentration if possible, and Class or Room from where materials were obtained.

4) Sharps Containers

Sharps containers should be used for the disposal of all sharps (needles, syringes, pipettes if applicable, etc). Disposal of broken sharps containers should be arranged through the Biology Lab Supervisor.

5) Glass Disposal

a) Glass should never be disposed in normal trash receptacles. They should be discarded in labeled broken glassware boxes. If possible, triple rinse the glassware before discarding the glassware in these boxes.

b) When full, seal off box and arrange with supervisor for box pick-up and replacement.

c) Do not overfill these boxes in any circumstance.

14. Chemical Handling

Encourage the use of poly-coated bottles or use bottle carriers for transporting chemicals that are in regular glass containers. Close caps securely and avoid storing chemical containers in hard to reach areas. Pour chemicals carefully, and never add water to concentrated acid. Metal containers and non-conductive containers (e.g., glass or plastic) holding more than five gallons must be grounded when transferring flammable liquids.

SECTION D-GUIDELINES FOR EMERGENCY PROCEDURES

No matter what approaches one may take to minimize laboratory hazards, emergency situations will occur. Although few staff members, students and visitors are capable in dealing with these situations to completion, all must understand the basics of:

Assessing and emergency situation
Communicating this to an appropriate level

Professional help obtained by contacting security at 7777 from campus phones or 464-1845 from cell or other phones is the best means of combating serious emergencies. Until their arrival, isolate the hazard as much as possible to keep people away. If first aid is required, locate someone with the required skills who is willing to help-be it you, lab supervisor, faculty member, student, another university employee, etc. First aid may be provided by anyone willing to assist who is knowledgeable in handling the matter at hand. Good Samaritan Laws cover those who are trained in first aid and certified in CPR.

Note that not all laboratory staff members are trained in first aid practices though training is available through Red Cross. Providing first aid where needed is NOT a condition of employment and first aid can only be administered by an individual on a volunteer basis.

GUIDELINES FOR EMERGENCY PROCEDURES

1. Alert other people immediately! Do this first!

2. Report all accidents. This should also include any near misses.

3. Get medical attention immediately, if necessary. In emergencies, call 7777.
Note: During this process the emergency operator will contact the appropriate response team and send them to your aid. Do not hang up until directed to do so.

When waiting for help send someone to meet the emergency response team and send someone to notify lab personnel.

4. In the event of an injury, the following conditions are required PRIOR TO administering first aid:

a. Others have been notified
b. Personal safety of care giver is not in jeopardy.
c. Care giver is knowledgeable concerning the treatment needed and associated hazards.
d. Victim agrees to treatment IF he/she is still conscious

5. Serious Wounds

A doctor should only attend to serious wounds. Temporarily cover wounds with clean cloth only.

6. Small Burns

Treat with cool water only. Do not use oils, powders, etc.

7. Inhalation of Noxious Gases

Quickly remove the victim from the lab into fresh air and call the doctor.

8. Ingestion of Poisonous Chemicals

Seek medical help immediately. Inducing vomiting may result in a more severe injury, as with some acids and bases. Induce vomiting if directed by medical personnel or if known to be beneficial.

Use the following contact information
Indiana Poison Control 800-222-1222

Have MSDS of substance available if possible for emergency personnel.

9. Skin Contact with Aggressive Chemicals:

a. Wash for 15 minutes with cool water.

To activate the safety shower, pull down on handle which extends from the ceiling. You may use the sink if area of contact is minimal.

b. Contaminated Clothing

Remove contaminated clothing immediately. If modesty is a concern, cover with clean apparel, towels, blankets, etc., and minimize personnel in affected area.

10. Eye Contact with Laboratory Chemicals

Rinse copiously with water for 15 minutes. To activate the eyewash, either pull down handle for wall-mounted handicapped accessible stations or use footpad on older models.

11. Blood Borne Pathogens

Blood borne pathogens (e.g., HIV and Hepatitis) can live in a pool of blood for weeks. The best person to clean up the blood is the person who bled, if at all possible. Otherwise, an individual trained in the handling of blood pathogens should be responsible for cleaning up the blood.

a. Secure the area
b. Seek advice concerning the cleanup
c. Disinfect the area with bleach after the cleanup
d. Use gloves during all stages of the cleanup

12 Mercury Spills and Cleanup
A small spill of mercury, where the amount is small and the spill is relatively contained, can be managed by using a mercury cleanup kit that can be obtained from SC 2226 if one is not available in the laboratory. Do not use sulfur or nitric acid to dissolve the mercury, as it will further complicate the disposal process. Contaminated materials used to clean up the mercury spill should be collected and sealed in a bag. To dispose the materials or a container of mercury, contact the lab supervisor to arrange for a pick-up.

For larger spills, where the amount is large or the spill has contaminated a large area, quarantine the area so that no one can enter and risk becoming contaminated (shoes, etc.). Contact Security at 7777 immediately!

Never use mercury near a drain.

13. Small Spill Cleanup: Four Basic Steps for Cleanup

Definition-Small Spill is defined as less than 1L of concentrated solvent or less than 1 pound of solid.

a. Personal Safety

If someone comes into contact with a chemical, immediately rinse the affected area with water and contact security if needed. Wear appropriate personal protection as needed.

For your safety and convenience, spill kits have been placed in convenient locations throughout the laboratories. You should familiarize yourself with the storage location and content. Call the Lab Supervisor if you need assistance.

b. Containment of the spill.

Close lab doors and windows. Outline the area of the spill with spill absorbent. For solvents, be sure to eliminate potential sources of ignition.

c. Absorption of the spill
Begin to absorb the rest of the spill with the spill absorbent.

d. Cleanup
Scoop the absorbent into a plastic bag or other appropriate container. Seal and label the container. Contact lab supervisor to arrange for pick-up

14. Large Spill Cleanup

For a large spill or extremely toxic release, call 7777 or 464-1845 immediately! Evacuate the area as quickly as possible.

15. Fire Alarms

a. Function

1) Signals occupants to leave the building
2) Notify the fire department

b. Alarm Sounds

Old Science Center Buzzer and Strobe
New Science Center Claxon (whoop sound) and Strobe

16. Emergency Phones

On the first, second, and third levels on the science center by the biology and chemistry labs, there are emergency phones. The silver call button will connect you with the laboratory supervisor for that lab. The red emergency button will connect you with Security.

ANYONE ABUSING THESE PHONES WILL BE SUBJECTED TO DISCIPLINE UNDER THE UNIVERSITY CODE OF CONDUCT!

17. Severe Storm Warnings

In the event of a storm warning, proceed to the basement level of the science center immediately. The building coordinator and security will verbally communicate this warning.

18. Personal/Building Security.

a. Personal Security
Personnel working late are encouraged to utilize the buddy system and keep their work area locked. Utilize caution on admitting anyone into your work area if alone or when in transit between destinations. Escort service may be arranged through security if needed.

b. Buildings Security
The labs and entrances are locked no later than 10:00 pm for the science center and are unlocked by 6:00 am. If after hours or weekend work is to be performed it is best to notify security of who will be present.

