

Chemical Hygiene Program



Department of Biological Sciences Biosafety Procedures

The person responsible for implementation of this plan is Teanna M. Staggs, Ph.D., Department Chair. The assigned Chemical Hygiene Officer is Susan F. Garza, Science Lab Tech III. This department has a Chemical Hygiene Committee comprised of the following personnel:

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- Susan F. Garza, sgarza@ccd.edu, 210-733-2694
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Biological Safety Program

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1. Introduction

The primary goal of biological safety (i.e., biosafety) is **containment** referring to a series of safe methods for managing infectious agents as well as harmful chemicals in the classroom laboratory setting. The purpose of containment is to reduce or eliminate human and environmental exposure to potentially harmful agents.

Primary and Secondary Containment

Primary containment includes measures to protect people and the immediate laboratory environment from exposure to infectious agents and chemicals. Good microbial techniques and safety equipment provide sufficient primary containment. Examples of primary barriers include safety equipment such as biological safety cabinets, enclosed containers with proper labeling, clear, enforced student laboratory practices and quick response in case of an accident. Occasionally, when it is impractical to work in biological safety cabinets, personal protective equipment, such as lab coats and gloves may act as the primary barrier between personnel and infectious materials or hazardous chemicals.

Secondary containment protects the environment external to the laboratory from exposure to infectious materials. Good facility design and operational practices by faculty and students provide secondary containment. Examples of secondary barriers include work areas that are separate from public areas, decontamination facilities such as emergency showers and eyewash stations, handwashing facilities, special ventilation systems, and safety equipment such as spill kits.

Elements of Containment

Ultimately, the three key elements of biological containment are laboratory practices, safety equipment, and facility design. To ensure minimal exposure, employees must assess the hazards associated with their work and determine how to apply the biosafety principle appropriately. Employees working with infectious agents, opportunistic pathogens or dangerous chemicals must be aware of the hazards associated with their work. These workers must be trained and proficient in biosafety procedures and techniques. The Department of Biological Sciences makes all employees aware to potential dangers upon employment with reminders during regular departmental meetings.

2. The following containment equipment is used by Department of Biological Sciences:

Biological Safety Cabinets

A biological safety cabinet is a primary barrier against biohazardous or infectious agents. Although biological safety cabinets surround the immediate workspace involving an agent, they

do not provide complete containment (i.e., aerosols can escape). Therefore, careful work practices are essential when working with agents that require a biological safety cabinet.

NOTE:

A biological safety cabinet is often referred to by other names such as: laminar flow hood, biohood, tissue culture hood, or biological fume hood.

All biological safety cabinets contain at least one High Efficiency Particulate Air (HEPA) filter. These cabinets operate with a laminar air flow (i.e., the air flows with uniform velocity, in one direction, along parallel flow lines).

Biological safety cabinets must be inspected and certified:

- When newly installed
- After filter or motor replacement
- After being moved
- Annually

Contact the Susan F. Garza for more information about inspections.

The following sections discuss safety procedures and guidelines for working with various types of biological safety cabinets. The San Antonio College Department of Biological Sciences uses a Class 2, Type A biological safety cabinet.

Types of Cabinets

The following table outlines various types of biological safety cabinets:

Type of Cabinet	Operation and Use
Class I	Only exhaust air is filtered. The user and environment are protected but the experiment is not. Operator's hands and arms may be exposed to hazardous materials inside the cabinet. This cabinet may be used with low to moderate-risk biological agents.
Class II:	Vertical laminar air flow with filtered supply and exhaust air. The user, product, and environment are protected.
Type A	Recirculates 70% of the air inside the cabinet. Do not use with flammable, radioactive, carcinogenic, or high-risk biological agents.
Type B1	Recirculates 30% of the air inside the cabinet and exhausts the rest to the outside. May be used with low to moderate-risk agents and small amounts of chemical carcinogens or volatiles.
Type B2	Offers total exhaust with no recirculation.

Type B3	Same as Class II Type A, but vented to the outside of the building.
Class III or Glovebox	Gas-tight and maintained under negative air pressure. Used to work with highly infectious, carcinogenic, or hazardous materials. All operations are conducted through rubber gloves attached to entry portals.

Using Biological Safety Cabinets

Follow these guidelines for using biological safety cabinets properly:

Preparation:

- Leave safety cabinets on at all times. Otherwise, turn the blower on and purge the air for at least five minutes before beginning work.
- Never turn off the blower of a biological safety cabinet that is vented to the outside.
- Turn off the UV light if it is on. Never work in a unit with the UV light illuminated. (UV light will damage your eyes.)
- Do not depend on the UV germicidal lamp to provide a sterile work surface; wipe down the surface with a disinfectant (70% alcohol is usually suitable).
- Place everything needed for your procedure inside the cabinet prior to beginning work. Arrange the equipment in logical order.
- Provide a container for wastes inside the cabinet. (Remember, nothing should pass through the air barrier until the entire procedure is complete.)
- Never place any items on the air-intake grilles.
- Place a disinfectant-soaked towel on the work surface to contain any splatters or spills that occur.
- Keep the laboratory door shut and post signs stating "CABINET IN USE" on all the doors. Restrict activities that will disturb the cabinet's airflow, such as entry, egress, and walking traffic.

Cabinet Use:

- Conduct work at least four inches from the glass view panel. The middle third area is ideal.
- Limit arm movement and avoid motions that could disturb airflow.
- If a burner is necessary, use the *Touch-O-Matic* type with a pilot light. Since flames cause air turbulence, place burners to the rear of the workspace.
- Never use flammable solvents in a biological safety cabinet unless it is a total-exhaust cabinet (e.g., Class II B2).

Experiment Completion:

- Enclose or decontaminate all equipment that has been in direct contact with the infectious agent.
- Cover all waste containers.
- To purge airborne contaminants from the work area, allow the cabinet to operate for five minutes with no activity inside the cabinet.
- Remove all equipment from the cabinet.
- Decontaminate interior work surfaces.

