CHEMICAL AND BIOLOGICAL SAFETY MANUAL

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SEE THE UNIVERSITY SAFETY AND HEALTH PROGRAM MANUAL FOR:

UNIVERSITY OSHA PROGRAM INFORMATION
WORKERS COMPENSATION PROCEDURES
GENERAL SAFETY PROCEDURES
ADMINISTRATIVE RESPONSIBILITIES

The effectiveness of the laboratory safety program depends on cooperation and understanding among all parties involved, particularly among faculty, and the laboratory safety committee. The general safety responsibilities of each of these key participants is summarized below:

Faculty:
1. Enforce safety rules on staff, students and on visitors.
2. Assure that proper safety equipment, such as safety showers and fire extinguishers, is readily available, operable, and known to all people in the laboratory.
3. Make certain that lab is equipped with adequate fume hood facilities and other safety equipment.
4. Ensure that appropriate warning signs are placed within the laboratory.
5. Provide staff training on hazard information safety rules, recommended good practices, etc.
6. Make material safety data sheets for hazardous chemicals used in the laboratory available for laboratory staff.
7. Develop specific project safety plans for procedures involving hazardous chemicals (see form in this section).

Safety Committee:
1. Have regular meetings which seriously address each department’s safety concerns.
2. Conduct regular self-inspection programs.
3. Follow-up on Safety & Risk Management inspection reports.

Safety Officer (Chemical Hygiene Officer)
1. Keep the laboratory Safety Manual up to date.
2. Conduct safety inspections of laboratories.
3. Check fume hoods and safety equipment.
4. Monitor hazardous material storage and disposal.
5. Investigate hazardous material incidents.
# LABORATORY INSPECTION CHECK LIST

## Manual Section

1. **1** Use of chemicals reviewed, hazards identified and precautions documented

2. **3** Chemical Right-To-Know training provided for each laboratory worker.

3. **3** Containers labeled

4. **3** Work with extremely hazardous substances evaluated

5. **4** Unattended operations - light on, warning sign, over-temperature protection provided

6. **4** Working alone - cross check arranged

7. **4** Eating/Drinking in separate area from chemicals

8. **4** Housekeeping maintained

9. **4** Warning on doors as needed (laser, radiation, etc.)

10. **4** Guards/electrical covers in place

11. **5** Gloves, goggles, apparel available as necessary

12. **8** Carcinogen precautions apply

13. **14** Biohazard precautions apply

14. **9** Flammables limited to 10 gallons outside a safety cabinet

15. **11** Compressed gases secured

16. **12** Time sensitive chemicals monitored
17. (13) Hazardous waste labeled and monitored

18. (16) Infectious waste labeled/sterilized

19. (17) Needles/Sharps put in hardwall or plastic containers and labeled

20. (11)* Exits not blocked or locked

21. (12)* Fire extinguisher and eye wash not blocked

22. (4) *Accident reporting procedures reviewed with lab workers

23. (19)* Chemical spill procedures reviewed with lab workers

Building: __________________________________________________________

Inspector/Lab Supervisor: ____________________________________________

Laboratory Room Number: __________

*University Safety and Health Program Manual
SPONSORED RESEARCH COSTS

General

When preparing budgets for grant proposals, special safety equipment and facility requirements peculiar to the project must be considered. In general, these needs should be budgeted as direct costs to the project. There are many health and safety services, however, that are provided by the Safety & Risk Management Office and thus do not need to be included in direct cost budgets.

Direct Costs

The following items should be budgeted as direct costs to the project:

- Personal protection devices (safety glasses, goggles, face shields, safety shoes, respirators, self contained breathing apparatus, etc.)
- Special fire protection equipment (safety cans, flammable storage cabinets, fire blankets, CO2 fire extinguishers for electrical equipment, etc.)
- Safety equipment (bench shields, fume hoods, biological safety cabinets, compressed gas cylinder supports, replacement filters for clean benches and biological safety cabinets, etc.)
- Renovations required to meet Occupational Safety and Health Act (OSHA) Standards (updating fume hoods to current standards, provision of eye lavages, safety showers, etc.)
- Medical examinations required by the OSHA Standards.
- Certification of biological safety cabinets.

Indirect Costs

The following health and safety costs are included in the indirect cost allocation and do not need to be included in the budget:

- Chemical, biological, and radioactive waste disposal.
- Personnel monitoring of exposure to physical, chemical, and biological agents.
- Workers' Compensation coverage for personnel engaged in the project and receiving salary or wages through the University Payroll Office.
- Periodic inspections of work places for proper functioning of safety equipment such as fume hoods.

Responsibility

Faculty are responsible for determining, in conjunction with the Safety & Risk Management Office, the specialized equipment and facilities that may be required for their project prior to submission of the grant proposal.
Hazardous Materials/Agents

Faculty planning to use radiation sources, chemical carcinogens, oncogenic viruses, or Class 3 and 4 etiologic agents should consult with the Safety & Risk Management Office to determine if special equipment or renovation will be required for their project.

