

SECTION 14- LABORATORY SAFETY MANUAL

(A PART OF THE UNIVERSITY SAFETY PLAN)

“HARD COPIES” ARE AVAILABLE THROUGH THE OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY

EMERGENCY CONTACTS

Environmental Health and Safety Department..... 257-2120

MEDICAL

University Health Center 257-4866

Ambulance 9-911

North Louisiana Medical Center (Emergency Department) 254-2100

Poison Control Center 1 (800) 222-1222

FIRE

Ruston Fire Department..... 9-911

POLICE

University Police..... 257-4018

Ruston Police 9-911

INTRODUCTION TO LABORATORY SAFETY

A significant amount of the teaching, research, and service functions at Louisiana Tech University routinely occurs in laboratories. The chemical, biological, and mechanical hazards used in these laboratories pose a variety of dangers to the health and safety of the students, faculty, staff and general public. These hazards must be identified and minimized to assure a safe workplace for all.

It requires the same time, effort, and concern to establish and maintain a safe work environment as does to develop and maintain a research or teaching program. The Environmental Health and Safety Department is available to any Unit to provide expertise in the areas of laboratory safety and help these Units arrive at reasonable and adequate solutions to potential safety issues.

Federal and state safety regulations and guidelines were consulted to develop this Manual. The Louisiana Tech University Safety Plan requires all University activities be conducted in accordance with Occupational Safety and Health Administration (OSHA) standards.

OSHA promulgated a final rule entitled "Occupational Exposures to Hazardous Chemicals in Laboratories" (commonly known as "The Laboratory Standard"). The purpose of the standard is to minimize the exposure of laboratory personnel to chemicals in the laboratory, avoid underestimation of risk, and provide adequate ventilation. Other OSHA regulations for the safe handling of chemical are also found in the "**Chemical Safety**" and "**Hazardous Communication**" **Section of the Louisiana Tech University Safety Plan.**

The Department of Health and Human Services and the Centers for Disease Control and Prevention regulate activities that involve Biohazards. A set of guidelines is available through the CDC and National Institutes of Health web pages to further assist Unit Heads in developing specific laboratory safety guidelines for their labs that use biohazardous materials.

Any activities involving the use of **Recombinant DNA, Radioactive, Pesticides, Euthanizing Agents, Nanoparticles and Infectious Agents** are closely regulated by the State and/or Federal governments. **ABSOLUTELY NO ACTIVITIES INVOLVING THESE AGENTS ARE TO BE CONDUCTED WITHOUT THE WRITTEN APPROVAL OF THE LOUISIANA TECH UNIVERSITY BIOHAZARD AND RADIONUCLIDE INSTITUTIONAL REVIEW COMMITTEE.**

Governmental regulations do not cover all safety issues that may be need to be addressed in a particular laboratory at the University, so the University's Safety Plan and this Manual can to be used as a guide to assist administrative/academic units in the development of specific safety plans for each of the laboratories under their purview.

SCOPE OF LABORATORY SAFETY PLAN

The laboratory safety requirements apply to all faculty, staff, and students engaged in the laboratory use of hazardous materials and equipment. The most commonly encountered hazardous materials are laboratory chemicals and potentially infectious agents. The laboratory use of hazardous chemicals is defined as the use or handling of chemicals in which all of the following conditions are met:

- Chemical manipulations are carried out on a “laboratory scale.”
 - Laboratory scale is defined as work with substances in which the containers used for reactions, transfer, and other handling of substances are designed to be easily and safely manipulated by one person.
- Multiple chemical procedure or chemicals are used.
- The procedures involved are not part of a production process.

The laboratory use of biohazardous material is defined as the use or handling of any material that is a risk to organisms, and includes the use of both ionizing radiation and infectious agents.

RESPONSIBILITIES LABORATORY SAFETY

All faculty, staff, and students are responsible for assuring a safety working and learning environment. Each individual is responsible for performing his/her job safely and assuring that others with which they work do the same.

1. **Budget Unit Heads (Deans, Directors, Department Heads)** are responsible for maintaining safe operations of the labs within their scope of administrative responsibility (ie: labs assigned to their administrative Unit) on a daily basis. Specific responsibilities included:
 - Provide the resources necessary to implement and maintain the unit’s safety program.
 - Ensure that the requirements of the Louisiana Tech University Safety Plan and Louisiana Tech University Safety Manual are followed in their areas of responsibility.
 - Provide the Louisiana Tech University Department of Environmental Safety with a list of all labs, storerooms, and preparation areas in their Unit in which potentially hazardous materials and equipment is used or stored. This list is also to include a statement of the types of hazards that exist in each area.
 - Validate the authenticity of the annual chemical/biohazard audit and the semi-annual laboratory audits of each lab, storeroom, and prep room within their Unit.
 - Attend a laboratory safety meeting for administrators and those conducted in their responsible area as needed. Document with a Louisiana Tech University Safety Meeting report Form
 - Maintain and update a current list of chemicals biohazards used in their labs and ensure that only the minimum amount of each that is necessary to accomplish the assigned laboratory tasks is maintained in the workplace.
 - Ensure that chemical and biological MSDSs are readily available in the lab in which the chemical and biological agents are being used.
 - Provide the necessary resources to fund the disposal of hazardous materials after their use in these labs.

2. **A Laboratory Safety Coordinator (LSC)** may be designated for each school, department, or other subdivision by the Budget Unit Head to serve as the budget unit liaison to the Louisiana Tech Department of Environmental Health and Safety (EHS). Responsibilities of the LSC include:
 - Ensure that safety training of all persons using the budget unit laboratories is documented using a Louisiana Tech University Safety Meeting Report Form.
 - Provide information about safety hazards to contract employees or maintenance employees working in the areas.
 - Serve as a conduit for information between laboratories in their budget unit and EHS.
 - Assist the EHS in inspections and other duties as available and as assigned.
 - Work with administrators and other employees to develop and implement appropriate safety policies and practices.
 - Monitor procurement, use, and disposal of chemicals used in the lab within their budget unit.
 - Maintain current knowledge concerning the legal requirements of regulated substances in the laboratory.
 - Conduct the annual chemical/biohazard audit and the quarterly laboratory survey for each lab, storeroom, and preparation area within their budget unit.
 - Seek ways to improve the university safety plans.
 -
3. **Faculty (including laboratory assistants) and Principle Investigators** are responsible for maintaining safe operations in their labs **at all times**. Specific responsibilities included:
 - **Being responsible for the safety of students while they are working in labs that are assigned to that faculty;**
 - **Must assure the LSC and the Budget Unit Head** that he or she or a designated Louisiana Tech University employee is present **at all times** in their laboratory when students or visitors are present.
 - Attend initial training and periodic updates of the requirements of the Laboratory Safety Program and their roles and responsibilities in maintaining it (Document on a Louisiana Tech University Safety Meeting Report Form). Updates are required whenever a new hazard is introduced to their work area or when they are reassigned to an area using new or different materials and/or procedures.
 - Every instructor or laboratory supervisor shall set a good example by:
 - observing all safety rules and recommendations;
 - wearing protective equipment where recommended;
 - being enthusiastic about safety. .

- taking effective corrective action promptly.
- maintaining discipline and enforce rules in the lab(s).
- prohibiting the consumption of food or beverages or the application of makeup in the lab(s);
- Carefully review all laboratory protocols for possible safety problems before they assigned to students.
- Providing to the LSC written standard operating protocols (SOP) for each laboratory procedures conducted in their work area(s). The SOP must include a list of the hazardous materials used in the procedure.
- Requiring any student or employee in their work area to adhere to all safety regulations and to use of appropriate personal protective equipment as required
- Assist the LSC to ensure an inventory is completed for all hazards used in their work areas.
- Reviewing and understanding MSDSs on materials used by students and employees under their direct supervision and inform them as new MSDSs become available.
- Ensuring MSDS files are available in the work area and are readily accessible to students and employees.
- Promptly forwarding all student and employee requests for safety information to the LSC or EHS.
- Ensuring that all containers of materials used in their work area are labeled by name, hazard category (if appropriate) and other pertinent information.
- Ensuring that all used hazardous material produced in the lab is properly disposed of in accordance with federal, state, local regulations.

4. Laboratory Workers and Students are required to:

- Attend all appropriate safety training sessions appropriate to maintain a safe work environment
- Comprehend and follow all appropriate safety procedures and standards appropriate to their laboratories.
- Remain informed of the appropriate use of hazardous materials and equipment in the lab.

4. The Environmental Health and Safety Officer (OEHSO) is responsible for providing overall coordination for the Louisiana Tech University Safety Plan. These responsibilities include:

- Providing initial training for Budget Unit Heads and other Administrators and of laboratory safety coordinators concerning requirements of the University's Safety Plan program and their responsibilities in it.
- Providing guidance for the preparation of procedures, inventories of chemical and other hazards, and training programs required by the University Safety Plan.
- Coordinating the disposal of all hazardous materials.
- Serving as the safety liaison between Budget Unit Heads and the Vice President of Administrative Affairs and the appropriate regulatory agencies.

LABORATORY TRAINING AND INSPECTION PROGRAM

All persons MUST receive comprehensive and documented laboratory safety training BY THE BUDGET UNIT HEAD OR THEIR DESIGNEE BEFORE they can work in any laboratories at Louisiana Tech University and obtain additional training when they add any potential hazardous material or process to the labs in which they work. Periodic safety updates (usually annually) are mandatory after any initial training.

All labs, stockroom and preparation area must be audited EVERY QUARTER The Budget Unit Head of the administrative unit in which each lab is located shall review the report and respond to and/or have measures taken to comply with corrective recommendations. The results of the audit forwarded to the Louisiana Tech University Environmental Safety Officer and to other appropriate administrators. The audit form is found in the appendix and on the Office of Environmental Safety web site.

Failure to obtain the required training or to perform the necessary audits may result in the loss of the use of all University laboratories.