19. Fire Fighting Prerequisites

THIS PERTAINS TO LARGE SCALE FIRES WHICH ARE NOT EASILY CONTAINED

When a fire occurs, the appropriate prerequisites for using fire fighting equipment are the following:

a. Notify others first

The fire alarm is preferred since it will
1) Set off continuous buzzers throughout the building,
2) Signal occupants to leave the building, and
3) Notify security and fire departments immediately.

b. Make sure personal safety is not in jeopardy.

c. Be properly trained concerning fire fighting equipment and its appropriate use. This can arranged through physical plant.

d. Ensure that appropriate fire fighting equipment is available.

e. As additional information and/or personnel become available.

1) Call Security with specifics.

2) Meet the fire department to direct them to the affected area.

20. Four Classes of Fire

a.Class A Fires (Combustible solids)

Class A fires are those involving combustible solids such as paper and wood items which leaves an ash. Typical extinguishers for Class A fires include water, CO2, halon, and dry chemical. Associated problems with these fires are destructive distillation that results in flaming vapors and toxic gases, hot ash, and residue capable of reigniting.

b. Class B fires (Flammable Liquids)

Class B fires are those involving flammable liquids. Typical extinguishers include CO2, halon, and dry chemical. Caution: compressed gas may spread and/or worsen fire if force from the extinguisher is excessive.

c. Class C Fires (Electrical equipment)

Class C fires are the same as Class A and B fires only involving electrical equipment. Typical extinguishers include CO2, dry chemicals (may result in equipment damage), and halon. Caution: Due to possible electrical shock, CLOSE the circuit prior to fighting the fire.

d. Class D Fires (Metals and Hydrides)

Class D fires are those involving reactive metals (Li, Na, K, An, Mg, etc.) and active hydrides (NaH, KH, LiAlH4, etc.). Typical extinguishers and control methods include inert powder (sand, talc, alkali metal salts) and Metal-X extinguishers.

E. Guidelines for Emergency Equipment

1. Safety Showers

Be certain safety showers/emergency eyewashes are properly located and maintained. Safety shower testing kit is located in SC 2226. Access to these devices should not be blocked for any reason.

2. Fire Extinguishers

Fire extinguishers must be available, charged, and hung in a location that is immediately accessible. If discharged, contact physical plant at 1729 to obtain a replacement.

3. First aid kits

First aid kits should be made available in each lab or placed at a central point for easy access. These kits should be checked periodically and the following items must be in the kits in accordance to ANSI 203.1-1998
1 Absorbent Compress
16 Adhesive Bandages
5 yd Adhesive Tape
10 Antiseptic Applications 0.5g each (check expiration)
6 Burn Treatment Applications 0.5g each (check expiration)
4 Sterile Pads 3x3in minimum
2 pair medical gloves
1 Triangular Bandages 40x40x56 in. minimum

4. Spill Kits

As needed, spill kits are available in laboratories and in the distribution center. Please be familiar to their location and use. Consult chemical hygiene officer or laboratory supervisors for instructions on how to use this equipment.

5. Fire Blankets

Fire Blankets should be provided in areas in which safety showers are not available or in laboratories that utilize water sensitive materials in which the shower would aggravate the problem. As with any fire, if possible, first alert others to the fire, evacuate anyone in the area and contact security at 7777 or 464-1845. Fire blankets can be used on Class A (Combustibles), Class B (Flammable liquids), Class C (Electrical) and some Class D (burning metals) fires. Ensure that you have a safe exit – an escape route in case you are unable to extinguish the fire. The fire should NOT be between you and the exit. Open the fire blanket and hold it in front of you to shield your body (especially the face and hands) from the fire. Cover the burning material completely, ensuring there are no gaps for oxygen to reach the fire. Leave the blanket in place until the fire department arrives. IMPORTANT: If using the fire blanket on a person, remove the blanket immediately after the flames are extinguished; get them to a safety shower immediately until first responders arrive.

6. Gas Mains

Each lab that utilizes natural gas is equipped with a shut off device either located inside the lab or just by the lab door. Please familiarize yourself with the location of these devices. Always leave the mains in an off position when not in use.

PART IV-CONTROLLING CHEMICAL EXPOSURES

IV. CONTROLLING CHEMICAL EXPOSURES

"Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous" 29 CFR 1910.1450(e)(ii)

There are three major routes of entry for a chemical to enter the body: inhalation, skin and eye contact, and ingestion. Types of controls for prevention of these various routes of entry include: good work practices, engineering controls, personal protective equipment and administrative controls. Personal protective equipment must be used in conjunction with, not as a substitute for such controls and/or good work practices. All areas using personal protective equipment shall adhere to the Occupations Safety and Health Administration 1910.132 Personal Protective Equipment Standard.

Each route of entry a chemical can take to enter the body can be controlled by a number of varying controls as explained below.

A. Inhalation Hazards

Inhalation of chemicals in the most common route of entry a chemical can take to enter the body. To avoid significant inhalation exposures, engineering controls such as substituting a less volatile or a less toxic chemical or substituting a liquid or solid chemical for a gaseous one are the best means of control. If substitution is not practical, ventilation should be used to lessen the chance of overexposure. The use of well functioning local exhaust ventilation such as laboratory chemical hoods (fume hoods) s, vented glove boxes and other local exhaust systems is often required to minimize exposure to hazardous substances. Biological safety cabinets are generally vented directly back into the laboratory and do not filter out chemical vapors. Dilution ventilation may be used to reduce exposure to non-hazardous nuisance odors.

If both substitution and engineering controls are unavailable, the use of personal protective equipment may be required to reduce inhalation exposures.

Finally, administrative controls can be utilized to reduce the risk of overexposure to hazardous chemicals. Some examples of administrative controls include:

- Minimizing exposure time for individual employees
- Restricting access to an area where a hazardous material is used
- Allowing a process that emanates nuisance odors to be done after typical office hours, when most of the Staff in the building have gone home
- Proper signage on lab doors to indicate special hazards within

B. Skin and Eye Contact Hazards

To reduce the risk of a chemical entering the body via skin and eye contact, engineering controls include substitution and appropriate ventilation as described above in Inhalation hazards. The more obvious means of preventing skin and eye contact is the wearing of personal protective equipment such as eye protection, face shields, gloves, appropriate shoes, lab aprons, lab coats, and other protective equipment as appropriate to the hazard. Since the chemical resistivity of the different types of protective equipment varies significantly, the lab supervisor should consult references to ascertain that the protective equipment is resistant to the chemical being protected against.

