Prepared by:_____ Date:_____

Reviewed by:_____ Date:_____

Approved by:_____ Date:_____

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Purpose

This protocol describes the safety procedures and guidelines followed in the Office of the Texas State Chemist laboratory.

Scope / Field of Application

This standard operating procedure applies to all individuals entering the Office of the Texas State Chemist laboratory.

Responsibilities

Chemist, Scientists – responsible for familiarizing themselves and following the guidelines and procedures contained within this SOP

Safety Chair – serve as liaison to EHSD, ensure the Safety Manual is up to date, coordinate safety training and monitor safety in the laboratory

Safety Committee – equally share the responsibility associated with safety training and monitoring, disseminate safety information to other team members and perform safety training

Lab Managers - monitor lab to ensure SOP is followed

Procedure

IN CASE OF EMERGENCY

To report any type of emergency
Dial 9911

Be prepared to supply the following information:

Our telephone number: 845-1121
Name of Building: Office of the Texas State Chemist
Building number: 1810
Location of Building: 445 Agronomy Rd
Explain what happened: Fire, Medical, Accident, etc.
Number of people needing help:
Name and approximate age of victim(s):
Previous illness, if any:
Name of caller:

Assign individuals to be outside the front and rear entrances
to the building so that they may direct response team to exact location.

MATERIAL SAFETY DATA SHEETS
MSDS's for hazardous materials are located on-line
and should be available from any laboratory personnel's desktop.

TABLE OF CONTENTS

BASIC RULES AND EMERGENCY PROCEDURES:

INTRODUCTION

As an employee you have a responsibility of doing your job well and safely. A priority of OTSC is to offer you a workplace free from recognizable and avoidable hazards to your health and safety.

Safety, however, is never a one-way street. It cannot be mandated, nor is it something that can be given to an employee. Rather, you must make a conscious effort to help ensure safe conditions for yourself and for other workers in the area. This requires an understanding of potential hazards on the job and knowledge of the policies and regulations in dealing with those hazards.

There are unavoidable sources of risk in any work environment. The laboratory is certainly no exception. To keep the hazards from causing injuries, each individual must know how to use the tools and equipment safely, and be informed of what to do in case of a fire, injury, or other emergency. However, information is not enough. Safety on the job is an attitude as much as it is knowledge. It means. . .

- Recognizing that accidents are not limited to those people who do not know how to prevent them. It is often the seasoned veteran, the person who "knows better," who becomes a victim by allowing familiarity to dull the edge of caution.

- Maintaining constant awareness. It involves your personal commitment to do every job safely.

- Alerting other workers to danger if they are not following the safety procedures.

- Notifying one's supervisor immediately of defective emergency equipment or other potential dangers.

- Participating on safety committees, assisting in making safety inspections, and assuring that all safety practices are carried out every time.

No work is so important that there is not time to do it safely and correctly!

This manual contains policies and procedures to help you protect yourself and those with whom you work. Because circumstances vary from area to area and job to job, this manual cannot contain all of the policies and procedures that apply specifically to your work. Be sure you understand the material presented as well as those safety measures that apply especially to you. Then, incorporate these policies and procedures into your daily work. Safety is an essential part of every job you perform.

Failure to comply with the policies in this manual can lead to disciplinary action and/or possible termination.

GENERAL SAFETY RULES

- There is **no eating or drinking in the lab**. Food is not permitted to be stored in the walk-in refrigerators, and the ice machine is not to be used for food or drink.

- Food utensils are not permitted in the lab.

- Lab doors are to be kept closed in order to comply with Fire Code 5000 of the NFPA and increase air balance within the lab.

- Mints/Gum, while permitted, should not be unwrapped in the lab area.

- **No indoor tobacco use.** All buildings on the Texas A&M University campus are smoke free.

- Visitors not on official business are to be discouraged from coming into the lab. **All visitors must sign in at the front desk,** obtain protective eye wear and be accompanied by an OTSC employee while in the lab. Visiting Scientist working in the lab must follow guidelines outlined in protocol M0054.

- Upon entering the lab, all visitors will be required to wear safety glasses if their own eyewear is not appropriate. If they refuse, they are to be politely requested to leave; explaining OTSC cannot assume the risk of an injury. This includes Physical Plant personnel or visitors using or demonstrating equipment.

- Children under 15 years of age will not be allowed in the lab without the approval of a manager or a director.

- Keep work area clean and uncluttered.

- All personnel must be aware of the hazards involved in the handling of any chemical or performance of any procedure that they might be required to perform. It is the responsibility of each individual to become properly and completely informed of all chemicals used in their area and their hazards.

- Before leaving an assigned laboratory work area for any reason, ensure no risk is being created by leaving the equipment/procedure unattended.

- Never perform hazardous lab procedures unless someone else is present in the building. Consult your supervisor as to what constitutes a hazardous procedure.

- Inform appropriate personnel and the supervisor in your work area when a non-routine hazardous condition may exist.

- Post appropriate warning signs in areas where non-routine hazardous conditions may exist.

- Memorize where fire extinguishers, showers, and eyewashes are located, as well as their proper use, so that they can be utilized rapidly and efficiently in an emergency.

- Never block access to a fire extinguisher.

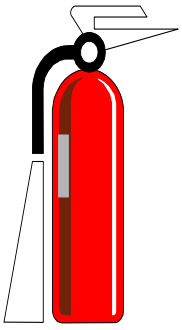
Contact your supervisor if:

- There is no specific rule governing the safe handling of a chemical or a procedure, or a rule does not seem to apply to a specific case. Consult with your supervisor or a safety advisor before proceeding.

- Any doubt exists as to the proper precautions to be taken, or if you do not understand directions or equipment. Remember that it is your health, your safety and the safety of your colleagues that is the primary concern.

- Before performing a procedure for the first time. Read the instructions carefully and discuss it with your supervisor. This will reduce confusion as to how the procedure may be safely performed.

HOW TO USE A FIRE EXTINGUISHER



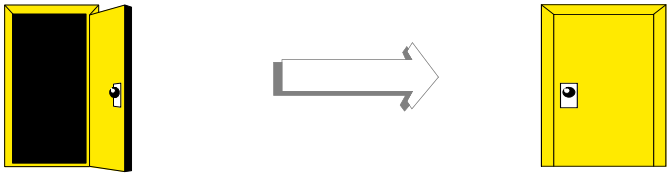
If a small fire occurs in your laboratory, follow the steps below to control it:

1. Notify other personnel that a fire exists.
2. Locate the nearest fire extinguisher.
3. Remove the safety pin from the handle. Twist the pin to first break the plastic usage indicator, which attaches the pin to the extinguisher.
4. Point the nozzle of the fire extinguisher at the base of the flame, then squeeze the release arm.
5. Use the fire extinguisher in this way until the flame is out, sweeping the area to fully cover the area.
6. Ensure that the fire is extinguished, back away from the area, then notify your supervisor.
7. Be sure that the fire extinguisher is recharged after each use, by notifying the Environmental Health and Safety Department.

IF A LARGE FIRE OCCURS, ACTIVATE THE ALARM AND FOLLOW EVACUATION PROCEDURES:

In case an evacuation of the lab or the sample preparation laboratory becomes necessary, the following evacuation plan will be observed:

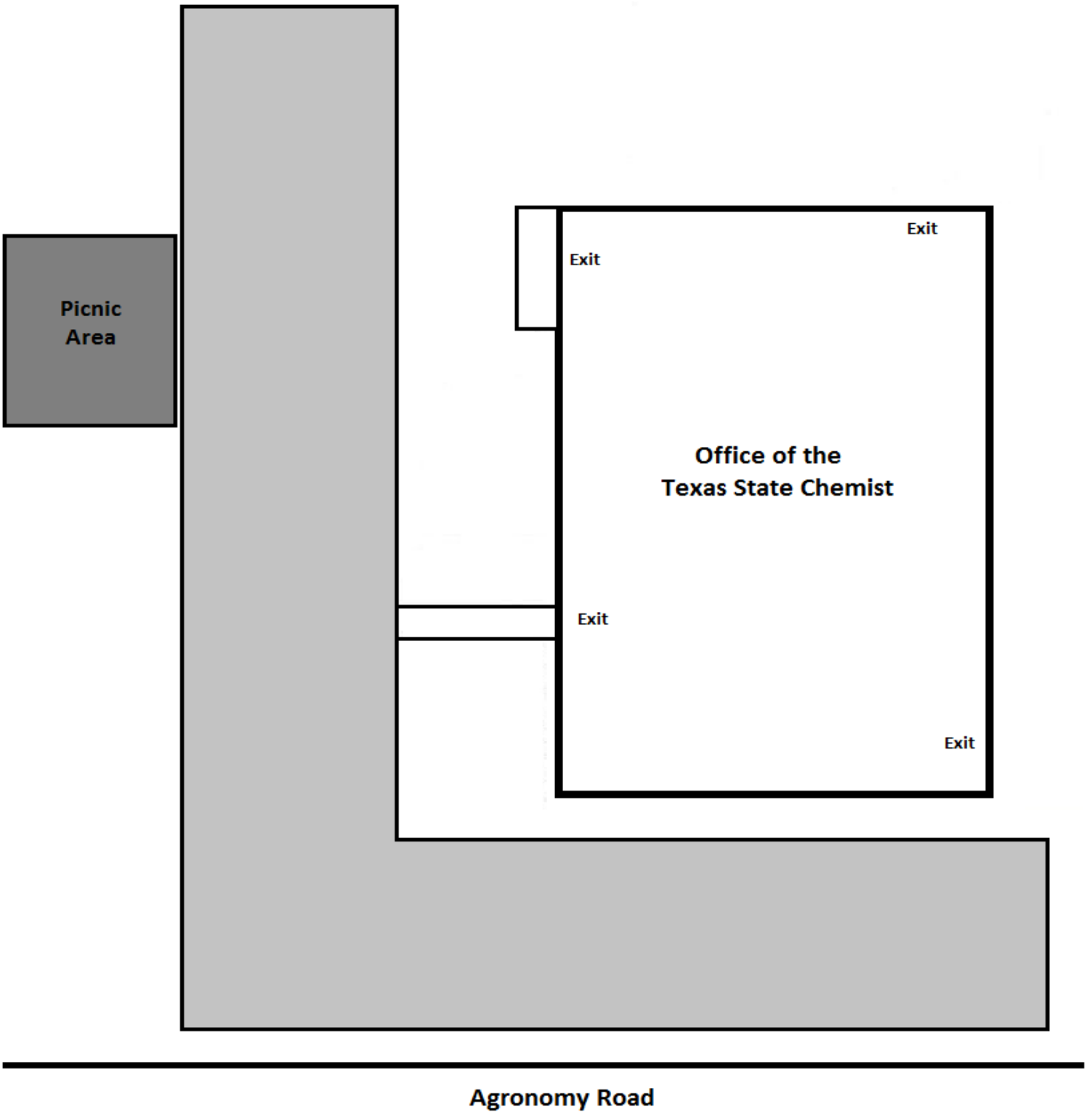
- EVERYONE must evacuate the building, even during known fire drills or false alarms.
- Activate building alarm.
- If it can be done quickly and safely, turn off any appliances or instruments that may pose a hazard to emergency personnel. The black "Emergency Power Off" button can also be depressed to cut power to the room.
- Inspect the room which you are in at the time of the emergency to be sure that the room is left unoccupied.
- Do not take extra time to retrieve personal belongings.
- Close the door to the room..