GENERAL LABORATORY SAFETY PROCEDURES FOR ALL LABS, STOCKROOMS, AND PREPARATION AREAS

- **Untrained employees, students or visitors shall not be permitted enter and work in laboratories except under adequate supervision.**
- **An instructor or investigator shall be responsible for no more than 25 persons in a laboratory at one time.**
- **No laboratory shall be occupied unless a University employee that has been properly trained in laboratory safety is present.**
- **All laboratories shall have access to safety showers, eyewash fountains, dry chemical powder, and/or carbon dioxide fire extinguishers, fume hoods, numerous laboratory wash sinks (provided with drainage, separate from sanitary drainage), and a well-marked and unimpeded evacuation route from the laboratory. A general alarm system for the entire building which alerts Louisiana Tech University Police shall also be provided. Automatic smoke and fire alarms are now in common use in many laboratories.**
- **Telephones with emergency phone numbers on them must be in close proximity to all labs**
- **The laboratory shall be equipped with properly functioning, adequately designed facilities and with safety shields and respirators for use where hazardous materials are being used, or where there is a possibility for splashing or breakage especially when glass apparatus is being used at reduced pressure.**
- **Before using an open flame or spark-producing equipment such as motors and open heaters, all laboratory personnel shall assure that no flammable vapors are in the area**
- **Suitable permanent signs shall be posted in areas where hazardous operations are being carried out or where hazardous materials are being used.**
- **First aid equipment shall be available in the labs and personnel must be trained in its use. Following the administration of any first aid, a nurse or doctor at the nearest medical facility shall give further examination and treatment. Contact the University Police for this information.**
- **Lab aprons or coats made of impervious and inert material should be worn when working with any hazardous material.**

- Eye protection and appropriate gloves are required when working with corrosives or aerosols of potentially infectious material .
- Mouth pipetting is strictly prohibited. Instead, use one of the various types of effective hand-pipetting devices now commonly available.
- No drinking or eating or the application of makeup is allowed in the laboratory.
- Contact lenses shall not be worn in the laboratory.
- Food must not be stored in laboratory refrigerators.
- Remember not to heat a closed system (ie: a tightly capped bottle or tube).
- Maintain good housekeeping habits. Do not allow aisles to get cluttered with chairs, stools, boxes, etc. or use counter tops for storage .
- Learn the location and use of fire extinguishers, water hoses, fire alarms, safety showers, and eyewashes.
- Eyewashes are required in all laboratory areas where any hazardous materials are used.
- Avoid inhaling toxic vapors and gases and use fume hoods where indicated.
- Do not store materials in fume or laminar flow hoods. Keep hoods clear and clean.
- Set up experiments such that it is not necessary to reach through the assembly to turn water, gas, or electricity on or off.
- Guard against casual handling of glassware, for it easily breaks.
- Use a brush and dustpan and wear eye protection when picking up broken glass, Fine pieces should be picked up using wet cotton held with tongs. Discard all chipped, broken glassware into a separate, specially-marked container. NOTE: ANY GLASS THAT HAS BEEN CONTAMINATED WITH A POTENTIALLY BIOHAZARDOUS MATERIAL MUST BE DECONTAMINATED BEFORE DISPOSAL.
- ALL glass must be disposed of in separate, specially-marked container used for glass disposal. NOTE: ANY GLASS THAT HAS BEEN CONTAMINATED WITH POTENTIALLY BIOHAZARDOUS MATERIAL MUST BE DECONTAMINATED BEFORE DISPOSAL,
- Centrifuges should not be used until the operator has received detailed instruction on proper operation of the instrument and ways to minimize the many hazards associated with the use of this instrument.

IT IS EXCEEDINGLY IMPORTANT THAT THE INSTRUCTOR/PI IDENTIFY ANY SAFETY HAZARD ASSOCIATED WITH ANY PROCEDURE THAT IS PERFORMED IN A LABORATORY, TO PROVIDE DOCUMENTED TRAINING OF ALL PARTICIPANTS ON HOW TO MINIMIZE THESE HAZARDS, AND TO PROVIDE THE PERSONAL PROTECTIVE EQUIPMENT APPROPRIATE FOR THE PROCEDURE.

CHEMICAL HYGIENE PLAN FOR LABORATORIES (CHPL) - INTRODUCTION

NOTE: MUCH OF THE INFORMATION CONTAINED IN THE CHPL IS DUPLICATED FROM THE CAMPUS-WIDE HAZARDOUS COMMUNICATION/CHEMICAL HYGIENE PLAN THAT IS LOCATED IN THE UNIVERSITY SAFETY PLAN)

A Chemical Hygiene Plan for is the written program that contains policies and procedures for the safe use of hazardous chemicals. Major objectives of the Plan are to:

- Minimize all chemical exposure – General precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals. Consumption or skin contact with chemicals should always be prohibited.
- Do not underestimate risk – All materials used in labs should be considered toxic including those of no documented risk significant hazard and exposure to all substances should be minimized; substances that are known hazards may require that special precautions should be taken when using them. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
- Provide adequate ventilation – The best way to prevent exposure to airborne substances is to work with them under hoods or other ventilation equipment.
- Maintain and update the chemical hygiene program – A chemical hygiene program for all labs is mandatory to minimize exposure to potential or real hazards; it must be a continuing effort.
- Observe the PELs, TLVs – The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American conference of Governmental Industrial Hygienists should not be exceeded for any chemicals.

BASIC RULES FOR WORKING WITH CHEMICALS - (The following are in addition to the General Laboratory Safety Procedures)

Accidents and spills

- **All personnel should know the emergency procedures for responding to chemical spills**
CONSULT THE CHEMICAL SAFETY SECTION OF THE UNIVERSITY SAFETY PLAN FOR INSTRUCTIONS ON HOW TO RESPOND TO A CHEMICAL SPILL
- All significant accidents **MUST BE DOCUMENTED ON THE PROPER FORMS (SEE SECTION 1 OF THE SAFETY PLAN)** and shall be carefully analyzed with the assistance of OEHSO

Avoidance of routine exposure.

- Each laboratory employee and student shall develop and implement work habits consistent with this Laboratory Safety Manual to minimize chemical exposure to themselves and others.
- All chemicals are hazardous under certain conditions, so exposure to all chemicals shall be minimized. General precautions which shall be followed for the handling and use of all chemicals include:
 - Skin contact with all chemicals shall be avoided.
 - All employees shall wash all areas of exposed skin prior to leaving the laboratory.
 - Never test chemicals by taste or odor. If in doubt, do not use an unlabeled chemical.

- Always remember that acids are poured into water, not vice versa.
- When flammable liquids are to be stirred, use air-driven agitators, not electric motor-driven units. Use a heating mantle or steam bath instead of an electric heating unit to heat flammable liquids. Storage of various concentrations of ethanol, 40% and above, must be in safety cans.

Handling Cryogenic liquids

- Store liquid nitrogen, liquid helium, dry ice, and any other liquefied gases in a well-ventilated area. **Do not store in walk-in cold rooms** as these are not ventilated. The sublimation of dry ice, for example, reduces the percentage of available oxygen, posing a threat to those who enter.
- Liquid nitrogen is commonly used for long storage of small biological samples. Generally, the sample containers are small ampules, which are lowered into the liquid nitrogen. Improper sealing of the ampules can cause an explosion upon removal from the liquid nitrogen temperatures. To prevent this, always test the ampules for tight-sealing by placing in a strong dye solution for a couple of minutes prior to freezing. When removing a sample container from the liquid nitrogen, wear safety goggles, lab coat, and heat resistant gloves. Quickly place the ampules in a beaker of warm water which is inside a styrofoam ice bucket, and cover immediately. All these precautions can be obviated by the use of plastic vials specifically designed for cryogenic use.

Collection for Chemical Waste

Check with the Environmental Health and Safety Department at 257-2120 for proper disposal of chemicals. The department operates a chemical collection service for chemical waste. For this service, simply call 257-2120 and leave a message. **MAKE SURE YOU HAVE COMPLETED THE PROPER FORMS REQUIRED FOR THE DISPOSAL OF THE CHEMICALS.** In general, well-diluted acids and bases (between the pH of 6-9) can be flushed directly down the drain with plenty of water.

Incompatible Chemicals

Separate storage areas should be provided for "incompatible chemicals" which may react and create a hazardous condition because of this reaction. The Environmental Health and Safety Department can provide an evaluation of chemicals in your laboratory and/or provide charts which list incompatible chemicals.

Laboratory Fume Hoods

A laboratory fume hood is a ventilated enclosed work space consisting of side, back, and top panels, a work surface or deck, a work opening called the face, and an exhaust plenum equipped with horizontal adjustable slots for the regulation of air flow distribution. **Potentially infectious and radioactive materials are only to be handled in hoods that are designed specifically for these purposes.**

- Laboratory fume hoods shall be operating properly and operations where flammable gas, toxic vapors, or noxious odors are given off shall be performed in these hoods.
- The specifications of flow of air through a fume hood shall be monitored on the basis of the substances and amounts being used. Flow varies markedly near the surface. Increased flow can

be achieved by use of a restriction in front of the hood such as a window or safety shield. Fans shall be located on the roof so that all ductwork in the building is under negative pressure. There shall be no recirculation of the air from fume hoods into the laboratory. A critical factor in determining whether a hood is safe or not is the velocity of air entering a hood at its face. A minimum face velocity of 100 lineal fpm (feet per minute) for general laboratory hoods is recommended. As University laboratory personnel are aware, many fume hoods on campus are rather old. With this in mind, the Office of Environmental Health and Safety has set the minimum face velocity for older, general use laboratory fume hoods at 85 fpm. Higher face velocities can be achieved in ordinary hoods by closing the sash or positioning bench shields to reduce the open face area. These are general recommendations for face velocities; but, in some situations, modifications may be warranted.

DEGREE OF HAZARD	MINIMUM MEASURED VELOCITY AT ANY POINT ACROSS HOOD FACE
Low Toxicity levels	50 fpm
Average toxicity levels in research involving a wide range of materials	75 fpm
Nominal toxicity hazards with low-level radioactive tracer materials	100 fpm
Significant chemical toxicity levels and moderately radioactive materials	150 fpm
Higher level of toxicity and highly radioactive materials	Consider the use of glove boxes and total enclosures if velocities in excess of 150 fpm are required

NOTE: Fume hoods in which radioisotopes are to be shall be evaluated by the Radiation Safety Office before use.

- The preferred location for fume hood exhaust duct discharge terminals is above the roof of the building. Ideally the point of discharge shall be above the transition zone between air moving freely past the building and away from the turbulent air restrained or trapped on the roof or the side of the building.
- Controls, discharge outlets, fans, and ducts of hoods exhausting radioactive, pathogenic, or highly toxic materials shall be clearly marked.

- Periodic inspections and air velocity checks of hoods are necessary if effective control is to be maintained. An inspection program shall be developed by each budget unit using hoods. This inspection program shall include:
 - Face velocity checks-if possible.
 - Housekeeping-accumulation of chemicals and/or equipment in hood. Such materials restrict air flow.
 - Sashes-adequate number of sashes, condition, ease of movement, and cleanliness.
 - Motor/Belt Inspection-belts and motors shall be checked on a regular basis.

Emergency Showers and Eyewash Stations

Immediate washing of the skin and eye with a generous amount of water is the most effective first aid treatment for chemical burns, **ALL** laboratories and areas where faculty, staff, students, or visitors are exposed to harmful chemicals shall be provided with safety showers conveniently located and tested frequently, readily available, operable, and known to persons concerned.

