LOUISIANA DELTA COMMUNITY COLLEGE

LABORATORY SAFETY MANUAL

This Manual is a Supplement to The Louisiana Delta Community College Safety Plan

EMERGENCY CONTACTS

Ambulance 911

North Louisiana Poison Control Center .....1 (800)222-1222

FIRE Monroe Fire Department.....911

Monroe Police..... 911

Security Coordinator……..345-9106

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PREFACE

The Laboratory Safety Manual ("Manual") was developed by the Louisiana Delta Department of Science and the Louisiana Delta Safety Committees to be used to address **general** laboratory safety issues that are common to most college **teaching** and **research** laboratories. It is an adjunct to the safety policies for all facilities and personnel that are specified in the Louisiana Delta Safety Plan ("Plan") and the Louisiana Delta Community College Exposure Control Plan for Bloodborne Pathogens.

The combination of safety requirements in these three documents apply to all faculty, staff, and students who engaged in the use of hazardous materials and specialized equipment in the College's laboratories and must be followed.

None of these documents addresses all of the unique safety issues which may be encountered in a specific laboratory or in the specialized laboratories. Nor do they address safety issues in laboratories using recombinant DNA technology, radionuclides, munitions, or additional safety policies required by many granting agencies. It is the responsibility of the Budget Unit Heads and the Laboratory Safety Coordinators of ALL laboratories to conduct a hazard analysis of each laboratory within their area of responsibility and to develop and implement any additional safety requirements which are needed to maintain a safe environment and to monitor ALL safety policies (including the safety training of personnel/students).

Any additional safety policies which are developed in a particular Budget Unit must be approved, at least, by the respective Division Heads of these units and by the College Safety Committee before these laboratories can become operational. The approval of other College committees may also be required.

INTRODUCTION TO LABORATORY SAFETY

A significant amount of the teaching, research, and service functions at Louisiana Delta routinely occur in laboratories. The chemical, biological, electrical, and mechanical hazards 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 ensure a safe workplace for all. **It requires the same amount of time, effort, and concern to establish and maintain a safe work environment as it does to establish and maintain a research or teaching program.**

The Louisiana Delta Safety Plan requires all College activities be conducted in accordance with standards of the Occupational Safety and Health Administration (OSHA), the Environmental Protection Agency (EPA), the Department of Health and Human Services/Centers for Disease Control/National Institutes of Health(DHHS/CDC/NIH), the Nuclear Regulatory Commission (NRC), the Louisiana Department of Administration's Office of Risk Management(ORM), and the Louisiana Department of Environmental Quality (DEQ)standards. These federal and State safety regulations and guidelines were consulted to develop the Louisiana Delta Community College Laboratory Safety Manual.

OSHA/ORM regulates general safety in the workplace, chemical hygiene, exposure control to chemicals and blood borne pathogens (www.osha.gov). EPA regulates chemical waste and disposal (www.epa.gov). DHHS/CDC/NIH regulates activities that involve biohazards. A set of guidelines is available through the CDC (www.cdc.gov). Any activities involving the use of **Recombinant DNA and Infectious Agents** are closely regulated by the federal government through the DHHS and CDC. **ABSOLUTELY NO ACTIVITIES WHICH INVOLVE THE USE OF OR DEVELOPMENT OF RECOMBINATE DNA OR THE USE OF INFECTIOUS AGENTS ARE TO BE CONDUCTED WITHOUT THE WRITTEN APPROVAL OF THE COLLEGE COUNCIL REVIEW COMMITTEE.**

NRC regulates all activities which involve the use of **radionuclides**. There are specific guidelines which are specified by NRC that must be followed when using these agents (www.nrc.gov). **ABSOLUTELY NO ACTIVITIES WHICH INVOLVE THE USE OF RADIONUCLIDES ARE TO BE CONDUCTED WITHOUT THE WRITTEN APPROVAL OF THE COLLEGE COUNCIL REVIEW COMMITTEE**.

GENERAL PROGRAM MANAGEMENT

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

1. A **Laboratory Safety Coordinator (LSC)** will be designated for each school, department, or other subdivision by the Budget Unit Head to serve as the budget unit liaison. Responsibilities of the LSC include the following:

a. Ensure that safety training of all persons using the budget unit laboratories is documented
b. Provide information about safety hazards to contract employees or maintenance employees working in the areas.
c. Serve as a conduit for information between laboratories in their budget unit.
d. Assist in inspections and other duties as available and as assigned.
e. Work with administrators and other employees to develop and implement appropriate safety policies and practices.
f. Monitor procurement, use, and disposal of chemicals used in the lab within their budget unit.
g. Maintain current knowledge concerning the legal requirements of regulated substances in the laboratory.
h. Conduct the annual chemical/biohazard audit and the semi-annual laboratory survey for each lab, storeroom, and preparation area within their budget unit.
i. Seek ways to improve the safety plans.