Administrative controls to reduce skin/eye contact include:

- Enforcement of policies pertaining to skin and eye protection
- Discarding or repair of cracked or broken glassware

C. Ingestion Hazards

Ingestion of chemicals is the least common route of entry into the body. However a laboratory worker can easily ingest chemicals into the body via contaminated hands if they are not washed prior to eating, smoking, or sticking part of the hand or a writing tool that has been in contaminated hands into the mouth. Some controls for preventing this route of exposure include engineering controls, such as isolating the hazardous substance so minimal contact is required (e.g., use glove box), personal protective equipment such as the wearing of gloves, and separate areas where eating, drinking and the application of cosmetics is permitted.

PART V-LABORATORY CHEMICAL HOODS (FUME HOODS) AND OTHER ENGINEERING CONTROLS

V. Laboratory chemical hood (fume hoods) and Other Engineering Controls

"A requirement that laboratory chemical hood (fume hood)s and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment." 29CFR 1910.1450(e)(3)(iii)

All laboratory fume hoods should comply with this standard at all times. This includes proper maintenance and ensuring hoods are functioning correctly.

The face velocity of the hoods should fall between 80 and 120 feet per minute (fpm) with the sash positioned at approximately half open unless specified otherwise. In general, fume hoods should not be used with the sash fully open. Any hood that does not meet these standards shall be labeled as faulty and physical plant should be notified immediately.

Because the status of the fume hood can change, air flow indicators are recommended. New hoods should be equipped with air flow monitoring devices which will alert the user if there is a problem with air flow. A simple visible test to ensure flow into the laboratory hood is to tape a tissue to the hood and note its movement.

Protective equipment should be checked periodically by the lab supervisor to ensure proper functioning.

Note on Biological Safety Cabinets:

These cabinets should be serviced by Trained Professional Personnel ONLY!!!!!!!! University personnel do not meet these requirements and thus an outside consultant should be contacted to perform checks on this equipment.

MONITORING RECORD FOR LABORATORY FUME HOODS

HOOD IDENTIFICATION NUMBER **DATE**

LOCATION **RE-TEST DATE**

TYPE AND FEATURES

HOOD MANUFACTURER

BYPASS?
YES NO

AUXILLARY AIR?
YES NO

FLOW CONTROLLED (VARIABLE AIR VOLUME)
YES NO

CONNECTION TO OTHER HOODS
YES NO

ADJUSTABLE SASHES

YES NO IF YES VERITCAL HORIZONTAL

DAMPER(S)

YES NO

FAN SWITCH

YES NO

BOTTOM AIR FOIL

YES NO

OTHER FEATURES, DESIGN CHARACTERISTICS

SPECIAL USE CONDITIONS (E.G., RADIONUCLIDES, PERCHLORIC ACID)

AUTOMATIC MEASURING DEVICES

HOOD STATIC PRESSURE MONITOR

YES NO

HOOD FACE VELOCITY MONITOR

YES NO

OTHER ALARMS, GAUGES?

YES NO

CAPTURE TEST

INTERFERENCE FROM DOORS, WINDOWS, WALKWAYS, SUPPLY AIR DIFFUSERS?

YES NO

IF YES, CONDUCT SMOKE TEST

RESULTS:

FACE VELOCITY MEASUREMENTS

LEFT TOP	**CENTER TOP**	**RIGHT TOP**
LEFT MIDDLE	**CENTER MIDDLE**	**RIGHT MIDDLE**
LEFT SURFACE	**CENTER SURFACE**	**RIGHT SURFACE**

TOTAL ALL MEASUREMENTS \ TOTAL SAMPLES =
AVERAGE FACE VELOCITY

SASH HEIGHT

HOOD AREA SASH OPEN

HOOD VLOW RATE

COMMENTS

TESTED BY

FORMS MUST BE RETURNED TO CHO FOR RECORDKEEPING. A COPY OF THE MOST RECENT TEST FORM SHOULD BE KEPT IN THE CHP FOR THAT ROOM

PART VI-EMPLOYEE INFORMATION AND TRAINING

VI. Employee Information and Training

"Provisions for employee information and training as prescribed in paragraph (f) of this section." 29 CFR 1910.1450(e)(3)(iv)

All individuals who work in laboratories who may be exposed to hazardous chemicals must be apprised of the hazards of chemicals present in their work area. THIS INFORMATION AND TRAINING AS OUTLINED BELOW MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT AND BEFORE NEW EXPOSURE SITUATIONS. Equipment necessary for the safe handling of hazardous substances must also be provided.

Upon request by departments or other administrative units or under their direction, Risk management or environmental health and safety will provide from time to time training presentations on general lab safety practices. However, training specific to a particular lab will be the responsibility of the employee's supervisor. The supervisor shall determine the frequency of refresher information and training.

A. Information

Laboratory workers shall be informed of the location and availability of the following

- 29 CFR Part 1910.1450 "Occupational Exposures to Hazardous Chemicals in Laboratories"
- This Chemical Hygiene Plan
- Reference materials on chemical safety as well as MSDS forms
- Access to Permissible Exposure Limits (PEL) for OSHA regulated substances, or if there is no applicable OSHA standard, the recommended exposure limits or threshold limit value (TLV) may be provided.
- Signs and symptoms associated with exposure to the hazardous chemicals found in lab

B. Training

Laboratory worker training shall include:

- Detection methods and observations that may be used to detect the presence or release of a hazardous chemical. Examples of detection methods include visual appearance, odor, and an understanding of chemical monitoring devices.
- Physical and health hazards of the chemicals "1,2,3 approach".
  1-Read label of bottle before pulling from shelf
  2-Reread label when moving towards work area
  3-Check label once more before starting work
- The work practices, personal protective equipment, and emergency procedures to be used to ensure that the employee may protect himself/herself from overexposure to hazardous chemicals
- The manufacturer's MSDS will generally contain much of the above information needed to comply with the information and training requirements of the OSHA lab standard. Hence, employees should peruse and understand the relevant MSDS and/or other comparable literature on the hazardous chemicals which are used or stored in the laboratory. Additional training for specific lab hazards must be provided by the employee's supervisor.
- The OSHA Lab Standard, the chemical hygiene plan, a library of MSDS and other health and safety references are maintained in SC 2226 for chemistry and in SC1264 for Biology.
- Health and Safety training information are available to students, faculty, or staff upon request.

- Copies of MSDS may be obtained from the chemical supplier. Though security maintains a library of MSDS, individual departments and laboratories are strongly encouraged to maintain their own files of MSDS and reference materials.

PART VII-PRIOR APPROVAL

VII. Prior Approval

“The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer’s designee before implementation.” 29 CFR 1910.1450(e)(3)(v)

Please keep in mind that the responsibility for approval of the acquisition and use of toxic chemical agents rest with the laboratory supervisor. Certain materials including radioactive materials, recombinant DNA and certain biohazards require prior internal or external approval at various levels. If there are questions, the laboratory supervisor or the environmental health and safety manager should be consulted.

For normal laboratory classes, the instructor will have clearance to carry out the directed experiment.

Research instructors should perform a risk analysis of materials they are working with and are responsible for training their students of how to work with these materials.