- The valve handle of safety showers and eyewash fountains shall be rigidly fixed and plainly labeled. The valve shall open readily in either direction and remain open readily in either direction and remain open until intentionally closed. Water flow pressure shall be sufficient to drench the subject rapidly or gently flow in the case of eyewash fountains. The shower and eyewash fountain area shall be kept clear of obstructions. Water of drinking purity shall only be used in safety showers and eyewash fountains.
- Emergency eyewash stations shall deliver a gentle flow of clean, aerated water. For chemical splashes, very complete irrigation of a 15 minute flush is recommended. Immediately flush the eye with copious amounts of water under gentle pressure after checking for and removing contact lenses. (Note: Though the use of contact lenses shall not be permitted in any laboratory, a student may inadvertently forget to remove theirs) Forcibly hold the eye open to wash thoroughly behind the eyelids. In the absence of an eyewash fountain, the injured shall be placed on his back and water gently poured into the eye. The injured eye shall be held open. The injured shall be given prompt medical attention, regardless of the severity of the injury. Keep the eye immobilized with clean, wet, cold pads while transporting the injured to medical attention. Neutralizing agents shall not be used for chemical burns to the eye.
- Portable eyewash stations are to be periodically inspect to make sure they are properly filled and ready to use. Change the water once a month with water of drinking purity. Test the unit's operation monthly.
- Documentation of the operational status of emergency showers and eyewash stations shall be kept in the Budget unit. Tests the operation of the unit to determine sufficiency of water flow and valve operation. Observe physical condition of unit and be sure unit is kept clear of obstructions

EXAMPLE OF A EMERGENCY EYE WASH AND SHOWER STATION INSPECTION REPORT

BUILDING/ LOCATION	EYE WASH/ SHOWER	OPERATIVE/ INOPERATIVE	DESCRIPTION/ RECOMMENDATION
-----------------------	---------------------	---------------------------	--------------------------------

Storage

Safe storage and transport of chemicals, particularly liquid glass bottles of one liter or more, shall be provided, and incompatible chemicals shall not be stored in close proximity to each other or allowed to react accidentally. Consult the MSDSs for proper storage requirements of all chemicals.

Disposal

A carefully planned disposal procedure for chemicals shall be set up. Usually small quantities of water soluble, neutral substances may be flushed down the drain with relatively large quantities of running water. Water immiscible materials require special handling. Some may be recoverable in adequate purity for reuse by distillation, extraction, etc. Others may be collected in metal or plastic safety containers for disposal by incineration or landfills. Plans for safe recovery of chemicals used in laboratory experiments shall be an integral part of written procedures and carefully observed. Disposal shall follow EPA rules or other generally accepted practices. Contact MSDSs and the Department of Environmental Health and Safety for disposal instructions

Electrical Outlets

All electrical outlets shall carry a grounding connection requiring a three-pronged plug. All electrical equipment except glasscloth heaters and certain model oscillographs requiring a floating ground shall be wired with a grounding plug. Continuity of grounding connections including leads to building ground itself shall be checked periodically by an authorized inspector. The National Electrical Code shall be followed in all installations. This includes proper grounding as well as proper equipment for hazardous areas.

Hearing Protection-Noise Control (See PPE Section of the Safety Plan)

Hearing conservation shall be practiced through controls at the time of design, modifications of existing sources of noise, and the use of ear protection. OSHA's limit is 85 dBA for eight hours.

Eye Protection – See PPE Section of the Safety Plan)

- Laboratories shall require eye protection to prevent injuries or blindness from accidents.
- The type of eye protection needed depends on the particular operation to be performed. For most laboratory work, safety glasses with clear side shields are adequate as long as safety showers or eyewash facilities are near at hand. Suitable clip-on side shields are available for use with prescription safety glasses. Where there is danger of splashing chemicals or flying particles, goggles are recommended.

- A U.S. Food and Drug Administration regulation requires that all eyeglass and sunglass lenses sold to the general public be of shatter-resistant material. Although this regulation improves the protection to the general public, such eyeglasses cannot be considered adequate for laboratories (and shops) which require industrial quality eye protective devices. American National Standard (A87.1-1968), "Practice for Occupational Safety" and Educational Eye and Face Protection Requirements shall be considered the minimum protection. The principle difference is that the ANSI standard requires hardened lenses with a minimum thickness of 3mm, lens-retaining frames, non-flammable frames, and other attributes not covered by the FDA regulation.
- Prior to any work in the chemical laboratory, plans and facilities shall be established for action to be taken in the event of splashing of chemicals in or near the eye. For chemical splashes, immediately flush the eye with clean water from a gently flowing source for ten to fifteen minutes. Hold the eye open to wash thoroughly behind the eyelids. An eye wash fountain shall be used, but if one is not available, injured persons shall be placed on their backs and water gently pored into the eye. This shall be followed by prompt treatment by a member of the medical staff or an ophthalmologist who may issue standing instructions to staff medical personnel. All injuries, especially eye injuries, shall be treated and reported to insure maximum attention and feedback to be used in programs designed to prevent future recurrences.
- Considerable discomfort can be produced in the eye by exposure to ultraviolet light. The absorption of this radiation by the cornea and conjunctiva produces conjunctivitis. Protective glasses shall be worn by all personnel whenever they may be exposed to erythemally effective radiation. For detailed information on radiation safety, contact the University Radiation Safety Officer at 257-2605.

Radiation Emergency Checklist

- Many chemicals emit ionizing radiation (are radioactive). Specific guidelines for the safe use of these are available from the University Radiation Safety Offices.
- In the case of a spill or release of a radioactive chemical:
 - All persons clear area and go to the closest safe place(carefully help anyone who is injured); turn off all hoods and water before leaving
 - Seal off area and post guards to keep people away.
 - Call Radiation Safety Office - 257-2603 and Louisiana Tech University Police - 257-4018 for help.
 - Tell Police and Radiation Officer (a) location of release; (b) your name; (c) what happened (ie: major or minor spill, exposed source. If there is air-borne contamination, fire or explosion. any major injuries.
 - Wait close by. Tie a handkerchief around your arm for quick identification.

Refrigerators

- Use of domestic refrigerators in a chemical laboratory constitutes a unique hazard, for explosions may occur when they are used for storage of volatile or unstable chemicals.
- Domestic (household) refrigerators shall not be used for chemical storage unless they have been modified in accordance with National Electric Code, Article 501.

- Chemicals stored in approved refrigerators shall be sealed and labeled with the name of the material, the date it was placed in the refrigerator, and the name and phone number of the person who stored the material.
- Refrigerators in which any toxic materials are stored shall bear a label located on the outside of the refrigerator door stating "No Food or Drink To Be Stored in This Refrigerator."

Safe Handling and Disposal of Carcinogens

Many chemicals are carcinogenic and if any of these cause cancer in any species they must be regarded as potentially hazardous to humans. To protect both the workers and the community against health hazards associated with the use of these substances, each compound must be recognized as a carcinogen and then handled with the appropriate precautions which exceed those for non-carcinogenic chemicals.

The National Cancer Institute and the National Institutes of Health Guidelines and Standards are followed at this facility. The Louisiana Tech Environmental Health and Safety Department is responsible for assisting with implementation of these procedures and for assuring compliance of the University. All persons working with carcinogens or potential carcinogens must adhere to all general laboratory safety rules, plus submitting to the appropriate medical surveillance policies. **Individual budget units are responsible for the added cost and recordkeeping associated with this surveillance.** The recommended medical surveillance includes:

- Pre-assignment Examinations - An appropriate pre-assignment physical examination should be provided to each person planning to work with carcinogenic chemicals. The purpose of this examination is to establish a baseline against which changes can be measured and to determine whether there exists any medical or other conditions that may lead to increased risk in the work situation.
- Periodic Examinations - All employees working with carcinogenic chemicals should be provided periodic physical examinations. The purpose of the periodic examination is to determine whether a change has occurred in the medical state or in other relevant conditions which might lead to increased risk in the work situation. The frequency will be dependent upon the work circumstances and the general health of the employee.
- Records - Medical records shall be maintained for the duration of the employee's employment by the Budget Unit Head and by the Environmental Health and Safety Department. Upon termination of the employee's employment, including retirement or death, copies of the medical records shall be transmitted to the Personnel Department, where the records will be maintained for an extended period of time in a manner that will insure ready access as needed.

Listed below are some of the types of chemicals that are known to have carcinogenic potential. The hazard will depend on the specific substance and concentration being used.

1. Polycyclic aromatic hydrocarbons with four or more rings
2. Aromatic amines
3. Nitrosamines

4. Nitrosamides
5. Epoxides and lactones
6. Hydrazines
7. Halo-ethers
8. Azo compounds
9. Nitrofurans, nitrothiophens, and nitroimidazoles
10. Nitrogen mustards and related alkylating agents
11. Urethanes

Lists of carcinogens are available from the Environmental Health and Safety Department and the International Agency for Cancer Research (IRAC) Monographs, the National Institute of Occupational Safety and Health (NIOSH), and the National Toxicology Program (NTP) Annual Reports on Carcinogens, and others.

The use of noncarcinogenic substances should be substituted for chemical carcinogens whenever possible. If substitution is not possible, care is required to avoid exposure through inhalation, ingestion, and skin absorption. For those who use only small amounts of chemical carcinogens on an infrequent basis, safety can normally be achieved by strict adherence to good laboratory practice. For those who use chemical carcinogens in any amount on a regular basis, the following should be noted and observed:

- a fully-fastened laboratory coat or a disposable jumpsuit, shall be worn in any work area in which carcinogens are being used. Clean clothing shall be provided weekly and shall not be worn outside the work area. Clothing contaminated by chemical carcinogens shall be decontaminated or disposed of immediately after an obvious exposure according to Department of Occupational Health and Safety recommendations. Contaminated clothing shall not be sent to the laundry until decontaminated. Gloves which are appropriate to the specific situation shall be used when handling carcinogens. Disposable gloves shall be discarded in an approved manner after each use and immediately after known contact with a chemical carcinogen .
- Entrances to all work areas where chemical carcinogens are being used or stored shall be posted with signs bearing the following legend:

CAUTION - CHEMICAL CARCINOGEN

Authorized Persons Only

- Access doors to work areas shall be kept closed.
- All work surfaces (bench tops, hoods, floors, etc.) on which chemical carcinogens are used shall be covered with stainless steel or plastic trays, dry absorbent plastic-backed paper, or other impervious material. The protective surfaces shall be examined for possible contamination immediately after each procedure involving the chemical carcinogen has been completed. Contaminated surfaces shall then be decontaminated or disposed of as is appropriate.