IMPORTANT:

Biological safety cabinets are not a substitute for good laboratory practices. Because aerosols can escape, take precautions to minimize aerosol production and to protect yourself from contamination.

Chemical Fume Hood Safety

Safe Work Practices for Laboratory Chemical Fume Hoods

No large open face hood with a low face velocity can provide complete safety against all events that may occur in the hood, nor provide protection for volatile airborne contaminants with a threshold limit value (TLV) in the low parts per billion range. For more ordinary exposures, a well-designed hood in a properly ventilated laboratory can provide adequate protection. However, certain work practices are necessary in order for the hood to perform capably. The following work practices are generally required; more stringent practices may be necessary under some circumstances.

- Conduct all operations that may generate air contaminants at or above the appropriate TLV inside a hood.
- Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder.
- Users should keep their faces outside the plane of the hood sash.
- Hood sash openings should be kept to a minimum. Hoods are tested (and should be used) with a hood sash opening of 15 inches.
- Do not use the hood as a waste disposal mechanism except for small quantities (< 10 mL) of volatile materials.
- Do not store chemicals or apparatus in the hood. Store chemicals in an approved safety storage cabinet.
- Keep the slots in the hood baffle free of obstruction by apparatus or containers.

- Minimize foot traffic past the face of the hood to prevent disruptions in air flow.
- Keep laboratory doors closed when working in the hood.
- Traps, scrubbers or incinerators should be used to prevent toxic and/or noxious materials from being vented into the hood exhaust system.
- Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.
- Use an appropriate barricade (e.g. a blast shield) if there is a chance of explosion or implosion.
- Remain alert to changes in air flow.
- Do not remove hood sash or panels except when necessary for apparatus set-up; replace the sash or panels before operating.
- Exhaust ports from the hood and supply air vents to the room (Nesbitt units or unit ventilators) should not be blocked.
- Prepare a plan of action in case of an emergency, e.g., a power failure.
- To save energy, turn off the blower and close the hood sash when the hood is not in use.

Fume Hood Facts

One of the most important safety devices in a laboratory is a properly functioning fume hood. The fume hood protects users from inhaling chemicals by constantly pulling air into the hood and exhausting it out of the building. Fume hoods also provide protection in the event of an explosion or fire.

A fume hood should be used in the following situations:

- When handling chemicals with significant inhalation hazards such as toxic gases, toxic chemical vapors, volatile radioactive material, and respirable toxic powders
- When carrying out experimental procedures with strong exothermic reactions
- When handling chemicals with significant vapor pressure
- When chemical vapors generated could cause a fire hazard
- When working with compounds that have an offensive odor

Air Velocity Maintenance and Measurements

To capture vapors adequately, a fume hood must provide an average face velocity of >100 linear feet per minute. However, excessive air velocities can cause turbulence that may bring the contaminants back into the user's breathing zone. The SRS Services, Division of Scientific Resources Southwest, Inc. checks campus fume hoods approximately every 12 months to verify that the air velocity at the work opening is within an acceptable range. The air velocity

measurements are noted on the hood. SRS also performs a smoke test at least once a year to verify inward air flow.

SRS will post a warning label on fume hoods with a face velocity outside the allowable range and will notify Physical Plant to correct the problem immediately. Questions about restrictions on the use of hoods posted with a warning label should be directed to Susan Garza, Science Lab Tech III, sgarza@accd.edu, 210-733-2694.

How to Use a Fume Hood

Adjust the sash. Position sashes at the arrows to ensure proper airflow velocities at the work opening. Adjust the sash to shield yourself from splashes or flying objects. Horizontally sliding sashes can be used as a body shield by wrapping your arms around the sash panel as you work.

Check that the hood is working properly. By law, all hoods must have a visual indicator that tells the user if the hood is working properly. New hoods often have pressure gauges and alarms. All other hoods must have at least a simple indicator such as a ribbon or tissue attached to the sash. If there is no indicator, you should tape a piece of tissue paper to the sash. If the indicator is not drawn into the hood, the fan is not working, and the hood should not be used. In this case, call the Susan Garza immediately.

Minimize storage. Do not take up hood space and block ventilation by storing unused equipment or chemicals in hoods. If large items must be kept in the hood, contact SRS for evaluation, certification and a smoke test.

Keep all work at least 6 inches inside the hood. The capture ability of a fume hood may not be 100% at the front of the hood.

Never lean your head inside the fume hood when chemicals are present.

Never close non-bypassed hoods completely. Leave at least a two-inch sash opening, particularly if flammable materials are present in the hood.

Avoid cross drafts. Someone walking rapidly past the work opening can create a cross draft that may disturb the direction of airflow and cause turbulence.

Prevent pollution. The chemical vapors generated in most hoods are exhausted into the atmosphere. To minimize pollution, seal all chemical containers not in use. Never use the hood to vent excess chemical waste. By law, all chemical containers must be capped when the hood is not operating.

Keep the hood clean. Remove old experimental glassware and clutter. Wipe up spilled chemicals or residues. Make sure you can see through the glass sash.

Do not heat perchloric acid in standard fume hoods. Perchloric vapors may create explosive perchlorates in the ductwork. Contact SRS if you are performing perchloric acid digestions.

Do not adjust the damper. Doing so may adversely affect fume hoods in other rooms. Users may adjust the baffles based on the vapor pressure of the materials being used.

3. CDC and NIH Biosafety Levels

The Centers for Disease Control (CDC) and the National Institutes of Health (NIH) have established four biosafety levels consisting of recommended laboratory practices, safety equipment, and facilities for various types of infectious agents. Each biosafety level accounts for the following:

- Operations to be performed
- Known and suspected routes of transmission
- Laboratory function

The Biology Department at San Antonio College works only with microbes that are considered acceptable at Biosafety Level 1.

Biosafety Level 1 precautions are appropriate for facilities that work with defined and characterized strains of viable organisms that do not cause disease in healthy adult humans (*e.g.*, *Bacillus subtilis* and *Escherichia coli*). For a complete listing of microbes used in the department, contact Dr. Staggs or Ms. Garza. Level 1 precautions rely on standard microbial practices without special primary or secondary barriers. Biosafety Level 1 criteria are suitable for undergraduate and secondary education laboratories.

