

Tuskegee University Laboratory Safety Manual

June, 2011

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Conduct laboratory inspections to ensure these goals are being met.

While the Lab Safety Manual is an important part of laboratory safety, not all safety issues involve chemicals. Therefore, it is important to establish additional safety policies and practices regarding biological, physical, electrical, and life safety considerations and incorporate them into the overall laboratory safety program.

RESPONSIBILITY FOR SAFETY

Responsibility for laboratory safety and chemical hygiene in the laboratory rests with the President, Provost, the responsible Dean, the responsible Department Head, the Laboratory Supervisor or Principal Investigator (PI), and the Laboratory Worker.

The University President and Provost

The University President has the ultimate responsibility to ensure the protection of the health and safety of its employees, students, and visitors in all laboratories within the University. The Provost, Deans, Directors, and the Department Heads must provide continuing support for institutional laboratory safety.

Deans and Department/Unit Heads

The responsibility for safety in a college (or other administrative unit) lies with the Dean of that College. The responsibility for safety in a Department or Unit rests with that Department/Unit Head.

Environmental Health & Safety Officer

Environmental Health & Safety Officer will serve as the Chemical Hygiene monitor (SO). The SO is a

The Laboratory Supervisor or Principal Investigator has the overall responsibility of administering and enforcing the LSM in the laboratory. Duties are as follows:

Ensure that the laboratory worker understands and

STANDARD OPERATING PROCEDURES AND TRAINING FOR EMPLOYEES

Know the location of all emergency equipment in the laboratory and the proper procedure for each.

Be familiar with all laboratory emergency procedures.

Be alert to unsafe conditions and actions, and alert the Safety Officer, Laboratory Supervisor or Principal Investigator.

Follow acceptable waste disposal procedures to avoid hazards to the environment.

Ensure that all chemicals are correctly and clearly labeled.

Post warnings when unusual hazards exist, such as flammable materials or biological hazards.

Use equipment only for its originally designed purpose.

Do not work alone in the laboratory if any hazardous procedures are being conducted.

Do not store, handle, or consume food in the laboratory.

Never prepare or consume food or beverages in

An approved chemical fume hood must be used when

Confine long hair and loose clothing when in the laboratory.

When working with corrosive liquids, or with allergenic, sensitizing or toxic chemicals wear gloves made of a material known to be resistant to permeation by the chemical. Test gloves for the absence of pinhole leak by air inflation; do not inflate by mouth.

Do not wear

Toxicity

Ingestion
(mg/kg)*(LD)

Inhalation

- is identified by the Department of Transportation as an oxidizer, an organic peroxide, or a Class A, B, or C explosive;

the EPA definition of reactive in 40 CFR 1361.23;

The OSHA definition of unstable in 29 CFR 1910.1450 or found to be reactive with other substances.

Reactive chemicals should be handled with all proper safety precautions, including segregation in storage and prohibition on mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.

Procedures for Corrosive Chemicals and Contact Hazard Chemicals

Corrosivity, allergenic, and sensitizer information is sometimes given in manufacturers' MSDSs and on labels. Also, guidelines on which chemicals are corrosive can be found in other OSHA standards and in regulations promulgated by DOT in 49 CFR and the EPA in 40 CFR

A corrosive chemical is:

A chemical that causes visible destruction of or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the US Department of Transportation in Appendix A to 49 CFR part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term

Store all adverse chemicals in locked and enclosed spaces with a slight negative pressure compared to the rest of the building.

Do not wear jewelry when working in designated areas, because the decontamination of jewelry may be difficult or impossible. Wear long sleeved clothing and gloves known to be resistant to permeation by the chemical to be used when working in designated areas.

CONTROL MEASURES AND EQUIPMENT

Chemical safety is achieved by continual awareness of chemical hazards and by keeping the chemical under control by using precautions, including engineering safeguards such as fume hoods. Laboratory personnel should be familiar with the precautions to be taken, including the use of engineering and other safeguards.

The Laboratory Supervisor or PI should be alerted to detect the malfunction of engineering controls and other safeguards and bring to the attention of appropriate personnel for corrections. All engineering safeguards and controls must be properly maintained, inspected on a regular basis and never overloaded beyond their design.