A worksheet is enclosed to help in this process and should be kept in Appendix V-

PART VIII MEDICAL CONSULTATION

VIII. Medical Consultation

“Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section.” 29CFR1910.1450(e)(3)(vi)

An opportunity to receive medical consultation shall be provided under the following circumstances: if an employee develops any symptoms thought to arise from chemical overexposure; after an event such as a major spill, leak, or explosion which may have resulted in an overexposure; or an overexposure is identified as the result of an evaluation by the Chemical Hygiene Officer. Any medical examination required by this Plan shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

Students, Faculty, and staff are to notify security immediately (7777) or 464-1845 for any incident involving the need for medical attention in the event of an emergency.

Accident reports are to be kept by security.

PART IX. CHEMICAL HYGIENE OFFICER

IX. Chemical Hygiene Officer

“Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer and, if appropriate, establishment of a Chemical Hygiene Committee.” 29 CFR1910.1450(e)(3)(vii)
Academic units are encouraged to have their own Chemical Hygiene Officers to help implement this plan in their units. Please consult the list of names to locate identities of Chemical Hygiene officer and respective safety committees.

LIST OF PERSONEL AND RESPONSIBILITIES

TITLE	NAME	EXT
ENVIRONMENTAL HEALTH MANAGER	BRYAN MORRISON	5393
CHEMICAL HYGIENE OFFICER	CHRISTOPHER HOGUE	7022
RADIATION SAFETY OFFICER	KENT SCHELLER	1903
BIOLOGICAL SAFETY OFFICER	ALEKSANDRA NORTON	1259
INSTRUMENT TECHNICIAN	VINCE FRAZIER	1839
LABORATORY SAFETY COMMITTEE		
CHAIRPERSON	SHELLY BLUNT	1268
MEMBER-CHAIR CHEMISTRY DEPT	JEFF SEYLER	1923
MEMBER-CHAIR BIOLOGY DEPT	HENRI MAURICE	5231
MEMBER-PHYSICS DEPT	KENT SCHELLER	1903
MEMBER-CHEMISTRY	CHRISTOPHER HOGUE	7022
MEMBER-BIOLOGY	ALEKSANDRA NORTON	1259

APPENDIX I

29 CFR 1910.1450

1910.1450(a)
Scope and application.
1910.1450(a)(1)
This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.
1910.1450(a)(2)
Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:
1910.1450(a)(2)(i)
For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.
1910.1450(a)(2)(ii)
Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.
1910.1450(a)(2)(iii)
Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.
1910.1450(a)(3)
This section shall not apply to:
..1910.1450(a)(3)(i)

1910.1450(a)(3)(i)
Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.
1910.1450(a)(3)(ii)
Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:
1910.1450(a)(3)(ii)(A)
Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and
1910.1450(a)(3)(ii)(B)
Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.
1910.1450(b)
Definitions --

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

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Carcinogen (***see select carcinogen***).

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

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

the mixture.

Compressed gas means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg C) regardless of the pressure at 70 deg. F (21.1 deg. C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

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

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

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

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.

Flammable means a chemical that falls into one of the following categories:

(i) ***Aerosol, flammable*** means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) ***Gas, flammable*** means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) ***Liquid, flammable*** means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) ***Solid, flammable*** means a solid, other than a blasting agent or explosive as defined in § 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not

have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 - 1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

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.

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

Laboratory means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safety manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

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

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

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

(i) Chemical manipulations are carried out on a "laboratory scale;"

(ii) Multiple chemical procedures or chemicals are used;

(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and

(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

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.

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

Oxidizer means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard means a chemical for which there is scientifically valid evidence tat it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.

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

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

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

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m(3);

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

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

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

1910.1450(c)

Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

..1910.1450(d)

1910.1450(d)

Employee exposure determination --

1910.1450(d)(1)

Initial monitoring. The employer shall measure the employee's 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).

1910.1450(d)(2)
Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.
1910.1450(d)(3)
Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.
1910.1450(d)(4)
Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.
1910.1450(e)
Chemical hygiene plan -- General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).
1910.1450(e)(1)
Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:
1910.1450(e)(1)(i)
Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and
1910.1450(e)(1)(ii)
Capable of keeping exposures below the limits specified in paragraph (c) of this section.
1910.1450(e)(2)
The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.
1910.1450(e)(3)
The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;
1910.1450(e)(3)(i)
Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;
1910.1450(e)(3)(ii)
Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;
1910.1450(e)(3)(iii)
A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;
..1910.1450(e)(3)(iv)

1910.1450(e)(3)(iv)
Provisions for employee information and training as prescribed in paragraph (f) of this section;
1910.1450(e)(3)(v)
The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;
1910.1450(e)(3)(vi)
Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;
1910.1450(e)(3)(vii)
Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and
1910.1450(e)(3)(viii)
Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:
1910.1450(e)(3)(viii)(A)
Establishment of a designated area;
1910.1450(e)(3)(viii)(B)
Use of containment devices such as fume hoods or glove boxes;
1910.1450(e)(3)(viii)(C)
Procedures for safe removal of contaminated waste; and
1910.1450(e)(3)(viii)(D)

Decontamination procedures.
1910.1450(e)(4)
The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.
1910.1450(f)
Employee information and training.
1910.1450(f)(1)
The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.
1910.1450(f)(2)
Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.
1910.1450(f)(3)
Information. Employees shall be informed of:
1910.1450(f)(3)(i)
The contents of this standard and its appendices which shall be made available to employees;
1910.1450(f)(3)(ii)
the location and availability of the employer's Chemical Hygiene Plan;
..1910.1450(f)(3)(iii)

1910.1450(f)(3)(iii)
The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;
1910.1450(f)(3)(iv)
Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and
1910.1450(f)(3)(v)
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.
1910.1450(f)(4)
Training.
1910.1450(f)(4)(i)
Employee training shall include:
1910.1450(f)(4)(i)(A)
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.);
1910.1450(f)(4)(i)(B)
The physical and health hazards of chemicals in the work area; and
1910.1450(f)(4)(i)(C)
The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
1910.1450(f)(4)(ii)
The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.
1910.1450(g)
Medical consultation and medical examinations.
1910.1450(g)(1)
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:
1910.1450(g)(1)(i)
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.
1910.1450(g)(1)(ii)
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.
1910.1450(g)(1)(iii)

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.
..1910.1450(g)(2)

1910.1450(g)(2)
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.
1910.1450(g)(3)
Information provided to the physician. The employer shall provide the following information to the physician:
1910.1450(g)(3)(i)
The identity of the hazardous chemical(s) to which the employee may have been exposed;
1910.1450(g)(3)(ii)
A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
1910.1450(g)(3)(iii)
A description of the signs and symptoms of exposure that the employee is experiencing, if any.
1910.1450(g)(4)
Physician's written opinion.
1910.1450(g)(4)(i)
For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:
1910.1450(g)(4)(i)(A)
Any recommendation for further medical follow-up;
1910.1450(g)(4)(i)(B)
The results of the medical examination and any associated tests;
1910.1450(g)(4)(i)(C)
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; and
1910.1450(g)(4)(i)(D)
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.
1910.1450(g)(4)(ii)
The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.
1910.1450(h)
Hazard identification.
1910.1450(h)(1)
With respect to labels and material safety data sheets:
1910.1450(h)(1)(i)
Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.
1910.1450(h)(1)(ii)
Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.
1910.1450(h)(2)
The following provisions shall apply to chemical substances developed in the laboratory:
..1910.1450(h)(2)(i)

1910.1450(h)(2)(i)
If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.
1910.1450(h)(2)(ii)
If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.
1910.1450(h)(2)(iii)
If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material safety data sheets and labeling.
1910.1450(i)

Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

1910.1450(j)

Recordkeeping.