Safety and Health Clause

Certain funding agencies, such as the National Institute of Health, require certification in writing that all applicable safety and health regulations will be complied with in the performance of the contract. This certification shall be made by the Vice Chancellor for Administration and Finance after receiving a statement from the Faculty that he has conferred with the Safety & Risk Management Office regarding necessary safety controls for the protection of life and health of employees and other persons and prevention of damage to property. The Safety & Risk Management Office will advise the Business Office as to the adequacy of facilities and changes, if any, necessary to comply with the Occupational Safety and Health Act of North Carolina and other applicable codes and standards.
CHEMICAL AND BIOLOGICAL SAFETY MANUAL
SPECIFIC PROJECT SAFETY PLAN

DEPARTMENT: ________________  LOCATION: ____________________

PROJECT NAME: _____________________________________________

PERSONS WORKING IN THE PROJECT: ______________________________________________

CHEMICAL SUBSTANCE INVOLVED:

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<tr>
<th></th>
<th>NAME</th>
<th>HAZARDS</th>
<th>LOW</th>
<th>MODERATE</th>
<th>HIGH</th>
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<td>CONTACT HAZARD</td>
<td>FLAMMABLE</td>
<td>CARCINOGEN ___ UNSTABLE</td>
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Briefly describe each step in the experiment, the associated hazards (toxic vapors, etc.) and the precautions (fume hood use, gloves, etc.). Also note any special conditions such as the need for warning signs, unattended operations etc.
HAZARD COMMUNICATION

Background and Scope

NC-OSHA has adopted the "Safety and Health Hazard Communication Standard" for workplace chemicals and gases. The basic provisions in the Standard require chemical manufacturers to evaluate the hazards presented by the chemicals they produce and to provide safety information to employers who purchase the products. Employers are required to maintain the information provided and establish an internal "hazard communication" program to ensure that employees are informed of the hazards and the measures necessary to protect themselves from any harmful exposure which may result from using the chemicals.

This program applies to any chemical which is used by Western Carolina University employees, except as follows:

- Wood products.
- Drugs or cosmetics for personal use.
- Consumer products (subject to the Consumer Product Safety Act) less than 5 gallons or 50 pounds so long as employee exposure is not greater than ordinary consumer use.
- Hazardous wastes subject to Environmental Protection Agency regulations.

Responsibilities

The University Safety Officer is responsible for overall management and coordination of the program.

University laboratory departments who use chemicals are responsible for:

- Maintaining Material Safety Data Sheets received.
- Assuring that chemical containers are clearly labeled.
- Employee attendance at chemical safety training sessions.

Maintenance of Material Safety Data Sheets (MSDS)

Chemical manufacturers are required to provide MSDS'S for all chemicals sold to Western Carolina University. The MSDS provides essential Safety and Health information on the chemical and must be maintained in the University's files so that they are accessible to employees.

The University Safety Officer is responsible for collecting and distributing MSDS'S. MSDS'S are maintained on file in the University Safety Office or the using Departmental Office. MSDS'S may be reviewed by employees who use chemicals by contacting the Safety Officer at extension 7443 or by contacting their Department Office.
Warning Labels

Chemical manufacturers must provide labels on chemical containers which provide the identity of the hazardous chemicals(s), the appropriate hazard warnings and the name and address of the manufacturer. These labels are to be maintained in legible condition at all times.

The Safety Officer will coordinate re-labeling of original containers and is to be contacted when any label is not readable, missing, etc.

Portable containers, (glassware) into which hazardous chemicals are transferred from labeled containers, are not required to be labeled if the portable container is to be used only by the employee making the transfer.

Employee Training

All employees who use chemicals are required to attend a Hazard Communication Training Program. In laboratory departments each faculty member responsible for a laboratory unit is responsible for providing training for employees within their laboratory unit. The Safety Officer will schedule and provide this program for staff departments. Employees are only required to attend one program unless (a) a new hazard is introduced into the workplace or (b) the employee transfers into a unit where different chemical hazards exist. In these cases updated training is required.

When new employees are hired, training is to be done at the time of the initial employment. University Departments are responsible for providing the Safety Officer with the names of new employees who use chemicals so that hazard communication training can be arranged.

Hazardous chemical safety training is to include at least the following information:

- Interpreting information on labels and MSDS's.
- Location of hazardous materials in the workplace.
- Location and availability of material safety data sheets.
- Acute and chronic effects of chemicals.
- Safe handling procedures.
- Personal protective equipment
- Methods used to detect leaks and releases
- Spill clean up and emergency procedures.
- Attendance records for each training session must be documented and forwarded to the Safety Officer.
Extremely Hazardous Chemical/Outside Contractors

All jobs or projects involving extremely hazardous chemicals* (explosive, unstable, poison A, highly toxic, HMIS/NFPA health rating of 4) shall be reviewed by the University Laboratory Safety Committee prior to starting work.

When outside contractors come to the University, they also must be informed of the hazards they may encounter on campus. Contractors working near where chemicals are stored or used are to be informed before beginning their work of the chemical hazards present. The University Department contracting the work is responsible for arranging for instructions to be provided by responsible University faculty, staff or the Safety Officer about the potential hazards.
LABORATORY SAFETY PRINCIPLES

Safety Awareness

The most important rule is that everyone involved in laboratory operations from the highest administrative level to the individual workers must be safety minded. Safety awareness can become part of everyone's habits only if the safety is discussed repeatedly and only if senior and responsible staff demonstrate a sincere and continuing interest in safety. Over familiarity with a particular laboratory operation may result in overlooking or underrating its hazards. This attitude can lead to a false sense of security, which frequently results in carelessness. Be alert to unsafe conditions and actions and call attention to them so that corrections can be made as soon as possible. Every laboratory worker has a basic responsibility to himself/herself and colleagues to plan and execute laboratory operations in a safe manner.

Unattended Operations

Frequently, laboratory operations are carried out continuously or overnight. It is essential to plan for interruptions in utility services such as electricity, water, and inert gas. Operations should be designed to be safe, and plans should be made to avoid hazards in case of failure. Wherever possible, arrangements for routine inspection of the operations should be made and, in all cases, the laboratory lights should be left on and an appropriate sign should be placed on the door.