- Procedures that involve the use of listed chemical carcinogens shall be conducted in a laboratory fume hood or other suitable local exhaust ventilation system at all times, and especially when: (1) the procedure involves the use of volatile chemical carcinogens, or (2) the procedure results in the generation of aerosols from procedures such as the opening of closed vessels; transfer operations; weighing; preparation of feed mixtures; and applications, injection, or incubation of a chemical carcinogen to experimental animals. Each laboratory-type hood or containment device used for containment of chemical carcinogens shall display a label bearing the following:

CAUTION - CHEMICAL CARCINOGEN

- All hoods must be designed to facilitate decontamination and exhaust treatment to neutralize carcinogens, if necessary. The exhaust air from laboratory-type hoods and other ventilated containment devices shall be appropriately treated such as by filtration, reaction, absorption, adsorption, incineration, or dilution so that the concentration of any chemical carcinogen or combination of chemical carcinogens in the final effluent which is discharged outdoors shall not exceed natural background levels. Exhaust air treatment systems that remove chemical carcinogens from the exhaust air by collection mechanisms such as filtration, absorption, and adsorption shall be operated in a manner that permits maintenance access so as to avoid direct contact with the collection medium. Specific design requirements are to be reviewed by the Environmental Health and Safety Department prior to installation. The Budget Unit Head shall be responsible for insuring that maintenance activities on fans, ductwork, hoods, filters, etc., are performed in a safe manner.
- Analytical instruments that are used with chemical carcinogens should be placed within an open face laboratory-type hood. When this is impossible, vapors or aerosols produced by these instruments shall be captured through local exhaust ventilation at the site of their production. When a sample is removed from the analytical instrument, it should be placed in a tightly-stoppered sample tube or otherwise safeguarded from contaminating the laboratory. In the event that the analytical equipment becomes contaminated, it shall be labeled:

CAUTION - CHEMICAL CARCINOGEN

until it has been completely decontaminated. These guidelines apply to analytical equipment even when only infrequently used for chemical carcinogens.

- A respirator use program shall be provided for emergency and maintenance personnel who enter areas where a potential for inhalation exposure to a chemical carcinogen is present. This program shall meet the requirements of the OSHA Standards for respiratory protection as detailed in 29 CFR 1910.134. The respirators shall be selected in accordance with the requirements of the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11. The selection and use of respirators shall be approved by the Environmental Health and Safety Department.
- Stock quantities of chemical carcinogens shall be stored in a properly-ventilated storage area that is secured at all times. The storage area shall be posted with a sign bearing the legend:

CAUTION - CHEMICAL CARCINOGEN

Authorized Persons Only

- An inventory of stock quantities shall be maintained by the Budget Unit Head. The inventory records shall include the quantities of chemical carcinogens acquired and dates of acquisition and disposition. Storage vessels containing stock quantities shall be labeled:

CAUTION - CHEMICAL CARCINOGEN

- Quantities of chemical carcinogens present in the work area shall not exceed the amounts required for use in one week. Storage vessels containing working quantities shall be labeled:

CAUTION - CHEMICAL CARCINOGEN

- Storage vessels containing chemical carcinogens shall be first placed in an unbreakable outer container before being transported to laboratory work areas. Contaminated materials which are transferred from work areas to disposal areas shall first be placed in a closed plastic bag or other suitable impermeable and sealed primary container. The primary container shall be placed in a durable outer container before being transported. The outer container shall be labeled with both the name of the chemical carcinogen and the warning:

CAUTION - CHEMICAL CARCINOGEN

- General housekeeping procedures which suppress the formation of aerosols, such as the use of a wet mop or a vacuum cleaner equipped with a HEPA filter to remove particulates, shall be used. Dry sweeping and dry mopping are prohibited because of the hazard of aerosol formation. In those instances where the chemical carcinogen or contaminated material is spilled, special procedures are required.
- Each vacuum service, including water aspirators, shall be protected with an absorbent or liquid trap and HEPA filter to prevent entry of any chemical carcinogen into the system. When using a volatile carcinogen, a separate vacuum pump or other device placed in an appropriate laboratory-type hood shall be used.
- Chemical carcinogens shall be packaged to withstand shocks, pressure changes, and any other conditions which might cause the leakage of contents incident to ordinary handling during transport. Shipments shall be in accordance to DOT regulations. **The treatment of animals with carcinogens is prohibited at Louisiana Tech University- Contact the Louisiana Tech University Institutional Animal Care Committee**, Contaminated material shall either be decontaminated by procedures that inactivate: the chemical carcinogen to produce a safe product or be removed for subsequent disposal. Chemical carcinogens which have spilled out of a primary container so as to constitute a hazard shall be inactivated IN SITU or shall be absorbed by appropriate means for subsequent disposal. A means for assuring adequacy of clean-up shall be provided, for instance, by use of wipe tests or fluorescence tests.

- Plans for handling and ultimate disposal of contaminated wastes shall be approved by the Environmental Health and Safety Department.
- When direct contact with chemical carcinogens could occur after a spill, signs stating the following shall be posted at all entrances to the area.

CANCER SUSPECT SUBSTANCE EXPOSED
IN THIS AREA
IMPERVIOUS SUIT INCLUDING GLOVES, BOOTS, AND
AIR SUPPLIED HOOD REQUIRED AT ALL TIMES
AUTHORIZED PERSONNEL ONLY

Budget Unit Heads are responsible for the cost and supervision of clean-up.

- A foot or elbow-operated handwashing facility shall be available within the work area. And a shower facility, other than emergency drench showers, shall be located in the building in which chemical carcinogens are used. The shower facility shall be available at all times.
- No recirculation of exhaust air from the work area is permitted.

Flammable Liquids

In any fire or explosion occurring in a laboratory at the University, the severity of the fire will depend to a great extent on the amounts of flammable liquids in the area and how they are stored. This section establishes maximum amounts of flammable liquids for various laboratories and describes the types of containers to be used for various chemicals.

Flammable and combustible liquids are defined as:

Flammable

Class IA Flashpoint below 73 degrees F (23 degrees C) and boiling point below 100 degrees F (38 degrees C)

Class 1B Flashpoint below 73 degrees F (23 degrees C) and boiling point at or above 100 degrees F (38 degrees C)

Class 1C Flashpoint at or above 73 degrees F (23 degrees C) and below 100 degrees F (38 degrees C)

Combustible

Class 2 Flashpoint at or above 100 degrees F (38 degrees C) and below 140 degrees F (60 degrees C)

Class IIIA Flashpoint at or above 140 degrees F (60 degrees C) and below 200 degrees F (93 degrees C)

Class IIIB Flashpoint at or above 200 degrees F (93 degrees C)

- All flammable and combustible liquids within a laboratory that are not in use shall be stored in approved storage cabinets, cans or storage rooms. Storage cabinets and cans should bear approved labels from UL (Underwriter's Laboratories) or FM (Factory Mutual). Special storage facilities must be provided for materials having uniquely hazardous properties, such as temperature-sensitive, water-reactive, or explosive materials. Flammable liquid storage in laboratories is regulated by the Uniform Fire Code (UFC) and NFPA. Evaluation of flammable liquid storage in your laboratory can be made by the Environmental Health and Safety Department. Storage of flammable liquids in refrigerators is not allowed unless the refrigerator is specially designed, wired, and labeled as being safe for flammable liquid storage. Flammable storage near refrigerators is allowed only if the refrigerator is explosion-proof.
- The amounts of storage of flammable liquids should be kept to a minimum. No more than 10 gallons should be stored out of flammable liquid storage cabinets or flammable liquid safety cans.
- These rules apply when dispensing flammable liquids:
 - Dispensing of flammable or combustible liquids should be carried out only under a fume hood or in an approved storage room.
 - All drums containing flammable liquids for dispensing should be vented with approved safety bungs.
 - Class I and II liquids shall not be dispensed by gravity from tanks, drums, barrels, or similar containers. Only approved drum pumps should be used.
 - All drums and equipment subject to static accumulation must be grounded.
 - Dispensing should only be into approved containers and any metal containers must be grounded to the drum.
 - All ignition sources must be eliminated from the area.
 - Good housekeeping standards should be maintained and all combustible material should be eliminated, particularly at the flammable liquids location.
 - Portable fire extinguishing equipment must be provided, such as dry chemical, foam, or carbon dioxide.
- Do not dispose of flammable or combustible liquids in a sink or drain. Call the Environmental Health and Safety Department at 257-2120 for information about the chemical disposal service available. All personnel must make every effort to provide an accurate description of all chemical constituents within the waste container. Unknown chemicals present serious problems for the chemical waste management program. Without a description, waste management personnel cannot handle or dispose of a chemical or chemical mixture in a safe manner; therefore, analysis is required. An analysis of one sample could easily cost
-

Peroxidizable liquids

Peroxide formation in solvents and reagents has been responsible for many serious explosions in laboratories and, therefore, presents a potential hazard throughout the University. Under normal storage conditions, some chemicals can form and accumulate peroxides, which explode violently when shocked or heated. The following information is designed to enable a worker to recognize peroxidizable compounds, to test for peroxides, and to handle them safely.

- There are essentially ten major structures that readily form peroxides. As determined from the literature, the first six have caused numerous explosions and the last four very few. Compounds containing the following structures can form peroxides:

STRUCTURES	EXAMPLES
1.	Ethers, acetals
2.	Olefins with allylic hydrogen, chloro- and fluoro- olefins, terpenes, tetrahydronaphthalene
3.	Dienes, vinyl acetylene
4.	Vinyl monomers including vinyl halides, acrylates, methacrylates, vinyl esters
5. Alkali Metals	Potassium
6. Alkali metal, alkoxides, and amines	Sodamine
7.	Paraffinic and allyl aromatic hydrocarbons, particularly those with tertiary hydrogen
8. Organometallic	Grignard Reagent
9.	Aldehydes, ketones, anhydrous acetaldehyde will undergo oxidation at 9 degrees C or below, or under ultraviolet light catalysis will form peracetic acid which may react with more acetaldehyde to give the explosive acetaldehyde monomer acetate
10.	Ureas, amines, lactams

- The more volatile the peroxidizable compound, the more likely that peroxides can be formed. Pure compounds are more subject to peroxide accumulation. Impurities may inhibit peroxide formation or catalyze their slow decomposition. Peroxide accumulation is a balance between peroxide formation rate and degradation rate under the environment of a given compound. For example, certain highly-reactive compounds such as organometallics accumulate peroxides at low temperatures because peroxide degradation rate is slowed relative to formation rate; in

contrast, less reactive compounds such as hydrocarbons or ethers are usually best kept at low temperature.