2. **Faculty (including laboratory assistants) and Principal Investigators** are responsible for maintaining safe operations in their labs **at all times**. Specific responsibilities include the following:

a. **Must assure the LSC and the Budget Unit Head** that a designated Louisiana Delta employee is present **at all times** in their laboratory when students or visitors are present.

b. Set a good example by (1) observing all safety rules and recommendations; (2) wearing protective equipment where recommended; and (3) being enthusiastic and proactive about safety.
c. Stay alert for unsafe conditions.

d. Take effective corrective action promptly.

e. Maintain discipline and enforce rules in the lab(s).

f. Prohibit the consumption of food and beverages and the application of makeup in the lab(s).

g. Review all laboratory protocols carefully for possible safety problems before they are assigned to students.

h. Provide to the LSC written standard operating protocols (SOP) for each laboratory procedure conducted in their work area(s). The SOP must include a list of the hazardous materials used in the procedure.

i. Require any student or employee in their work area to adhere to all safety regulations and

to use appropriate personal protective equipment as required.

j. Assisting the LSC to ensure that an inventory is completed for all hazards used in their work areas.

k. Review and understand MSDSs on materials used by students and employees under their direct supervision and inform them as new MSDSs become available.

l. Ensure that MSDS files are available in the work area and are readily accessible to students and employees.

m. Forward all student and employee requests for safety information promptly to the LSC.

n. Ensure that all containers of materials used in their work area are labeled by name, hazard category (if appropriate), and other pertinent information.

o. Ensure that all used hazardous material produced in the lab is properly disposed of in accordance with federal, state and local regulations.

3**. Laboratory Workers and Students** are required to:

a. Attend all appropriate safety training sessions to maintain a safe work environment.

b. Comprehend and follow all safety procedures and standards appropriate to their laboratories.

c. Remain informed of the appropriate use of hazardous materials and equipment in the lab.

LABORATORY TRAINING AND INSPECTION PROGRAM

All persons MUST receive comprehensive and documented laboratory safety training BEFORE they can work in any laboratories at Louisiana Delta Community College and obtain additional training when they add any potential hazardous material or processes to the labs in which they work. Periodic safety updates (usually annually) are mandatory after any initial training.

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

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

Untrained employees, students, or visitors shall not be permitted to 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 an employee who 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 Monroe Police shall also be provided.

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 ensure 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. 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, aerosols, or potentially infectious material. Mouth pipetting is strictly prohibited. No drinking, eating, or application of makeup is allowed in the laboratory. Food must not be stored in laboratory refrigerators. Do not heat a closed system (i.e.: 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 and fire extinguishers are required in all laboratory areas where any hazardous materials are used. Safety showers must be located within 100 feet of all such labs. 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 lab bench assembly to turn water, gas, or electricity on or off.

Guard against casual handling of glassware, as 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. ANY GLASS THAT HAS BEEN CONTAMINATED WITH A 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 associated hazards of the

instrument**.**

CHEMICAL HYGIENE PLAN

The Chemical Hygiene Plan is an integral part of the Safety Plan. These Sections contain detailed policies and procedures for the safe storage, use, and disposal of hazardous chemicals.

All personnel who use chemicals in the course of their work MUST adhere to requirements specified in the Louisiana Delta Community College Safety Plan, as well as those in this Manual.

The goals of the Chemical Hygiene Plan are as follows:

a. Minimize all chemical exposure – General precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals.
b. Do not underestimate risk – All materials used in labs should be considered toxic as well as a significant hazard including those of no documented risk. 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.
c. Provide adequate ventilation – The best way to prevent exposure to airborne substances is to work with them under hoods or other ventilation equipment.
d. 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.
e. 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 guidelines supplement the General Laboratory Safety Procedures and those in the Louisiana Delta Safety Plan:

1. Accidents and spills

a. All personnel should know the emergency procedures for responding to chemical spills.

b. Eye contact: promptly flush eyes with water for a prolonged period (15 minutes), and seek medical attention.

c. Ingestion or skin contact: Consult MSDS.

d. Clean-up: Promptly clean up spills using appropriate protective apparel, equipment and proper disposal methods.

e. All significant accidents should be carefully analyzed.

2. Avoidance of routine exposure.

All laboratory employees and students 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 the following:

a. Skin contact with all chemicals shall be avoided.

b. All employees shall wash all areas of exposed skin prior to leaving the laboratory.

c. Never test chemicals by taste or odor. If in doubt, do not use an unlabeled chemical.

d. Always remember that acids are poured into water, not vice versa.

e. 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.

3. Handling Cryogenic Liquids

Liquid nitrogen, liquid helium, dry ice, and any other liquefied gases must be stored in a well-ventilated area. The sublimation of dry ice, for example, reduces the percentage of available oxygen, posing a threat to personnel who enter.

4. Chemical Purchase, Labeling, and Storage

Any chemical that is obtained for use in any University Laboratory MUST be logged into the chemical inventory for that Budget Unit and into the chemical inventory for each laboratory in which the chemical is to be used.

Chemical purchases should be limited to those quantities reasonably expected to be used within 6 months or 1 year of purchase. Some more hazardous chemicals and chemicals with short shelf lives should be purchased in 3 month quantities or less. Chemicals MUST be labeled at the time they are received with the date received, expiration date, and the initials of the person who received the chemical. They also must be labeled with the date the chemical container is opened.

ALL USERS OF A CHEMICAL MUST REVIEW THE MATERIAL SAFETY DATA SHEET ON ALL CHEMICALS WHEN THOSE CHEMICALS ARE RECEIVED IN THE BUDGET UNIT TO DETERMINE STORAGE, HANDLING, AND DISPOSAL REQUIREMENTS.

All containers, regardless of size, that contain chemicals must be labeled with the same information that is found on the original container. Any mixtures of chemicals which are prepared for use in a lab must also be labeled as to chemical content, date of preparation, and initials of the person who prepared the solution.