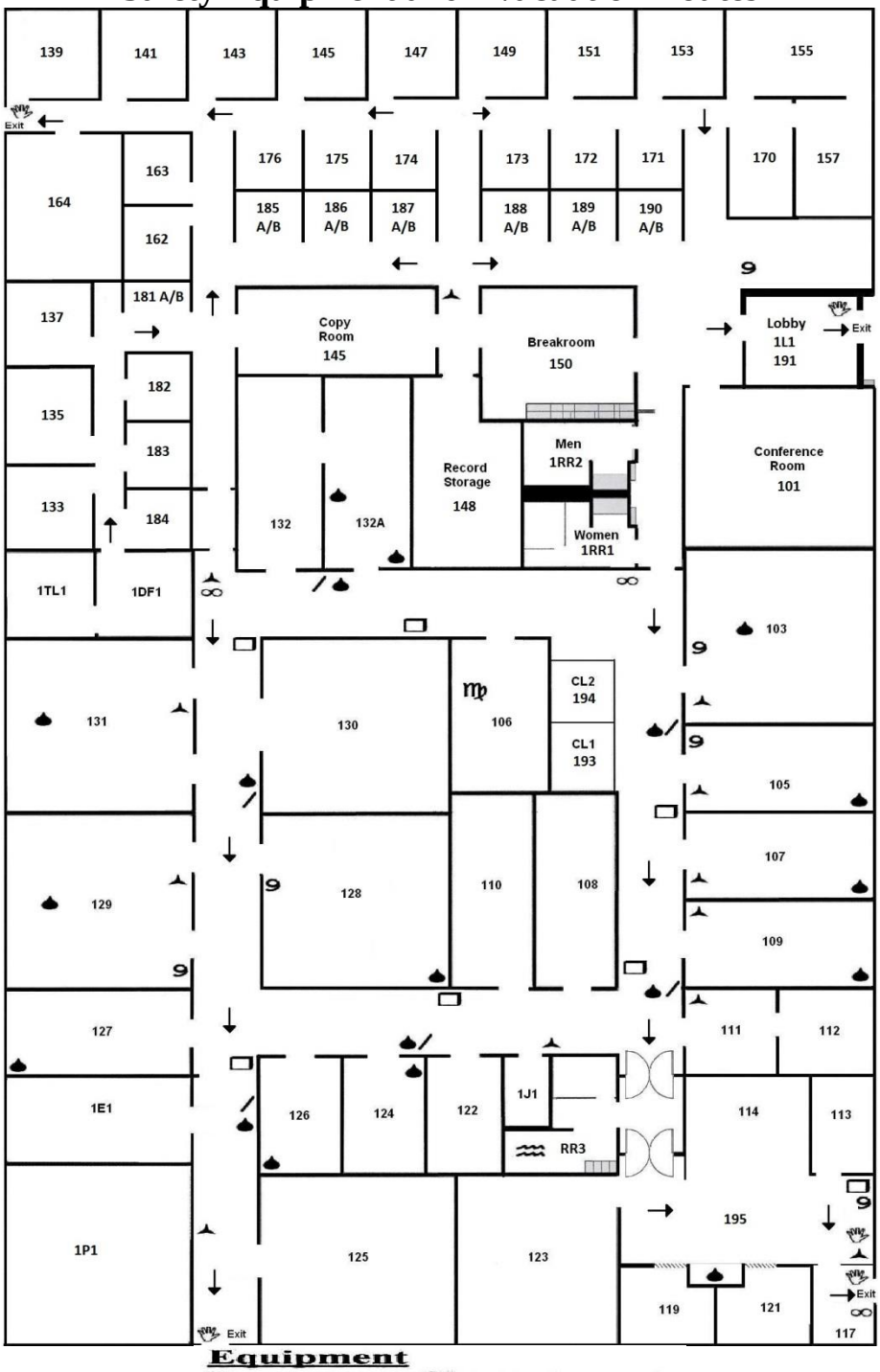
- Leave the building by the nearest and safest exit available.
- Meet at the picnic area and report to your group supervisor.
- Do not return to the building until authorized to do so by upper management**.**

The Environmental Health and Safety Department offers a fire extinguisher handling and demonstration class. Internal training should include certification of fire extinguisher handling.

Fire Alarm Assembly Area



Safety Equipment and Evacuation Routes



Equipment

Emergency Shower ...../
Eye Protection ..... ∞
Eyewash ..... ♠
Fire Blanket ..... ❒
Fire Extinguisher ..... ⅄
First Aid Kit 9
Manual Fire Alarm ..... ♨
Mercury Spill Kit ..... ♍
Regular Shower ..... ≋
Safety Supplies ..... ⌘

PERSONAL SAFETY RULES

- Appropriate eye protection must be worn at all times while in the laboratory, prep lab and the hallways in the lab. This consists of at least prescription glasses or safety glasses. Prescription or safety glasses are inadequate protection for some procedures. Lab goggles and/or face shields shall be worn while performing or in the vicinity of these procedures:
    1. Waste disposal and cleanup
    2. Working with acid baths, and washing glassware which contains/contained hazardous substances.
    3. Acid digestion on hot plate.
    4. When dispensing a chemical that poses a significant hazard to the eyes and there is a reasonable risk of the chemical splashing. Examples of chemicals that fit this description include but are not limited to:
        - Sulfuric Acid
        - Hydrochloric Acid
        - Perchloric Acid
        - Nitric Acid
        - Acetonitrile

- The only exception to wearing safety glasses in the laboratory is when looking into the microscope.

- Contact lenses are permitted in the laboratory provided that approved eye protection is worn.

- Wearing lab coats is not mandatory but highly recommended, especially while handling any caustic or toxic chemical. Lab coats must be laundered by OTSC. Do not wash them at home. Place soiled lab coats in receptacles located outside the washroom.

- Lab coats and gloves are prohibited in the Office area of OTSC.

- Ear plugs or hearing protectors must be worn in any room when there is a high noise level. The permissible noise exposure limits can be found on the OSHA website at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9735&p_table=STANDARDS

- Wear the appropriate protective gloves when the health hazard is greater than 2. The health hazard is the number in the blue section on the NFPA diamond. Wash your hands after removing protective gloves.

- Long hair should not be allowed to interfere when working with chemicals or mechanical devices.

- Sandals, cut out or toeless shoes, etc. may not be worn in the laboratory. Shorts may be worn as long as they are appropriately modest for a work environment.

- It is suggested that a spare set of clothes and shoes be kept on hand in case a change of clothing is necessary.

- Guidelines for specific chemical hazards may be found under SPECIAL CASES section of this manual.

- Remove gloves prior to touching door knobs, telephones, light switches, etc. to avoid contamination of common surfaces.

GUIDELINES FOR THE SELECTION OF PROTECTIVE GLOVES

Selection Factors

There are many factors and hazards to consider when selecting a glove material. Since no one glove can possibly protect against all types of hand hazards, a hazard assessment of the task to be performed can be used to pinpoint the glove properties required to complete the job safely. For example, determine whether the chemical(s) used are pure or a mixture. *Chemical combinations* can alter the physical properties of the individual chemicals changing the effect they have on various glove materials. Also, consider the *concentration* and *temperature* of the chemical. The higher the concentration and temperature, the shorter the breakthrough time. Consider the length of *exposure* to the chemical. Routine laboratory work may only require protection against small splashes or intermittent contact, while major spill clean-up may involve complete immersion or continual contact with the chemical. Take into account the degree of *dexterity* required for the task. Work that involves detailed motions may require a thinner glove material. Look for *cut and abrasion hazards*. A glove that provides excellent chemical resistance without adequate resistance to tears, punctures, or abrasions is virtually worthless.

Chemical Resistance Testing

Different glove materials offer varied degrees of protection. Likewise, the degree of protection varies from one manufacturing process to another. Therefore, a given glove material from one manufacturer may not have the same degree of protection as one obtained from a different manufacturer when tested with the same chemical. Use the test results provided by the specific manufacturer of the glove in question for determining its suitability for a task. Glove manufacturers conduct permeation and degradation tests in accordance with standards established by the American Society for Testing and Materials (ASTM). These tests measure the following three criteria:

Breakthrough time: The elapsed time between initial contact of the chemical on the glove surface and the analytical detection on the inside of the glove. Typically expressed in units of time with a greater than symbol (i.e. >480 min or >2 hrs.). May also be expressed as "ND" for none detected.