Group designations for the storage of peroxidizable compounds are as follows:

GROUP 1 (3 MONTHS)	GROUP 2 (6 MONTHS)	GROUP 3 (12 MONTHS)
Divinyl acetylene	Acetyl	Acrylic acid
Isopropyl ether	Cumene	Acrylonitrile
Potassium metal	Cyclohexene	Butadiene
Sodium amine	Diacetylene	Chloroprene
Vinylidene chloride	Dicyclopentadiene	Chlorotrifluoroethylene
	Diethyl ether	Methyl methacrylate
	Dimethyl ether	Styrene
	Dioxane	Tetrafluoroethylene
	Ethylene Glycol	Vinyl acetate
	Glyme	Vinyl acetylene
	Methyl acetylene	Vinyl chloride
	Methyl iso-butyl ketone	Vinyl pyridine
	Methylcyclopentane	
	Tetrahydrofuran	
	Tetrahydronaphthalene	
	Tetralin	
	Vinyl ethers	

- All peroxidizable compounds should be stored away from heat and light. Sunlight is a common promoter of peroxidation. Peroxidizable liquids should be stored in metal cans if possible. Particular care should be given to insure good closure on storage containers. Whenever possible, store peroxidizable compounds (except certain inhibited vinylmonomers) under a nitrogen atmosphere. All containers with peroxidizable chemicals should be protected from physical damage and ignition sources.

- Group 1 materials are those which accumulate peroxides to a hazardous level simply on storage. These must be evaluated for peroxide content at least every three months after opening and are dated if safe or disposed of in an approved manner if the peroxide level is high.
- Group 2 and Group 3 materials should not be stored for longer than 12 months after opening unless shown by a suitable test not to have accumulated peroxide. Discretion must be used with respect to storage after opening. Should it be desirable to retain Groups 2 or 3 materials which give a positive test for peroxide, the material must be treated to remove the peroxide, rebottled, and the label redated.
- Quantities of uninhibited vinyl monomers greater than 500 gm should not be stored for longer than 24 hours. For storage in excess of 24 hours, quantities of vinyl monomers greater than 10 gm should be inhibited with a suitable inhibitor. The name and quantity of the inhibitor should be indicated on the label. Storage of less than 10 gm of an inhibited vinyl monomer for longer than a 24 hour period should be done only with discretion.
- When handling peroxidizable compounds stored in cylinders, care must be taken to insure that the cylinders are maintained free of air.

Inspection of Laboratories Using Chemicals- This is done as part of the overall laboratory inspection program

BIOHAZARD CONTROL

This summary presents certain safety requirements for handling POTENTIALLY INFECTIOUS MATERIALS. These requirements are based on criteria specified in the CDC publication, "Biosafety in Microbiological and Biomedical Labs". A current edition of this manual is available in the Department of Environmental Safety. The operational requirements therein serve, in part, to indicate that facilities and resources should be made available to minimize hazards in work with specific microorganisms.

General Requirements

- Only authorized employees, students, and visitors shall be allowed to enter infectious disease laboratories or utility rooms. All persons must have documented training in the safe handling of infectious agents.
- MSDSs for infectious agents used in these labs must be available in these labs. See LSC for these MSDSs.
- When the building vacuum line is used, suitable traps or filters shall be interposed to insure that pathogens do not enter the fixed system.
- Before centrifuging, inspect tubes for cracks; inspect the inside of the trunnion cup for rough walls, caused by erosion of adhering matter; carefully remove bits of glass from the rubber cushion. A germicidal solution added between the tube and trunnion cup not only disinfects the

outer surface of both of these but also provides an excellent cushion against shocks that might otherwise break the tube.

- Avoid decanting centrifuge tubes. If you must do so, wipe off the outer rim with a disinfectant afterwards; otherwise, the infectious fluid will spin off as an aerosol. Avoid filling the tube to the point that the rim becomes wet with culture.
- A ventilated and filtered safety centrifuge cabinet is recommended to house and safeguard while centrifuging infectious substances. Use a J safety centrifuge cup. Centrifuging shall always be done in closed containers and, whenever possible, in closed centrifuge heads. When centrifuging is done in a ventilated glove box, the glove panel shall be in place with the glove parts covered. A centrifuge in operation creates reverse air currents that may cause escape of agent from an open cabinet.
- An aerosol containment hood or enclosure shall be provided for sonicators, cream separators, and similar aerosol producing apparatus.
- Ensure that all infectious fluid cultures or viable powdered infectious materials in glass vessels are transported, incubated, and stored in easily handled, non-breakable, leak-proof containers that are large enough to contain all fluid or powder in case of leakage or breakage of the glass vessel
- All inoculated Petri plates or other inoculated solid media shall be transported and incubated in leak-proof pans or other leak-proof containers.
- No person shall work alone in a lab where potentially infectious material is used. Use the "buddy system."
- Prepared solutions of suitable disinfectants, along with instructions for use, shall be maintained in each laboratory in a conspicuous location. The location shall be labeled "Disinfectants for Emergency Use" and with the composition and expiration date of the disinfectant.
- An Emergency Notification Sign, available from the Office of Environmental Health and Safety, shall be posted by the responsible instructor/researcher on the exterior door of each lab giving instructions to follow in the event of an emergency such as a fire or spill. Instructions shall emphasize precautionary measures.
- Floors, laboratory benches, and other surfaces in the buildings in which infectious substances are handled shall be disinfected with a suitable germicide as often as deemed necessary by the supervisors. After completion of operations involving planting, pipetting, centrifuging, lyophilizing, and similar procedures with infectious agents, the surroundings shall be disinfected.
- Floor drains throughout the building shall be flooded with water, glycol, or a safe disinfectant at least once a week in order to fill traps and prevent back up of sewer gases.
- Floors shall be swept with push brooms only. The use of floorsweeping compound is recommended because of its effectiveness in lowering the number of airborne organisms. Water used to mop floors shall contain suitable disinfectants. Elimination of sweeping through use of vacuum cleaners utilizing absolute filters or through wet mopping only is highly

desirable. Custodial services shall be performed by laboratory personnel only-not by Physical Plant or University contractors.

- Develop the habit of keeping your hands away from your mouth, nose, eyes, and face. This may prevent self-inoculation.
- Deep freeze and dry ice chests and refrigerators shall be checked and cleaned out **at least semi-annually** to remove broken ampules, tubes, etc., containing infectious material. A tray can be used to line the bottom of the refrigerator or freezer to catch and retain broken containers.
- Books and journals shall not be taken into rooms where work with infectious agents is in progress.
- An effort shall be made to keep all other surplus materials and equipment out of these rooms.
- According to the level of risk, the wearing of laboratory or protective clothing may be required for persons entering these laboratories.
- Contaminated laboratory clothing shall not be worn in clean areas or outside the building.
- All laboratory rooms containing infectious substances shall designate separate areas or shelters labeled: "INFECTIOUS-TO BE AUTOCLAVED," or "NOT INFECTIOUS-- TO BE CLEANED" to place these material in. All work areas including cabinetry shall be prominently marked with the Biohazard Warning Control. Cultures shall be labeled with the name of the agent, instructor/researchers' names, and date transfer was made.
- Care shall be exercised in the use of membrane filters to obtain sterile filtrates of infectious materials. Because of the fragility of the membrane and other factors, such filtrates cannot be handled as noninfectious until culture or other tests have proven their sterility.
- All serum and human body fluid specimens shall be handled with impervious rubber gloves.
- All laboratories shall be sprayed with insecticides as often as necessary to control flies and other insects. Consult Physical Plant pesticide control personnel for spraying. Advise them of hazards in the laboratory before work begins.
- No infectious materials shall be pipetted by mouth or blown out of a pipette. Do not use a pipette for mixing or for bubbling air through an infectious mixture. Hand pipetting devices shall be used to pipette all microorganisms, tissue, cell cultures, caustic or corrosive chemicals, poisons, organic solvents, radioactive materials, mutagens, carcinogens, or tetragens.
- Contaminated pipettes shall be placed in a pan containing enough suitable disinfectant to allow complete immersion. The pan and pipette can be autoclaved as a unit and replaced by a clean pan with fresh disinfectant.
- Only single-use syringes of the Luer-Lok type with self-sheathing needles shall be used with infectious materials.

- Use an alcohol-soaked pledget around the stopper and needle when removing a syringe and needle from a rubber-stoppered vaccine bottle.
- Expel excess fluid and bubbles from a syringe vertically into a cotton pledget soaked with disinfectant or into a small bottle or cotton.
- Syringes and needles shall be disposed of into specially-marked Sharps containers (not into the "trash"). Blunt needles (cannulas) shall be used wherever sharp needles are not required.
- A safety box or safety shaker tray shall be used to house or safeguard all containers of potentially infectious substances on shaking machines.
- Broth cultures shall be made and used in a manner that avoids wetting the plug or cap.
- Food, candy, gum, or beverages for human consumption shall not be taken into these laboratories. Smoking shall not be permitted in any area.
- Employees who have been working with infectious materials shall wash and disinfect their hands thoroughly before smoking, eating, or drinking.
- Industrial water from lab sinks shall not be used for human consumption.
- To minimize hazard to firemen, maintenance personnel, or emergency crews at the close of each workday all infectious or toxic material shall be: (1) placed in the refrigerator, (2) placed in the incubator, or (3) autoclaved or otherwise disinfected before the building is closed.
- No infectious substances shall be allowed to enter a building drainage or refuse disposal system without proper sterilization
- Mechanical garbage disposal units shall not be installed for use in disposing of contaminated wastes. These units release considerable amounts of aerosol.
- Water Baths and warburg baths used to inactivate, incubate, or test infectious substances shall contain a suitable disinfectant. For cold water baths, 70% propylene glycol is recommended.

Sterilization and Disinfection Procedures

The following guideline apply to the sterilization of contaminated materials:

- All infectious or toxic materials, equipment, or apparatus shall be autoclaved or otherwise disinfected before being disposed of. Each individual working with infectious material shall be responsible for its disinfection before disposal.
- Autoclaves must operate at temperatures **greater than 120C and at a pressure at least 15 psi for at least 30 minutes for proper sterilization.** Treatment conditions to achieve sterility will vary in relation to the volume of material treated, its contamination level, the moisture content, and other factors. Examples of this variation in these conditions are:
 - Laundry-250 F (121 C) for 30 minutes with 15 minutes pre-vacuum of 27 inch Hg.
 - Trash-250 F (121 C) for 1 hour with 15 minutes pre-vacuum of 27 inch Hg.