4. Universal Precautions

The World Health Organization (WHO) laboratory biosafety manual, produced by the Special Program on Safety Measures in Microbiology (SMM), provides internationally applicable guidance on biosafety developed by several expert working groups.

Recognizing that laboratory accidents and infections are caused primarily by poor practice and technique, the manual emphasizes safe practice and training procedures. It also presents basic standards of laboratory design for work with microorganisms by degree of infective risk and a guide to selecting and using essential biosafety equipment and materials. Although oriented to biosafety, the manual also provides a general laboratory safety checklist and safety procedures for using and handling laboratory chemicals.

The manual is intended primarily for the guidance and use of laboratory supervisors, biosafety officers, and others responsible for laboratory safety programs. The following are highlights of the universal precautions for laboratories, per the biosafety manual:

- Universal precautions should apply to blood and all body fluids containing visible blood, semen, vaginal secretions, tissues, cerebrospinal fluid, synovial fluid, pleural fluid,

peritoneal fluid, pericardial fluid, and amniotic fluid. *Universal Precautions* is an approach to infection control where all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

- Hands should be washed immediately when contaminated with blood or other bodily fluids, after removing gloves, and after completing laboratory activities.
- Use of needles and syringes should be limited to situations in which there is no alternative. If used, needles should not be recapped, purposely bent or broken by hand, removed from disposable syringes, or otherwise manipulated by hand. After use, disposable syringes and needles, scalpel blades, microscope slides, cover slips or other sharp items should be placed in puncture resistant containers for disposal; these containers should be located as close as practical in the use area. Reusable sharps should be placed in a puncture-resistant container for safe transport to the processing area.
- Laboratory workers should use protective barriers appropriate for the laboratory procedure and the type and extent of exposure anticipated. For example:
 - All persons processing blood should wear gloves.
 - Surgical or examinations gloves should not be washed or disinfected for reuse.
 - General-purpose utility gloves should not be used for housekeeping, instrument cleaning, and decontamination procedures and can be decontaminated for reuse as long as they remain in tact.
 - Masks and protective eyewear or face shields should be worn if mucous membrane contact with blood or bodily fluids is anticipated (i.e., removing tubes from the hematocrit centrifuge).
 - Gowns, laboratory coats, or aprons should be worn during procedures that are likely to generate splashes of blood, bodily fluids or infectious cultures and should be removed before leaving the laboratory.
 - Routine procedures, such as histologic and pathologic studies or microbiological culturing, do not require a Biological Safety Cabinet (BSC). BSCs (Class I or II) should be used whenever procedures are conducted that have a high potential for generating droplets (i.e., blending, sonicating, and vigorous mixing.)
- All specimens of blood should be put in a well-constructed container with a secure lid to prevent leakage during transport.
- Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure.
- Food and drink shall not be kept in refrigerators, freezers, shelves, cabinets or on countertops or benchtops where blood or other potentially infectious materials are present.

- Mechanical pipetting devices should be used in the laboratory. Mouth-pipetting must not be performed.
- Laboratory work surfaces should be cleaned of visible material and then decontaminated with an appropriate chemical germicide after a blood or bodily fluid spill and when work activities are completed.
- Contaminated materials used in laboratory tests should be decontaminated before reprocessing or be placed in bags and disposed of in accordance with institutional and regulatory policies for disposal of infective waste.
- Contaminated scientific equipment should be clean and then decontaminated before repair in the laboratory or transport to the manufacturer.
- Area posting of warning signs should be considered to remind employees of continuing hazards of infectious disease transmission in the laboratory.

5. General Biosafety Guidelines for Faculty and Staff within the Biology Department at San Antonio College

Work with biohazardous materials and hazardous chemicals share common safety protocols and require special precautions and procedures. Follow these guidelines when working with infectious agents or chemicals:

Personal Hygiene Guidelines for Faculty and Staff:

- Wash your hands thoroughly, as indicated below:
 1. After working with any biohazard or chemical
 2. After removing gloves, laboratory coat, and other contaminated protective clothing
 3. Before eating, drinking, smoking, or applying cosmetics
 4. Before leaving the laboratory area
 5. Do not touch your face when handling biological material
 6. Never eat, drink, smoke, or apply cosmetics in the work area

Clothing Guidelines:

- Always wear gloves, safety goggles (when appropriate) and a surgical mask (when appropriate) when working with infectious agents or hazardous chemicals.
- Closes toed shoes, jeans and lab coats are recommended when working with hazardous chemicals.

- Do not wear potentially contaminated clothing outside the laboratory area.
- To remove contaminated clothing gloves, peel them from the inside out.

Handling Procedures:

- Use mechanical pipetting devices. NO mouth pipetting.
- Minimize aerosol production.
- Add disinfectant to water baths for infectious substances.
- Exercise extreme caution if performing labs involving centrifugation of blood.
- Use secondary leak-proof containers when transporting samples, cultures, inoculated petri dishes, and other containers of biohazardous materials.

Work Area:

- Keep laboratory doors shut when experiments are in progress.
 - Limit access to laboratory areas when experiments involve biohazardous agents.
 - Ensure that warning signs are posted on laboratory doors. These signs should include the universal biohazard symbol and the approved biosafety level for the laboratory.
 - Decontaminate work surfaces daily and after each spill.
 - Decontaminate all potentially contaminated equipment.
 - Transport contaminated materials in leak-proof containers.
 - Keep miscellaneous material (i.e., books, journals, etc.) away from contaminated areas.
 - Completely decontaminate equipment before having maintenance or repair work done.
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6. Biological and Infectious Waste

Biohazardous material is biological in nature, capable of self-replication, and has the capacity to produce deleterious effects upon other biological organisms, particularly humans. Susan Garza, Dr. Teanna Staggs or Corporal Leonardo Nieves, Biosafety Officer for the campus can provide assistance in recommending safe handling procedures and laboratory design

Infectious waste includes any waste item contaminated with biological agents suspected as being capable of transmitting disease. Infectious waste can be divided into three primary groups. These include:

- **Liquid wastes such as blood, other body fluids, or culture media which is known or suspected to be contaminated with disease agents.**
- **Soft materials such as dressings, bandages, bedding, toweling, etc. that are saturated to the point that they are capable of releasing blood, body fluids, or other potentially infectious materials when handled or compressed.**
- **Sharps are objects or instruments that are contaminated with blood, body fluids or other infectious agents which could penetrate the skin or could do so if broken.**

Examples of sharps waste include:

- **glassware**
- **pipettes (glass and hard plastic)**
- **hypodermic needles**
- **scalpel blades**
- **lancets**
- **bacterial slides and cover slips**

Sharps Disposal Options

Sharps waste (e.g. hard plastic and glass pipettes, slides, coverslips, cotton tipped applicators) are to be deposited in commercially available sharps containers.