Degradation: A change in one or more of the physical properties of a glove due to contact with a chemical. Can appear as swelling, softening, discoloration, shrinkage or cracking of the glove material. Rating is generally expressed as poor (P), fair (F), good (G), excellent (E), or not recommended (NR). A good degradation rating does not guarantee an acceptable breakthrough time.

Permeation rate: The rate at which a chemical passes through a glove material. This process involves absorption on the glove surface, the diffusion of the chemical through the material, and the desorption on the glove's inside surface. Expressed as the mass of the permeated chemical per area of glove material per unit time (i.e. $\mu g/cm^2/min$ or $g/cm^2/min$). Measurement is limited by the lower detection limit of the equipment used. May be expressed as poor (P), fair (F), good (G), excellent (E), or not recommended (NR) rather than numerically. Permeation can be deceiving and give a false sense of security because it can occur even though there is no visible damage to the glove itself.

Glove Materials

Latex	Natural rubber general use lab glove that provides minimal chemical resistance to some acids, alkalies, salts and ketones. Inherently elastic and resilient.
Butyl	A synthetic rubber material that offers the highest permeation resistance to gas and water vapors. Especially suited for use with esters and ketones.
Neoprene	A synthetic rubber material that provides excellent tensile strength and heat resistance. Neoprene is compatible with some acids and caustics. It has moderate abrasion resistance.
Nitrile	A synthetic rubber material that offers superior puncture and abrasion resistance in addition to chemical resistance. A very good general duty glove. Nitrile provides protection from oils, greases, petroleum products and some acids and caustics. Resists swelling and degradation by hydrocarbons and organic solvents.
PVC	Also known as polyvinyl chloride or vinyl. A synthetic plastic material that provides excellent resistance to most acids, fats and petroleum hydrocarbons. Good abrasion resistance.
PVA	Also known as polyvinyl alcohol. A water-soluble synthetic material that is highly impermeable to gases. Excellent chemical resistance to aromatic and chlorinated solvents. **This glove cannot be used in water or water-based solutions.**
Viton	A fluoroelastomer material that provides exceptional chemical resistance to chlorinated and aromatic solvents. Viton is very flexible, but has minimal resistance to cuts and abrasions. Viton protects against toxic and carcinogenic substances. **These gloves will degenerate in acetone.**
SilverShield or 4H	A lightweight, flexible plastic laminate that resists permeation from a wide range of toxic and hazardous chemicals including aromatics, ketones, alcohols, esters, and chlorinated and aliphatic solvents. Also resists water-based solutions of most acids and bases. It offers the highest level of overall chemical resistance, but has virtually no cut resistance. Ideal for underlining other gloves.
Kevlar	A fabric glove usually with PVC dots for grip and wear resistance used for glass handling. Provides cut and abrasion resistance.
Autoclave	Cotton terry cloth knit gloves used for removing hot objects from the autoclave or oven. Heat resistance up to 232^{o}C (450^{o}F). Intermittent use up to 260^{o}C (500 ^{o}F).

Thickness
As would be expected, thicker gloves provide better protection against chemicals, but thinner gloves offer better sensitivity and flexibility. The general rule of thumb stated by manufacturers is that doubling the thickness of a glove quadruples the breakthrough time of the chemical. Glove thickness is stated in either mils or gauge. A 10-gauge glove equals 10 mils, or 0.010 inches. When choosing gloves look for the stated thickness on the manufacturers test data and be sure any comparisons are based on gloves of the same thickness.

Thickness and durability also depend on whether the gloves are supported or unsupported. Supported gloves consist of a fabric liner that is coated with a polymer. The liner is generally a knit material and can be palm coated only or fully coated. Supported gloves are very durable. Unsupported gloves refer to gloves produced by dipping a glove form directly into a compound. Unsupported gloves offer better sensitivity and dexterity.

Inspection and Care
Even the most resistant gloves will break down after repeated exposures. Prior to each use, inspect gloves for signs of chemical degradation such as swelling, cracking, shrinking, or discoloration of the material. The presence of any of these defects indicates the glove material has undergone a physical change due to chemical contact and will no longer provide adequate protection. Inspect heat resistant gloves and Kevlar gloves for holes and thin areas prior to use.

DO NOT reuse disposable gloves! Make it a practice to change disposable gloves frequently and to wash hands between each change. Remove gloves prior to touching door knobs, telephones, light switches, etc. to avoid contamination of common surfaces.

For additional information on protective gloves, search the internet for safety gloves or protective gloves, and consult these sites:

http://www.des.umd.edu/ls/gloves.html

http://www.bestglove.com/

EMERGENCY/FIRSTAID PROCEDURES

If you feel ill or faint, do not continue to work. Sit down either in a chair or on the floor. Notify a colleague to arrange help. Under no conditions should you attempt to go to the hospital or the health center ALONE.

IN THE EVENT OF AN ACCIDENT:

- If the injury is of a minor nature, obtain the assistance of a colleague.
- If medical attention is needed, but not immediately life-threatening, the injured person should visit a clinic of their own choosing, such as their health insurance provider. Inform the clinic that the injury occurred during work hours.
- Notify the appropriate supervisor immediately.
- If the injury is serious or life-threatening, call the emergency number for TAMU (9911), and follow the directions on the front-page bulletin of this manual. Keep the injured person warm and comfortable until medical help arrives. Never move the injured person unless necessary to prevent further injury.
- All accidents must be documented. The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible. The Resource Secretary will then fill out the appropriate accident report form located at the Texas A&M Agriculture Human Resources website, http://www.tamus.edu/assets/files/safety/pdf/employersfirstreportofinjury.pdf . The State Chemist should also be notified as soon as possible.

Minor Chemical Burns

- Apply LARGE quantities of water to the burned area immediately for **at least 15 minutes**.
- Do NOT try to neutralize the area with acid or base.
- Remove clothes from the affected area. Since the extent of the burn can increase rapidly with time, modesty is not a factor for consideration.
- Gently pat the burned area with a sterile cloth until dry. If the area remains irritated, continue flushing with water.
- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Burns Caused by Heat

- Burns are classified by depth of the skin damage, i.e., the greater the damage the higher the "degree" of the burn. Burns result from hot objects or scalding fluids contacting the skin.

- The symptoms of first-degree burns include redness or discoloration of the skin, mild swelling, and pain. Apply cold water from an ice bath, or submerge the burned area in cold water. The goal is to remove as much heat from the burned area as possible without over chilling the skin. If needed, place a loose dressing on the area.

- For any burns that are more severe, obtain medical help immediately. More severe burns are larger in area, may form blisters, or in extreme cases, have charred skin.

- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Chemical Burns of the Eyes

If the eyes are exposed to any chemical or chemical vapor, it is absolutely critical that they be flushed IMMEDIATELY with copious amounts of water. Each second saved could prevent loss of sight.

- The victim should proceed or be taken as quickly as possible to the nearest eyewash station.

- Activate the eyewash.

- Expose the eyes to the stream of water. Pull the eyelids back and rotate the eye so that all of the surfaces are exposed to water.

- Wash the eyes for **a minimum of 15 minutes**.

- After the wash, the individual should be accompanied to the health center or a local hospital emergency clinic for an eye examination.

- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Deep Puncture Wounds

- Do not remove the object that has caused the puncture.

- Try to stop the bleeding from the wound with direct pressure, but do not apply pressure on the object itself.

- Call the emergency number and report the accident.

- Notify the appropriate supervisor.

- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Injury Caused by Electric Shock

Note: The extent of damage caused by an electric shock is not easily ascertained, as the majority of the damage typically occurs internally. Thus, the damage may be more extensive than is readily apparent.

- Before assisting the victim, be certain that the source of the electric shock and the surrounding area no longer poses a threat to the victim or to yourself. If power cannot be turned off at a circuit breaker, remove the shock source with a non-conducting object, such as a piece of wood.
- Cover the victim with a blanket and elevate the feet above the head.
- Call the emergency number and report the accident.
- Be prepared to administer mouth-to-mouth resuscitation and/or cardiopulmonary resuscitation if the victim stops breathing or there is no pulse.
- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Personal Contamination by Hazardous Substances

- Remove contaminated clothing.
- Flush affected area with copious amounts of water.
- Report exposure to your supervisor.
- Seek medical attention, if necessary.
- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Poisoning or Suspected Poisoning

- Call the emergency number and report the accident at **9911** immediately and tell them:
  - The name of the suspected poison
  - Circumstances and symptoms of poisoning
  - Other pertinent information
- The supervisor of the injured person should fill out a *Supervisor's Report of Injury* form (located on page 14) and give it to the Resource Secretary as soon as possible.

Documentation:

The following form is to be filled out by the supervisor responsible for the employee who was injured. The form with all information provided should then be used to fill out the accident report form located at the A&M Agriculture Human Resources website, http://www.tamus.edu/assets/files/safety/pdf/employersfirstreportofinjury.pdf .