- Glassware-250 F (121 C) for 1 hour with 15 minutes pre-vacuum of 27 inch Hg for filled NTH Glassware can.
 - Liquids-250 F (121 C) for 1 hour for each gallon.
 - Animals-250 F (121 C) for 8 hours with 15 minutes pre-vacuum of 27 inch Hg.
 - Bedding-250 F (121 C) for 8 hours with 15 minutes pre-vacuum of 27 inch Hg.
- Infectious or toxic materials shall not be placed in autoclaves overnight in anticipation of autoclaving the next day.
- Autoclaves shall be checked for operating efficiency, if spore formers are used.
- When gas sterilants are used, the following conditions must be maintained to achieve sterilization:
- Ethylene Oxide base-Sixteen hours exposure to a concentration of 750 mg/liter (approximately 5%) at 30 to 60% relative humidity and at ambient temperatures (> 70 F).
 - Paraformaldehyde-16 hours exposure to a concentration of 1.0 mg/liter at 40 to 60% relative humidity at ambient temperatures (>70 F).

The following apply to disinfectants:

- Mercurials are not recommended for general use because they have poor activity against vegetative bacteria and are useless as sporicides. Although the mercurials exhibit good activity against viruses (1 :500 to 1: 1:1000 concentration), they are toxic and not recommended.
- Quantitav Ammonium Compounds are acceptable as general-use disinfectants to control vegetative bacteria and non-lipid-containing viruses. However, they are not active against bacterial spores at the usual-use concentrations (1.750).
- Phenolic Compounds are recommended for killing vegetative bacteria, including Mycobacterium tuberculosis, fungi, and lipid-containing viruses.
- Chlorine Compounds are recommended for certain disinfecting procedures, provided the available chlorine needed is considered. Low concentrations of available chlorine (50 to 500 ppm) are active against vegetative bacteria and most viruses. For Bacterial spores, concentration of approximately 2500 ppm are needed. The corrosive nature of these compounds, their decay rates, and lack of residuals are such that they are recommended only in special situations.
- Iodophors show poor activity against bacterial spores, but they are recommended for general use (75 to 150 ppm). They are effective against vegetative bacteria and viruses. Their advantages are:
- Iodophors possess a wide spectrum of antimicrobial and antiviral activity.
 - Iodophors have a built-in indicator. If the solution is brown or yellow, it is still active.
 - Iodophors are relatively harmless to man. Iodophors can be readily inactivated and iodophor stains can be readily removed with solutions of Na₂S₂O₃ (Sodium Thiosulfate).
- Alcohols, in concentrations of 70 to 95 percent, are good general-use disinfectants, but they exhibit no activity against bacterial spores.

- Formaldehyde Solutions, in concentrations of 8 percent, exhibit good activity against vegetative bacteria, spores, and viruses.
- Activated Glutaraldehyde, in two percent solutions, exhibit good activity against vegetative bacteria, spores, and viruses. Use shall be limited and controlled because of its toxic properties and the damage to the eyes.
- Formaldehyde-Alcohol, in solutions of 8 percent in 70 percent alcohol are considered very good for disinfection purposes because of their effectiveness against vegetative bacteria, spores, and viruses. For many applications, this is the disinfectant of choice.

Biosafety Ventilation Equipment

Biological Safety Cabinets are the principal equipment used to provide physical containment. They are used as primary barriers to prevent the escape of aerosols into the laboratory environment. This is an important function, because most laboratory techniques are known to produce inadvertent aerosols that can be readily inhaled by the laboratory worker. Certain cabinets can also protect the experiment from airborne contamination. The selection of a Biological Safety Cabinet is based on the potential hazard of the agent used in the experiment, the potential of the laboratory technique to produce aerosols, and the need to protect the experiment from airborne contamination. Three types of Biological Safety Cabinets are used in the microbiological laboratory: the Class I, the Class II, and the Class III cabinets, They are as follows:

- The Class I Biological Safety Cabinet
 - The Class I cabinet is a ventilated cabinet that may be used in three operational modes: (1) with a full-width open front, (2) with an installed front closure panel without gloves, and (3) with an installed front closure panel equipped with arm-length rubber gloves. Materials may be introduced and removed through the panel opening and, if provided, through the hinged front view panel or a side UV air look. Lights, vacuum, gas (do not provide if cabinet is to be operated, sealed, and include gloves), water, and drain can be provided. The materials of construction shall be selected to withstand wear, corrosive action of gases and liquids, and decontaminants. Room air flowing into the cabinet prevents the escape of airborne contaminants from the cabinet work area. It flows across the work space, over and under a back wall baffle, out through a HEPA filter and blower in an overhead duct to the building air exhaust system or outdoors. When operated with a full-width open front, a minimum inward face velocity normal to the work opening of at least 75 fpm is required.
 - Protection is provided to the user and the environment, but not to the product (experiment). A wide range of activities is accommodated using equipment as varied as pipetting aids, burettes, pH meters, sonicators, shielded centrifuges, blenders, and lyophilizers. Chemical carcinogens and low levels of radioactive materials and volatile solvents can be used in Class I cabinets with minimum face velocities of 100 fpm. When these materials are used in the Class I cabinet, a careful evaluation shall be made to determine that concentrations do not reach dangerous levels or cause problems of decontamination of the cabinet.

- The cabinet is a partial containment unit. Its primary barrier-function can be compromised by the pumping action of sudden withdrawal of the hands, the opening and closing of the room door, or rapid movements past the front of the cabinet. Aerosols created in large quantities may overcome even higher face velocities. Also, the cabinet does not protect the experimenter's hands and arms from contact with hazardous materials. Such protection is dependent on technique and the use of gloves and other protective clothing.

➤ The Class II Biological Safety Cabinet

- The Class II cabinet is commonly known as a laminar airflow Biological Safety Cabinet. Class II cabinets have a front opening for access to the work space and for introduction and removal of materials. Airborne contaminants in the cabinet are prevented from escaping across this opening by a curtain of air formed by (1) unfiltered air flowing from the room into the cabinet and (2) HEPA filtered air supplied from an overhead grille in the cabinet. This curtain of air also prevents airborne contaminants in the room from entering the workspace of the cabinet across the front opening. The curtain of air is drawn through a grille at the forward edge of the work surface into a plenum below. Air from this plenum is HEPA filtered and recirculated through the overhead grille down into the cabinet. A portion of this filtered air is used to maintain the air curtain and the remainder passes down onto the work surface and is drawn out through grilles at the back edge of the work surface. The HEPA filtered air from the overhead grille flows in uniform downward movement to minimize air turbulence. It is this air that provides and maintains a clean-air work environment. A percentage of air drawn through the front and back grilles of the work surface, which is equal to the flow of room air into the cabinet, is also filtered by HEPA filters and exhausted from the cabinets.
- The selection of utility services and materials of construction are similar to those for Class I cabinets.
- There are two types of Class II cabinets, A and B. These differ principally in the following ways:
 1. Vertical Dimension of the front opening
 2. Proportion of air recirculated
 3. Velocity of airflow to work surface
 4. Manner of discharge of exhaust air
 5. Whether contaminated air plenums are under positive reasure
- The Type A cabinet has a fixed front access opening. The inward face velocity through the front opening is at least 75 fpm. Contaminated air plenum are normally operated at positive pressure. The cabinet operates with a high percentage (approximately 70%) of recirculated air. The Type A cabinets can be operated with recirculation of the filtered exhaust air to the room in which they are located. This minimizes extra demand on supply and exhaust air systems unless the buildup of heat and odor from there circulated exhaust air requires otherwise.

- Type B cabinets do not recirculate their exhaust air to the room. They have a vertical sliding sash rather than the fixed opening of the type A. Inward air velocity of 100 fpm is attained at an 8 inch sash opening. The cabinet operates with a low percentage (approximately 30%) of recirculated air.
- Type A and B cabinets are partial containment units with the same limitations as Class I cabinets. These cabinets provide protection to the user, environment, and product (experiment). Activities are accommodated that use pipetting aids, burettes, pH meters, sonicators, blenders, lyophilizers, and shielded centrifuges. The Type B cabinets can be used with dilute preparations of chemical carcinogens, of low-level radioactive materials, and of volatile solvents when the face velocity of 100 fpm is maintained. When these materials are used, however, a careful evaluation shall be made to determine that concentrations do not reach dangerous levels or cause problems of decontamination of the cabinets. The Type A cabinets cannot be used with toxic, explosive, flammable, or radioactive substances because of the high percentage of recirculated air.

➤ The Class III Biological Safety Cabinet

- The Class III cabinet is a totally enclosed ventilated cabinet of gas-tight construction. Operations within the Class III cabinet are conducted through attached rubber gloves. When in use, the Class III cabinet is maintained under negative air pressure of at least 0.5 inch water gauge. Supply air is drawn into the cabinet through HEPA filters. The cabinet exhaust air is filtered by two HEPA filters installed in series or one HEPA filter and an incinerator. The exhaust fan for the Class III cabinet is generally separate from the exhaust fans of the facility ventilation systems.
- Materials are introduced and removed through attached double-door sterilizers and dunk baths with liquid disinfectants. The usual utility services can be provided, but not gas. Liquid wastes go to a holding tank for appropriate decontamination before release into "common" sewage lines. Stainless steel is the usual construction material. Modular designs provide for inclusion of refrigerator, incubator, deep freeze, centrifuge, animal holding, and other, special cabinet units.
- The Class III cabinet provides the highest level of personnel and environmental protection. Protection is also provided to the product (experiment). Most activities can be accommodated: the usual cultivation of microorganisms, fertile eggs, tissue, cells; microscopy; serology; animal dissections and injections; experimental aerosol exposures; various physical measurements; and many others on a small-to-large scale. Selected gaseous atmospheres can be maintained at desired humidity and temperature conditions.
- The Class III cabinet protection can be compromised by puncture of the gloves or accidents creating positive pressure in the cabinet. Flammable solvents shall not be used in the cabinets unless a careful evaluation has been made to determine that concentrations do not reach dangerous levels. When required and determined safe, these materials shall only be introduced into the system in closed, nonbreakable containers. These materials shall not be stored in the cabinet. Electric heaters are preferred over portable, canned-gas heaters. Flammable gas shall not be piped to the units.

➤ Laminar Flow Clean Air Cabinet

- This cabinet is not suitable for work with biohazards. Personnel are exposed to contaminated air because the cabinet's positive pressure allows air to flow out of the cabinets. Such units are suitable only for use with known clean materials where product protection is the only objective.
- Since each of the previously-described types of safety cabinets has its advantages and limitations, the principal investigator shall carefully assess the program and match specific requirements to the appropriate contamination control cabinet.
- Pertinent factors are:
 1. Proposed Activity-procedures which may cause aerosols are of particular concern.
 2. Risk of the Infected Agent-all known characteristics of the agent shall be evaluated, i.e., infectivity, history of known laboratory-acquired human infections, concentration of the viable agent to be used, classification of the etiologic agent on the basis of hazard, etc.
 3. Control Objectives-the control protection desired shall be determined from the proposed activity and the specific agent: a. Product protection only; b. Personnel protection only; c. Personnel and product protection
- The capability of biological safety cabinets to protect personnel and the environment from exposures to potentially hazardous aerosols is dependent on both the ability of the laboratory worker to use the cabinet properly and the adequate functioning of the cabinet itself. A biological safety cabinet shall never be used to contain hazardous materials unless it has been demonstrated to meet certain minimum safety specifications.
- Certification of the cabinets for minimum safety specifications is required whenever (1) a new cabinet has been purchased and installed, but before it is used, (2) after it has been moved or relocated, and (3) at least annually. This service is provided by several outside companies in the near by area. Please consult the Office of Environmental Health and Safety for names of companies.