Contaminated Petri plates will be collected in large biohazard containers lined with red biohazard bag. Following in-house sterilization (autoclaving), the treated wastes can then be transferred from the reusable sharps containers to a commercially available infectious waste box. The box which is not to exceed 40 pounds and will contain no liquid is then picked up by BFI.

Noncontaminated large broken glassware will be collected in commercially available broken glass boxes. When full, the box is taped shut. The final disposal of the boxed waste will be coordinated by the building's Housekeeping representative.

Biological Waste Disposal

The Texas Department of Health (TDH) and the Texas Natural Resource Conservation Commission (TNRCC) regulate the disposal of biohazardous waste. Waste that contains infectious materials and waste that may be harmful to humans, animals, plants, or the environment is considered biohazardous. Examples of biohazardous waste include the following:

- Waste from infectious animals
- Bulk human blood or blood products
- Microbiological waste (including pathogen-contaminated disposable culture dishes, and disposable devices used to transfer, inoculate, and mix pathogenic cultures)

- Pathological waste
- Sharps
- Hazardous rDNA and genetic manipulation products

San Antonio College stipulates that biohazardous waste meets strict safety requirements for the following:

- Segregation
- Treatment
- Labels
- Packaging
- Transportation
- Documentation

IMPORTANT:

Disinfect all infectious material prior to disposal.

The following sections offer general safety guidelines and procedures for disposing of biological waste.

Segregation

Segregation is necessary when working with hazardous biological agents.

- Any waste that could cause a laceration or puncture must be disposed of as "Sharps." Sharps must be segregated from other waste.
- Do not mix waste that requires incineration with glass or plastics or uncontaminated waste such as paper towels and student papers.
- Do not mix biological waste with chemical waste or other laboratory trash.
- Segregate hazardous biological waste from nonhazardous biological waste.

Handling and Transport

Follow these guidelines for handling and transporting biohazardous waste:

- Properly trained personnel (not the custodial staff) are responsible for transporting treated biological waste from the building. Contact Susan Garza for information on our

biohazardous waste removal contract. Only properly trained technical personnel may handle untreated biohazardous waste.

- Contain and label all treated waste before allowing contracted transport from the building.
 - Avoid transporting untreated biohazardous materials and foul or visually offensive materials through non laboratory areas.
 - Do not use trash/laundry chutes, compactors, grinders, sinks or toilets to transfer, process or dispose of untreated biohazardous waste.
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Labeling Biohazardous Waste

Follow these guidelines for labeling biohazardous waste:

- Clearly label each container of untreated biohazardous waste and mark it with the Biohazard Symbol.
 - Label containers intended for landfill disposal to indicate the method of treatment. Cover the Biohazard Symbol with this label.
 - Label autoclave bags with special tape that produces the word "AUTOCLAVED" upon adequate thermal treatment. Apply this tape across the Biohazard Symbol before autoclaving the bag.
 - Label all containers for sharps as "ENCAPSULATED SHARPS."
 - It is recommended to label nonhazardous biological waste as "NONHAZARDOUS BIOLOGICAL WASTE."
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Disposal Methods

Different materials require different disposal methods to ensure safety. Follow these guidelines for physically disposing of biological waste.

1. Animal Carcasses and Body Parts:

- **Pigs:** Once the pigs have been put in bags for the students, please store them in the large white buckets that they came in or the green plastic boxes. You can pour the liquid down the sink. Please don not store pigs in cardboard boxes. To dispose of the pigs, use one of the waste hauler boxes and line it with two biohazard bags. Drain all liquid out of the pig bags and put 10 pigs per box. Place the boxes in the storeroom. There is a dolly in the AV room.

- **Hearts, brains, eyes and kidneys**, line a bucket with a red biohazard bag, Tie off with a rubber band and take it to the storeroom. Remember, no liquid.

2. **Liquid Waste:**

- Liquid waste, including bulk blood and blood products, cultures and stocks of etiological agents and viruses, cell culture material, and rDNA products should be disinfected by thermal and then discharged into the sanitary sewer system.

3. **Metal Sharps:**

- All materials that could cause cuts or punctures, must be contained, encapsulated, and disposed of in a manner that does not endanger other workers. Needles, blades, etc. are considered biohazardous even if they are sterile, capped, and in the original container.

4. **Pasteur Pipets and Broken Glassware:**

- Place in a rigid, puncture resistant container. Disinfect by thermal or chemical treatment, if contaminated. Label the container as "Broken Glass" and scheduled for pickup by the housekeeping staff.

NOTE:

If broken glass is commingled with metal sharps, encapsulation is required for disposal.

Nonhazardous Biological Waste

Most biological waste that is not infectious or otherwise hazardous to humans, animals, plants, or the environment may be discarded as regular waste or sewage. The only exceptions are animal carcasses and body parts. These wastes must be incinerated or sent to a commercial rendering plant for treatment. In addition, there are no record-keeping requirements for nonhazardous biological waste.

Follow these guidelines for nonhazardous biological waste:

- It is recommended to autoclave or disinfect all microbial products, even if they are not biohazardous.
- Avoid disposing of waste in a manner that could cause visual or odorous problems.
- Do not label nonhazardous biological waste as hazardous (e.g., do not use the Biohazard Symbol, red bags, etc.). Instead, it is recommended to label the container as "NONHAZARDOUS BIOLOGICAL WASTE."