NOTIFY YOUR LSC IMMEDIATELY IF YOU OBSERVE A CONTAINER OF UNLABELED CHEMICAL. YOUR LSC WILL PROPERLY DISPOSE OF THE CONTAINER AND ITS CONTENT WITHOUT HESITATION. A "FIRST-IN, FIRST-USED" SYSTEM OF CHEMICAL STOCK KEEPING MUST BE PRACTICED. NO CHEMICALS, REGARDLESS OF TYPE, SHOULD BE STORED LONGER THAN 5 YEARS, WITH MANY THAT WILL DETERIOATE INTO UNSTABLE FORMS IN MUCH SHORTER PERIODS.

Excessive storage of chemicals in individual labs should be limited to "working quantities" (the lowest practical minimum of 1 month supply or less) to minimize unnecessary hazards to laboratory workers. LABORATORIES SHOULD NEVER BE USED FOR LONG-TERM STORAGE OF ANY CHEMICAL. **The storage of quantities of chemicals which exceed "working amounts' must be stored in a controlled-access area, under the supervision and control of the LSC in that Budget Unit**.

5. Incompatible Chemicals

Separate storage areas should be provided for "incompatible chemicals" which may react and create a hazardous condition because of this reaction. The Department of Environmental Health and Safety can evaluate chemicals in your laboratory and/or provide charts which list incompatible chemicals. Also consult your MSDSs on all chemicals you plan to store together.

6. Collection for Chemical Waste/Disposal

Appendix A is the Louisiana Delta Hazardous Chemical Management Plan which details the proper methods for the identification, labeling, collection and storage of hazardous chemicals waste. This Plan MUST be followed. The LSC must advise all laboratory personnel in their Budget Unit on that Unit's policies and those in the Hazardous Chemical Management Plan for the proper methods of collecting and disposal of chemical waste and outdated chemicals and to coordinate these activities for that Unit. Some chemical such as well-diluted acids and bases (between the pH of 6-9) and certain chemicals can be flushed directly down the drain with plenty of water, but should only be done with the approval of the LSC or the Budget Unit Director.

7. 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 materials are to be handled only in hoods that are designed specifically for these purposes and NOT IN FUME HOODS.

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 or not a hood is safe is the velocity of air entering a hood at its face. A minimum face velocity of 100 linear fpm (feet per minute) for general laboratory hoods is recommended.

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 the following:

a. Perform face velocity checks if possible.
b. Limit accumulation of chemicals and/or equipment in hood. Such materials restrict air flow.
c. Assess number of sashes, condition, ease of movement, and cleanliness.
d. Do motor/belt inspection-Belts and motors shall be checked on a regular basis by Facilities Maintenance Personnel.

8. Emergency Showers and Eyewash Stations

Immediate washing of the skin and eyes 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, made readily available, remain operable, and be 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, remain open readily in either direction, and remain open until intentionally closed. Water flow pressure shall be sufficient to drench the subject rapidly or provide gentle flow in the case of eyewash fountains. **The shower and eyewash fountain area shall be kept clear of obstructions.** Only water of drinking purity shall 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 generous amounts of water under gentle pressure after checking for and removing contact lenses. Forcibly hold the eye open to wash thoroughly behind the eyelids. In the absence of an eyewash fountain, the injured person shall be placed on his/her back and water shall be gently poured into the eye. The injured eye shall be held open. The injured person 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 person to medical attention. Neutralizing agents shall not be used for chemical burns to the eye.

Portable eyewash stations are to be periodically inspected to ensure that 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 is part of the semi-annual lab audit. Test the operation of the units to determine sufficiency of water flow and valve operation. Observe physical condition of unit, and be sure unit is kept clear of obstructions.

9. Electrical Outlets

All electrical outlets shall carry a grounding connection requiring a three-pronged plug. All electrical equipment except glass-cloth heaters and certain model oscillographs requiring a floating ground shall be wired with a grounding plug. Continuity of grounding connections including leads to a 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 the use of proper equipment in hazardous areas.

10. Hearing Protection-Noise Control

Hearing conservation shall be practiced and controlled at the time of design and modifications of existing sources of noise, and with the use of ear protection. OSHA regulations allow noise levels for exposure times as follows:

Noise Level (dBA)	Exposure Time (hours)
85	8
95	9
100	2
105	2
115	¼

11. Eye Protection – See General Safety Requirements

a. 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.

b. The U.S. Food and Drug Administration 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 standard. The principal 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.

c. 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 10 – 15 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 poured 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 ensure maximum attention and feedback will be used to prevent future recurrences.

d. 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.

12. Refrigerators

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.

In accordance with "Labeling of Refrigerators Located in the Laboratories," 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."**

13. Flammable Liquids

In any fire or explosion occurring in a laboratory at the College, 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 liquids are defined as follows:

Class IA	Flashpoint below 73° F (23° C) and boiling point below 100° F (38° C)
Class IB	Flashpoint below 73° F (23° C) and boiling point at or above 100° F (38° C)
Class 1C	Flashpoint at or above 73° F (23° C) and below 100° F (38° C)
Class II	Flashpoint at or above 100° F (38° C) and below 140° F (60° C)
Class IIIA	Flashpoint at or above 140° F (60°C) and below 200° F (93° C)
Class IIIB	Flashpoint at or above 200° F (93° 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 (Underwriters 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. 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 without flammable liquid storage cabinets or flammable liquid safety cans.