Ventilation

Laboratory ventilation should be not less than six calculated air changes per hour. This flow is not necessarily sufficient to prevent the accumulation of chemical vapors. Therefore, when working with toxic chemicals fume hoods should always be utilized.

Fume hoods should provide 80 ft² linear feet per minute of airflow when the sash is open 18 inches.

Laboratory employees should understand and comply with the following:

Work should not be done if hood has been red tagged, the low flow alarm is on, and the vaneometer indicates no air movement is occurring through the hood. Or the user detects chemical odors coming out of the hood. Environmental Health & Safety officer should be contacted immediately to investigate the problem.

A fume hood is a safety backup for condenser traps, or other devices that collect vapors and fumes. It is not used to "dispose" of chemicals by evaporation unless the vapors are trapped and recovered for proper waste disposal.

Any apparatus inside the fume hood should be placed on the floor of the hood at least six inches away from the front edge.

The sash should be kept at least 4 inches from the work surface. The sash should be kept at least 4 inches from the work surface.

The hood fan should be kept "ON" whenever a chemical is inside the hood, whether or not any work is being done inside the hood.

Personnel should be aware of the steps to be taken in the event of power failure or other hood failure.

Maintenance personnel should inspect hood vent ducts and fans, following the manufacturer's procedures at

Table2

Sec1 LabType	Sec2 HazardClass	Sec3 Maximum Quantity/100sqft
Non teachinglab	I	10 gal
Non teachinglab	Combinationof I, II, IIIA	20 gal
Teachingab	I	5 gal
Teachingab	Combinationof I, II, IIIA	10 gal

Please see section 3 regarding the maximum quantity of flammable or combustible chemicals allowed per container

Eyewash Fountains and

When exposure monitoring reveals an exposure level to be above the action level or permissible exposure limit for which there are exposure monitoring and medical surveillance requirements, medical surveillance should be established as prescribed by the standard.

When an event such as a spill, leak, or explosion occurs resulting in the likelihood of a hazardous exposure, medical consultations should be provided to determine the need for a medical examination.

All medical exams and consultations must be performed by or under the direct supervision of a licensed physician and should be provided without cost to the exposed individual, without loss of pay, and at a reasonable time and place. The laboratory supervisor should provide the following information to the physician:

The identity of the hazardous chemical(s) to which the individual may have been exposed;

A description of the conditions under which the potential exposure occurred including quantitative exposure information, if available; and

A description of the signs and symptoms of exposure that the individual is experiencing if any.

The Department of Environmental Health & Safety must obtain a written opinion from the physician performing the examination or consultation, which must include the following:

Any recommendation for further medical follow up.

The results of the medical examination and any associated tests.

Any medical conditions which may be revealed in the course of examination which may place the individual at increased risk as a result of exposure to a hazardous chemical found in the laboratory; and

Statement that the individual has been informed by the physician of the results of the consultation or examination and any medical condition that may require further examination or treatment. The written opinion should not reveal specific findings of diagnoses unrelated to occupational exposure

CHEMICAL HANDLING AND EXPOSURES

GENERAL

Chemical reactivity, recommended protective equipment, and spill and first aid procedures. Because of this, each student and employee should be familiar with the location and types of information available in MSDS. If there are any questions about

Corrosives include strong acids, strong bases, dehydrating agents, and oxidizing agents. These chemicals erode the skin and respiratory epithelium, damage the eye and cause severe bronchial irritation.

Acids

All concentrated acids can damage the skin and eyes. Nitric, chromic, and hydrofluoric acids are particularly damaging because of the types of chemical burns they inflict.

When handling these chemicals appropriate gloves, aprons, and face shields must be used.

Bases

Common bases include sodium hydroxide, potassium hydroxide

Chemicals should not be stored on shelves above eye level;
Never stack bottles on top of each other;

Never store chemicals in aisles, stairways and hallways, or floors;

Store chemicals only on sturdy shelving, which has a raised lip edging, and has been secured to the wall;

Bottles of flammable liquids should not be stored near combustible materials;
All chemical containers should be labeled with the date of receipt and the initials of the responsible person.