7. Provisions for Faculty, Staff and Housekeeping safety

Handwashing Facilities means a facility providing an adequate supply of running potable water, soap and single use towels.

The employer shall ensure that appropriate personal protective equipment in the appropriate sizes is readily accessible at the worksite or is issued to employees. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives shall be readily accessible to those employees who are allergic to the gloves normally provided.

- Disposable (single use) gloves such as surgical or examination gloves, shall be replaced as soon as practical when contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised.
- Disposable (single use) gloves shall not be washed or decontaminated for re-use.

Masks and Eye Protection. Masks in combination with eye protection devices, such as goggles or glasses with solid side shields, shall be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.

Lab coats, Aprons, and Other Protective Body Clothing. Appropriate protective clothing such as, but not limited to, aprons, lab coats, or similar outer garments shall be worn in occupational exposure situations. The type and characteristics will depend upon the task and degree of exposure anticipated.

Employers shall ensure that the worksite is maintained in a clean and sanitary condition. The employer shall determine and implement an appropriate written schedule for cleaning and method of decontamination based upon the location within the facility, type of surface to be cleaned, type of soil present, and tasks or procedures being performed in the area.

To ensure that housekeeping staff is not exposed to contaminated material, all professors will police laboratories after use and clean up any contaminated materials or materials that the housekeeping staff might not know how to handle. All equipment and environmental and working surfaces shall be cleaned and decontaminated after contact with blood or other potentially infectious materials.

- Contaminated work surfaces shall be decontaminated with an appropriate disinfectant after completion of procedures; immediately or as soon as feasible when surfaces are overtly contaminated or after any spill of blood or other potentially infectious materials; and at the end of the work shift if the surface may have become contaminated since the last cleaning.
- Protective coverings, such as plastic wrap, aluminum foil, or imperviously-backed absorbent paper used to cover equipment and environmental surfaces, shall be removed

and replaced as soon as feasible when they become overtly contaminated or at the end of the workshift if they may have become contaminated during the shift.

- All bins, pails, cans, and similar receptacles intended for reuse which have a reasonable likelihood for becoming contaminated with blood or other potentially infectious materials shall be inspected and decontaminated on a regularly scheduled basis and cleaned and decontaminated immediately or as soon as feasible upon visible contamination.
- Broken glassware which may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means, such as a brush and dust pan, tongs, or forceps. Broken items will be properly boxed.

Disinfection and Sterilization

Biological safety depends on proper cleanup and removal of potentially harmful agents. Disinfection and sterilization are two ways to help ensure biological safety in the laboratory.

- **Disinfection:** Reduction of the number of pathogenic organisms by the direct application of physical or chemical agents.
- **Sterilization:** Total destruction of all living organisms.

The following sections discuss guidelines and procedures for biological disinfection and sterilization.

General Guidelines

Choosing the best method for disinfection and sterilization is very important. The proper method depends on the following:

- Target organisms to be removed
- Characteristics of the area to be cleaned

Once you have chosen the proper method for disinfection or sterilization, follow these guidelines to ensure laboratory safety:

- Frequently disinfect all floors, cabinet tops, and equipment where biohazardous materials are used.
- Use autoclavable or disposable materials whenever possible. Keep reusable and disposable items separate.
- Minimize the amount of materials and equipment present when working with infectious agents.

- Sterilize or properly store all biohazardous materials at the end of each day.
 - Remember that some materials may interfere with chemical disinfectants — use higher concentrations or longer contact time.
 - Use indicators with autoclave loads to ensure sterilization.
 - Clearly mark all containers for biological materials (e.g., *BIOHAZARDOUS - TO BE AUTOCLAVED.*).
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Types of Disinfectant

The following disinfectants may be used in the Biology Department:

Alcohols- Ethyl or isopropyl alcohol at 70-80% concentration is a good general purpose disinfectant; not effective against bacterial spores.

Quaternary Ammonium Compounds (Quat 267) - Cationic detergents are strongly surface active; extremely effective against lipoviruses; ineffective against bacterial spores; may be neutralized by anionic detergents (i.e., soaps).

Chlorine - Low concentrations (50-500 ppm) are active against vegetative bacteria and most viruses; higher concentrations (2,500 ppm) are required for bacterial spores; corrosive to metal surfaces; must be prepared fresh; laundry bleach (5.25% chlorine) may be diluted and used as a disinfectant.

Sterilization Methods

There are three common methods for sterilizing laboratory materials: wet heat (autoclaving), dry heat, and ethylene oxide gas. San Antonio College uses an autoclave to sterilize contaminated material.

WET HEAT

When used properly, the damp steam heat from an autoclave effectively sterilizes biohazardous waste. Sterilization occurs when contaminated materials reach 15 psi pressure at 250°F or 121°C for at least 30 minutes.

IMPORTANT:

For the autoclave process to be effective, sufficient temperature, time, and direct steam contact are essential.

Potential problems with wet heat sterilization and autoclaves include the following:

- Heavy or dense loads require higher temperature for sterilization.

- Poor heat conductors (e.g., plastic) take longer to sterilize.
- Containers may prevent steam from reaching the materials to be sterilized.
- Incomplete air removal from the chamber can prevent contact between the steam and the load.
- Deep trays can interfere with air removal.
- Tightly stacked loads can impede steam circulation and air removal.
- Double-bagging will impede steam penetration.
- Some bags and containers rated as *autoclavable* have thermal stability but they do not allow steam penetration.

8. Recombinant DNA Laboratories

The Federal rDNA guidelines define rDNA as ". . . molecules which are constructed outside of living cells by joining natural or synthetic DNA segments to DNA molecules that can replicate in a living cell." The Federal definition also includes the replicated progeny of these molecules as well as cells, plants, and animals that harbor such molecules. Transgenic plants and animals also come under the guidelines, even if the transgenic DNA was not cloned prior to introduction. The Biology Department at San Antonio College does not conduct bench level research involving the creation of new recombinant DNA molecules. Laboratory investigations involving plasmid transformation kits, PCR (Polymerase Chain Reaction) and other basic molecular biology techniques are performed. Therefore, all faculty and staff working with the materials for these labs are informed of safe practices regarding rDNA (recombinant DNA). The Departmental Safety Officer, Susan Garza, or the Department Chair should be contacted with any questions regarding this area.