THE FOLLOWING RULES APPLY WHEN DISPENSING FLAMMABLE LIQUIDS:

a. Dispensing of flammable or combustible liquids should be carried out only under a fume hood or in an approved storage room.

b. All drums containing flammable liquids for dispensing should be vented with approved safety bungs.

c. 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.

d. All drums and equipment subject to static accumulation must be grounded.

e. Dispensing should only be into approved containers, and any metal containers must be grounded to the drum.

f. All ignition sources must be eliminated from the area.

g. Good housekeeping standards should be maintained, and all combustible material should be eliminated, particularly at the flammable liquids location.

h. Portable fire extinguishing equipment must be provided, such as dry chemical, foam, or carbon dioxide.

i. **Do not dispose of flammable or combustible liquids in a sink or drain.** 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.

14. 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 College. 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. 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.

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 ensure 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.

15. 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". The operational requirements herein serve, in part, to indicate that facilities and resources should be made available to minimize hazards in work with specific microorganisms or other biohazards.

1. General Requirements

A. Only authorized employees, students, and visitors shall be allowed to enter these laboratories or utility rooms. All persons must have documented training in the safe handling of infectious agents.

B. MSDSs for infectious agents used in these labs must be available in these labs. See LSC for these MSDSs.

C. When the building vacuum line is used, suitable traps or filters shall be interposed to ensure that pathogens do not enter the fixed system.

D. 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.

E. 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.

F. 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.

G. An aerosol containment hood or enclosure shall be provided for sonicators, cream separators, and similar aerosol producing apparatus.

H. 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.

I. All inoculated Petri plates or other inoculated solid or liquid media shall be transported and incubated in leak-proof pans or other leak-proof containers.

J. 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 included on the label.

K. Floors, laboratory benches, and other surfaces in the buildings on which infectious or potentially infectious substances are handled shall be disinfected with a suitable germicide as often as deemed necessary by the lab supervisors. After completion of operations involving planting, pipetting, centrifuging, lyophilizing, and similar procedures with infectious agents, the surroundings shall be disinfected.

L. 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.

M. Floors shall be swept with push brooms only. The use of floor sweeping 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 College contractors.

N. Develop the habit of keeping hands away from mouth, nose, eyes, and face. This may prevent self-inoculation.

O. Deep freezers, 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.

P. Books and journals shall not be taken into rooms where work with infectious agents is in progress.

Q. 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.

R. Contaminated laboratory clothing shall not be worn in clean areas or outside the building.

S. All laboratory rooms containing infectious substances shall designate separate areas or shelters labeled "INFECTIOUS-TO BE AUTOCLAVED," or "NOT INFECTIOUS-- TO BE CLEANED" in which to place these materials. 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.

T. 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.

U. A respirator or gas mask shall be worn when changing a glove or gloves attached to a safety cabinet or changed because an infectious aerosol may be present in the cabinet.

V. All serum and human body fluid specimens shall be handled with impervious rubber gloves.

W. 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.

X. 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.

Y. Only single-use syringes of the Luer-Lok type with self-sheathing needles shall be used with infectious or potentially infectious materials.

Z. **Syringes and needles** shall be disposed of into specially-marked Sharps containers (not into general-use waste containers). Blunt needles (cannulas) shall be used whenever 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 firefighters, 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.**

2. Sterilization and Disinfection Procedures

The following guidelines apply to the sterilization of contaminated materials:

1. All infectious or potentially infectious materials, equipment, or apparatus shall be autoclaved or otherwise disinfected before being disposed of. Each individual working with infectious or potentially infectious material shall be responsible for its disinfection before disposal.

2. 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 follow:

a. Laundry-250 F (121 C) for 30 minutes with 15 minutes pre-vacuum of 27 inch Hg.
b. Trash-250 F (121 C) for 1 hour with 15 minutes pre-vacuum of 27 inch Hg.
c. Glassware-250 F (121 C) for 1 hour with 15 minutes pre-vacuum of 27 inch Hg for filled NTH Glassware can.
d. Liquids-250 F (121 C) for 1 hour for each gallon.
e. Animals-250 F (121 C) for 8 hours with 15 minutes pre-vacuum of 27 inch Hg.
f. Bedding-250 F (121 C) for 8 hours with 15 minutes pre-vacuum of 27 inch Hg.

3. **Materials shall not be placed in autoclaves overnight in anticipation of autoclaving the next day.**

4. Autoclaves shall be checked for operating efficiency using commercially available check strips or controls.

5. When gas sterilants are used, the following conditions must be maintained to achieve sterilization:

   a. Ethylene oxide base-16 hours' exposure to a concentration of 750 mg/liter (approximately 5%) at 30 to 60% relative humidity and at ambient temperatures (>70 F).
   b. 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 guidelines apply to disinfectants:

1. 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.

2. Quantitary 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.

3. 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.

4. 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 as follows:
    - 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 Sodium Thiosulfate.

5. Alcohols, in concentrations of 70% to 95%, are good general-use disinfectants, but they exhibit no activity against bacterial spores.

6. Formaldehyde Solutions, in concentrations of 8%, exhibit good activity against vegetative bacteria, spores, and viruses.

7. Activated Glutaraldehyde, in 2% solutions, exhibit good activity against vegetative bacteria, spores, and viruses. Its use, however, shall be limited and controlled because of its toxic properties and the damage to the eyes.

8. Formaldehyde-Alcohol, in solutions of 8% in 70% alcohol, is 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.

3. 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 biological laboratory: the Class I, the Class II, and the Class III cabinets.

a. 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, and 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 lyopilizers. 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.

b. 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.