SUPERVISOR'S REPORT OF INJURY

Name of Injured Party _____

*Date of Injury*_____ *Time of Injury*_____ *Date Lost Time Began* _____

*Nature of Injury (cut, burn, etc.)*_____

*Part of Body Injured or Exposed*_____

How and Why Injury/Illness Occurred:

_____

Was employee performing his/her regular job? Yes _____ No _____

Worksite Location of Injury (stairs, dock, lab, etc.) _____

Cause of Injury (fall, tool, machine, chemical reagent, etc.) _____

_____

Names of Witnesses _____

_____

Return to work date / or expected date _____

Doctor's Name (seen for this injury) _____

Doctor's Mailing Address (street or PO Box) _____

_____

Date Reported _____ *Supervisor's Name* _____

CHEMICALS

- **Storage**
  - ◊ Store acids and bases in separate locations, near floor level labeled cabinets.
  - ◊ Isolate perchloric acid from organic materials and from sulfuric acid. Do not store perchloric acid on a wooden shelf.
  - ◊ Do not store peroxide forming chemicals (e.g. ethyl ether, dioxane) for more than twelve months or beyond the date recommended by the manufacturer.
  - ◊ Refrigerate flammables in an explosion-proof refrigerator.
  - ◊ Glass chemical containers should never be stored on the floor.
  - ◊ Make certain all chemicals are labeled clearly to identify contents.
  - ◊ Physically separate incompatible chemicals.
  - ◊ Segregate by hazard class:
    - ◊ Health Hazards (Toxins, Poisons, Carcinogens, etc.) 
    - ◊ Corrosives 
    - ◊ Reactives/Oxidizers 
    - ◊ Flammables 
    - ◊ General Storage (e.g. salts and other routine dry chemicals - relatively modest hazards).
  - ◊ Keep exits, passageways, areas under benches and desks, and emergency equipment free of stored equipment and materials.
  - ◊ Date when received and again when opened. (Dating containers is especially important for chemicals with a short shelf life like ethyl ether which, because of its explosion hazard, should not be kept for more than 6 months after being opened and must never be kept past its expiration date)
  - ◊ Do NOT:
    - ◊ Store chemicals on benches.
    - ◊ Store chemicals in fume hoods or under sinks.
    - ◊ Expose to heat or direct sunlight.
    - ◊ Store hazardous materials above shoulder height of shortest person in lab.

- **Expiration Dates**
  - ◊ All chemicals received at the Office of the Texas State Chemist are recorded in the ICN database and receive an ICN label which identifies the chemical with a unique number, a received date and expiration date. When assigning the expiration date to chemicals received, there are three basic groups: Expiration dates according to EHSD, according to manufacturer and NA (Not Applicable).

  - ◊ EHSD has stated that the following chemicals must be used within one year of purchase or 6 months after opening and must be disposed of before the expiration date:
  - ◊ Chloroform
  - ◊ Perchloric Acid
  - ◊ Ethyl Ether
  - ◊ Tetrahydrofuran (THF)
  - ◊ Cyclohexane
  - ◊ Butadiene
  - ◊ Isopropyl Ether
  - ◊ Dioxanes

    Note: When multiple bottles of the chemicals listed above are received in one order each bottle must be given a unique ICN number to ensure the inventory is properly monitored. Once the chemical is opened, the chemist responsible for the chemical will inform one of the lab attendants to change the expiration date in the ICN database, to reflect expiration 6 months after opening. The inventory of the chemicals listed above will be monitored by a program that checks the ICN database and sends an email to the responsible chemist, the lab manager and the safety committee when one of these chemicals expire.

  - ◊ If the chemical has a manufacturer suggested expiration date this is the date that should be recorded in the ICN database and on the ICN label.

  - ◊ If a chemical has a retest date listed on the container this date will be used as the expiration date.

  - ◊ If the chemical is not in the EHSD list mentioned above and does not have a manufacturer expiration date then the expiration date will be 5 years from the date received.

  - ◊ If a chemical reaches the 5 year expiration date and the chemist does not wish to dispose of it, he/she can extend the expiration date up to 5 years, initial and date.

- Return chemicals, supplies, and associated equipment to their proper place after use.

- **If a container is to be used for waste, remove, cover or deface the original label. Then relabel it clearly with a marker or label so that its contents will be obvious**.

- Electrically ground all metal solvent containers prior to transfer of any solvent.

- Liquid chemical bottles should be secured when transporting between laboratories.

- Never pour toxic or water insoluble flammable solvents down the sink.

- To prepare ethyl ether containers for disposal, be sure to add ferrous sulfate to eliminate the danger of explosion due to the formation of peroxides.

- When mixing solutions, ALWAYS add the concentrated liquid to the dilute liquid. Always add acid to water.

- Organics should not be evaporated in the hood. Use a waste container to dispose of them. **Organic waste containers must be capped when not in use.**

OTHER SPECIAL PROBLEM REAGENTS

- Ethers: extremely volatile and flammable; vapors are heavier than air and may result in flashback; form potentially explosive peroxides upon exposure to air and light; store in a well ventilated area; do not store in a refrigerator unless it is an explosion-proof type.

- Perchloric acid: reacts violently with organics; safe use requires special fume hood with water washdown system; must be stored to prohibit contact with organic materials (e.g. wood).

CHEMICAL SPILL RESPONSE

Introduction/Summary:

The following are guidelines and instructions as to what to do in the event of a chemical spill. Most spills are minor in nature, and can be quickly and efficiently handled by the chemist involved. On occasion, though, a spill event occurs which needs the involvement of a well-trained spill response team. This ensures that these infrequent events are handled in a safe, professional manner.

In the event that the volume of a spill exceeds the capacity for the chemist to handle, the EHSD can be contacted at the following numbers:

EHSD OFFICE (8 AM – 5 PM): 845-2132

24 Hour SPILL RESPONSE (Communication Center): 845-4311

The chemist involved will handle the spills that do not require the presence of the EHSD team, and: 1) are too large for an individual to safely and comfortably clean up, 2) contain a **hazardous chemical** (see note below), and/or 3) contain unknown chemicals/waste. In any event that the presence of a spill response team is required, a **Chemical Spill Incident Report** must be completed by the chemist(s) involved.

NOTE: There is a list of chemicals that AAS has deemed **hazardous**, and has set volume limits for each of these chemicals. Any spill of a **hazardous** chemical that exceeds these limits requires the immediate contact of EHSD. Laminated yellow cards are affixed to the front doors of those rooms where these chemicals are stored/used. These cards contain special instructions and precautions necessary to handle spills that involve these chemicals.

PREPAREDNESS

Preparation and communication are the two key elements necessary to properly respond to a spill event. Proper response cannot take place where either or both of these are minimal/absent. To ensure preparedness, the following must be accomplished:

1. Make MSDS's for all chemicals easily available on your computer by bookmarking the following sites:

   http://hazard.com/msds/

   http://www.ilpi.com/msds/index.html

2. Obtain proper clean-up supplies, including personal protective clothing and equipment. Instruction must be given to personnel in how to properly put on and use personal protection equipment (such as respirators).

3. Properly train personnel regarding the location and proper use of clean-up materials. This training must include participatory instruction on how to handle various types of chemical spills and information on how to minimize handling/exposure of the spilled chemical(s).

4. Train personnel to know how to shut off power, ventilation, and other systems which can potentially either cause ignition of the spilled chemical, or spread the effects of the spill beyond the confines of the affected area.

With these steps, the involved chemist will be adequately prepared to respond to those spill incidents noted previously. Ensuring communication is addressed in the next section.

RESPONSE GUIDELINES

The following guidelines demonstrate that the focus of responding to any chemical spill is communication. Once an event occurs, all of this information needs to be addressed as quickly as possible: what has happened, where it has happened, what and who are involved, what needs to be done, how to follow through after addressing the immediate concerns of the spill. After the incident has been resolved, review and prevention steps must be addressed. Once a spill happens:

1. **STEP BACK.** Is this a minor spill that can be easily managed? If not, **WALK AWAY** from the spill area.

2. **WHAT HAS HAPPENED?** As help is being sought, put in mind all the details of the incident: who was involved? What happened? When and where did it happen? What chemical(s) were involved?

3. **GET HELP! ALERT OTHERS!** Don't try to handle a major spill by yourself – **GET HELP!** Immediately, alert others to the spill, and communicate everything you know about the event to those who can help. Notify an area supervisor and the Safety Committee Chair that a spill event has occurred. Some spills will require the notification of EHSD spill response personnel (see telephone numbers on the previous page). Laminated yellow cards are affixed to the front doors of those rooms where **hazardous chemicals** are used. Any spill of a **hazardous** chemical that exceeds these limits identified on these yellow cards requires the immediate contact of the EHSD Spill Response Team. The EHSD Spill Response Team is available to assist with any spill. If you are not 100% sure you can safely clean up the spill then contact the EHSD Spill Response Team.

4. **SEAL OFF THE AFFECTED AREA.** Evacuate all nonessential personnel from the affected area, and eliminate all unnecessary traffic. If only one lab is affected by the spill then turn off all systems that will exacerbate the situation – shut off power and turn off all sources of ignition, and shut down recycling ventilation systems as necessary. Clearly mark the area so that others will know not to enter the spill site.

5. **SPILLS IN THE HALLWAY.** If a spill occurs in the hallway then the entire laboratory area must be treated as a single lab. Use cones at the entrance to seal off the affected area and notify people not to enter the lab.

6. **CONTAIN THE SPILL.** Contain the spill so that other people and areas are not affected. Ensure that liquid chemical spills do not enter the floor drains by covering any potentially effected drains with a drain cover.

7. **TURN ON THE EMERGENCY VENTALATION SYSTEM.** There is a red button located in the vicinity of the light switch of each lab, depressing this button will turn on the emergency ventilation system. Activating the emergency ventilation system causes the hoods to run at maximum speed. It is important to turn the emergency ventilation system off as soon as it is not needed; this is done by pressing the red button again.

8. **PEOPLE FIRST!** First responders (those arriving first to the scene) need to make sure they have all the personal protection needed. **Protect yourself first!** If not, no one else can be helped! Then, **look for/attend to all injuries and exposures.** Remove these individuals from the spill site (if possible), or protect them from further injury/exposure if this is not possible. Summon medical assistance if necessary. The clean up of the spill can wait until **after** affected personnel are attended to.

9. **PRIMARY ASSESSMENT OF THE SITUATION.** Identify the chemical(s) involved in the spill. Are any **hazardous** chemicals involved? What are the basic properties of the chemical(s) involved? What other hazards

are present? Gather all information needed to develop a plan for cleaning the spill.

10. **DEVELOP A PLAN OF ACTION.** Never act on a spill until the thoughts are clear **and** a plan of action is in mind.

11. **GET THE PROPER EQUIPMENT AND MATERIALS.** Remember: **personal protection first!** Gather everything needed to clean up the spill. ***Spill supplies are located in a bright yellow bucket inside each lab.*** Extra supplies are available in the stockroom.