Working Alone

Generally, it is prudent to avoid working in a laboratory building alone. Under normal working conditions arrangements should be made between individuals working in separate laboratories outside of working hours to crosscheck periodically. Alternatively, security guards may be asked to check on the laboratory worker. Experiments known to be hazardous should not be undertaken by a worker who is alone in a laboratory.

Under unusual conditions, special rules may be necessary. The supervisor of the laboratory has the responsibility for determining whether the work requires special safety precautions, such as having two persons in the same room during a particular operation.

Eating, Drinking and Smoking

Contamination of food, drink, smoking materials, and cosmetics is a potential route for exposure to toxic substances. Food should be stored, handled, and consumed in an area free of hazardous substances. Non-laboratory areas, such as nearby break rooms, lounges, or conference rooms should be designated for storage and consumption of food and beverage for laboratory personnel. Coffee, soft drinks, snacks, and lunches are not to be brought into laboratory areas. Areas where food is permitted should be prominently marked and warning sign

(e.g., EATING AREA - CHEMICALS NOT PERMITTED) posted. Glassware or utensils that have been used for laboratory operation are not to be used for food or beverages. Laboratory refrigerators, ice chests, cold rooms and such are not to be used for food storage. Separate equipment should be dedicated to that use and prominently labeled.
Housekeeping

There is a definite relationship between safety performance and orderliness in the laboratory. When housekeeping standards fall, safety performance inevitably deteriorates. Work areas are to be kept clean, and chemicals and equipment must be properly labeled and stored. Cleanup should follow the completion of any operation or at the end of each day. Wastes are to be deposited in appropriately labeled receptacles. Temporary holding containers must be clearly marked. Chemicals that are no longer needed should not be permitted to accumulate in the laboratory. Stairways and hallways should not be used as storage areas. Access to exits, emergency equipment, and controls, must be maintained free from obstructions.

Warning Signs and Labels

Laboratory areas that have special or unusual hazards must be posted with warning signs. Standard signs and symbols have been established for a number of special situations, such as radioactive materials, radiation hazards, biological hazards, fire hazards, and laser operations. Other signs should be posted to show the locations of safety showers, eyewash stations, exits, and fire extinguishers. Waste containers must be labeled for the type of waste for which they are intended. The safety - and hazard - sign systems in the laboratory should enable a person unfamiliar with the usual routine of the laboratory to escape in an emergency (or help combat it if appropriate).

Maintenance Personnel

Facilities Management, Housekeeping, and other support personnel may also be exposed to potential physical and chemical hazards in connection with work going on in the laboratory. They must be informed about the risks involved and educated about how to avoid potential hazards.

Guarding for Safety

All mechanical equipment is to be equipped with guards that prevent access to electrical connections or moving parts (such as the belts and pulleys of a vacuum pump). Each laboratory worker should inspect equipment before using it to ensure that the guards are in place and functioning.

Careful design of guards is vital. An ineffective guard can be worse than none at all, because it may give a false sense of security. Emergency shutoff devices may be needed in addition to electrical and mechanical guarding.

Shielding for Safety

Safety shielding is to be used for any operation having the potential for explosion such as (a) whenever a reaction is attempted for the first time (small quantities of reactants should be used to minimize hazards), (b) whenever a familiar reaction is carried out on a larger than usual scale (e.g., 5-10 times more material) and (c) whenever operations are carried out under non-ambient conditions. Shields are to be placed so that all personnel in the area are protected from hazard.
System Under Pressure

Reactions should never be carried out in, nor heat applied to, an apparatus that is a closed system unless it is designed and tested to withstand pressure. Pressurized apparatus should have an appropriate relief device. If the reaction cannot be opened directly to the air, an inert gas purge and bubbler system should be used to avoid pressure buildup.

Cold Traps and Cryogenic Hazards

The primary hazard of cryogenic materials is their extreme coldness. The surfaces they cool, can cause severe burns if allowed to contact the skin. Gloves and a face shield may be needed when preparing or using some cold baths.

Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air, which leads to an explosion hazard. Appropriate insulated gloves should be used when handling dry ice. Dry ice should be added slowly to the liquid portion of the cooling bath to avoid foaming over. Workers should avoid lowering their head into a dry ice chest: Carbon dioxide is heavier than air, and suffocation can result.

Glassware

Accidents involving glassware are a leading cause of laboratory injuries. Careful handling and storage procedures should be used to avoid breaking glassware. Adequate hand protection should be used when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass hose connections. Tubing should be fire polished or rounded and lubricated and hands should be held close together to limit movement of glass should fracture occur. The use of plastic or metal connectors should be considered. Glass-blowing operations should not be attempted unless proper annealing facilities are available. Vacuum-jacketed glass apparatus should be handled with extreme care to prevent implosions. Equipment such as Dewar flasks should be taped or shielded. Only glassware designed for vacuum work should be used for that purpose. Proper instruction should be provided in the use of glass equipment designed for specialized tasks, which can represent unusual risks for the first-time user. (For example, separator funnels containing volatile solvents can develop considerable pressure during use.) Glassware, which is to be heated, should be Pyrex or a similar heat-treated type. Hand protection should be used when picking up broken glass. (Small pieces should be swept up with a brush into a dustpan.) Broken glassware should be disposed of in a special container marked "BROKEN GLASS".
CHEMICAL HYGIENE

Toxic Effects of Chemicals

All chemicals have toxic effects at some dose level for some route of exposure. It is therefore wise to minimize exposure to chemicals. Chemicals can have local or systemic effects. Local toxicity refers to the direct action of chemicals at the point of contact. Systemic toxicity occurs when the chemical agent is absorbed into the bloodstream and distributed throughout the body, affecting one or more organs. Toxic effects are also classified as acute or chronic. Acute effects are observed shortly after exposure. Chronic effects result from long term exposures or appear after a latency period.