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 reassure

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 plenums 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 their 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, Iyophilizers, 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.

c. 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 laboratory activities can be accommodated: the usual cultivation of microorganisms, fertile eggs, and tissue cells, microscopy, serology, animal dissections and injections, experimental aerosol exposures, various physical measurements, and many others on a small-to- large scale. 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.

d. 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 include the following:

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.**

- **The Budget Unit Head in the Units having these hoods are responsible for obtaining and funding this certification.**

- **Records of this certification must be kept in the respective Budget Units and be available for inspection at any time.**

4. Blood, Body Fluid, un-Fixed Animal Tissue

It is possible for a person to becoming infected with organisms found in ANY animal tissue or fluids.

IT IS ESSENTIAL THAT ANY PERSON WORKING WITH ANIMAL TISSUE OR FLUIDS FROM ANY ANIMAL EXERCISE THE "UNIVERSAL PRECAUTIONS" SPECIFIED IN THE EXPOSURE CONTROL PLAN FOR BLOOD-BORNE PATHOGENS.

ADDITIONAL MEASURES MUST BE TAKEN WHEN WORKING WITH HUMAN BLOOD, TISSUE OR BODY FLUIDS.

The Budget Unit Head in areas in which these tissues or fluids are being used is responsible for assuring that these requirements are met.

FINE ARTS SURVEY

Probably the earliest recognition of the hazards of various arts and crafts was by Bernardini Remazzini 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.

1. 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:

- Class A-Fires caused by wood, paper, textiles.
- Class B-Fires caused by flammable liquids.
- Class C-Electrical fires.
- Class D-Fires caused by combustible metals.

a) Smoking shall not be permitted in any area containing flammable materials. Flammable vapors can travel considerable distances. Post "NO SMOKING" signs.

b) Used solvents, towels, rags, and other flammable debris shall be placed in approved waste containers and disposed of daily.

c) 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 College’s Hazardous Waste Program.

d) Flammable solvents shall be covered and kept in safety containers for storage. See "Storage of Flammable Liquids."

e) Clean up spills of flammable liquids immediately; practice good housekeeping.

2. Hazardous Materials

A. Label all containers clearly as to their contents and special hazards. (Many manufacturers have Material Safety Data Sheets available on request for their products.) In all cases, never use a material without knowing how to use it safely.

B. Post safe-working studio guides listing any dangerous process or toxic material often used in the area.

C. 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 College's Hazardous Waste Program.

D. 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.

E. 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, and uranium oxide.

3. Personal Protection

A. 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 ensure a completed seal. (Misused face masks can cause serious injury; a dusk mask used in toxic organic vapors can concentrate the exposure to lethal levels.)

B. The face and eyes shall be protected from (a) flying particles from grinding, sanding, welding, drilling, cutting, chipping, etc.; (b) splashes or dusts of acid, alkali, and solvents; and (c) harmful radiation from infrared, ultraviolet, or glare. Specialized goggles, spectacles, face shields, or helmets shall be used.

C. Emergency showers and eye wash stations shall be kept operable at all times and shall be inspected regularly.

D. 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.

E. 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.

4. Housekeeping

   A. Cleaning up after work and keeping work areas clear of hazardous materials are essential to prevent needless exposure. As a guide to all areas, the following are the daily housekeeping requirements of the ceramics area:
      1) Basic studio and clay mixing room - Sweep with sweeping compound, damp mop, and empty trash.
      2) Glaze room - Sweep with compound, wet mop, empty trash, and sponge down all tables and counter tops.
      3) Kiln yard - Empty trash, sweep with compound, or hose down floor.

   B. 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.

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

   A. 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. (Closing all solvent containers and removing solvent drenched rags, towels, and paint spills reduce the amount of air contamination considerably.)

   B. 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 ensure efficiency.) All fans shall be properly maintained and kept clean.

   C. 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.

   D. 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 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 onslaught of symptoms or reactions. Metal fume fevers, "zinc shakes," can appear from four to twelve hours after exposure to certain welding processes.

FIELD WORK

On occasion, Louisiana Delta staff and students are required to go into the field to pursue academic and/or research work. Most field work requires travel to remote areas where individuals are, many times, away from cities or towns and normal support services. Armed with this knowledge, it is contingent on all who participate in such endeavors to provide for their own safety as much as possible.

The following safety rules are minimal at best because field work can take place in such diverse environments. It is expected that these rules be followed where conditions warrant:

- Personal Safety (Louisiana and Gulf Coast)-Field work in mountainous or desert terrain shall only be undertaken under the supervision of someone experienced in the area.

- Vehicle Safety (Gulf Coast)-Vehicle operation in mountainous or desert terrains shall not be undertaken without prior experience or training.

- Boat and Trailer Operation.

1. <u>Personal Safety</u>

    A. Always carry an individual first aid kit and know how to use it effectively.

    B. Never split up with you partner. Always know where all members of your party are located.

    C. Use two-way radios in remote locations, especially if your party splits up.

    D. Beware of the long-term effects of the sun. Carry salt tablets, plenty of food and water (or Gatorade), and sunscreen. Wear adequate clothing. Shorts and abbreviated tops are not appropriate for all day exposure to tropical sun.

    E. 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.

    F. Carefully check all field gear before heading out; carry duplicates of critical items, i.e., individual first aid kits. Know any potential medial 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 how to use first aid emergency procedures.