1910.1450(j)(1)

The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

1910.1450(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

1910.1450(k)

Dates --

1910.1450(k)(1)

Effective date. This section shall become effective May 1, 1990.

1910.1450(k)(2)

Start-up dates.

1910.1450(k)(2)(i)

Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.

1910.1450(k)(2)(ii)

Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

1910.1450(l)

Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[55 FR 3327, Jan. 31, 1990; 55 FR 7967, March, 6, 1990; 55 FR 12777, March 30, 1990; 61 FR 5507, Feb. 13, 1996]

APPENDIX II

ANSI Z87.1

ANSI Z87.1-2003

ANSI Z87.1-2003
The new standard is a voluntary standard and there is no requirement that manufacturer or end user comply with it unless it is mandated by the United States Department of Labor – OSHA. However, in the past, most manufacturers have chosen to comply with revisions to the Z87.1 Standard. Currently, OSHA requires (29 CFR 1910.133) that eye protectors comply with the 1989 version of the Z87.1 Standard, and eye protection devices now in use may continue to be used.

*****All of the protective eyewear we sell already complies with the performance requirements of the new standard. The new marking requirements will be phased in over time by each manufacturer.*****

1. Two Levels of Protection:
Basic and High
LENSES: The new standard designates that lenses will be divided into two protection levels, Basic Impact and High Impact as dictated by test criteria. Basic Impact lenses must pass the “drop ball” test, a 1" diameter steel ball is dropped on the lens from 50 inches. High Impact lenses must pass “high velocity” testing where 1/4" steel balls are “shot” at different velocities.

Spectacles: 150 ft./sec.
Goggles: 250 ft./sec.
Faceshields: 300 ft./sec.

FRAMES: Now, all eyewear/goggle frames, faceshields or crowns must comply with the High Impact requirement. (This revision helps eliminate the use of “test lenses”, and assures all protectors are tested as complete - lenses in frame - devices). After making an eye hazard assessment, employers (safety personnel) should decide on appropriate eyewear to be worn, although High Impact would always be recommended. All of our spectacles are High Impact protectors.

2. Now, Products Must Indicate
Impact Protection Level.
To identify a device’s level of impact protection, the following marking requirements apply to all new production spectacles, goggles and faceshields. Basic Impact spectacle lenses will have the manufacturer’s mark, i.e. an AOSafety product will have “AOS” and a Pyramex product will have a "P" etc. Goggles and faceshields will have AOS and Z87 (AOS Z87). High Impact spectacle lenses will also have a plus + sign, (AOS+) or "P+" etc. All goggle lenses and faceshield windows are to be marked with the manufacturer's mark, Z87, and a + sign (AOSZ87+).

*Note: Lenses/windows **may have** additional markings. Shaded lens may have markings denoting a shade number such as 3.0, 5.0 etc. Special purpose lenses may be marked with “S”. A variable tint lens may have a “V” marking.*

3. Sideshield Coverage Area Increased
Sideshield coverage, as part of the lens, part of the spectacle, or as an individual component, has been increased rearward by 10-millimeters via a revised impact test procedure. While side protection in the form of wraparound lens, integral or attached component sideshield devices is not mandated in this standard, it is highly recommended. Further, OSHA does require lateral protection on eye protection devices wherever a flying particle hazard may exist, and flying particle hazards are virtually always present in any occupational environment. All of our non-prescription safety spectacles meet the requirements of OSHA and the new Z87.1 for side protection.

4. No Minimum Lens
Thickness Requirement
For High Impact Lenses.
The new standard does not have a “minimum lens thickness” requirement for High Impact spectacle lenses. The previous standard required a 2-millimeter “minimum”. However, the protective advantages of wrap-around lenses and the many other advancements in eyewear design, have eliminated this

need.

Note: Glass lenses still fall into the Basic Impact lens category. The “minimum lens thickness” of 3 millimeters remains in effect for this category.

APPENDIX III GLOVE SELECTION CHART

NOTE: THIS CHART IS MEANT AS AN GENERAL REFERENCE FOR GLOVE SELECTION FOR THE FOLLOWING CHEMICALS. IT IS RECOMMENDED THAT YOU CONSULT THE GLOVE DESIGNER FOR CONFIRMATION OF PROPER GLOVE SELECTION.

Chemical	Neoprene gloves	Latex or rubber gloves	Butyl gloves	Nitrile latex gloves
*Acetaldehyde	VG	G	VG	G
Acetic acid	VG	VG	VG	VG
*Acetone	G	VG	VG	P
Ammonium hydroxide	VG	VG	VG	VG
*Amyl acetate	F	P	F	P
Aniline	G	F	F	P
*Benzaldehyde	F	F	G	G
*Benzene	P	P	P	F
Butyl acetate	G	F	F	P
Butyl alcohol	VG	VG	VG	VG
Carbon disulfide	F	F	F	F
*Carbon tetrachloride	F	P	P	G
Castor oil	F	P	F	VG
*Chlorobenzene	F	P	F	P
*Chloroform	G	P	P	E
Chloronaphthalene	F	P	F	F
Chromic acid (50%)	F	P	F	F
Citric acid (10%)	VG	VG	VG	VG
Cyclohexanol	G	F	G	VG
*Dibutyl phthalate	G	P	G	G
Diesel fuel	G	P	P	VG
Diisobutyl ketone	P	F	G	P
Dimethylformamide	F	F	G	G

Dioctyl phthalate	G	P	F	VG
Diaxane	VG	G	G	G
Epoxy resins, dry	VG	VG	VG	VG
*Ethyl acetate	G	F	G	F
Ethyl alcohol	VG	VG	VG	VG
*Ethyl ether	VG	G	VG	G
*Ethylene dichloride	F	P	F	P
Ethylene glycol	VG	VG	VG	VG
Formaldehyde	VG	VG	VG	VG
Formic acid	VG	VG	VG	VG
Freon 11	G	P	F	G
Freon 12	G	P	F	G
Freon 21	G	P	F	G
Freon 22	G	P	F	G
*Furfural	G	G	G	G
Gasoline, leaded	G	P	F	VG
Gasoline, unleaded	G	P	F	VG
Glycerin	VG	VG	VG	VG
Hexane	F	P	P	G
Hydrazine (65%)	F	G	G	G
Hydrochloric acid	VG	G	G	G
Hydrofluoric acid (48%)	VG	G	G	G
Hydrogen peroxide (30%)	G	G	G	G
Hydroquinone	G	G	G	F
Isooctane	F	P	P	VG
Kerosene	VG	F	F	VG
Ketones	G	VG	VG	P