Routes of Exposure

Dermal Contact: One of the most frequent exposures to chemicals is by contact with the skin. Spills and splash can result in overt contamination of the skin. Also, laboratory personnel may unconsciously contaminate themselves when they touch work surfaces, glassware, or equipment which become contaminated during experimental activity. A common result of skin contact is localized irritation or dermatitis. However, a number of materials are absorbed through the skin to produce systemic poisoning. The main portals of entry for chemicals through the skin are the hair follicles, sebaceous glands, sweat glands, and cuts or abrasions of the outer layers of the skin. The follicles and glands are supplied with blood vessels, which facilitate the absorption of chemicals into the body. Chemicals can also gain entrance into the body when contaminated hands touch the mouth, nose eyes, sores, or cuts.

Inhalation: Inhalation of toxic vapors, mists, gases, or dusts can produce poisoning by absorption through the mucous membrane of the mouth, throat, and lungs and can seriously damage these tissues, by local action. Inhaled gases or vapors may pass rapidly into the capillaries of the lungs and be carried into the circulatory system. The degree of injury resulting from inhalation of toxic substances depends on the toxicity of the material, its solubility in tissue fluids, its concentration, and the duration of exposure.

Inhalation hazards are often associated with gases and volatile chemicals but solids and non-volatile liquids can also present an inhalation hazard for laboratory personnel. Laboratory chemicals in the form of dusts and particulates can become airborne when transferred from one container to another. Grinding and crushing procedures can also produce aerosols. Splash created from spills and during vigorous shaking and mixing also results in aerosol formation. Many of the generated during such procedures do not settle out but remain suspended in the air and are carried about by air currents in the room. Some of these are capable of being inhaled and deposited in the respiratory tract. For many operations it is not obvious that an aerosol is being generated and laboratory personnel may not be aware that a hazardous situation exists. Actually, all laboratory operations involving an open vessel will result in the release of an aerosol. Such operations include weighing, stirring, pouring, injections with a needle and syringe, animal handling, and removing caps and stoppers. Alert laboratory personnel will take care not to create unnecessary aerosols.

Ingestion: Ingestion of toxic materials in the laboratory can also occur when contaminated hands come in contact with the mouth or with food items which are placed in the mouth. Food items and utensils themselves can become contaminated when stored in the laboratory. The practice of mouth can result in aspiration of toxic materials.
Injection: Accidents involving needles and syringes can result in injection of contamination through the skin. The needle and syringe is one of the most hazardous items used in the laboratory especially when combined with the task of inoculating an uncooperative animal. Also, containers of toxic chemicals may break resulting in hazard from contact with broken contaminated glass.

Ocular Exposure

The eyes are of particular concern because they are so sensitive to irritants. Ocular exposure can occur via splash or when contaminated hands rub the eyes. Few substances are innocuous in contact with the eyes and a considerable number are capable of causing burns and loss of vision. The eyes are very vascular and provide for rapid absorption of many chemicals.

Safe Handling Practices for Toxic Materials

Access Control: Access to laboratories, which have extremely toxic chemicals, should be controlled by the faculty member. The laboratory door should be kept closed while experiments are in progress. This not only protects those people who might otherwise enter the laboratory, but also reduces interruptions to laboratory staff, which could lead to accidents.

Personnel Practices: Personnel should wash their hands immediately after completion of any procedure involving toxic chemicals and when they leave the laboratory. The use of liquid soap dispensers, preferably foot operated, is recommended.

Eating, drinking, smoking, chewing of gum, application of cosmetics, or storage of utensils, food, or food containers should not be allowed in laboratories where toxic materials are used. The practice of mouth pipetting should also not be allowed. Mechanical pipettes aids are to be used for all procedures.

Decontamination of Work Surfaces: Work surfaces should be protected from contamination by using disposable plastic backed paper or stainless steel trays. Other items and equipment, which become contaminated during experimental activity, should be decontaminated with an appropriate solvent.

Minimizing Aerosols: Since all procedures involving an open vessel of liquids or powders generate aerosols, the laboratory worker should develop techniques which might include discharging liquids form pipettes as close as possible to the fluid level of the receiving vessel, or allowing the contents to run down the wall of the receiving vessel. Dropping the contents from a height will generate greater aerosol. Rapid mixing of liquids with pipettes by alternate suction and expulsion or forcibly expelling material from a pipette should be avoided. Care should also be taken when discarding gloves or plastic backed absorbent paper used to cover the work surface so that contamination is not aerosolized in the process. Dry sweeping or dry mopping contaminated laboratory floors could spread contamination. Floors should be cleaned with a wet mop or with a vacuum cleaner equipped with a HEPA filter.
Use of Chemical Fume Hoods:

Chemical fume hoods are the primary containment device in the laboratory used to control airborne contaminants generated by experimental procedures. Chemical fume hoods provide personnel protection by means of directional airflow from the laboratory into the hood through the face opening. This airflow reduces the potential for escape of airborne contaminants into the laboratory. Procedures involving volatile chemicals and those involving solids or liquids that may result in the generation of toxic vapors should be conducted in a chemical fume hood rather than on the open bench. Placing a reacting chemical system within a hood, especially with the hood sash closed, places a physical barrier between the workers in the laboratory and the chemical reaction. This barrier can afford laboratory workers protection from chemical splash, sprays, fires, and minor explosions. Hoods should be evaluated before use to ensure adequate face velocities. Hoods are checked by the Safety & Risk Management Office to determine the face velocity. An adequate face velocity for most applications is 100 feet per minute ± 10%. Hoods with low face velocity <90 feet per minute are posted as "low toxic only" use. Although chemical fume hoods do protect laboratory personnel from exposures to hazardous materials, they must be used properly in order to maximize their effectiveness. The following practices should therefore be observed when using fume hoods:

- Hood work areas should be clear of unnecessary equipment and materials, which can disrupt airflow and block, vents. Hoods should not be used for storage of chemicals.