    G. 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.

H. Use common sense in all field situations. Carry adequate energy food and liquids for snacking on long or hot days. Consider electrolyte replacement in your selection of drinks.

2. Vehicle Safety

A. Always let someone know your destination, route, and arrival time so that authorities can be notified if you are delayed.

B. 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 the trailer to be sure the electrical connection between vehicle and trailer is working properly.

C. Check the log book inside the 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.

D. 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.

E. 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.

F. If you get stuck in sand or soft sediment, let some air out of your tires for better traction. Beware of approaching storms if you are on dirt roads. Watch the weather.

G. 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.

H. 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.

I. 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.

APPENDIX A

HAZARDOUS CHEMICAL MANAGEMENT PLAN

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PREFACE

Similar to the strict environmental legislation imposed on industrial corporations, the University community is confronted with the regulation of emissions, discharges, and waste generation. As a result, federal and state environmental agencies are monitoring college campuses to ensure compliance to the imposed regulations. Particular emphasis is being placed upon the generation, storage, and disposal of hazardous chemical waste. Consequently, to minimize potential health and environmental impacts, and to comply with current federal and state hazardous waste regulations, Louisiana Delta Community College has developed a Hazardous Chemical Management Plan and Training Program.

The Louisiana Delta Hazardous Chemical Management Plan incorporates the following sections:

APPLICABLE HAZARDOUS WASTE REGULATIONS

In response to the national concern for the proper management of hazardous waste, numerous environmental regulations have been enacted to form the current federal hazardous waste regulation program. This section provides a brief review of the regulations used to generate the Louisiana Delta Hazardous Chemical Management Plan.

Resource Conservation and Recovery Act (RCRA)

To meet the disposal needs resulting from the Clean Air and Clean Water Acts, Congress enacted the Resource Conservation and Recovery Act in 1976, as an amendment to the Solid Waste Disposal Act of 1965. The main objective of RCRA was to address the safe disposal of large volumes of waste, both hazardous and nonhazardous, generated by society.

The RCRA framework does not address the problems of hazardous waste encountered at abandoned or inactive sites, or those requiring emergency response. The Comprehensive Environmental Response Compensation, and Liabilities Act (CERCLA), also known as Superfund, addresses such occurrences.

Hazardous and Solid Waste Amendments (HSWA)

As amended by the Hazardous and Solid Waste Amendments of 1984, the scope of RCRA was increased to include legislation covering waste minimization, land bans on untreated hazardous waste, new technology standards for land disposal facilities, new requirements for small quantity generators, and standards for underground storage tanks.

Superfund Amendments and Reauthorization Act (SARA) - Title III

In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act (EPCRA) as Title III of the Superfund Amendments and Reauthorization Act. Although listed under Superfund, SARA Title III is a completely separate law and is therefore labeled Title III.

Under Title Ill, Louisiana Delta is required to notify state and local authorities of releases of a reportable quantity (RQ) of extremely hazardous substances (40 CFR, Part 355, Appendix A). To date, Louisiana Delta has not experienced a release of this magnitude.

Louisiana Administrative Code. Title 33. Part V. (LAC 33:Y)

It is the intent of the RCRA to have the nation's hazardous waste managed by the individual states, with only minimal oversight from the federal government. As a result, the State of Louisiana has developed an EPA-approved hazardous waste program under Title 33, Part V, of the Louisiana Administrative Code. The regulations created under this plan parallel those defined under RCRA Subtitle C. Under Title 33 of the Louisiana Administrative Code, the RCRA governing authority in the State of Louisiana is the Department of Environmental Quality (DEQ).

RESPONSIBILITIES OF COLLEGE PERSONNEL

All college personnel who use hazardous chemicals are assigned the following responsibilities:

- completion of an annual chemical inventory
- identification of hazardous waste, minimization of hazardous waste, on-site treatment and disposal
- labeling, collection, and storage of hazardous waste

Success of this plan will occur only through the full cooperation of all College personnel.

Completing an Annual Chemical Inventory

Each department using chemicals to perform its function is required to submit an annual chemical inventory to the Division Head. The information provided by the chemical inventory enables the Department to perform the following functions:

- to isolate particularly hazardous chemicals,
- to identify substances that warrant specific disposal procedures,
- to identify excess and unused chemicals, and
- to maintain a perpetual inventory of departmental chemicals.

All data obtained from the chemical inventory are entered into a computerized chemical inventory database. Capabilities of the database include, but are not limited to, the following operations: identifying all locations of a selected chemical, determining all chemicals stored in a specific building, or listing the chemicals owned by a particular department. In the event of a fire or a hazardous chemical spill, this information alerts emergency response personnel of imminent danger.

Identifying Hazardous Waste

The following section describes the criteria designating a chemical as hazardous waste. This section is provided for information purposes only. If a college member has any question as to the classification of a particular chemical waste, the substance shall be retained for evaluation appropriate safety personnel.

All personnel generating chemical waste must determine if the waste is hazardous by considering the characteristics and chemical composition of the waste. A current listing of all hazardous wastes can be found in 40 CFR 261, which classifies waste under two categories:

1. Category I wastes include known chemicals and process streams whose hazardous nature has been prescribed by prior determination. Wastes listed in this section will fall under one of the following classifications:

    - non-specific source wastes (F-wastes, 40 CFR 261.31), specific source wastes (K-wastes, 40 CFR 261.32), or

    - commercial chemical products (acutely toxic P-wastes and toxic U-wastes, 40 CFR 261.32(e) and (t), respectively).