Inventory

Proper inventory control is essential in the laboratory. All PI's or laboratory managers are required to inventory (Appendix 3) their chemicals when they set up their labs. Chemicals that are inherited with the lab should be disposed of if they are of no use. Subsequent receipt of chemicals must be dated, initialed, and included on the chemical inventory list when they are received. Additionally, the following principles are involved in this process:

Chemicals should be purchased in limited amounts. A six month supply or less is generally the amount preferred.

Information about every chemical received, such as date received, manufacturer, and quantity, is recorded to ensure a "cradle to grave" record for that substance; refer to Appendix 3, Chemical Inventory Form.

A first in, first out system should be used. This practice ensures less of likelihood that chemicals will deteriorate beyond use or exceed their shelf life.

Chemicals should be examined semi-annually. During the inspection, those chemicals which have the following conditions should be disposed of by the proper procedures:

those that exceed their appropriate shelf life;

deterioration of the chemical (visible by change in color; sedimentation or opacity);

questionable labels or no label;

leaking containers;

Corroded caps.

Special Considerations

In addition to the general requirements for storing chemicals, various groups of chemicals have special considerations.

Flammables

When flammables must be stored in a refrigerator, an approved flammable material storage or explosion resistant unit that has been labeled as such must be used. Containers should never be stored in a refrigerator uncapped. Chemical containers should be capped to ensure a seal that is both vapor tight and unlikely to permit a spill.

The contents of any compressed gas cylinders shall be clearly identified for easy, quick, and completed determination by any laboratory worker. Such identification should be stenciled or stamped on the cylinder or a label, provided that the label cannot be removed from the cylinder. Commercially available three part tag systems can be very useful for identification and inventory. No compressed gas cylinders shall be accepted for use that does not legibly identify its contents by name. Color coding is not a reliable means of identification; cylinder colors vary with the supplier, and label on cap has little value, as caps are interchangeable if the labeling on cylinder becomes unclear or an attached tag is so defaced to the point the contents cannot be identified, the cylinder should be marked "contents unknown" and returned directly to the manufacturer.

Lines

All gas lines leading from a compressed gas supply should be clearly labeled to identify the gas, the laboratory served, and the relevant emergency telephone numbers. The labels should be color coded to distinguish hazardous gases (such as flammable, toxic, or corrosive substances) (e.g., a yellow background and black letters). Signs should be conspicuously posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions (e.g., **HYDROGEN FLAMMABLE GAS NO SMOKING NO OPEN FLAMES**).

Handling and Use

Gas cylinders shall be secured at all times to prevent tipping. Cylinders may be attached to a bench top, individually to the wall, placed in a holding cage, or have a non tip base attached. Cylinders shall never be stored on their side.

When new cylinders are received, they should be inspected. During this inspection, one should insure the proper cap is securely in place and the cylinder is not leaking. Cylinders shall have labels clearly indicating the gas. Labels should then not be

When the cylinder needs to be removed or is empty, all valves shall be closed, the system bled, and the regulator removed. The valve cap shall be replaced, the cylinder clearly marked as "empty," and returned to a storage area for pickup by the supplier. Empty and full

Generally, when cleaning glassware a simple cleaning with soap and water is sufficient. In some cases more aggressive techniques may be necessary. For biologically contaminated glassware the contaminated glassware should be autoclaved before cleaning. When using chemicals, such as an acid wash, to further clean

Electrical cords or other lines shall not be suspended unsupported across rooms or passageways. Do not route cords over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc. Do not run cords through holes in walls or ceilings or through

Never use red biohazard bags to autoclave. Use blue autoclave bags that can be obtained from the Scientific Supply Store.

Autoclaves

The use of an autoclave is a very effective way to decontaminate infectious waste. Autoclaves work by killing microbes with steam and pressure. Although they are very effective sterilizers, accidents and injury can occur through improper use. In order to safely operate the autoclave, the following procedures must be utilized.

Use caution when handling an infectious waste autoclave bag, in cases where sharp objects were inadvertently placed in the bag. Never lift a bag from the bottom to load it into the chamber.