Handling Recombinant Molecules or Cultures containing rDNA

1. All experiments will be conducted under the supervision of the professor for that lab.
2. Students will wear appropriate laboratory protective attire (gloves, lab coats, goggles)
3. All materials will be disposed in biohazard containers.
4. Living cultures and molecular biology waste will be autoclaved prior to pick up by the contracted waste disposal company.
5. Counters will be disinfected following every lab.

9. Importing and Shipping Biological Materials

The Biology department does not export any biological samples. We do on occasion have to order new microbial cultures for laboratory exercises. These cultures are ordered from biological supply sources which are approved vendors for educational facilities. Microbes of the lowest possible virulence are always ordered. Upon receipt of the samples, the organisms

are stocked and stored in appropriate storage media in a refrigerator in the laboratory prep room which is designated for stock cultures.

10. Biological Spill Response

SPILL CLEAN UP

All Biology Department personnel who work with or in proximity to chemicals or other harmful substances must be prepared to respond to an accidental release or spill. Four components are required for effective response to a spill:

- Written safe work procedures
- Clean-up material (i.e. spill kit)
- Personal protective equipment (PPE)
- Knowledgeable, well-trained staff

Individuals working with hazardous materials are required to take chemical safety training which informs personnel on how to effectively respond to a spill. Spill clean-up procedures and a spill-kit checklist are provided below to aid in an effective, quick response. For further information, contact Susan Garza, Science Lab Tech III at 210-733-2694.

PRELIMINARY PROCEDURES

1. Ensure own personal safety and that of other personnel in the vicinity of the spill.
2. Can the spill be controlled or cleaned up by on-site personnel (i.e., the appropriate equipment, personal protective equipment and trained personnel are available)?
 - If **NO, EVACUATE and CALL 911.**
 - If **YES,**
 - Control any risk of injuries before taking action
 - The “responsible person” (person who had possession, charge or control of a substance immediately before its must act quickly to:
 - **CONTAIN**
 - **CONTROL**
 - **CLEAN UP** the spill
 - **DECONTAMINATE** the spill area

Spill may be cleaned up and the area decontaminated using the following procedures:

GENERAL PROCEDURES

1. Notification/Evacuation

- a) Notify other people in the vicinity of the spill.
- b) Inform the department chair.
- c) Evacuate and post warnings in the area if necessary.

2. Hazards of Spilled Material

- a) Before responding to the spill, obtain

- Name of the chemical(s) or microbe
- Quantity spilled, and
- Hazards of the chemical (review Material Safety Data Sheets (MSDS)); Contact Department Chair or one of the Microbiology professor if biological.

4. Clean-Up Procedures

a) Perform clean-up procedures *only* if:

- All hazards have been identified and assessed;
- the appropriate spill control material, equipment and protective clothing are available (*see PPE Checklist and Spill Kit Description*);
- personnel are familiar with equipment and clean-up procedures;
- more than one person is in the lab and available to participate; and
- no ignition sources are present.

b) Put on the appropriate protective clothing, obtain spill kit and cautiously enter the spill area.

c) Turn off any device, instrument, or machine that could exacerbate the spill.

5. Follow the SPECIFIC PROCEDURES according to the type of spill.

SPECIFIC PROCEDURES

FLAMMABLE SOLVENTS, ACIDS AND CAUSTICS

DO NOT attempt to clean up a solvent spill if there is an ignition source present.

- Turn off any device, instrument, or machine that could exacerbate the spill. Use caution if any device is not spark proof and the spill includes flammable materials.
- Follow General Procedures Step 1-4.
- Apply absorbent pad to cover the spill area.
- After material is completely absorbed, transfer the pad(s) to an appropriate disposal container that is compatible with the spilled solvents and seal the container. Refuse bag in included in the spill kit.
- Decontaminate and wash spill area surfaces with water and wet sponge.
- Contact the Susan Garza at 210-733-2694 for directions concerning disposal of the container and its contents.
- Complete an accident report (See Appendix) and inform the Department Head and/or Departmental Safety Officer.

Living Microbial Cultures

1. Remove any large items (broken culture tubes, Petri plates, etc) from the area with gloved hand.
2. Spray down the area with disinfectant and remove any large material with gloved hands or designated broom/dust pan.
3. Spray down floor or counter with disinfectant and wait 30 minutes before cleanup
4. Mop floor to remove any remaining debris
5. Complete an accident report (See Appendix) and inform the Department Head and/or Departmental Safety Officer

SPILL KIT INFORMATION

The ACCD Risk Management office provides a spill kit for the department. The amounts and nature of the chemicals housed in the Department of Biological Sciences Department does not require a more extensive kit.

Vendor: W.W. Gainger

Cat. Part #: 3AP01

Kit Contents:

- 15 pads
- 3 socks
- 1 pair goggles
- 1 pair gloves
- 1 refuse bag
- 1 instruction sheet

CHEMICAL CLOTHING CHECKLIST

- Disposable Gloves
- Chemical Resistant Goggles
- Lab coat
- Closed toed shoes

11. Student Laboratory Safety

These safety procedures are provided to every student taking a laboratory course in the Biology Department at San Antonio College. The rules are broken down by discipline (Anatomy/Physiology, General Biology and Microbiology) and are provide in every student's syllabus, provided verbally at the beginning of each semester by the professors and posted in the laboratories. Students are also required to read and sign a safety contract before participating in any laboratory course.