2. Category II wastes include those designated as hazardous based on classical analytical procedures. The four waste categories include ignitability, corrosivity, reactivity, and toxicity.

If a waste is listed under Category I, or it exhibits any one of the characteristics listed under Category II, it must be handled through the Louisiana Delta Community College Hazardous Waste Disposal System. In addition, if an unknown material cannot be identified by either prior knowledge of the process which produced it, or by a proper label, it must be analyzed. **THE COST OF ANALYSIS IS THE RESPONSIBILITY OF THE DEPARTMENT GENERATING THE WASTE**.

Any mixture of a hazardous waste and a solid waste is deemed hazardous if the hazardous waste is a listed waste (Category I) or if the mixture exhibits any of the four characteristics designating a Category II waste.

A. Characteristic of Ignitability

The EPA chose the characteristic of ignitability to identify wastes that could potentially ignite during storage, transport, or disposal. A "solid" waste (a term including solid, semi-solid, liquid, or contained gaseous materials) that exhibits the characteristic of ignitability, but is not listed as a hazardous waste under 40 CFR 261 (i.e., a Category I waste) has an EPA hazardous waste number of D001. A waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties (40 CFR 261.21):

- it is a liquid that has a flash point less than 60°C (140°F),
- it is a non-liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, bums so vigorously and persistently that it creates a hazard, or
- it is an ignitable compressed gas or oxidizer (49 CFR 173).

B. Characteristic of Corrosivity

The EPA chose the characteristic of corrosivity because wastes with low or high pH react dangerously with other wastes. A solid waste that exhibits the characteristic of corrosivity, but is not listed as a hazardous waste under 40 CFR 261 (i.e., a Category I waste) has an EPA hazardous waste number of D002. A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has the following property (40 CFR

261.22):

- aqueous solution with a pH less than or equal to 2 or greater than/equal to 12.5.

C. Characteristic of Reactivity

The characteristic of reactivity was chosen because the potential for explosion during transportation, storage, or disposal. A solid waste that exhibits the characteristic of reactivity but is not listed as a hazardous waste under 40 CFR 261 (i.e., a Category I waste) has an EPA hazardous waste number of D003. A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties (40 CFR 261.23):

- it is normally unstable and readily undergoes violent change without detonating;
- it forms potentially explosive mixtures with water;
- when mixed with water, it generates toxic gases in a quantity sufficient to present danger to human health or the environment;
- it contains cyanide or sulfide which, when exposed to pH conditions between 2.0 and 12.5, can generate toxic gases;
- it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

D. Characteristic of Toxicity

A solid waste exhibits the characteristic of toxicity if the extract from a representative sample of the waste contains any of the contaminants listed in Table 1 at a concentration greater than the regulatory limit. EPA hazardous waste numbers D004 through D043 correspond to the toxic contaminant causing the sample to be hazardous.

The EPA has selected the Toxicity Characteristic Leaching Procedure (TCLP) as the method for determining the characteristic of toxicity. The procedure (reference 40 CFR 261, Appendix II) is designed to identify wastes likely to leach hazardous concentrations of particular toxic constituents into the ground water as a result of improper management (U.S. Env. . . , 1989a).

Since the late 1980s, the shift from "end-of-pipe" pollution control to prevention of waste generation at the source has become the primary goal of the Environmental Protection Agency (Spearot, 1993). Consequently, waste minimization is an integral part of the Louisiana Delta Community College Hazardous Chemical Management Plan. Waste minimization is defined as

> "any source reduction or recycling activity that results in either reduction of total volume of hazardous waste or reduction of toxicity of hazardous waste, or both, as long as that reduction is consistent with the general goal of minimizing present and future threats to human health and the environment" (U.S. Env. . . , 1989a).

The most effective means to reduce or eliminate the need for and cost of hazardous waste disposal is to limit or eliminate the processes that generate the waste (Stillman, 1991).

The following reduction options (i.e., reducing the quantity of hazardous chemicals used) are recommended to reduce the generation of hazardous wastes:

- Use alternate chemicals which do not require treatment as hazardous waste when discarded (e.g., using alcohol or digital thermometers in place of mercury thermometers).
- Adopt prudent purchasing practices (i.e., order only what is needed). For some hazardous chemicals, disposal costs are frequently more than the original purchase price. Bulk purchases of hazardous chemicals offer no savings if the unused stock is given up for disposal (Stillman, 1991).
- Maintain a current chemical inventory to prevent the purchase of hazardous chemicals that may already be in stock.
- Reduce the size of laboratory experiments to decrease the amount of waste produced.

Recycling of unused chemicals can also reduce the amount of hazardous waste requiring disposal. The following recycling practices can significantly reduce the generation of hazardous wastes:

- Determine if surplus or unused hazardous chemicals can be used by another person or department.
- Look internally before purchasing additional chemicals.

Each individual utilizing hazardous chemicals is responsible for initiating the practices listed above. Louisiana Delta Community College welcomes any questions or recommendations pertaining to hazardous waste minimization.

Performing On-site Treatment and Disposal

In addition to reduction and recycling, on-site treatment reduces the amount of hazardous waste requiring disposal. Many chemical wastes which are unable to be used by other departments (i.e., are non- recyclable), can be detoxified within the laboratory and discharged to the sanitary sewer. For example, neutralization of pure acids and bases, followed by disposal to the sanitary sewer system, is the simplest form of on-site treatment. Unfortunately, detoxification procedures are beyond the ability of most departments.