Do not overfill an autoclave bag. Steam and heat cannot penetrate as easily to the interior of a densely packed autoclave bag. Frequently the outer contents of the bag will be treated but the innermost part of an overfull bag will be unaffected.

Do not overload an autoclave. An overpacked autoclave chamber does not allow efficient steam distribution. Considerably longer sterilization times may be required to achieve decontamination if an autoclave is tightly packed.

Conduct autoclave sterility testing on a regular basis using appropriate biological indicators

caution. See the following links for more information: [http://www.fda.gov/cdrf/occurit/24-03-2007/08161551a12jv/04563701.D052j/04563701.D052j.D081.D081.D081.D04\(2.0\)TDF.000](#)

Do not to leave an autoclave operating unattended for a long period of time. Always be sure someone is in the vicinity while an autoclave is cycling in case there is a problem.

All Autoclaves should be placed

the refrigerator/freezers should be explosion resistant and labeled to indicate they are suitable for storing flammable materials.

The explosion resistant refrigerator/freezer has a sparkproof, corrosion resistant interior. The electrical components are encased and the door gaskets are non sparking. The explosion proof variety is engineered for sparkproof operation externally. This type of refrigerator/freezer is hard wired at installation to meet local electrical codes for maximum safety in hazardous areas, such as a chemical storage room.

All laboratory refrigerators regardless of type should never be used to store human food and must have labels indicating this on the door.

Drying Ovens

Drying ovens are commonly used to remove water or other solvents from samples and to dry laboratory glassware. Since these ovens do not have a provision for preventing the discharge of volatilized substances into the air, organic compounds should not be dried in these units.

Conventional units should not be used to dry any chemical that is moderately volatile and might pose a health hazard of acute or chronic toxicity. Glassware rinsed in an organic solvent should not be dried in an oven. Over temperature control devices must be used when ovens are used unattended after hours.

Thermometers containing mercury should not be used in ovens. should not be used in ovens. (10) 124 DT DT 00

PERSONAL PROTECTIVE EQUIPMENT

Potential hazards in the laboratory are numerous. Personal protective equipment (PPE) plays a major role in reducing the direct effects of accidents. PPE consists of eye protection, face protection, laboratory coats and aprons, shoes, gloves, and respirators.

PPE should always be used in conjunction with other means of control, such as engineering technology (i.e. fume hoods or auxiliary ventilation), and should never be the primary means of protection when working with chemicals. Because no personal protective equipment or clothing ever extends 100% protection, PPE should be considered secondary protection. PPE does not take the place of proper handling of chemicals and hazardous materials.

While use of PPE can minimize exposure to the hazards encountered in the laboratory environment, the equipment must be used properly. When the laboratory worker is in doubt of proper usage procedures, Laboratory Supervisor or PI can provide appropriate instruction.

EYE PROTECTION

Because of the vulnerability and fragility of the eye, laboratory workers, visitors and students must wear eye protection at all times while in the lab. Eye protection should conform to the Standard for Occupational and Educational Eye and Face Protection, Z87.1, established by the American National Standards Institute (ANSI).

In the event that an accident should occur, eye wash fountains are readily available; refer to VI.A.2, Eye Wash Fountains, for eye wash guidelines. These devices should be inspected regularly to maintain proper working order. Additionally, safety glasses and goggles should be cleaned and inspected frequently for scratches or fogging, and replaced if they are found to reduce visibility.

Safety Glasses

Safety glasses protect the eyes against flying objects and minor splashes. Safety glasses are the minimum acceptable eye protection, and should be made of impact resistant hardened glass or plastic. Many safety glasses have side shields molded into or attached onto the ear pieces. Side shields on safety glasses provides some peripheral protection, but cannot provide adequate shielding from all flying debris and chemical splashes. Goggles or face shields should be worn when significant hazard exists.

Safety Goggles

Safety goggles provide protection for the eye from flying objects or splashing chemicals. To prevent lenses from fogging, impact protection goggles have screened areas on the sides to provide ventilation. However, these do not provide full shielding from chemical splashes. When full protection from harmful chemical splash is needed, splash goggles should be worn.