12. **CLEAN UP THE SPILL.** This is a team effort. There must be **at least two (2)** persons attending to a spill clean up at all times. This gives a person who is actively cleaning the spill someone to hand in extra cleaning supplies (as necessary), and to give instant relief should this be necessary. Establish exhaust ventilation if needed **and** it is safe to do so. Dispose of all items in an approved spill bag.

13. **FOLLOW-UP CLEANING.** Make sure the spill site is thoroughly cleaned. Neutralize the pH of the site if an acid/base was involved, and ventilate the area (if necessary) before allowing normal occupancy/activity. **TAG ALL ITEMS NEEDING DISPOSAL, AND REPLENISH ALL SUPPLIES USED IN CLEAN UP**.

14. **DOCUMENTATION OF THE EVENT.** Determine what caused the spill. Record all actions taken, personnel involved in responding, who did what, supplies used, first aid rendered, and how long personnel were in contact with the chemical(s) (for both exposed individuals and clean up personnel). Every piece of information is needed to be able to review the event, to judge if the response/clean up was effective or not, and to determine what corrective actions need to be taken to prevent a similar spill in the future. Make adjustments/improvements to response program as needed.

Using these guidelines, the proper steps will be taken to ensure that information is communicated, and ensure a safe, efficient response to the spill event. However, let it also be known that these guidelines will not enable the chemist to handle every conceivable scenario. If there is any question as to how to handle a spill, the EHSD office is available for consultation on how to proceed in the response. Using these guidelines, a response may be initiated but discontinued if the spill's effects are larger in scope than originally thought. Use common sense, and err on the side of safety when taking each step.

CONTAINMENT AND CLEAN UP

How a spill is contained and cleaned up is of critical importance. All chemical spills should be cleaned up as soon as it is possible to do so in a safe manner. Improper containment or clean up technique may make the situation worse than if left alone. This section gives some specific guidelines on containing and cleaning up spills.

There are six classes of hazards associated with spills, but many of these can be treated using the same technique. The general hazard classes are:

Flammables/Organics	Reactives (to either air or water)
Acids	Toxics
Bases	Biologicals

These classes have both solid and liquid chemicals within them.

CONTAINMENT

Simply put, containment is preventing a spill from growing in size and effects (migration). Depending on the location of the spill and chemical(s) involved, containment can be as simple as closing a door (to restrict access and prevent dust generation), or it can necessitate the use of dikes, drain plugs, and other devices. Containment is the first step in cleaning up the spill, and prevents the spill from migrating while first responders tend to injuries and exposures to personnel. Always **USE PROPER PERSONAL PROTECTION** before addressing any spill. Prepare and protect yourself from the worst scenario possible.

Solid chemical spills are usually self-contained. Take measures to prevent the spilled solid chemical from spreading or generating dust. Restrict traffic around the site, and forbid any mopping/sweeping activity in the spill area until after the spill has been cleaned up.

Liquid chemical spills require diking to prevent spreading. It is preferable to contain a liquid spill towards the middle of the room, if this is possible. This is particularly true of acids and organics, which will easily migrate under and through baseboards, cabinets, and furniture, and thus compound the spill problem greatly. An enclosing dike may be made using several different things: long universal sorbent socks, spill pillows, sand, clay litter, vermiculite – anything that will prevent the liquid from spreading **AND** will not react with the spilled liquid. Drain mats are required to prevent the spill from migrating into plumbing, sewers, and waterways, if a drain exists within the spill site.

Use common sense in preventing spill migration; for instance, every floor has some slope to it, however minor, and spilled liquids always migrate down that slope. Drains should be blocked first, in case the spill gets past the dike. Proper containment will provide a much easier clean up of the spill. In some cases, it may be necessary to dike and contain a spill that the EHSD team has been called in to handle.

CLEAN UP

Cleaning up a spill will usually follow the general guidelines set forth below. Unusual clean up procedures will likely need the presence of the EHSD spill response team. In any event, the **USE OF PROPER PERSONAL PROTECTION AND CLEAN UP EQUIPMENT** is required for cleaning any spill in a safe, efficient manner.

Dry/crystalline/powdered solid chemical spills:

1. Using a **plastic** broom and dustpan, scoop as much of the spilled chemical as possible. Be careful to **use the brush as a stop** to help in using the pan to scoop the chemical up, and **not as a sweep** to push the chemical onto the pan. The latter generates dust in the cleaning process. If necessary, use a fine mist of water to suppress dustiness, but **ONLY** if it is safe to do so.

2. Dispose of the spilled chemical, and all disposable items used to clean up the spill, into a spill bag. Tie it off, and attach a waste disposal tag.

Liquid chemical spills (including Organics/Flammables, Acids, and Bases):

1. After containment (described previously), begin placing spill pillows along the inside of the dike, working toward the center of the spill area. Replace soaked pillows with fresh ones as needed. **DO NOT** try to neutralize the spilled chemical (or spill pillows) when working with an **acid/base** spill. This can potentially cause greater problems (by poison gas production or unnecessary heat of reaction generation).
2. Use the emergency exhaust ventilation during the clean up to clear away accumulated vapors. Make sure fume hoods are fully open.

3. After removal of the spilled liquid, remove all traces of the chemical from the spill area. For **acid** or **base** spills, neutralize the pH of the affected area. Mop the area with a vinegar solution (for **bases**) or a baking soda solution (for **acids**). Check the pH of the area with litmus paper (if available) after mopping; the pH of the area should be neutral (pH 5-9).

4. **CAUTION:** If the spill involved a solution containing **heavy metals** (Cadmium, Arsenic, Selenium, Lead, and Mercury), the wash water must be captured, and disposed of in the waste barrel marked for heavy metals.

5. For an **organic/flammable** solvent spill, rinse the area with soapy water, and soak up with spill pillows. Depending on the chemical, access to the spill site may need to be restricted while any residue evaporates.

6. Dispose of the used spill pillows, and all disposable items used to clean up the spill, into a spill bag. Tie it off, and attach a waste disposal tag.

SPECIAL CASES

The following chemical types are classified as special cases. Spill handling involving these chemicals requires the use of special personal protection, clean up equipment/materials and/or special techniques. Cleaning these spills

(exception: **biological spills**) will require notification of EHSD, either for requesting spill response, or for consultation concerning our own response.

Chemicals specified by AAS as significant health hazards have been investigated by the AAS safety committee. These reagents exist in large enough quantities in the AAS laboratory that, if spilled, would require special health, especially inhalation, precautions. The committee has defined specific cleanup procedures, cleanup equipment, and the maximum volume limit for in-house response for each specified hazard. Yellow Hazardous Chemical Cards, identifying these specific reagents and their appropriate spill responses, are located outside each room where the reagents are used.

Mercury and its compounds have a large potential for health and environmental danger because they form vapors easily and are readily absorbed through the skin. In spill incidents, containment and clean up must be handled with extreme care. Small, contained spills may be handled using commercially available mercury clean up kits, as may small spills involving analytical standards in the ppm/ppb ranges. Larger or unconfined spills (including those of pure standards), or mercury found in sink traps, must be cleaned up by EHSD. Sulfur dust should **not** be used in cleaning a mercury spill; while it does capture the mercury well, the dust will only compound efforts to restore the spill site to normal occupancy/activity.

Chlorinated organic solvents pose similar dangers as to those listed above, for the same reasons: they form vapors easily and are readily absorbed through the skin. **Chloroform** is the chemical of this class used in this laboratory. This solvent affects both the nervous and respiratory systems, with significant inhalation of its vapors causing loss of consciousness. Special care must be exercised when approaching and handling a spill involving this chemical.

Carbon Disulfide, and Ammonium Hydroxide all have vapors that easily migrate to other areas to hinder normal occupancy and activity. These compounds are known to cause severe respiratory and/or optical damage, even in small amounts. Persons exposed to significant concentrations of vapors from these chemicals require prompt medical attention. A spill involving any of these chemicals requires special personal protection and handling for a safe response, containment, and clean up.

Carbon Disulfide is extremely flammable, which makes elimination of all spark and ignition sources first priority. Its low boiling point (46° C) requires a very rapid response time. Personal protection must include full-face protection (vapors cause eye irritation), and all clean up equipment must be non-metallic. Persons exposed to carbon disulfide require medical attention immediately, as prolonged inhalation of vapors may cause damage to both the central and peripheral nervous systems, as well as to the liver and kidneys.

While not included in the list of ***hazardous chemicals*****, ammonium hydroxide** is a very potent and noxious base that can overwhelm a respirator cartridge in a spill of a liter or more. It causes severe burning of the nasal and respiratory linings, and with prolonged exposure can cause respiratory collapse. Self-contained breathing equipment should be used for containing and cleaning up spills larger than a 4 liter bottle.

Biological Spills This category of spill will be one of three scenarios. The first is that of blood shed from a severe wound occurred in the workplace; the second is a punctured/torn autoclave bag dripping waste (prior to autoclaving). The third involves the spilling of bacterial suspensions. None of these three scenarios are acutely dangerous in and of themselves; all are handled in the same way: wipe the area clean, and follow up with a bleach solution (10%) for 20-30 minutes. This will destroy any tissue/microorganisms that could spread from the spill site.

Mycotoxins. All of the mycotoxin samples and standards handled in the lab are highly carcinogenic, targeting the liver, brain, and central nervous system. All are inhalation and ingestion hazards. Gloves must be worn whenever handling mycotoxin samples. Any spill involving mycotoxins requires special cleaning steps and acute attention to personal safety. The spill site must be decontaminated with a 5% sodium hypochlorite solution (bleach) for 30 minutes then cleaned again with acetone. Press the Emergency Ventilation button and evacuate the room until all fumes have dissipated.