- Work should be carried out as far back in the hood as possible. Moving apparatus 10 cm back from the front edge can improve performance by 90%.

- Experiments should be planned so that, as much as possible, all of the materials needed for a procedure are present in the hood to eliminate disruption of airflow by carrying equipment in and out during a procedure.

- Disruptive room air currents should be minimized by avoiding traffic near fume hoods and opening and closing doors near fume hoods while experiments are in progress.

- Keep the sash as low as possible.

- Use equipment with legs, if possible.

- Adjust the inside baffle at back of the hood so the bottom slot is wide open and the one at the top is closed or partially closed. This will favor airflow across the workbench where heavier than air solvent vapors congregate.
EYE PROTECTION

Required for Students

University policy on eye and face protection for students is derived from legislation enacted by the North Carolina General Assembly entitled "Policy for Eye and Face Protection," and passed in 1969. This Act requires that eye protective devices be worn by students in shops and laboratories where work involves:

- Hot solids, liquids, or molten metals; or
- Milling, sawing, turning, shaping, cutting, or stamping of any solid materials; or
- Heat treatment, tempering, or kiln firing of any metal or other materials; or
- Gas or electric arc welding; or
- Repair or servicing of any vehicle; or
- Caustic or explosive chemicals or materials.

Eye protective devices are to be worn at all times while participating in any of the above programs.

Required for Visitors

This act also provides that visitors to such shops and laboratories be furnished with and required to wear eye safety devices while such programs are in progress.

Required for Employees

University policy on eye and face protection for employees is derived from the Occupational Safety and Health Act of North Carolina (OSHANC). OSHANC states that:

Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. In such cases, employers shall make conveniently available a type of protector suitable for the work to be performed, and employees shall use such protectors. No unprotected person shall knowingly be subjected to a hazardous environmental condition. Suitable eye protectors shall be provided where machines or operations present the hazards of flying objects, glare, liquids, injurious radiation, or a combination of these hazards.

Standards and Types of Equipment:

Equipment Standards

The North Carolina legislation and OSHA-NC specifies that eye and face protective devices, which include spectacles, goggles, and face shields, shall comply with American National Standards Institute (ANSI) Z87.1-1979 and later revisions thereof. All eye and face protective devices currently on State Contract meet ANSI standards.
Selection of Appropriate Devices Based on Hazard

The type of device required will depend on the nature of the hazard and the frequency with which it is encountered. There are three basic types of eye protection, which will meet the majority of University maintenance, shop, and laboratory requirements. These are: safety spectacles (with or without side shields), dust goggles, and chemical goggles. Each of these meets the basic eye protection standards for frontal exposure to flying particles.

Side Shields

Safety Glasses with side shields, or goggles, are required where flying particles are likely to enter at an angle, and are usually required where two or more people are working in close proximity. Safety glasses with permanently attached side shields, or impact goggles, will provide this protection. Clip-on side shields do not meet ANSI standards.

Chemical Goggles

Safety chemical goggles are required to provide protection against corrosive or hot liquids or fine particles capable of penetrating the ventilation holes in dust goggles.

Special Eye Protection

Detailed information on eye protection requirements is available from the Safety Officer for the following hazards:

- Welding and brazing operations
- Lasers
- Ultraviolet radiation
- Ionizing particulate radiation

Selection Based on Frequency of Use

Dust goggles are the least expensive approved eye protection devices available, fit most head size and facial shapes, and may be worn over ordinary glasses. They are recommended for visitors, employees, and students who require eye protection periodically for short duration (less than two hours per day).

Adjustable safety glasses and prescription safety glasses are generally more comfortable than goggles and are therefore recommended for employees who require eye protection frequently or for long duration (more than 2 hours)

Photogray Lenses

Photogray lenses will not be approved unless a medical need is certified by an eye professional. Photogray lenses will only be provided for employees needing eye protection whose job assignments are largely out-of-doors.
Contact Lenses

Contact lenses are not recommended for use where eye hazards exist because they do not protect the portion of the cornea they cover; furthermore, dissolved vapors, liquids, and dust particles tend to creep behind the lens.

Face Shields

Face Shields do not meet eye protection standards and are only for face protection. Appropriate eye protection devices must be worn under the face shield.

Cost, Care, and Reclamation:

Providing Protection

The University is committed to a policy of providing eye and face protective device without cost to employees. Each department is responsible for funding of its employee eye and face protection program. Departments may also furnish eye protective devices to students or may require students to purchase devices at the University Book Store. Visitors should be furnished with temporary eye protection without cost.

Eye Examinations and Prescription Frames

Scheduling and payment for eye examinations to obtain prescriptions and professional fittings for safety glasses are the responsibility of the employee and/or student.

Frames and lenses for prescription and non-prescription safety glasses will be paid for by the University from a selection currently on a statewide contract. Only those items listed on the state contract will be furnished by the University.

Return of Protective Devices

Non-prescription eye protective devices issued to employees, students, and visitors remain the property of the University and are to be returned when the use of the devices is no longer necessary. For students this will normally be at the end of each semester and for employees it will be on termination of employment or change in duties where eye protection is no longer required.

Replacement of Damaged Devices

Glasses damaged during normal wear and use may be replaced without charge to the employee or student at the discretion of the department head or designated administrative officer.