Animals

- Plans for a biohazard program involving animals shall be submitted to the appropriate Budget Unit Head. And the University Animal Care Committee for approval. All animals, equipment, and the animal room itself shall be treated as contaminated. Each animal shall be identified to indicate inoculation with infectious substances.
- Cages used for infected animals shall be cared for in the following manner:
 - Careful handling procedures shall be employed to minimize the dissemination of dust from cage refuse and animals.
 - Cages shall be sterilized by autoclaving. Refuse bowls and watering devices shall remain in the cage during sterilization.

- All watering devices shall be of a non-drip type.
- Each cage shall be examined each morning and at each feeding time so that dead animals can be removed.
- Animals in cages with shavings shall be transferred to clean cages as often as necessary. If cages have false screen platforms, the catch pan shall be replaced before it becomes full.
- The names of the investigators, a description of infectious agent, the date and method of administration, and an emergency telephone number shall be placed on each cage.
- If properly maintained, Ultraviolet lamps and reflectors can prevent the airborne spread of infections between cages. Depending upon the location of the ultraviolet lamps, it may be necessary to shield them to protect animals and personnel from eye damage. Protective goggles may be necessary. High-efficiency, spun-glass filter materials used on the sides or top of a small animal cage will also prevent cross-infection. Consult the Animal Care Committee.
- Several types of ventilated cages are available and useful where airborne organisms are under investigation. Ventilated lids can be made to fit ordinary animal cages by use of air-tight gaskets around the rim of the lid, which are connected to a central exhaust system through an absolute filter. Horsefall type cubicles or flexible film isolators may also be used.
- Doors to animal rooms shall be kept closed at all times except for necessary entrance and exit. The doors shall be marked by a conspicuous sign, HAZARDOUS BIOLOGICAL MATERIALS. The conventional biohazard symbol shall be used.
- Unauthorized persons shall not be permitted entry to animal rooms.
- A container of suitable disinfectant shall be kept in each animal room for disinfecting gloves and boots and for general decontamination. Floors, walls, and cage racks shall be mop-washed with a suitable disinfectant frequently.
- Floor drains in animal rooms shall be flooded with water, glycol, or a suitable disinfectant periodically to prevent backing up of sewer gases.
- Shavings or other refuse on floors shall not be washed down the floor drains.
- Animal rooms shall have a licensed pest control service.
- Special care shall be taken to prevent live animals, especially mice, from finding their way into disposable trash.
- Animal rooms in infectious disease units shall be ventilated under negative pressure with respect to corridors or adjoining non-infectious areas. Ten to fifteen changes of air per

hour generally are sufficient, depending upon the species of animal. There shall be no recirculation of room air in infectious areas.

- Use disinfectant vaporizers to decontaminate an animal room after experiments. No personnel or animals shall be in the room during this process.
- Special attention shall be given to the humane treatment of all laboratory animals in accordance with the Principles of laboratory Animal Care as promulgated by the National Society for Medical Research and the ,National Institute of Health.
- Heavy gloves shall be worn when feeding, watering, or removing infected animals. Under no circumstances shall bare hands be placed in the cage to move any object.
- When animals are to be injected with pathogenic material, the animal caretaker shall wear protective gloves and the laboratory workers shall wear surgeon's gloves. Every effort shall be made to restrain the animal to avoid accidents that may result in dissemination of infectious materials. Before and after injection of an animal, swab the site of the injection with a disinfectant.
- If the handler receives a bite or scratch, the wound (even a superficial one) shall be scrubbed for three minutes with soap and water followed by a thorough rinsing with warm water, drying with an absorbent cotton, and swabbing with 1 % solution of Zephiran Chloride. The injured person shall seek medical attention promptly. If a fever develops, the handler shall report for medical aid and inform the doctor that he works with animals.
- Report any bite wounds to employees on a DA 2000- "Employers Report of Occupational Injury or Disease Report." Students shall report bite wounds to their instructors and to the Student Health Center. Appropriate medical care shall be sought immediately.
- Necropsy of infected animals shall be carried out in ventilated biological safety cabinets equipped with absolute exhaust filtration. The inside of the ventilated cabinet and other potentially contaminated surfaces shall be disinfected with a suitable germicide before and after the necropsy.
- Rubber gloves shall be worn when performing necropsies.
- Surgeon's gowns shall be worn over laboratory clothing during necropsies .
- Small animals shall be restrained and placed within a metal tray. Large animals shall be processed in an appropriate room designated for the purpose of necropsy.
- Upon completion of necropsy, all potentially contaminated materials shall be placed In suitable disinfectant or left In the necropsy tray. The entire tray shall be autoclaved at the conclusion of the operation.
- Grossly contaminated rubber gloves shall be cleaned in disinfectant before removal from hands.

- Dead laboratory animals shall be placed in proper leak-proof containers and thoroughly autoclaved before removal and incineration, if zoonotic potential is present;
- The selection of an appropriate biosafety level for work with a particular agent or animal study is dependent upon a number of factors. The most important of these include: the virulence, pathogenicity, biological stability, communicability of the agent, the nature of function of the laboratory, the quantity and concentration of the agent, the availability of the agent, and the availability of effective vaccines or therapeutic measures.
- The laboratory supervisor and/or principal investigator shall seek approval of the Budget Unit Head or other administrative directors and the University's BRIRC prior to initiation of experiments dealing with bio-hazard materials. The principal criteria to be satisfied is the safety of University personnel and students.
- If a combination of increasingly stringent primary and secondary containment procedures and facilities is used, laboratory studies and manipulations can be safely conducted on agents that are correspondingly more hazardous.
- In general, the biosafety level used for activities using infectious agents or infected animals shall be commensurate with that required for the agent of highest virulence known or likely to be encountered in the course of contemplated work. For example: all diagnostic sera of human origin shall be considered potentially infectious for hepatitis and handled under conditions which reasonably preclude cutaneous, oral, and parenteral exposure to personnel. Sputa shall be considered as potentially infectious for tuberculosis and should be handled under conditions which reasonably preclude the generation of aerosols, or which contain any aerosols generated. If, in the course of diagnostic or other laboratory examinations, there is evidence that the materials being studied contain only an agent of higher or lower risk than expected, the biosafety level shall be raised or lowered accordingly.

Inspection of Labs in which Potentially Biohazardous Material Is Used

Quarterly inspections of each lab are required. Use the Louisiana Tech University Laboratory Safety Form

[FINE ARTS LABS SAFETY-](#) **NOTE- ALL GENERAL SAFETY AND GENERAL LAB SAFETY RULES APPLY**

Probably the earliest recognition of the hazards of various arts and crafts was by Bernardino Ramazzini in his book published in 1713, *The Disease of Workers*. Many of the art hazards and diseases described by Ramazzini can be found among artists and crafts people today. Although many art teachers and students know of certain hazards common to specific work practices and materials, this awareness often does not extend to many of the new materials and processes, some of which can be highly toxic. Many factors affect the degree of the hazards: frequency and duration of exposure, health and age of individuals, whether a woman is pregnant, amounts of materials used, even genetic background is crucial to the potential effect of the substance or process used. Remember, art materials are chemicals; faculty, staff, and students shall consider all the ways they may be exposed to these chemicals. Inquiries about specific art materials and how to work safely with them shall be made when first learning about a particular art

technique. Lung, liver, kidney, heart, and many nerve tissue disorders are becoming all too common among artists and crafts people.

Fortunately, the solution to preventing many of the illnesses and injuries found in art making activities is not complex: recognition of the potential hazards and reasonable hygienic and protective measures are the basic requirements. The lists that follow include general conditions that can exist in the art labs, shops, and studios with precautions and advice on ways to make these areas safer.

Fire Protection

- Every lab, shop or studio that stores or uses flammable or combustible materials must have a fire extinguisher suited to that type of material: (See Fire Safety Section)
- Smoking shall not be permitted in any area containing flammable materials, because flammable vapors can travel considerable distances.
- Used solvents, towels, rags, and other flammable debris shall be placed in approved waste containers and disposed of daily.
- Large quantities of used solvents such as turpentine or other paint thinners shall be transferred to DOT approved 55 gallon metal drums, appropriately marked and placed in the University's Hazardous Waste Program.
- Flammable solvents shall be covered and kept in safety containers for storage. See "Storage of Flammable Liquids."
- Clean up spills of flammable liquids immediately; practice good housekeeping.
- Do not store flammable liquids near heat sources or escape routes.

Hazardous Materials

- Label all containers clearly as to their contents and special hazards. (Many manufacturers have available on request, Material Safety Data Sheets, for their products.) In all cases, never use a material without knowing how to use it safely.
- Post safe-working studio guides listing any dangerous process or toxic material often used in the area.
- Hazardous liquids shall be neither poured into sinks or drains, nor dumped on or buried in the ground. These materials shall be placed in the University Hazardous Waste Program.
- Do not eat, smoke, or drink in areas with hazardous materials. This can result in ingestion of toxic materials. Furthermore, smoking can multiply the harmful effects of materials on the lungs and, in some cases, can convert materials into more hazardous forms. Post appropriate signs.
- Some materials are too hazardous for any exposure; those most related to art making activities are: Arsenic oxide, Asbestos, Benzene (benzol), Benzidine dyes, Carbon tetrachloride, chloroform, Trichloroethylene, Chromater pigment powder, Phenol (carbolic acid), Tetra Chloroethane, Uranium oxide.

Personal Protection

- Faculty, staff and students subject to exposure of non-toxic dust shall wear approved dust masks. If hazardous dusts or vapors are present, specialized air-purifying respirators shall be required. The respirator filter shall be appropriate for the particular contaminant present in the area. Persons with beards shall wear specialized respirators with fittings to insure a completed seal. (Misused face masks can cause serious injury; a dust mask used in toxic organic vapors can concentrate the exposure to lethal levels.)
- The face and eyes shall be protected from (a) flying particles from grinding, sanding, welding, drilling, cutting, chipping, etc., (b) splashes or dusts of acids, alkalis, and solvents, and (c) harmful radiation from infrared, ultraviolet, or glare. Specialized goggles, spectacles, face shields, or helmets shall be used.
- Emergency showers and eye wash stations shall be kept operable at all times, and shall be inspected regularly.
- Proper clothing including long-sleeved shirts, long pants, protective smocks, boots, or enclosed shoes with gloves shall be worn to protect from flying particles, chemical splashes, dust and radiation. Separate clothing for work ; that can be cleaned apart from regular clothing is preferred.
- Hearing protection, by the use of ear plugs or muffs, is an important consideration when working with equipment that produces high noise levels. If you have to talk loudly or shout to communicate within three feet, or if you experience a hearing loss after several hours exposure, you probably have a noise hazard. See "Personal Protective Equipment."