Safety Shields

Portable shields should be non-combustible. They can be made of laminated safety glass or polymeric materials such as polycarbonate or methacrylate. When used on the laboratory bench, safety shields should surround the hazard, with minimum openings to allow maneuvering of apparatus inside. Like safety glasses and goggles, safety shields should be cleaned and inspected frequently. Cracked or pitted safety shields should be replaced. The most common example of a safety shield is the window of a laboratory fume hood. Portable safety shields can also be used on the laboratory countertop.

PROTECTIVE CLOTHING

Laboratory Coats and Aprons

Laboratory coats or aprons should always be worn when working with chemicals. These garments should be replaced if they become perforated or torn. A laboratory coat can provide protection against contact with dirt and minor chemical splashes or spills. It also provides protection for the user's clothing. The laboratory coat does not, however, significantly resist penetration by organic liquids or concentrated acids and bases. If the coat becomes contaminated, it should be removed immediately.

Laboratory coats should be made of cotton or synthetic such as Tyvek or Nomex. Garments should not be made of rayon and polyester due to their tendency to melt and cause greater injury when ignited. Lab coats should always be removed whenever leaving the laboratory so potential chemical or biological contamination is not spread to other areas. In addition, lab coats should be laundered frequently.

Aprons can provide better protection from corrosive and irritating liquids than laboratory coats. They should always be worn when pouring concentrated acids. These are generally made of rubber or plastic and resist penetration better than woven fabric. However, since plastic aprons can be subject to static electricity and therefore may be a source of "sparks", these aprons are not recommended when working with flammables or other materials that may ignite easily. Aprons should be cleaned periodically.

Shoes

Normally, special work shoes are not required. However, open-toed or cloth shoes are unacceptable in the laboratory. While leather shoes offer protection in case of spills, leather readily absorbs organic liquids. If shoes become contaminated, they should be discarded. Disposable shoe covers may be needed when particularly hazardous materials are handled.

GLOVES

When properly selected, gloves can offer protection from exposure to a wide variety of hazardous and infectious substances. Gloves should be chosen on the basis of the materials being handled.

Thermally Resistant Gloves

Thermally resistant gloves are used when handling exceptionally hot or cold materials. Before each use, gloves should be inspected for punctures and tears and replaced, if necessary.

Chemically Resistant Gloves

Chemically resistant gloves should be worn whenever potential contact exists between the skin and corrosive or toxic materials. Neoprene, polyvinyl chloride, nitrile, and

When a laboratory has a "negative" pressure, more air is exhausted from the room than is provided through the supply system. Negative pressure allows air to flow from the surrounding areas into the laboratory. This prevents odors and contaminants from exiting the laboratory. Air pressure in laboratories shall be negative

The hood sash should be kept closed unless manipulations are being performed within the hood. When the hood is being used the sash should be open no more than 18 inches or where your hood sticker has been placed. This is necessary to protect the user's face in the event of an explosion and prevent chemical exposures when the products used are not being contained by the hood.

Hoods should never be used as a means of disposal for chemicals through evaporation. If vaporization of large quantities of chemicals is necessary as a part of the process, a means of collecting the vapor by distillation or scrubbing should be considered, rather than allowing it to escape to the environment. Wastes should be disposed of by established procedures; refer to section 8.0, Laboratory Wastes, for more information.

Hoods may be turned off when not in use if adequate general laboratory ventilation can be maintained when they are not running. Hoods must be left on if any chemicals are in the hood or if the hood is required to maintain negative room pressure.

Materials such as paper and dust should not be permitted to enter the exhaust ducts of the hood. They can adversely affect the performance of the system by lodging in ducts and fans. Equipment, such as hot plates and heating mantles, should be placed at least 6 inches from the hood sash. Generally, equipment should be placed as far to the back of the hood as practical.

Fume hood Performance Determination

In order for a hood to work properly, it must exhaust air properly. The simplest evaluation method is to determine the face velocity of the hood with a hot wire anemometer while the exhaust system is operating. When the hood has its own exhaust blower and is located in a room with additional hoods, all hoods should be turned on during testing. In a central exhaust system, all hoods should be in operation.