Anatomy and Physiology Labs

- A.** Each instructor will be asked to include instructions in their syllabus outlining what is expected from the students in the laboratory. The students are expected to:
- Clean up after themselves.
 - Wash, dry and return dissection tools to the appropriate tray section.
 - Dispose of scalpels, toothpicks, slides, coverslips, lancets and other appropriate materials in the Sharps container after use.
 - Place paper towels and gloves in the regular trash can.
 - Only dissected material goes into the red biohazard bags.
 - Do not wash blank slides, dispose of slides and coverslips in the Sharps container.
 - Clean your desk.

- B.** Each instructor will be given a list outlining how to dispose of various materials. They will be expected to box/bag their own dissected material and place them in the storeroom.
- **Pigs:** Once the pigs have been put in bags for the students, please store them in the large white buckets that they came in or the green plastic boxes. You can pour the liquid down the sink. Please do not store pigs in cardboard boxes. To dispose of the pigs, use one of the waste hauler boxes and line it with two biohazard bags. Drain all liquid out of the pig bags and put 10 pigs per box. Place the boxes in the storeroom. There is a dolly in the AV room.
 - **Hearts, brains, eyes and kidneys,** line a bucket with a red biohazard bag, Tie off with a rubber band and take it to the storeroom. Remember, no liquid.
 - **Miscellaneous instructions to make life better for all of us:**
 - If you are working in the afternoon or evening please be the last to leave the room and lock the cabinets and doors.
 - If you find a crummy slide in the slide boxes you can put a big X through the label and leave it for the lab tech. Please do not replace bad slides with slides from the stock boxes without putting the proper sticker color on them.
 - Please do not borrow models from another room. They do not get returned.
 - Change out a full Sharps containers.
 - Please change bulbs in the overhead and in microscopes.
 - If a sink is leaking, put a sign on the faucet that is leaking and then leave the lab tech a note.

Microbiology Lab

Each student should bring the following laboratory supplies:

- A permanent marker (black ink, Sharpie brand is best)
- TimeMed tape (masking or medical tapes and computer generated labels are not permitted. Do not use markers to write directly on glassware. Do not use white-out on glassware.
- Liquid hand soap (liquid with a flip top or screw on cap).

The following rules apply to all microbiology lab sessions:

- Read your laboratory manual prior to the beginning of each laboratory. Wash your hands and disinfect your lab bench at the beginning and end of each laboratory session.

- Wear clothing which you can risk being ruined by the numerous biological stains present in the laboratory.
- Absolutely no eating or drinking in the laboratory. Do not even bring food or beverage containers into the room for storage until later. Do not apply cosmetics. Do not chew gum. Those materials must be discarded outside the laboratory. Liquid or solid food wastes in the bottom of trash receptacles serve as the perfect medium for growing microbes.
- Gas burners will be in use. Be extremely careful with hair and clothing. Individuals with long hair should pull the hair back with a barrette or rubber band for safety. Make sure you know where the emergency fire blanket, fire extinguisher and shower are located. There is also an eye wash station in the lab.
- Treat every culture as if it were extremely pathogenic and use aseptic technique at all times. Dispose of all cultures and contaminated materials in the proper receptacles for sterilization. Never pour an unsterilized culture in the drain or in the trash. No mouth pipetting. Sharps containers are provided for disposal of any broken items. Sharps containers are also used for pipettes, disposable loops and anything else that might puncture through a plastic bag. Petri plates are discarded in a special biohazard container. No paper towels or gloves in biohazard or sharps containers. Discarded test tubes and any glassware requiring autoclaving and/or washing should be placed on the cart beside the rear exit doorway. Any student who is immunocompromised (Meaning you have any medical condition which predisposed you to infection including pregnancy) for any reason should inform the instructor as well as your personal physician so that appropriate safety measures can be implemented to insure your health.
- Use proper labeling procedures for any cultures you create. Disposable plastics should be labeled directly with a sharpie. Glass items (test tubes, flasks, etc.) should have a tape label. Proper labeling includes your last name, course section (2420-001, 2420-005, etc.), date, instructor's name and organism name or number. All labels must be removed before discarding cultures.
 - Report all accidents especially burns to the instructor immediately. The campus nurse is located in room 119 of this building.
 - All purses, book bags, umbrellas and other personal belongings will be stowed at the front of the laboratory. At your lab bench, you will only need lab supplies and your lab book. This rule is to maintain clear, safe walkways.
 - Each lab section will have a number and a specific area in which to incubate or refrigerate lab experiments. Ask your professor where your assigned areas are.

For Microbiology Professors:

- Keep the front instructor=s desk free of clutter. Do not pull reagents and/or media from the shelves and place on instructor=s desk or carts. Please instruct students as to the location of media and reagents and have them obtain their necessary materials. Do not keep carts in the lab; they simply attract junk.
- Clean out your incubators and refrigerators space at the end of each semester. Throw out all student culture or have them do it. However, ultimately, the instructor is responsible for removing all labels of cultures left behind.
- Monitor your students regarding the proper labeling and disposal of waste/contaminate materials in appropriate receptacles.
- Monitor use of microscopes insuring that oil is not used on the 40X objective, microscopes are cleaned and stored properly and students are assigned microscopes to use each semester.
- If a bulb burns out, change it. Bulbs are located on a shelf in the stock room.
- Label all microscopes that need repairs we cannot perform. Hang tags are located on the shelf of the stockroom where the bulbs are located. Each tag should describe the problem. Do not just label it, ABad@ or ADoes not work@.
- When requesting new cultures for purchase, only non-virulent (non-pathogenic) species should be requested and specify strain and/or catalog number to lab tech when you make the request. She does not know one *E. coli* from the others.
- Please coordinate your lab curriculum with the materials and media readily available in the lab. If you do additional labs which require a lot of specialty media, you will be asked to make that for yourself.
- Each professor is expected to maintain a set of personal stock cultures. You will be provided with those once. After that, notify the lab coordinator if you loose one of your stocks. However, please continually passage your own stocks on a regular basis. To supply your students with cultures for experimentation, each professor is expected to make subcultures for his/her class as needed.

General Biology

Food and Drinks

- Absolutely no food is to be brought into the lab room.
- Drinks are permitted at the discretion of the instructor. Any spilled drinks are to be cleaned up by those involved.