Replacing Lost Devices

Replacement of lost or stolen devices will be the responsibility of the employee or student to whom they were issued.
Cleaning Material

Eye protective devices are personal items and should be issued for the exclusive use of each individual. Materials for cleaning eye and face protective devices are to be made available to employees and students by each department.

Disinfection Before Reissuance

Eye protective devices must be thoroughly cleaned and disinfected before being issued to another person. Information on procedures for disinfection is available from the Safety Officer (7443).

Eye Contamination:

Eye Wash Facilities

Every laboratory or work place using caustic and/or corrosive chemicals shall be equipped with emergency eye wash facilities.

First Aid - Chemical Burns

When the eye has received chemical irritation, the preferred first aid is to flood the eye with water immediately for at least 15 minutes and seek medical treatment as soon as possible. Neutralizers or other medication should be used only on the advice, or under the direction, of a physician.
GLOVES AND LABORATORY CLOTHING

Use of Gloves

Proper protective gloves should be worn when handling corrosive or toxic materials and materials of unknown toxicity, sharp edged objects, and very hot or very cold materials. Gloves should be selected on the basis of the material being handled, the particular hazard involved, and their suitability for the operation being conducted. Glove materials are eventually permeated by chemicals. However, they can be used safely for limited time periods if specific use and glove characteristics (i.e., thickness and permeation rate and time) are known. Common glove materials include neoprene, polyvinyl chloride, nitrile, and butyl and natural rubbers. These materials differ in their resistance to various substances. Double gloving is recommended when handling highly toxic or carcinogenic materials. Before each use, gloves should be inspected for discoloration, punctures, and tears. Before removal, gloves should be washed, if the material is impermeable to water.

Leather gloves may be used for handling broken glass or for inserting glass tubes into rubber stoppers, and for similar operations where protection from chemicals is not needed. Insulated gloves should be used when working at temperature extremes. Various synthetic materials such as Nomex and Kevlar can be used briefly up to 1000 F. Gloves made with these materials or in combination with other materials such as leather are available. It is best not to use gloves made either entirely or partly of asbestos, which is regulated as a carcinogen under OSHA. It is the responsibility of the laboratory supervisor to determine whether specialized hand protection is needed for any operation and to ensure that needed protection is available.

If you have asbestos gloves call the Safety Officer so that they can be picked-up for disposal.

Laboratory Clothing and Protective Apparel

The clothing worn by laboratory workers can be important to their safety. Such personnel should not wear loose (e.g., saris, dangling neckties, and overlarge or ragged laboratory coats), skimp (e.g., shorts and/or halter-tops), or torn clothing and unrestrained long hair. Loose or torn clothing and unrestrained long hair can easily catch fire, dip into chemicals, or become ensnared in apparatus and moving machinery: skimp clothing offers little protection to the skin in the event of chemical splash. If the possibility of chemical contamination exists, personal clothing that will be worn home should be covered by protective apparel. Finger rings can react with chemicals and also should be avoided around equipment that has exposed moving parts, or electrical hazards.

Appropriate protective apparel is advisable for most laboratory work and may be required for some. Such apparel can include laboratory coats and aprons, jump suits, special types of boots, shoe covers, and gauntlets. It can be either washable or disposable in nature. Garments are commercially available that can help protect the laboratory worker against chemical splashes or spills, heat, cold, moisture, and radiation.

Laboratory coats are intended to prevent contact with dirt and the minor chemical splashes or spills clothing and may itself present a hazard (e.g., combustibility) to the wearer; cotton and synthetic materials such as Nomex or Tyvek are satisfactory; rayon and polyesters are not. Laboratory coats do not significantly resist penetration by organic liquids and, if significantly contaminated by them, should be removed immediately.
Plastic or rubber aprons provide better protection from corrosive or irritating liquids but can complicate injuries in the event of fire. Furthermore, a plastic apron can accumulate a considerable charge of static electricity and should be avoided in areas where flammable solvents or other materials could be ignited by a static discharge.

Disposable outer garments (e.g., Tyvek) may, in some cases, be preferable to reusable ones. One such case is that of handling appreciable quantities of known carcinogenic materials, for which long sleeves and the use of gloves are also recommended. Disposable full-length jump suits are strongly recommended for high-risk situations, which may also require the use of head and shoe covers. Many disposable garments, however, offer only limited protection from vapor penetration and considerable judgement is needed when using them. Impervious suits fully enclosing the body may be necessary in emergency situations.

Laboratory workers should know the appropriate techniques for removing protective apparel, especially any that has become contaminated. Chemical spills on leather clothing or accessories (watchbands, shoes, belts and such) can be especially hazardous because many chemicals can be absorbed in the leather and then held close to the skin for long periods. Such items must be removed promptly and decontaminated or discarded to prevent the possibility of chemical burn.

Foot Protection

Shoes should be worn at all times in laboratories or other areas where chemicals are used or stored. Perforated shoes, sandals, or cloth sneakers are not recommended to be worn in laboratories or areas where mechanical work is being done.

Safety shoes are used to protect the feet against injuries from heavy falling objects, against crushing by rolling objects, or against lacerations from sharp edges. Safety shoes are required for employees whose job duties frequently require the lifting, carrying, or moving, etc. of objects weighing more than fifteen pounds, which, if dropped, would likely result in a foot or toe injury. The state personal protective equipment policy as of February 1, 1985, stipulates that employees who are required to wear safety shoes will be reimbursed up to a certain amount for one pair of shoes. For further information concerning eligibility types of shoe protection, purchasing, etc., contact the Health and Safety Office.
CARCINOGENS

Control Practice

Planning and implementation of control practices for the prevention of occupationally acquired cancer and for the protection of the general environment is to be included in all research programs and staff jobs involving known or suspected chemical carcinogens.