The evaluation is performed by EHSD and is conducted annually. The results are recorded and expressed in feet per minute. A certification sticker is placed on the hood indicating the date it was

tested. The sticker is placed on the hood indicating the date it was tested. The sticker is placed on the hood indicating the date it was tested. The sticker is placed on the hood indicating the date it was tested.

Class

Toxic:

A toxic waste contains one or more of the constituents listed in Table 1 of the Chemical Waste

Proper disposition of all hazardous materials used in laboratories is the responsibility of the principal investigator or researcher to whom

If laboratory equipment is to be left for the next occupant, clean or decontaminate it before departing the laboratory. If exhaust or filtration equipment has been used with extremely

For unrestricted use or transferred to a new Principal Investigator until it has been decommissioned by the Radiation Safety Officer (RSO).

Similarly, any equipment which has been used for

Evacuate the area.

University Police Gives specific information, such as building name, floor, room number, and whether chemicals are involved. Arrange for someone to meet the fire fighters outside the building, and close doors to help control spread of smoke and fire.

Be sure that everyone in the building or building or

In the event of any major spill, 911 are to be contacted concerning any chemical spill. 911 staff will then contact the EHSD person best suited to respond to the incident.

Explosive Chemicals

Upon receipt of request for assistance with, or notice of, potentially explosive chemicals, the following actions will be taken by EHSD:

Inspect the suspect material. Determine hazard potential. Seek available assistance from faculty or lab personnel involved, Sponsored Research Chemistry Department or other qualified professionals.

If determined that explosive potential exists and the material must be removed:

Contact the University Safety Officer who will provide guidance and locate an independent contractor who is licensed to remove and dispose of explosive materials.

If immediate danger exists, notify Tuskegee University Police who will make arrangements for pickup by the Tuskegee City Fire Department and the Macon County Hazardous Materials Team, and take care of building evacuation when required.

After material is removed, observed disposal and file necessary reports.

The Environmental Health & Safety Department will endeavor provide notification 24 r48 hours before removal, and will not compromise the safety of the building occupants or facilities.

APPENDIX
Laboratory Inspection/Compliance Checklist

Safety and Health Program	Yes	No	N/A	Comments
1. There is a written safety and health plan for employees that address cleanup procedure and spill containment.				
2. The program identifies, evaluates, and control safety and health hazards, and provides emergency response.				
3. A person is designated with responsibility and authority to direct all				

hazardous waste and operations.				
4. There is comprehensive work plan that outlines normal operating procedures.				
5. There is a list of all personnel with functions and responsibilities using the facility.				

Personal Protective Equipment	Yes	No	N/A	Comments
1. Personal protective equipment (gowns, gloves, masks, goggles, etc.) is available and used to protect employees from hazards and potential hazards likely to be encountered.				

with hazardous substances.				
3. All employees leaving a contaminated area is appropriately decontaminated, with contaminated clothing and equipment properly disposed of or decontaminated.				
4. Decontamination procedures are monitored by the principal investigator or director to determine its effectiveness.				

Waste Storage and Transport	Yes	No	N/A	Comments
1. All waste containers meet DOT, OSHA, and EPA regulations for the waste contained.				
2. Waste containers are inspected for integrity before being moved.				

Personnel Protection/Safety

Yes

No

N/A

Comments

BasidLaboratorySafety			
Chemical/MedicalWasteManagement			
EmergencyResponse			
LaboratorySpecificTraining(Corrosivesflammables,explosives,unstablechemicals, carcinogenic,mutagenic,teratogenic,compressedgases, human blood/blood products, radioactive materials)			
TrainingConducted	Training Date	Trainee Initials	PI/Trainer Initials
RecommendedBiosafetyTraining			
BiosafetyTraining			
BloodbornePathogens			
HumanInfectiousAgents			
RecombinantDNA			

I have been trained on and/or read and understood the above mentioned items. I understand it is my responsibility to comply with the Tuskegee University Lab Safety Manual and Biosafety Manual and all other University policies and procedures. I will request additional information