Labeling, Collecting and Storing Hazardous Waste

Each department generating hazardous chemical waste must create a dedicated "satellite accumulation area." Besides providing a controlled storage location for hazardous chemicals, satellite accumulation eliminates the case-by-case pickup of wastes needing disposal.

Container Requirements

Numerous requirements exist for containers located in satellite accumulation sites, including container labeling, storage, and collection procedures.

1. All containers shall remain closed at all times, except when adding waste. This will prevent release of the waste if the container were to fall on its side.
2. All containers should be compatible with their contents (e.g., acid should not be stored in metal containers). Hazardous chemical waste must not be placed in unwashed containers that previously contained an incompatible waste.
3. All containers shall be in good condition (i.e., no apparent structural defects, leakage, etc.) with a clean outer surface. Containers not meeting this requirement will require replacement.
4. All containers shall be less than or equal to 5-gallon capacity, filled to no more than 90% capacity, to promote safety during transport.

Container Labeling Requirements

Accurate labeling of hazardous waste containers is essential to enable the efficient and safe identification of containers by LA Delta representatives. Containers that have lost their labels must be treated as unknowns requiring analytical testing at the expense of the responsible department.

The following labeling instructions apply for each hazardous waste container located at a satellite accumulation area:

1. A properly filled out "hazardous waste identification tag" must be securely attached before introducing waste into the container. The tag must remain clearly visible at all times and shall include the following information:

    - person responsible for contents (i.e., person most familiar with the waste), telephone, building name, and office number of responsible person;
    - complete chemical name (chemical formulas, abbreviations, or trade names are prohibited); and
    - volume percent total (i.e., the percentage of each chemical type stored in the container).

2. Labels should be clearly printed using indelible ink pen (i.e., no pencils, markers, or cursive writing), except for compatible waste collection, as described in (1) above.

3. If a waste is accidentally deposited into the wrong container, note the chemical

composition of the added waste, the approximate volume of the added material, and the date it was deposited in the container.

Container Storage and Collection Requirements

The following requirements apply to each satellite accumulation area:

1. To minimize the amount of hazardous chemical waste stored at a satellite accumulation area, it is requested that a hazardous chemical pickup be scheduled monthly.
2. No more than 55 gallons of hazardous waste or one quart of acutely hazardous waste shall be stored at a satellite accumulation area. The storage areas must be secured to prevent inadvertent access (i.e., locked when unattended). This will prevent inadvertent use of designated containers by other areas.
3. Wastes must be compatible with other wastes and hazardous materials in the same area. Incompatible wastes such as strong acids and strong bases must be separated.
4. Each satellite accumulation area must be inspected weekly by the individual responsible for that site. The inspector shall check for container deterioration, leaks, compatibility with contents, and proper labeling. The results of weekly inspections shall be recorded.

Adherence to these requirements will promote the safe storage of hazardous chemical waste, and satisfy State hazardous waste regulations. The State of Louisiana Department of Environmental Quality has the right to inspect any satellite accumulation area on campus at any time. If such an inspection were to occur, violation of any of these requirements would result in substantial fines to the College as a direct consequence of departmental inaction.

Special Notes to College Personnel Producing Hazardous Wastes

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- **Penalties for the illegal disposal of hazardous chemical waste**: Currently, the solid waste and sewer systems at Louisiana Delta Community College are routinely monitored for hazardous waste constituents. Federal and state regulatory agencies are authorized to seek civil or criminal penalties for illegal disposal of hazardous chemical waste. Individuals guilty of such violations can be brought to court and face mandatory penalties as well as imprisonment.

- **Satellite accumulation considerations**: Although waste may be accumulated at a satellite accumulation site until the total waste accumulation reaches 55 gallons, it is recommended to request a monthly waste pickup as a minimum. A regular monthly pickup schedule will enhance safety by minimizing the quantity of waste on-site at any time.

- **Plan ahead for waste pickups**: In addition to accuracy, it is equally important to submit timely requests for waste disposal. This will prevent exceeding the Storage limit and promote safety at the satellite accumulation site.

- **Label your waste completely**: It is up to the responsible faculty or staff member to

complete these items as carefully and conscientiously as possible. The incorrect or illegible labeling of any substance could result in injury to College personnel.

- **Disposal of empty chemical containers**: Empty containers of waste, commercial products or chemicals can be disposed of in the dumpsters if no free-standing liquid remains in the containers and all disposal requirements noted on the label are complied with. Pesticide containers must be triple rinsed and perforated on both ends prior to disposal.

EMERGENCY RESPONSE TO HAZARDOUS WASTE SPILLS

The following general rules should be followed in the event of a hazardous materials spill or other emergency

- **Activate fire alarm if necessary**: Be familiar with fire alarm pull station locations and operation in your building. Activate the alarm if the incident could threaten the health of individuals in the building.

- **Treat life threatening injuries**: The first priority in the event of an emergency is to protect the lives and health of individuals. In doing so, do not unnecessarily jeopardize your own safety.

- **Evacuate all personnel and prevent access to the area**: Barricades of some sort should be set up to prevent inadvertent access to the area of the spill.

- **Contain the spill (if it can be done safely) to prevent further release into the environment**: If the spill can be safely contained, prevent release to the sanitary sewer system, the stormwater sewer system, and the ground.