Lacquer thinners	G	F	F	P
Lactic acid (85%)	VG	VG	VG	VG
Lauric acid (36%)	VG	F	VG	VG
Lineoleic acid	VG	P	F	G
Linseed oil	VG	P	F	VG
Maleic acid	VG	VG	VG	VG
Methyl alcohol	VG	VG	VG	VG
Methylamine	F	F	G	G
Methyl bromide	G	F	G	F
*Methyl chloride	P	P	P	P
*Methyl ethyl ketone	G	G	VG	P
*Methyl isobutyl ketone	F	F	VG	P
Methyl methacrylate	G	G	VG	F
Monoethanolamine	VG	G	VG	VG
Morpholine	VG	VG	VG	G
Naphthalene	G	F	F	G
Naphthas, alyphatic	VG	F	F	VG
Naphthas, aromatic	G	P	P	G
*Nitric acid	G	F	F	F
Nitric acid, red and white fuming	P	P	P	P
Nitromethane *	F	P	F	F
(95.5%)				
Nitropropane (95.5%)	F	P	F	F
Octyl alcohol	VG	VG	VG	VG
Oleic acid	VG	F	G	VG
Oxalic acid	VG	VG	VG	VG
Palmitic acid	VG	VG	VG	VG

Perchloric acid (60%)	VG	F	G	G
Perchloroethylene	F	P	P	G
Petroleum distillates (naphtha)	G	P	P	VG
Phenol	VG	F	G	F
Phosphoric acid	VG	G	VG	VG
Potassium hydroxide	VG	VG	VG	VG
Propyl acetate	G	F	G	F
Propyl alcohol	VG	VG	VG	VG
Propyl alcohol (iso)	VG	VG	VG	VG
Sodium hydroxide	VG	VG	VG	VG
Styrene	P	P	P	F
Styrene (100%)	P	P	P	F
Sulfuric acid	G	G	G	G
Tannic acid (65%)	VG	VG	VG	VG
Tetrahydrofuran	P	F	F	F
*Toluene	F	P	P	F
Toluene diisocyanate (TDI)	F	G	G	F
*Trichloroethylene	F	F	P	G
Triethanolamine (85%)	VG	G	G	VG
Tung oil	VG	P	F	VG
Turpentine	G	F	F	VG
*Xylene	P	P	P	F

Table C.1. Gloves chemical resistance selection chart

*Limited Service

VG = Very Good G = Good F = Fair P = Poor (not recommended)

APPENDIX IV- REFERENCE MANUALS AVAILABLE

THE FOLLOWING IS A LIST OF MANUALS AND INFORMATION AVAILABLE IN SC 2226

SAFETY IN ACADEMIC CHEMISTRY LABORATORIES FOURTH EDITION 1985 AMERICAN CHEMICAL SOCIETY.

OUT OF HARM'S WAY: SAFE HANDLING OF CORROSIVE CHEMICALS WARREN KINGSLEY 1996 AMERICAN CHEMICAL SOCIETY-ACS LAB SAFETY SERIES

HEALTH AND SAFETY POLICY STATEMENTS BY JAMES A KAUFMAN

READ THE LABEL AMERICAN CHEMICAL SOCIETY

THE WASTE MANAGEMENT MANUAL FOR LABORATORY PERSONNEL 1990 AMERICAN CHEMICAL SOCIETY

NIOSH/OSHA POCKET GUIDE TO CHEMICAL HAZARDS

HANDBOOK OF REACTIVE CHEMICAL HAZARDS BRETHERICK

HANDBOOK OF LABORATORY SAFETY AND HEALTH 2ND EDITION

RAPID GUIDE TO HAZARDOUS CHEMICALS IN THE WORKPLACE

RAPID GUIDE TO CHEMICAL INCOMPATIBILITIES

POTENTIALLY CARCINOGENIC CHEMICALS INFORMATION AND DISPOSAL GUIDE

QUICK SELECTION GUIDE TO CHEMICAL PROTECTIVE CLOTHING

HAZARDOUS CHEMICALS DATA BOOK 2ND EDITION, WEISS

HANDBOOK OF OCCUPATION SAFETY AND HEALTH

CANCER CAUSING CHEMICALS SAX

PRUDENT PRACTICES IN THE LABORATORY-HANDLING AND DISPOSAL OF CHEMICALS

SAFETY IN THE RESEARCH LABORATORY HOWARD HUGHES MEDICAL INSTITITUTE

STARTING WITH SAFETY 1991 AMERICAN CHEMICAL SOCIETY

APPENDIX V

EVALUATION OF HAZARDS AND RISK ASSESSMENT

EVALUATION OF HAZARDS AND RISK ASSESSMENT

PURPOSE:

THIS CHP IS DESIGNED FOR GENERAL LABORATORY USE FOR THE COLLEGE OF SCIENCE AND ENGINEERING. HOWEVER, IF SIGNIFICANT HAZARDS ARE PRESENT, MORE INFORMATION MAY BE NEEDED TO FULFILL LABORATORY SAFETY REQUIREMENTS FOR A GIVEN LAB.

THE USE OF THE FOLLOWING WORKSHEET ALONG WITH INFORMATION GIVEN IN THIS APPENDIX SHOULD GUIDE THE PRIMARY USER OF THE LAB IN ASSESSING HAZARD PRESENCE.

IF QUESTIONS ARISE, PLEASE CONTACT THE LAB SUPERVISOR OR CHEMICAL HYGIENE OFFICER FOR ASSISTANCE.

A COPY OF THIS ASSESSMENT SHOULD BE KEPT ON FILE WITH THE LAB SUPERVISOR FOR THAT LAB AND SHOULD BE KEPT IN THIS SECTION OF THIS CHP.

ANY INFORMATION IN HERE SHOULD BE CONVEYED TO ALL PERSONNEL AS PART OF THEIR TRAINING AS GIVEN IN SECTION VI.

RISK ASSESSMENT WORKSHEET WITH HAZARDOUS MATERIALS

INSTRUCTIONS: PLEASE FILL OUT A BRIEF REPORT WITH THE FOLLOWING INFORMATION. PLEASE INFORM YOUR STUDENTS ABOUT THE INFORMATION ON THIS WORKSHEET AS PART OF THEIR TRAINING.