How to decontaminate spills or destroy specific toxins used in the BSL2 lab.
Staphylococcal Enterotoxins - soak with 10% bleach for ≥15 minutes or steam autoclave at ≥121° C for ≥1 hour.
Botulinum toxins - soak with 10% bleach for ≥30 minutes or steam autoclave at ≥121° C for ≥1 hour.
Ricin - soak with 20% bleach for ≥30 minutes or steam autoclave at ≥121° C for ≥1 hour.
T-2 toxin - soak with 50% bleach for ≥30 minutes. Note: steam autoclaving is **not** effective in destroying T-2 toxin.

DOCUMENTATION AND FOLLOW-THROUGH

A spill event must be documented from start to finish, especially in these special cases. One spill response team member needs to be filling out a "Chemical Spill Incident Report" while containment/evacuation/clean up is in progress. Include all information possible about what happened, who responded, and how it was handled. The report must also include the length of exposure time for all parties involved (clean up and response team members as well as those injured/exposed during the spill). These incident reports need to be kept by the Safety Committee Chair in a notebook log.

The most critical part of spill response is the final review: Was the response safe and effective? What can be learned from this spill to make the next response better? Are there any adjustments or improvements needed? Are there any corrective actions that can be taken to prevent this type of spill from occurring again? The incident report needs to be discussed at the next Safety Committee meeting to answer these questions.

Chemical Spill Incident Report

Date_____ Room # _____

Person(s) involved in the spill incident: _____

How the spill occurred? _____
_____

Chemical(s) spilled and the approximate quantity: _____
_____

Person(s) exposed to chemical(s) during the spill and their injuries:_____
_____
If injury, attach Injury Report

How was the spill cleaned up? _____
_____
_____
_____

What specific safety protection equipment was used? _____
_____

How were the spilled chemical(s) and the clean-up materials disposed of?_____
_____

First Supervisor to have been informed of the spill:_____

Person(s) involved in the clean up: _____

Corrective actions: _____

*Signature of Responsible Chemist:_____

Signature of Immediate Supervisor: _____

Signature of Director: _____

*Give Supervisor and Safety Chair a completed copy of this report.

LAB PRACTICES

AUTOCLAVES

General Procedures

- Autoclaves operate under steam pressure of 18-20 psi. The resulting temperatures are 121^{o}C or more. Even if familiar with the use of the equipment, new personnel should ask for assistance with operation, packaging, loading, and labeling procedures before using.

- For the autoclave process to be effective in achieving sterilization, sufficient temperature, time, and direct steam contact are essential. Air must be completely removed from the sterilizer chamber and from the materials to allow steam penetration so that the material being autoclaved will be at treatment temperature for sufficient time to achieve kill.

- Jacket pressures will remain at 18-20 psi and 121^{o}C. Chamber pressure will reach 18-20 psi and 121^{0}C during sterilization.

- Super heated liquids quite frequently boil over when slightly shaken and may result in burns. Always use protection recommended for handling hot materials.

- Use the appropriate cycle (gravity or liquid) for the time necessary for the item being autoclaved.

- If you have any questions about the use of the equipment, talk with your supervisor.

Packaging

- Use bats or other containers labeled “Biohazard” for microbiological waste.

- Do not seal containers or bags tightly.

- Do not put sharp objects such as broken glassware into an autoclave bag.

- You must place a strip of autoclave tape (displays the word “autoclaved” when it has been autoclaved) on any item being autoclaved.

Loading

- Place containers that may boil over or leak (agar plates, etc.) inside an autoclavable pan.

- Never place items in direct contact with the bottom of the autoclave.

- Do not overload; leave sufficient room for thorough steam circulation.

- Make sure that the plug screen in the bottom of the autoclave is clean.

Documentation

- Document the treatment of each load of autoclaved waste for the date of treatment, amount of waste treated, method of treatment, date and initial.

ELECTROPHORESIS

Electrophoresis equipment may be a major source of electrical hazard in the laboratory. The presence of high voltage and conductive fluid in this apparatus presents a potentially lethal combination.

Many people are unaware of the hazards associated with this apparatus; even a standard electrophoresis operating at 100 volts can deliver a lethal shock at 25 milliamps. In addition, even a slight leak in the device tank can result in a serious shock.

Protect yourself from the hazards of electrophoresis and electrical shock by taking these precautions:

- Use physical barriers to prevent inadvertent contact with the apparatus.
- Use electrical interlocks.
- Frequently check the physical integrity of the electrophoresis equipment.
- Use warning signs to alert others of the potential electrical leads.
- Use only insulated lead connectors.
- Turn the power off before connecting the electrical leads.
- Connect one lead at a time using one hand only.
- Ensure that your hands are dry when connecting the leads.
- Keep the apparatus away from water and water sources.
- Turn the power off before opening the lid or reaching into the chamber.
- Do not disable safety devices.
- Follow the equipment operating instructions.

MICROBIOLOGICAL BSL2 SAFETY PROCEDURES

- Access to the microbiological laboratory is limited to individuals who are working in the lab.
- Persons who are at increased risk of acquiring infection, or for whom infection may have serious consequences, are not allowed in the microbiological laboratory. The Director has the final responsibility for assessing each circumstance and determining who may enter or work in the microbiological laboratory.
- Laboratory personnel will receive appropriate immunizations or test for the agents handled or potentially present in the microbiological laboratory.
- When appropriate, considering the agent(s) handled, a baseline serum samples for microbiological laboratory and other at-risk personnel will be collected and stored.
- The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures.
- Personnel must receive annual lab specific safety training.
- Personnel must receive additional training when procedural or policy changes occur.
- Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.
- Entry Procedure
    - Wear clean labcoat whenever you enter the lab or put one on immediately upon entry.
    - Put on protective gloves before handling potentially infectious materials.
- Individual not listed on the authorized personnel list, located on the outside of the door, can only be admitted by the Director or the Microbiological Laboratory Supervisor and they must be accompanied by an authorized individual at all times.
- Perform all procedures carefully to minimize the creation of splashes or aerosols. Any manipulation of select agents and toxins that creates splashes or aerosols must be performed in the BSL2 safety cabinet.
- Decontaminate all work surfaces on the completion of work or at the end of the day and after any spill or splash of viable material with disinfectants that are effective against the agents of concern.
- A high degree of precaution must always be taken with any contaminated sharp item, including needles, syringes, slides, capillary tubes and scalpels.

- Plasticware should be substituted for glassware whenever possible.
- Only needle-locking syringes or disposable syringe-needle units are used for injection or aspiration of infectious materials.
- Used disposable needles must not be bent, sheared, broken, recapped, removed from disposable syringes or otherwise manipulated by hand before disposal; rather, they must be carefully placed in conveniently located puncture-resistant, autoclavable container used for sharps disposal.
- Broken glassware must not be handled directly by hand, but must be removed by mechanical means such as a brush and dustpan, tongs, or forceps. Containers of contaminated needles, sharp equipment, and broken glass are decontaminated before disposal, according to any local, state, or federal regulations.
- Cultures, tissues, specimens of body fluids, or potentially infectious wastes are placed in a container with a cover that prevents leakage during collection, handling, processing, storage, transport, or shipping.
- Contaminated equipment must be decontaminated according to any local, state, or federal regulations before it is sent for repair or maintenance or packaged for transportation in accordance with applicable local, state or federal regulations, before removal from the facility.
- Immediately report all spills and accidents that result in overt exposures to infectious materials to the Director.
- Provide medical evaluations, surveillance, and treatment as appropriate and maintain written records.
- Immediately report all spills and accidents which results in overt exposure to organisms that contain recombinant DNA (not currently used at the Office of the Texas State Chemist) to the Institutional Biosafety Committee and NIH/OBA. Reports to NIH/OBA shall be sent by:

  Fax 301-496-9839
  Email oba@od.nih.gov
  Mail Office of Biotechnology Activities
  National Institute of Health MSC 7985
  6705 Rockledge Drive, Suite 750,
  Bethesda, Maryland 20892-7985. (For non-USPS deliveries, use Zip Code 20817.)

- An insect and rodent control program must be in effect.
- A properly maintained biological safety cabinet must be used whenever conducting procedures with a potential for creating infectious aerosols or splashes.
- Cloth chairs are not permitted in the microbiological laboratory.

- Face protection (goggles, mask, face shield or other splatter guards) must be used for anticipated splashes or sprays of infectious or other hazardous material to the face when the microorganisms must be manipulated outside the BSC.

- Gloves must always be worn whenever handling potentially infectious materials, contaminated surfaces or equipment.

- Dispose of gloves whenever they are overtly contaminated, when work with infectious material is completed, or when the integrity of the glove is compromised. Disposable gloves are not to be washed, reused, or used for touching "clean" surfaces (keyboards, telephones, etc.).

- Protective laboratory coats must be worn while in the microbiological laboratory.

- Put dirty labcoats in the hamper located in the microbiological laboratory. If you are planning to wear your labcoat again, hang it up in the microbiological laboratory on the coat rack. Labcoats should never be worn outside the microbiological laboratory once they are worn inside the microbiological laboratory.

- Labcoats will be put in the washer by BSL2 personnel.

- Do not make or answer phone calls while in the microbiological laboratory.

- Individuals wash their hands after they handle viable materials, after removing gloves and before leaving the microbiological laboratory.

- Exit Procedure
    - Remove gloves
    - Remove labcoat
    - Hang up labcoat or put it in the hamper (located within the microbiological lab).
    - Wash hands

- Custodial duties will be performed by BSL2 personnel under the direction of the microbiological supervisor.

- Materials to be decontaminated outside of the immediate microbiological laboratory are placed in a durable, leakproof, autoclavable biological waste bag and closed for transport from the laboratory.

- All containers and vials will be wiped down with 10% bleach or 70% alcohol before exiting the BSL2 lab for storage in the hall cryofreezer. Note: Use bleach only on vials to prevent the ID markings from being removed.

- A spill contact time of at least 20-30 minutes with 10% should be sufficient for most microbiological spills. Increasing the bleach contact time is important with spills containing high organic matter. 70% EtOH, Lysol II and other household disinfectants are ineffective against bacterial endospores.