Definition

Chemical carcinogens are chemicals, which have been demonstrated to cause a malignant disease or an increased incidence of cancer, by the appearance of tumors at an earlier time than would be otherwise expected, or by promotion of tumors initiated from exposure to other chemicals.

OSHA currently regulates twenty-three chemical carcinogens, twenty-one of which may exist at WCU. However, the OSHA Research Division has listed in THE REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES more than 2000 substances for which there is allegedly some degree of evidence of tumorigenicity or carcinogenicity, some of which will be subject to future regulation.

Some potential carcinogens found in research laboratories will not be included in these lists, because they are not ordinarily found in the industrial workplace and because there may not have been sufficient carcinogenicity testing. The faculty member is responsible for knowing the available information relating to the hazard potential for the chemicals used in his/her laboratory and should exercise judgment, in consultation with the Safety Officer as to the appropriate safety precautions which should be followed.

Facility Requirements

A designated work area must be established, access for which is restricted to personnel who are aware of the hazards of the substances in use and the precautions which are necessary. A foot or elbow operated hand wash facility should be available within the work area. A shower facility, should be also located in the building.

The designated area may be the entire laboratory or a device such as a laboratory hood.

The exhaust ventilation system should maintain an inflow of air from the unregulated area into the work area. The exhaust air from the work area must be discharged directly to the outdoors clear of occupied buildings and air intakes. No re-circulation of exhaust air from the work area is permitted. The exhaust air from glove boxes should be treated by HEPA and charcoal filtration. The need for and type of treatment for other primary containment equipment should be determined by the Health and Safety Office. Exhaust air treatment systems that remove chemical carcinogens from the exhaust air by collection mechanism such as filtration or absorption should be operated in a manner that permits maintenance so as to avoid direct contact with the collection medium. All exhaust air from primary containment equipment must be discharged directly to the outdoors so that it is dispersed clear of occupied buildings and air intakes.
Protective Clothing

Protective clothing such as a full-fastened laboratory coat or a disposable jumpsuit is to be worn in any area in which chemical carcinogens are being used. Clean clothing is to be provided weekly and should not be worn outside of the work area. Clothing contaminated by chemical carcinogens is to be decontaminated or disposed of immediately after an obvious exposure. Contaminated clothing must not be sent to the laundry until decontaminated. Gloves must be worn when handling chemical carcinogens. The practice of double gloving when handling chemical carcinogens is recommended. Disposable gloves are to be discarded after each use and immediately after known contact with a chemical carcinogen.

Work Area Identification

Entrances to all work areas, where chemical carcinogens are being used or stored, must be posted with signs bearing the legend: CAUTION - CHEMICAL CARCINOGEN Authorized Personnel Only.

Use of Primary Containment Equipment

Procedures involving volatile chemical carcinogens and those involving solid or liquid chemical carcinogens that may result in the generation of aerosols must be conducted in a chemical fume hood, a biological safety cabinet, a glove box, or other suitable containment equipment. Examples of aerosol-producing procedures are: the opening of closed vessels; transfer operations; weighing preparation of feed mixtures; and the application, injection, or incubation of a chemical carcinogen into experimental animals. Class II, type B biological safety cabinets are suitable for the conduct of tissue culture and other biological procedures involving chemical carcinogens. The faculty member should obtain guidance from the Health and Safety Office on the selection and use of Class II biological safety cabinets. Primary containment equipment used for chemical carcinogens must display a label bearing the legend: CAUTION - CHEMICAL CARCINOGEN.

Use of Analytical Instrumentation

Analytical instruments, when used with chemical carcinogens, are to be placed entirely within a chemical fume hood. When this is impossible, vapors or aerosols produced by these instruments should be captured through local exhaust ventilation at the site of their production. When a sample is removed from the analytical instrument, it should be placed in a tightly stoppered sample tube or otherwise safeguarded from contaminating the laboratory. Analytical equipment that becomes contaminated should not be used until it has been completely decontaminated.

Storage, Inventory and Identification

Stock quantities of chemical carcinogens are to be stored in designated storage areas. The storage areas should be posed with signs bearing the legend: CAUTION - CHEMICAL CARCINOGEN Authorized Personnel Only. An inventory of stock quantities is to be maintained by the faculty member, who should provide copies to the Health and Safety Office. The inventory records should include the quantities of chemical carcinogens acquired and dates of acquisition and disposition. Storage vessels containing stock quantities should be labeled: CAUTION - CHEMICAL CARCINOGEN.
Working Quantities

Quantities of chemical carcinogens present in the work area should be kept to a minimum. Quantities should not normally exceed the amounts required for use in one week. Storage vessels containing working quantities should be labeled: CAUTION - CHEMICAL CARCINOGENS.

Laboratory Transport

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

Protection of Vacuum Lines

Each vacuum service, including water aspirators, is to be protected with an absorbent or liquid trap and a HEPA filter to prevent entry of any chemical carcinogen into the system. When using a volatile carcinogen, a separate vacuum pump or other device placed in an appropriate chemical fume hood should be used.

Packaging and Shipping

Chemical carcinogens are to be packaged to withstand shocks pressure changes, and any other condition, which might cause leakage of contents incident to ordinary handling during transportation. Shipments are to be in accordance with DOT regulations.
Decontamination

Contaminated materials must either be decontaminated by procedures that decompose the chemical carcinogen, or be removed for subsequent disposal. Chemical carcinogens, which have spilled out of a primary container so as to constitute a hazard, must be inactivated in situ or should be absorbed by appropriate means for subsequent disposal. A means for assuring adequacy of clean up should be provided, for instance wipe tests or fluorescence tests.