LAB

INSTRUCTOR IN CHARGE

SYNOPSIS OF EXPERIMENT

REAGENTS TO BE USED

EQUIPMENT TO BE USED (HOT PLATES, BUNSEN BURNERS, DISTILATION APPARATUS, ETC)

HAZARDS PRESENT

1. **CHEMICAL**
2. **PHYSICAL**
3. **BIOLOGICAL**
4. **MECHANICAL**
5. **RADIATION**
6. **HI/LOW PRESSURE**
7. **ELECTRICAL**
8. **STRESS**
9. **NOISE**

PERSONAL PROTECTIVE EQUIPMENT AVAILABLE

EMERGENCY EQUIPMENT AVAILABLE/PROTOCOL

ATTACH MSDS FOR CHEMICALS TO THIS WORKSHEET

SUBMIT COPY OF WORKSHEET TO SUPERVISOR AND KEEP COPY WITH CHP

FILLING OUT THE WORKSHEET

THE WORKSHEET SHOULD BE FILLED OUT AS A SEPARATE DOCUMENT USING THE TEMPLATE ON PAGE 77.

THE DOCUMENT NEEDS TO START WITH THE FOLLOWING INFORMATION:

DATE OF ASSESSMENT
ROOM NUMBER
INSTRUCTOR IN CHARGE
SYNOPSIS OF PROCESS THIS ASSESSMENT IS FOR
(NOTE: IF YOU ARE PERFORMING MORE THAN ONE PROCESS, UNLESS MATERIALS ARE SIMILAR, YOU WILL HAVE TO FILL OUT MORE THAN ONE DOCUMENT)

THE ASSESSMENT PROCEDURE

1. MATERIALS YOU ARE WORKING WITH

BEGIN A LIST OF EVERYTHING YOU ARE WORKING WITH THAT COULD POSE A HAZARD. THIS WILL PRIMARILY FOCUS ON CHEMICALS AND EQUIPMENT (NOT NECESSARILY INCLUDING BEAKERS, SPATULAS, ETC,) YOU ARE PLANNING ON USING.

2. DETERMINE THE HAZARDS YOU ARE WORKING WITH

IN GENERAL, NINE TYPES OF HAZARDS CAN BE PRESENT WITH ANY TASK:

> **CHEMICAL: ARE THEY TOXIC, FLAMMABLE, CORROSIVE, REACTIVE? HOW CAN THEY BE DISPOSED OF? (SEE APPENDIX VI FOR MORE INFORMATION)**
>
> **PHYSICAL: ARE THERE ANY TASKS INVOLVING AN EXCESSIVE USE OF PHYSICAL LABOR?**
>
> **BIOLOGICAL: TOXIC SIDE EFFECTS? REACTIVITY? EXPOSURE? DISPOSAL?**
>
> **MECHANICAL: THE EQUIPMENT I AM WORKING WITH? IS THERE A SHOCK HAZARD? BURN HAZARD? CAN I HURT MYSELF WITH THIS?**
>
> **RADIATION: ARE WE WORKING WITH RADIOACTIVE MATERIALS? HOW DO WE DISPOSE? HOW DO WE STORE?**
>
> **HI/LOW PRESSURE: ARE YOU WORKING WITH ANYTHING IN HIGH OR LOW PRESSURE ENVIRONMENTS? IS THERE A RISK OF IMPLOSION?**
>
> **ELECTRICAL: SHOCK HAZARDS PRESENT. IF WE NEED ELECTRICITY, WILL A BACK UP GENERATOR BE NEEDED?**
>
> **STRESS: ARE THERE ANY STRESSORS THAT PERTAIN TO THE USER OR THE REACTION THAT COULD CAUSE HARM?**
>
> **NOISE: HOW LOUD IS THE LAB OR REACTION? SHOULD WE WEAR EAR PLUGS?**

MAKE A LIST OF POTENTIAL HAZARDS THAT THE TASK INVOLVES. HAVE YOUR LAB STAFF WORK WITH YOU ON PREPARING THIS LIST.

NOTE ON CHEMICAL ASSESSMENT: IT IS HELPFUL TO OBTAIN A COPY OF THE MSDS FOR EACH CHEMICAL YOU ARE USING AND KEEP IT AVAILABLE IN THE LAB AS WELL AS THIS ASSESSMENT.

3. DETERMINE WHAT PERSONAL PROTECTIVE EQUIPMENT AND SAFETY EQUIPMENT IS AVAILABLE IN THE LAB.

YOU NEED TO DETERMINE IF THE EQUIPMENT IN THE LAB IS SUFFICIENT FOR WHAT YOU ARE WORKING WITH. IF YOU DO NOT HAVE THE PROPER SAFETY EQUIPMENT, YOU EITHER NEED TO CHANGE YOUR PROTOCOL OR ORDER THE NECESSARY EQUIPMENT AFTER OBTAINING PERMISSION FROM THE LAB SUPERVISOR OR CHEMICAL HYGIENE OFFICER.

4. A PLAN FOR HANDLING THE HAZARDS

IF PROTOCOLS ARE ALREADY LISTED IN THE CHP FOR THE HAZARDS PRESENT AND IS DEEMED SUFFICIENT YOU ARE SET TO GO. SIMPLY REFER TO THE SECTIONS IN THE CHP WHICH ADDRESSES THESE HAZARDS IN THE ASSESSMENT WORKSHEET.

IF A HAZARD IS PRESENT THAT IS NOT HANDLED IN THE CHP THAN A PROTOCOL MUST BE DEVELOPED AND ATTACHED TO THE WORKSHEET. YOU SHOULD HAVE LAB SUPERVISOR APPROVAL FOR THE PROTOCOL AS A BACKUP.

5. PERIODIC REVIEW

REVIEW THIS INFORMATION AND UPDATE AS NEEDED. A RECOMMENDED TIME FRAME IS ONCE EVERY YEAR.

APPENDIX VI. CHEMICAL HAZARDS: TYPES AND INFORMATION

PURPOSE:

THIS SECTION DETAILS HOW TO DETERMINE WHAT TYPES OF HAZARDS ARE PRESENT WITH CHEMICALS AND HOW TO OBTAIN ADDITIONAL INFORMATION BESIDES THE DETAILS GIVEN IN THIS CHEMICAL HYGIENE PLAN.

PLEASE NOTE THAT THIS SECTION PROVIDES A BASIS OF DETERMINING HAZARDS WITH CHEMICALS, IT IS NOT MEANT TO SERVE AS THE ONLY SOURCE OF HAZARD DETERMINATION.

A. SOURCES OF INFORMATION

In most cases a chemical Material Safety and Data Sheet (MSDS) is the best source of obtaining hazard information of a chemical. Be advised that MSDS's can be vague on information and other sources may have to be referred to for better information.

The following is a list of resources you may consult for additional information

Occupational Health Guidelines for Chemical Hazards

Chemical Safety Data Sheets

A Comprehensive Guide to the Hazardous Properties of Chemical Substances

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indicies

Fire Protection for Laboratories Using Chemicals

Betherick's Handbook of Reactive Chemical Hazards

Sax's Dangerous Properties of Industrial Materials

Sigma-Aldrich Library of Chemical Safety Data

B. Types of Toxicity

1. Irritants

Irritants are noncorrosive chemicals that cause reversible inflammatory effects on living tissue by chemical action at the site of contact. A wide variety of chemicals are irritants thus eye and skin contact should be avoided.