VACUUM/PRESSURE

- Switch off vacuum when not in use.
- Use only vacuum tubing for connections to vacuum equipment.
- Apply vacuum only to glassware made specifically for that purpose, and wrap flasks with flexible tape (duct, electrical, etc.) prior to applying suction.
- Relieve vacuum slowly in all parts of system before opening apparatus.
- Inspect all vacuum equipment for flaws prior to use. Discard all chipped, cracked or broken vacuum glassware.

ELECTRICAL EQUIPMENT

- Do not use electrical equipment if not in good working order. Check for frayed or damaged power cords or broken control switches.
- Avoid all contact with water when using electrical equipment.
- Use grounded outlets with breakers only. No extension cords.
- Ensure that instruments used in series are of the same voltage.
- Ensure that main power switch is "OFF" and instrument unplugged before servicing, if possible.
- Never by-pass any safety device.
- Do not use electrical equipment such as mixers or hot plates around flammable solvents.
- Use only carbon dioxide, dry powder or Halon extinguishers in case of fire in or near electrical equipment.
- In case of power outage, turn off or unplug equipment to prevent damage; if fumes are present close appropriate hood and doors. Evacuate if necessary.
- Do not use any electrical appliance or piece of equipment that will exceed the rated amperage of the intended circuit. Remember that any other appliance on that circuit will also need to be considered when calculating the total number of amps to be drawn. If you are uncertain about the rated amps for a given circuit, request your

supervisor to ask for assistance from the Physical Plant.

- If, during the course of an experiment, a circuit breaker trips, turn off all electrical appliances on that circuit and notify your supervisor.

- When using multiple outlet plugs for electrical outlets, use caution not to exceed the rated amperage of the circuit. The device should have its own circuit breaker. If you reach a point of an insufficient number of outlets, it is time to have the circuit load evaluated.

LIFTING

- Physical differences make it impractical to set up safe lifting limits for all workers. Height and weight do not necessarily indicate lifting ability.

- For lifting an object, observe the following guidelines:

1. Inspect the object to be lifted.

2. Look and know where you are going.

3. Wear necessary protective equipment, such as gloves, aprons and safety shoes.

4. If a load is too heavy or bulky for you to handle alone, get help.

5. On a job that requires two or more people, work together. Assign one individual to call signals.

6. Use correct lifting methods:
    a. Make a preliminary judgment before lifting to be sure you can handle it.
    b. Set your feet solidly, one foot slightly ahead of the other.
    c. Crouch as close to the load as possible.
    d. Keep the back straight.
    e. Get a good grip on the object using the palms of the hands.
    f. Lift with your legs and your forearms to prevent back strain.
    g. Keep a firm grip on the object as it is being moved.

7. When raising an object over shoulder height, rest one end of the object on a ledge or bench, then shift the position of your hands as necessary and lift the object.

8. Before you put a load down, make sure your fingers and toes are clear.

9. When you must change direction, do not twist the body; use your feet to turn the whole body.

- Use a lifting belt for heavy objects.

FLAMMABLE LIQUIDS

- All solvents should be handled carefully, even though they may be relatively inactive from a chemical point of view. Some of the commonly used solvents are volatile and are harmful when relatively small amounts are inhaled. Some are readily absorbed through the skin and most are flammable.

- Avoid generation of static sparks when transferring a flammable liquid from a drum by electrically grounding the drum.

- Store large volumes of flammable liquids in the Flammable Storage room 122. The door to this room should be closed when the room is unoccupied.

- Keep minimum quantities of flammable liquids in the laboratory. Use older reagents first. All flammable liquids must be stored in approved safety container.

- Keep flammable liquids away from heat, direct sunlight, and strong oxidizing agents such as chromic acid, permanganates, chlorates or perchlorates.

- Handle flammable materials in a fume hood, avoiding simultaneous use of oxidizers.

GAS CYLINDERS

- Ensure the cap is firmly in place when storing or moving a cylinder. (This protects the valve stem from being accidentally broken off.) Move gas cylinders with an appropriate hand-truck. The protective cap must be in place before the cylinder is released from its support.

- Always support gas cylinders by straps, chains or a suitable stand to prevent them from falling over.

- Close all cylinders and bench valves when not in use.

- Ensure that the appropriate regulator is used on each gas cylinder.

- Never use a cylinder that cannot be positively identified as to content.

- Never force a cylinder valve.

- Never use oil or grease on a regulator or tank valve. Do not use a regulator or tank if oil or grease is present with oxygen or other oxidant. Combustible substances in contact with an oxidant are explosive.

- Reactions for which cylinders of toxic, flammable or reactive gases are used should be run in fume hoods, and suitable racks should be provided to hold the cylinders.

- In case of fire, turn off the flammable gas, then oxidizing gas if possible! Do not extinguish a flame involving a highly combustible gas until the source of gas has been shut off. Otherwise it can re-ignite with an explosion.

- Remove regulator from almost empty cylinder and replace protection cap at once; return the cylinder to the storage are designated for "EMPTY" cylinders

Cryogenic Cylinders and Dewers

- Make sure the cryogenic cylinder is not damaged.

GLASSWARE

- Wear heat resistant gloves or use tongs when handling glassware or equipment that has been heated.

- When glassware is ready to by cleaned, take it to the Washroom, room 132, and specify any special cleaning instructions.

- Lubricate all contact surfaces and wear protective gloves (Kevlar™) when inserting glass into a stopper or tubing; insert the glass so that the applied force is away from your body. Do not use excessive force.

- Do not stopper glass flask containing hot condensable vapors.

Glass Disposal Guidelines

- Dispose of chipped or broken glassware in the Broken Glass receptacle. All broken glassware must be immediately swept up and removed from the bench or floor and placed in a receptacle provided solely for that purpose.

- Do not place any glassware in trashcans. Notify your supervisor of any significant breakage.

- Broken glassware may be placed in a rigid, sealed container (e.g. a box). Label the container "Broken Glass."

- **No glassware is to be purposely broken upon disposal!!**

- Large containers may be safely thrown away in the dumpster if the following procedure is followed:

    - The container is triple rinsed with water.

- Puncture plastic and metal containers to prevent reuse.
- The label must be removed, covered or defaced.
- Affix a disposal Reagent Sticker.

Example of a Disposal Reagent Sticker:

CAUTION:
Reagent Chemical Bottle
DO NOT RE-USE

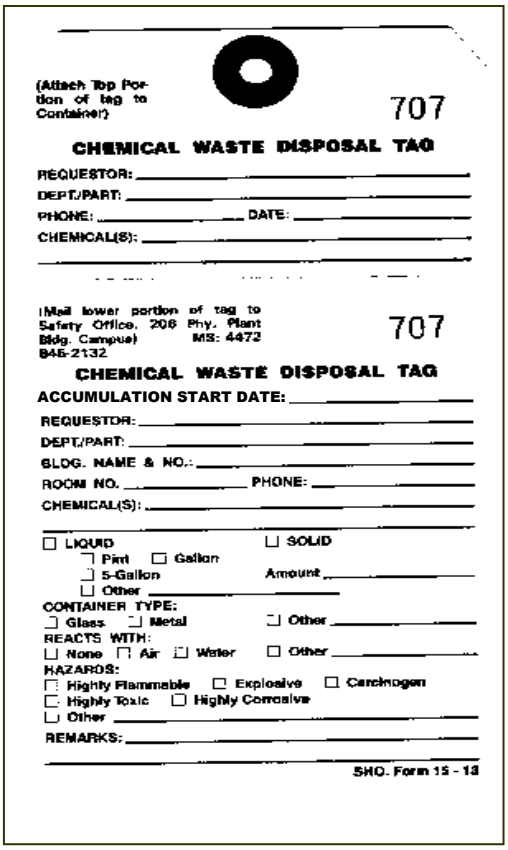
Sharps

- Take care not to stick yourself with a needle.
- Do not place used syringes in pans containing pipets or other glassware that require sorting.
- Do not recap used needles.
- Never leave sharps unsecured.
- Dispose of needles in an approved sharps autoclavable container.
- Insure that sharps container is autoclaved before disposal.
- After the sharps container is sterilized, Plaster of Paris should be added and allowed to dry before disposal, this will immobilize the sharps and insure that no one is accidentally stuck by them.
- Needles, blades, etc. are considered biohazardous even if they are sterile, capped, and in the original container.

HAZARDOUS WASTE DISPOSAL

A CHEMICAL WASTE DISPOSAL TAG MUST BE ATTACHED TO EACH CONTAINER

On some occasions it may be permissible to place very small containers in a larger container and tag the larger container. The small containers must then be identified on a separate sheet of paper. The Environmental Health and Safety Office must be consulted before this is permitted.


(Attach Top Portion of tag to Container)
707
CHEMICAL WASTE DISPOSAL TAG
REQUESTOR:
DEPT./PART:
PHONE: DATE:
CHEMICAL(S):
(Mail lower portion of tag to Safety Office, 208 Phy. Plant Bldg. Campus) MS: 4472
845-2132
707
CHEMICAL WASTE DISPOSAL TAG
ACCUMULATION START DATE:
REQUESTOR:
DEPT./PART:
BLDG. NAME & NO.:
ROOM NO. PHONE:
CHEMICAL(S):
LIQUID SOLID
Pint Gallon
5-Gallon Amount
Other
CONTAINER TYPE:
Glass Metal Other
REACTS WITH:
None Air Water Other
HAZARDS:
Highly Flammable Explosive Carcinogen
Highly Toxic Highly Corrosive
Other
REMARKS:
SHQ. Form 15 - 13

- All chemical waste should be disposed of properly. Check the REAGENTS section of the method protocol for instructions on waste disposal.
- Check the Use string, encircling the container. Tape may be used in some cases, for example, the waste barrels.
- **Rubber bands are not acceptable.**
- Do not fill the container above the shoulder of the bottle. Most bottles now have bands of raised dots on the shoulder as a reminder.
- Both upper and lower sections of the tag must be completely filled out. This information is essential for communication purposes.
- The person in charge of a lab should be the requestor.
- Container must be…
  - Compatible with the chemical contents
  - Closed or sealed in such a manner that leakage will not occur
  - Stored in a protected area and be accessible to collection personnel
- **Identify the contents by chemical or common name.**
- Include remarks which describe the associated hazards of the chemical contents.