Housekeeping

- Cleaning up after work and keeping work areas clear of hazardous materials is essential to prevent needless exposure. As a guide to all areas, the following are the daily housekeeping requirements of the ceramics area.
- Basic studio and clay mixing room-Sweep with sweeping compound, damp mop, and empty trash.
- Glaze room-Sweep with compound, wet mop, and empty trash, and sponge down all tables and counter tops.
- Kiln yard-Empty trash, sweep with compound, or hose down floor.
- Offices and hallways-Sweep and remove trash. (Damp mop weekly.)
- In many areas with high accumulations of hazardous dust such as the ceramics clay mixing room, sculpture's investment making area, and stained glass cleaning room, special consideration shall be made for cleaning the furniture and lighting fixtures. Vacuum cleaning is preferable.

Ventilation

There are two basic types of ventilation, general and local exhaust ventilation. General ventilation attempts to dilute the concentration of toxic materials in the air with fresh air. Local exhaust attempts to remove contaminants before they mix with the general room air. Those areas with local systems such as printmaking and metal-smithing shall insure efficient ventilation through good maintenance and cleaning. If restricted air flow is suspected, the Office of Environmental Health and Safety shall be contacted.

Though few local exhaust systems exist, reasonable ventilation can be obtained as follows:

- Natural ventilation. Open doors and windows to bring in outside air. Increased natural ventilation is valuable in the painting studios, though it can cause general heating or cooling problems.
- General exhaust ventilation can be achieved by placing a fan in a window or other wall opening. (Windows near the one containing the fan shall be closed to insure efficiency.) All fans shall be properly maintained and kept clean.
- Floor or box fans provide little ventilation but will stir up the air and help prevent stagnant accumulations of heat and moisture. In small confined areas with operable windows or outside doors, some contaminants can be pushed out by such fans.

Many art materials contain the warning "Use With Adequate Ventilation" on their labels. Opening a door or window is simply not adequate. In order to reduce air contaminants, certain commonly used art materials shall be restricted. Spray paints, spray glues, spray fixatives, contact cements, and rubber cements shall not be used indoors unless approved local exhaust systems are available. The problem with many art materials is that they have a poor odor warning properties. Epoxy resins and glues for bonding plexiglass do not give off strong odors, yet both may cause liver damage and both are suspected carcinogens. Another problem is the length of time between exposure to certain hazardous materials and the onset of symptoms or reactions. Metal fume fevers, "zinc shakes," can appear from four to twelve hours after exposure to certain welding processes. The first symptoms to silicosis (exposure to air-borne silica sand), may appear anywhere from six months to twenty years after initial exposure.

Welding, Cutting, or Brazing

See "Safety Plan,-Safety in Welding and Cutting Operations."

Woodworking

See "Safety Plan-Rules for Woodworking Machines."

Use of Hand Tools and Portable Power Tools

See "Safety Plan-Rules for Control of Hand and Portable Power Tools."

GEOLOGY AND GEOPHYSICS LAB SAFETY-NOTE- ALL GENERAL SAFETY AND GENERAL LAB SAFETY RULES APPLY

While geology and geophysics suggest considerable time spent in the field, there is also much lab work associated with these sciences.

Hazards encountered field geology are addressed in the following “Field Lab safety” section. Most of the hazards encountered in laboratory geology are chemical hazards and are addresses in the Chemical Safety and Hazardous Communication Sections of the Safety Plan and in the “chemical” portion of this Laboratory Safety Plan. One application requires special attention: “the acid room”. An acid room is primarily used for the reduction of rock by chemical means and the separation of the resulting residues utilizing heavy liquids. These processes require the use of organic and inorganic chemicals with the accompanying hazards of burns, toxic reactions through vapors and skin contact, and ignition of flammable substances.

FIELD LABS SAFETY- NOTE- ALL GENERAL SAFETY AND GENERAL LAB SAFETY RULES APPLY

Louisiana Tech University staff and students are required to go into the field to pursue some types of academic and/or research work. Most field work requires travel to remote areas that do not have normal support services. **Just as is the case with a campus-based laboratory, it is critical to remember that any faculty or staff member who is in charge of a particular field activity are solely responsible for the safety of all student who are participating in the field activity that they have assigned to these students.** UNDER NO CIRCUMSTANCES SHOULD STUDENTS BEGIN A FIELD EXERCISE UNTIL THE FACULTY/STAFF MEMBER HAS FULLY BRIEFED THEM ON THE HAZARDS THAT THEY MAY ENCOUNTER AND HOW THE STUDENT CAN AVOID THEM.

Though all field environments differ, some general rules for personal safety and vehicular safety rules apply to all field situations it is imperative that the following are minimal safety rules for working in the field are minimal at best due to the fact that field work can take place in such diverse environments. It is expected that these rules be followed where conditions warrant:

Personal Safety

- Faculty should “scout out” any area to become familiar with the terrain and any hazards before taking students into that area. They should brief the students on the layout of the area where the field exercise it to take place.
- Students should work in groups and should never attempt a field exercise without a faculty or staff member present.
- Never split up with your partner in the field unless each knows where the other is headed and has agreed upon a meeting place and time. Work alone at your own risk.
- Students should be equipped with GPS devices and maps (if appropriate) of the area where the field exercise it to take place. Students should be encouraged to carry their cell phones or a “two-way” radio to use for communications while in the field. **Remember, cell phone often will not have reception!**

- Always carry a snakebite kit and an individual first aid kit. Know how to use both effectively.
- You know what you like to eat; it is also a good idea to know what likes to eat you in a given area, i.e., know the animal hazards in your particular area, as well as their habits. Charging through the brush like a bull is asking for a potential snake bite.
- Beware of the long-term effects of the sun. Carry salt tablets or electrolyte-replacement drinks, plenty of food and water and sunscreen. Wear adequate clothing. Shorts and abbreviated tops are not appropriate for all day exposure to the sun.
- Carry extra food and survival gear in case you have to spend the night out unexpectedly. Watch the weather when you are away from the vehicle. Obtain advance weather forecasts when preparing for departure.
- Carefully check all field gear before heading out; carry duplicates of critical items, i.e., individual first aid kits. Know any potential medical problems of companions in the field and how to treat them before being placed in an emergency medical situation. Know the physical limitations of all members of your field party - stamina and medical limitations. If you endanger one member of a party in remote terrain, you endanger the whole party. Know how to treat common field ailments, i.e., heat exhaustion, heat stroke, blisters, dehydration, as well as first aid emergency procedures.
- Be sure all members of a field party know how to get out of a field area and find help in case of an emergency. Do not sleep on the way to the work site and expect to know the way out.

Vehicle Safety

NOTE- ALL DRIVER SAFETY POLICIES APPLY- SEE SAFETY PLAN.

REMEMBER THAT ALL STUDENTS MUST HAVE SIGNED A CURRENT "HOLD HARMLESS AGREEMENT" BEFORE BEGINNING ANY FIELD TRAVEL. THE "HOLD HARMLESS AGREE FORM IS FOUND IN THE "FORMS" SECTION OF THE EHS HOME PAGE. **FAILURE TO SIGN THIS FORM IS A VIOLATION OF STATE LAW AND BOTH THE STUDENT AND THE FACULTY/STAFF MEMBER IN CHARGE WILL BE HELD ACCOUNTABLE FOR SUCH VIOLATION!!**

- Highway Travel
 - Always let someone know your destination, route, and arrival time so that authorities can be notified if you are delayed.
 - Perform your own safety inspection of the vehicle before leaving. Check lights, turn indicators, brakes, acceleration, steering, spare tire, inflation, working jack, chains, door locks, tire conditions, etc. If pulling a trailer, check brake lights and turn indicators on trailer to be sure electrical connection between vehicle and trailer is working properly.
 - Check the log book inside vehicle for list of recent repairs and servicing. Check fuel level and other fluid levels under the hood: water, transmission, oil, power brakes, etc. Be sure that you know the fuel capacity, fuel consumption rate, and distance to destination. Plan ahead for fuel stops. If possible, talk to the person who last had the vehicle for potential complaints about it, i.e., pulls when braking, etc.
 - Carry a tow bar or nylon tow strap made for that purpose. Tow chains can break, and the whiplash can cause injury to personnel or vehicle. Carry a large block of wood on which to put the base of the jack in case you have to jack up in mud or soft sediment. Carry a high-lift jack.

➤ Off-Road Travel

- Beware of the following off-road hazards: barbed wire and bailing wire (these can be picked up and wrapped around your axle); animals (cattle, deer, etc., especially at night); and objects such as logs, rocks, etc., which can damage your vehicle or cause hang ups. Know what is behind you before you back up, especially in woods, marshes, and parking lots. The farther you get from a main road, the more care should be used in crossing dry and wet washes and attempting 4WD roads. Always carry a shovel for digging if road operation is anticipated.
- If you get stuck in sand or soft sediment, let some air out of your tires for better traction. Spot large planks or toppled fenceposts as you drive into a field area. People have been known to use planks placed end to end to get out of mud and buried fence posts as a dead-man winch out
- Beware of approaching storms if you are on dirt roads; it is better to make a run for the nearest gravel road than try for one more sample locality and spend the night in your vehicle. Watch the weather.
- Get all flats repaired immediately or replace damaged tires.
- Carry a large first-aid kit in your vehicle at all times including a first-aid manual. Know what you have got, and how to use it.
- If you plan to be in an area so remote that you cannot walk out, carry some survival gear in your vehicle: sleeping bags, canned food, space blankets, extra individual first-aid kits, etc. You may have to spend the night in the vehicle.
- Use seatbelts at all times-both on and off the highway. Conduct your own safety inspections of your vehicle, especially tires, while in the field. Always lock your vehicle when you leave it in the field; most of your gear is irreplaceable while you are in the field and some of it may be needed to get you home safely.

HAZARDOUS CHEMICAL WASTE MANAGEMENT PLAN- SEE CHEMICAL SAFETY IN SAFETY PLAN

LABORATORY SAFETY SURVEY-

SEE "FORMS SECTION OF THE ENVIRONMENTAL HEALTH AND SAFETY WEB PAGE