2. Corrosives

Corrosive substances cause destruction of living tissue by chemical action at the site of contact and can be solids, liquids, or gases. Corrosive materials are probably the most common toxic substances encountered in the laboratory. Eye and skin contact should be avoided as well as inhalation of these substances due to the fact that these substances can damage the respiratory system as well.

3. Allergens

These substances may trigger an immediate or delayed allergic response depending on the exposure and sensitivity of the person affected. Substances commonly known for triggering such an effect are diazomethane, formaldehyde, various isocyanates, benzylic and allylic halides, and certain phenol derivatives. If dealing with these substances, be aware of the warning signs of an reaction and be prepared to have first response on call.

4. Asphyxiants

Asphyxiants are substances that interfere with the transport of an adequate supply of oxygen to the vital organs in the body. Exposure of asphyxiants can lead to rapid collapse and death. Common asphyxiants are acetylene, carbon dioxide, argon, helium, ethane, nitrogen, and methane.

5. Reproductive and Developmental Toxins

Reproductive toxins are substances that have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. It is important to protect both the male and female (especially in the case of a pregnant female) from these hazards when present.

Pregnant females should be kept away from these materials at all time or be adequately protected if exposure cannot be avoided.

6. Neurotoxins

Neurotoxic chemicals can induce an adverse effect on the structure or function of the central and peripheral nervous system which can be permanent or revisable.

7. Carcinogens

A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long term exposure, and their effect may become evident only after a long period of time.

Please note the difference between carcinogen and carcinogenic. Carcinogens are chemicals known for causing cancer while carcinogenic means the substance is capable but not known for causing cancer.

C. Levels of toxicity

LD50-This term is a measure of the dose that it would take of a substance to kill 50% of a population of the subject studied. The subjects usually are either rats or rabbits and the values are measured in g/kg.

The following table summarizes the degree of toxicity and lethal dose for a human:

TOXICITY RATING	ANIMAL LD50 (PER KG)	LETHAL DOSE FOR 150KG HUMAN
EXTREMELY TOXIC	LESS THAN 5 MG	LESS THAN 7 DROPS
HIGHLY TOXIC	5 TO 50 MG	BETWEEN 7 DROPS AND 1 TEASPOON FULL
MODERATELY TOXIC	50 TO 500 MG	1 TEASPOONFULL AND 1 OUNCE
SLIGHTLY TOXIC	500 MG TO 5 GM	BETWEEN 1 OUNCE AND 1 PINT
PRACTICALLY NONTOXIC	ABOVE 5 GM	ABOVE 1 PINT

Be aware that the levels of toxicity are approximate and each person reacts differently to the exposure.

D. TLV's and PEL's

To help the worker, OSHA has implemented the use of the Threshold Limit Value to determine the concentration of chemical that a person can be exposed to without adverse effects. The TLV value(may be listed asTLV/TWA) is based upon the concentration of chemical a person can be exposed to safely in an eight hour work period. If a chemical is

of higher toxicity, a TLV/STEL value may be given which is the concentration a person can be exposed to in 15 minutes without adverse side effects.

In the absence of a TLV value, a PEL value may be given which in principle covers the same concept of a TLV.

For general purposes a substance with a PEL or TLV value of less than 50 ppm should be handled in a fume hood.

Monitoring of these chemicals should be determined periodically using specialized equipment or trained personel. Be aware that the PEL or TLV may be lower than the Detectable odor threshold meaning that you may be overexposed even before you can smell the chemical.

E. FLAMMABLE HAZARDS

1. Flammable substances, those that readily catch fire and burn in the air, may be solid, liquid or gaseous. Proper use of substances that can cause fire requires knowledge of their tendencies to vaporize, ignite, or burn under the variety of conditions of use in the laboratory.

For a fire to occur, three conditions must exist simultaneously: an oxidizing atmosphere; a concentration of flammable gas or vapor that is within the flammability limits of the substance; and a source of ignition. Prevention of the coexistance of flammable vapors and ignition sources is the optimal way to deal with the hazard.

2. Flash points

The flash point is the lowest temperature at which a liquid has a sufficient vapor pressure to form an ignitable mixture with air near the surface of the liquid.

3. Ignition temperature

The ignition temperature of a substance, whether solid, liquid, or gas is the minimum temperature required to initiate or cause self-sustained combustion independent of the heat source. The lower the ignition temperature, the greater the potential for a fire by typical laboratory equipment.

4. Limits of flammability

Each flammable gas and liquid(as a vapor) has two fairly definite limits of flammability defining the range of concentrations in mixtures with air that will propegate a flame and cause an explosion. The lower flammability limit is the minimal concentration while the maximum concentration is referred to as the upper flammability limit. Concentrations lower than the lower limit and higher than the upper limit will not ignite.

F. Reactive Hazards

1. Water Hazards

Water reactive materials are those that react violently with water. Common water reactives are alkali metals, many organometallic compounds, and some hydrides. Some anhydrous metal halides, oxides, and nonmetal oxides and halides react exothermically with water and the reaction can be violent.

2. Pyrophoric materials

For pyrophoric materials, oxidation of the compound by oxygen or moisture in air proceeds so rapidly that ignition occurs. Many reducing agents, such as metal hydrides, alloys of reactive metals, low-valent metal salts, and iron sulfides are also pyrophoric.

3. Incompatible Chemicals

Accidental contact of incompatible chemicals could result in an explosion, or the formation of toxic substances or both. Tables VI-3 and VI-4 list the classes of incompatible chemicals and care should be taken in the segregation and storage of these materials.

G. Explosive Hazards

1. An explosive is any chemical compound or mechanical mixture that when exposed to heat, impact, friction, detonation, or other suitable initiation, undergoes rapid chemical change, evolving large volumes of highly heated gases that exert pressure on the surrounding medium. Shock sensitive compounds include acetylides, azides, nitrogen triiodide, organic nitrates, nitro compounds, perchlorate salts, many organic peroxides, and compounds containing diazo, halamine, nitroso, and ozonide functional groups.

2. Peroxides

Organic peroxides are the most hazardous substances handled in the laboratory. They are generally low-power explosives that are sensitive to shock, sparks, or other accidental ignition. Also potentially hazardous are compounds that undergo autooxidation to form organic hydroperoxides and/or peroxides when exposed to the oxygen in air. These chemicals should not be stored for a long period of time and testing for peroxide formation may be necessary before using the materials in a reaction.

3. Dusts

Some dusts (flour, coal, magnesium, zinc, carbon powder, sulfur) can combust in the air in a powerful explosion. Care must be taken that these materials should be used with adequate ventilation and should not be exposed to ignition sources.

Source: Prudent Practices in the Laboratory, 4th edition.