Laboratory Safety

- Latex gloves are to be worn when handling body fluids (urine, blood, saliva, etc.) from other students, and when handling fresh or preserved materials for dissection.
- Protective eyewear is recommended.
- Sterile blood lancets are to be used only once and disposed of in the Sharp's container.
- Freshly prepared slides and disposable test tubes containing body fluids are to be disposed of in the Sharp's container. Pour all fluids down the drain before placing test tubes into the Sharp's container.
- Used paper towels, tooth picks, and latex gloves are to be thrown in the garbage cans and not in the Sharp's container.
- Broken slides, cover glasses, and test tubes are to be placed in the Sharp's container. Large broken items (beakers, bottles, etc.) are to be disposed of by the lab instructor.
- Dispose of all fresh and preserved materials in the biohazard containers provided in each lab. Do not put fluids, paper towels, or latex gloves into the biohazard containers.

Maintain a Clean Laboratory

(for students)

- Dissection equipment and pans are to be cleaned, dried, and returned to their proper location.
- Fluids from various dissections or experiments are to be disposed of according to the instructor's directions.
- Do not leave any glassware drying on paper towels next to the sink. If glassware is to be used again, dry and return to its proper location.
- Return all chemicals to their proper location.
- Report any spilled dyes, stains, or other chemicals to the instructor immediately.
- Return microscopes, slides, and models to their proper storage area.

- Remove all debris from sinks before and after each lab session.
- Clean table and counter tops before you leave class.

Lecture and Laboratory Procedure for Biology Instructors

- Have students clean up their work area and counter tops at the end of each session. Do not permit students to leave glassware or equipment drying on paper towels next to the sink area.
- Remove all items (answer sheets, blank sheets of paper, models, experimental equipment, handouts etc.) from the tabletop you use for your lecture or lab session before you leave class.
- If you have the lab tech (Susan) make up special preparations for your lab, as a courtesy to other instructors, be sure to return all items to the designated area in the storeroom assigned by Susan when you are finished. When carts are left for Susan to clean, be sure to indicate the name of the instructor and the room number from which the material came so each lab can be restocked. By leaving used preparations in the classroom, you take up space that the instructor who follows you may need. Susan has many things to do and we need to help her out by returning lab preps to the storeroom when we are finished with them.
- If you want to leave preparations in a classroom to be used again, make sure to tag the set up with your name and when you plan to use it.

12. Appendix:

LABORATORY ACCIDENT REPORT FORM

This form is to be filled out by the responsible faculty member and filed with the Department Safety Officer.

Name: _____ Date: _____

Social Security #: _____ Student?Staff?or Faculty?___

Department: _____ Date/Time of Incident: _____

Campus Address: _____ Campus Telephone: _____

Home(Local) Address: _____ HomePhone#: _____

Location of accident: _____

Cause of Injury: _____

Type of Injury: _____

Medical Facility: _____ Ambulance Needed: Y N

Physician: _____

Witnesses: Name Address Phone #

Brief description of incident (include the use of personal protective equipment, fume hood, safety shower and/or fire extinguisher): Use back side of form for extra space....

Name of Faculty Member : _____

Signature of Faculty Member: _____

Safety In The Science Laboratory - A Student Contract

Accidents happen every day in many activities. Statistically, most accidents happen in the home or while driving a car. Few accidents have occurred in the science classroom. However, in order to decrease the chances of any accidents occurring, all students and visitors to the science laboratories are required to follow the safety procedures listed below:

Student Contract

1. All accidents should be reported to the teacher immediately, no matter how minor.
2. Only those laboratory activities where instructions and permission have been given by the teachers should be performed.
3. Only materials and equipment authorized by the teacher should be used.
4. Written and verbal instructions should be followed carefully. All instructions given by the teacher should be closely followed.
5. Students should prepare for each laboratory activity by reading all instructions. Follow all directions carefully and intelligently. Make note of any deviations announced by your instructor.
6. No food, beverage, or smoking is permitted in any science laboratory.
7. Never taste, smell, or touch chemicals unless specifically instructed to do so.
8. Take great care in noting odors or fumes. Use a wafting motion of the hand. Never put a bottle to your nose and breathe deeply.
9. Hands should be washed thoroughly (15 sec) with soap at the conclusion of each laboratory period.
10. Students should know the location of the emergency, first aid and fire fighting-equipment.
11. Students should know the proper fire drill procedure and know where to get help fast.
12. Long sleeves should be rolled up above the wrist. Ties, coats and sweaters should be removed. Long hair should be tied back during laboratory activity.
13. Student apparel should be appropriate for laboratory work. Long hanging necklaces, bulky jewelry and excessive and bulky clothing should not be worn in the laboratory. Closed-toed shoes are a must.
14. Work areas should be kept clean and tidy.
15. Students should always clean and wipe dry all desks, tables or laboratory work areas, at the conclusion of each laboratory activity as part of good housekeeping practices.
16. Broken glass should be removed from work areas and the floor as soon as possible. Never handle broken glass with your bare hands. Broken glass should be placed (using proper techniques) in the labeled, sharps box.
17. All solid waste should be placed in separate waste containers, jars or other designated receptacles. Do not discard any solids in the laboratory sinks.

18. Do not bring any substance into contact with a flame unless specifically instructed to do so.
19. Students are not permitted in laboratory storage or supply rooms.
20. Upon first entering the laboratory, students are not permitted to touch laboratory equipment until directed to do so.
21. Direct viewing of the sun, infrared, ultraviolet light or laser sources should be avoided at all times.
22. Never allow the open end of a heated test tube to be pointed toward anyone.
23. Horseplay, running, pushing, shoving and practical jokes will not be tolerated.
24. Only authorized laboratory activities should be attempted at home.
25. Students should conduct themselves in a responsible manner at all times in a laboratory situation.

Agreement

I, _____ , have had the safety

(Student's name)

rules for the science laboratory explained to me and agree to follow these safety regulations while in science class. I further agree to follow all other written and verbal instructions given in class by the teacher.

(Student's Signature)

(Date)