If you are uncertain on how to dispose of a chemical, please ask the Safety Committee Chair to call the

Environmental Health and Safety Dept. for the correct disposal procedure.

FUME HOODS

- Hoods should be turned off and the sash closed when not in use. If the hood is a variable speed hood it can not be turned off, just make sure the sash is closed when not in use.

- Equipment and other materials should be placed and all work should be performed a minimum of 6 inches behind the sash opening. This practice will reduce exposure of laboratory area to chemical fumes due to air turbulence.

- When the hood is in use, the sash should be kept at the optimum air flow height. A sticker affixed directly next to the sash indicates this height. The sash is your primary barrier for protection against fire and explosion that may take place in fume hoods.

- Paper and other materials should not be permitted to enter the exhaust duct of the hood. Foreign objects can be drawn into the duct work and exhaust fan, and will adversely affect the performance of the fume hood.

- Hoods are not intended for the storage of chemicals or equipment. All excess chemicals and equipment should be stored in areas designed for long term storage.

- Equipment and other materials should not be stored against the baffle area (slot at back of hood). This baffle provides a means for air movement through the fume hood. If blocked, the hood will not provide consistent air movement.

- Large equipment placed in fume hoods should be elevated a minimum of 1½" above work surface to allow unrestricted air movement beneath equipment.

- While personnel are working in the fume hood, the sash should be pulled down to a level that will protect the user's face and upper chest. The only time the fume hood sash should be fully open is while setting up equipment for an experiment.

- Do not rely on the fume hood exhaust to protect you from splashes or projectiles -- WEAR APPROPRIATE SAFETY EQUIPMENT DICTATED BY TYPE OF CHEMICALS AND EQUIPMENT BEING USED.

- If you question whether the hood is working properly, call the Environmental Health and Safety Department.

- **Special Precautions for Perchloric Hoods:**

    - Persons using perchloric acid shall be thoroughly familiar with its hazards.

- Spilled perchloric acid should be thoroughly washed away with large amounts of water.
- The use of organic materials or chemicals in the hood should be avoided.
- Gas flames or oil baths should not be used within the hood.
- Goggles or face shields should be used, as well as utilization of the fume hood sash whenever possible for additional safety.
- *Perchloric acid fume hood wash down procedure:*

    1. This procedure shall be performed after each use of perchloric acid.
    2. Unplug all apparatus in the fume hood.
    3. Close the sash.
    4. Turn on the wash down spray.
    5. The wash down spray must be on for a total of at least 15 minutes.

RESPIRATORS

Summary

This section provides information on how to properly put on respirators and fit test them, and it defines the instances where it is necessary to use them. There are two types of respirators available for use: the full face-piece assembly and the half mask face-piece assembly. The latter is available in three sizes. These devices are air-purifying respirators designed to provide appropriate respiratory protection against hazardous vapors, gases, and/or particulate matter. They should not be used in areas low in oxygen, or by individuals with facial hair that could interfere with an airtight fit.

Note: A respirator will not be issued to a person until the person is trained by a qualified respirator trainer and instructed on the proper procedure for fit testing. The individual must also sign documentation stating that (s)he has received proper respirator training and has been issued a respirator.

Equipment Needed

Respirator
Appropriate Cartridges

Chemicals:

Amyl Acetate ("Banana Oil") fit test ampules
Use only with adequate ventilation. Avoid prolonged or repeated breathing of vapor or contact with skin or eyes.

Instances Where Wearing a Respirator is Required

There are certain instances or occasions where wearing a respirator is required while working in the lab. These instances are:

*where health situations warrant protection from certain chemicals as determined by the employee and/or their supervisor

*when dumping organic or hazardous waste into a collection barrel

Of course, if any individual feels comfortable wearing a respirator in situations that are not specified from above then (s)he is welcome to do so.

Procedure for the Half Mask Respirator

1. Inspect your respirator to make sure that it is in "good condition." A respirator is in good condition if all parts of the respirator (headbands, face-piece, inhalation and exhalation valves, cartridge holders, and cartridge filters) are free from breaks, tears, distortion, dents and other damage, and all parts are clean and free from contamination. Also, make sure that the inhalation and exhalation valve flaps are in place, and check the elasticity and flexibility of the material of your respirator.

2. Properly assemble your respirator by screwing the appropriate cartridges onto the inhalation connectors. (Refer to the appendix at the end of this protocol for appropriate cartridge usage.)

3. Remove protective eyewear or eyeglasses before putting on the respirator. Grasp the front of the respirator and place the portion of the face-piece containing the exhalation valve under the chin and the narrow portion on the nose bridge.

4. Place the cradle suspension system on the head so that the front strap rests across the top of the head and the back strap rests just on the ears. Hook the bottom headband strap behind the neck and below the ears.

5. Adjust the headband straps by holding the headband yoke with one hand and pulling on the elastic material in the appropriate direction with the other. For proper positioning and comfort, adjust the upper headband strap first, then adjust the lower straps. Do not overtighten.

Procedure for the Full Face-piece Respirator

1. Visually check your respirator to make sure that all components are in good condition (refer to the definition above) and secure.

2. Properly assemble your respirator by screwing the appropriate cartridges onto the inhalation connectors. (Refer to the appendix at the end of this section for appropriate cartridge usage.)

3. Adjust the five facepiece headstraps to their full outward position and put on the facepiece by spreading the headstrap outward with the thumbs. Push the harness top up the forehead and continue up and over the head until the harness is centered at the rear of the head and the chin is fitted into the chin cup.

4. Make sure the facepiece is centered on the face and tighten lower headstraps. Tighten the two upper headstraps and finally tighten the forehead strap.

Testing For Fit

The individual must test the efficiency of the respirator seal to the face before entering a hazardous area. This can be accomplished by performing a negative pressure fit check, a positive pressure fit check, and/or a "Banana Oil" fit test. These fit tests can be applied to both full facepiece and half mask facepiece respirators. **(AT LEAST TWO OUT OF THE THREE TESTS MUST BE PERFORMED EACH TIME A RESPIRATOR IS WORN AND BEFORE WORKING WITH HAZARDOUS SUBSTANCES.)**

Procedure for Negative Pressure Fit Check

1. Cover the cartridges either with the palms of your hands or gloves.

2. Inhale and hold your breath for five seconds.

3. If the facepiece collapses slightly and there is no detection of air leaks between the facepiece and your face, a good fit has been obtained. If there are air leaks, readjust the tension of the straps and repeat the negative pressure check.

Procedure for Positive Pressure Fit Check

1. Use your hand to close the opening in the exhalation valve guard and simultaneously exhale.

2. If the facepiece slightly bulges and there are no air leaks detected between the face and the facepiece, a good fit has been obtained. If air leaks have been detected, readjust the tension of the straps and repeat the positive pressure check until a good seal has been obtained.

Procedure for "Banana Oil" (isoamyl acetate vapor) Fit Check

1. Before conducting the "Banana Oil" test, the respirator must be equipped with organic vapor cartridges to remove the testing agent from the inhaled air. If you do not have these cartridges on your respirator, have your trainer assist you by screwing the appropriate cartridges onto the inhalation connectors.

2. Have the trainer take one of the fit test ampules and crush it. The crushed ampule should be moved around the area where the facepiece seals to the face. (It is also beneficial for the wearer to talk during the procedure.) If no "banana" odor is detected then a good fit has been obtained. If odor is detected, then readjust the tension of the straps and repeat the test until no odor is detected.

Note: The service life of the cartridges will vary depending on the proper care and the working environment in

which used. If you smell, taste or sense irritation from the contaminants while using the appropriate cartridges on a well-fitting mask, then your cartridges have expired and need replacing.

To Take off the Respirator

1. Go to an uncontaminated area and remove the facepiece.

2. If needed, clean and sanitize the facepiece assembly. Caution: The cartridges must be removed from the respirator prior to cleaning. Don't allow the cartridges to come in contact with water or cleaning solution.

3. Clean the respirator and store it in a tightly sealed plastic bag between uses.

APPENDIX 1: APPROPRIATE CARTRIDGE USAGE

Name of Cartridge	Gas and Vapor Protection Type	Approved For
3M 6002	Acid Gas	Chlorine, Chlorine dioxide, Hydrogen chloride, Hydrogen sulfide, Sulfur dioxide
3M 6003	Organic Vapor/Acid Gas Cartridge	Chlorine, Chlorine dioxide, Hydrogen chloride, Hydrogen Fluoride, Hydrogen sulfide, Organic Vapors, Sulfur dioxide
3M 6004	Ammonia, Methylamine	Ammonia, Methylamine
3M 6005	Formaldehyde/Organic Vapor	Formaldehyde/Organic Vapor
3M 6006	Organic Vapor/Acid Gas/Ammonia/Methylamine/ Formaldehyde	Ammonia, Chlorine, Chlorine dioxide, Formaldehyde, Hydrog en chloride, Hydrogen Fluoride, Hydrogen sulfide, Methylamine, Organic Vapors, Sulfur dioxide
3M Pre-Filter (Must be used with 3M Filter Retainer 501)	3M Pre-Filter, P95	Filters at least 95% of airborne particles and is strongly resistant to oil.

Revision History

Revision 002 – New format and change of contact lens policy December 2014

Revision 003 – Added MSDS links September 2013

Revision 004 – Added chemical expiration date guidelines February 2014

Revision 005 – Edited evacuation guidelines May 2014

Revision 006 – Edited Chemical Storage, Spill Response and Chemical Expiration sections. May 2015

Revision 007 - Added more information on how to decontaminate microbiological spills or destroy specific toxins used in the BSL2 lab. March 2016