Disposal

Plans for handling and ultimate disposal of contaminated wastes are to be approved by the Health and Safety Office.

Animal Experimentation

Animal care personnel are to wear a completely closed jumpsuit or a complete clothing change and laboratory issue shoes or booties, head cover, and gloves. Clean clothing should be provided daily. Animal care personnel engaged in procedures where exposure to airborne particles contaminated with chemical carcinogens could occur must wear an appropriate facemask or respirator.

The selection and use of an appropriate face mask or respirator is to be approved by the Health and Safety Office. The facemask or respirator is not to be worn outside of the animal room. Used filters should be disposed of and the respirator housing should be decontaminated daily. Personnel should shower after completion of procedures that may result in the creation of airborne contamination in the animal room.

Experimental animals are to be housed in cage systems that confine feed, feces, urine, and bedding within the enclosure. When using a volatile chemical carcinogen, the cage must be used in conjunction with appropriate ventilation systems. Alternative animal housing methods must be approved by the Health and Safety Office.

Medical Consultation

Medical examinations are to be completed for employees who develop signs or symptoms associated with a hazardous chemical or whenever there is reason to believe that the employee has been exposed to a substance above OSHA limits.

OSHA Regulated Carcinogens:

- Asbestos - See Policy #26 (WCU Safety Manual)
- 4-Nitrophenyl
- Alpha-Naphthylamine
- Methyl chlorometehyl ether
- 3,3'-Dichlorobenzidine (and its salts)
- Bis-Chloromethyl ether
- Beta-Naphthylamine
- Benzidine
- 4-Aminodiphenyl
Benzene
Ethyleneimine
Beta-Propiolactone
2-Acetylaminofluorene
4-Dimethylaminoazobenzene
N-Nitrosodimethylamine
Vinyl chloride
Inorganic arsenic
1,2-dibromo-3-chloropropane
Acrylonitrile
Ethylene Oxide
4,4 - Methylene dianiline
Formaldehyde
1,3-Butadene
Methylene Chloride
FLAMMABLES

General

It is the policy of the University to use the recommendations contained in the National Fire Protection Association (NFPA) Codes as minimum guidelines to acceptable practices on Campus. A number of the NFPA Codes have been incorporated into the Occupational Safety and Health Act (OSHA) Standards, the North Carolina State Fire Prevention Code, or are mandated as a condition of insurance coverage by the North Carolina Department of Insurance. Questions regarding the applicability of specific NFPA Codes should be directed to the University Safety Officer.

The purpose of this policy statement is to list the basic standards for the storage and use of flammable and combustible liquids applicable to Campus operations. The standards listed here are by no means comprehensive but represent those cited most frequently during inspections of Campus facilities.

Definitions

Laboratory/Shop Unit:

A laboratory or shop unit is defined as a room, or suite of rooms, separated from adjacent areas by fire resistant walls and doors.

Flash Point

The minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture in air.

Flammable Liquids:

A flammable liquid is any liquid having a flash point below 100°F (37.8°C). Flammable liquids are also known as Class I liquids and subdivided according to flash point and boiling point as indicated in the Table below.

Combustible Liquids:

A combustible liquid is any liquid having a flash point at or above 100°F, and is known as a Class II or III liquid as indicated in the following Table:

<table>
<thead>
<tr>
<th>Classes</th>
<th>Flammables</th>
<th>Combustibles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IA IB IC</td>
<td>II III</td>
</tr>
<tr>
<td>Flash point</td>
<td>&lt;73° &lt;73° 73° - 100° 100° - 140° &gt;140°</td>
<td></td>
</tr>
<tr>
<td>Boiling Point</td>
<td>&lt;100° &gt;100°</td>
<td></td>
</tr>
</tbody>
</table>
Maximum Container Size for Point of Use Storage

The potential fire hazard depends on the flash point and the quantity of liquid being used. The following table gives the maximum size container allowed for each class of liquid:

<table>
<thead>
<tr>
<th>Container Type</th>
<th>IA</th>
<th>IB</th>
<th>IC</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass or Plastic</td>
<td>1 gal</td>
<td>1 gal</td>
<td>1 gal</td>
<td>1 gal</td>
<td>1 gal</td>
</tr>
<tr>
<td>Metal</td>
<td>1 gal</td>
<td>5 gal</td>
<td>5 gal</td>
<td>5 gal</td>
<td>5 gal</td>
</tr>
<tr>
<td>Safety Cans</td>
<td>2 gal</td>
<td>5 gal</td>
<td>5 gal</td>
<td>5 gal</td>
<td>5 gal</td>
</tr>
</tbody>
</table>

Maximum Quantities

The potential fire hazard also depends on the total quantity of flammable and combustible liquids present within a containment unit and the type of containers in which the liquids are stored. The maximum quantity allowed per unit is as follows:

1) Shelf or open storage/use:
   a) Glass, plastic, or cans: 10 gallons
   b) Safety cans: 25 gallons

2) Approved storage cabinets:
   a) Class I & II: 60 gallons
   b) Class III (maximum - 2 per unit): 120 gallons

3) Inside Storage Room (meeting NFPA Code recommendations)
   a) with sprinkler: 4-10 gal/ft²
   b) without sprinkler: 2-4 gal/ft²

University Guidelines

It should be emphasized that the quantity of flammables on hand must be kept to a minimum and that only in unusual circumstances will the maximum quantities be permitted. The following guidelines have been adopted by the University:

- If a one-gallon quantity of one specific liquid represents more than a thirty-day supply of a Class IA or IB flammable, one-pint (IA) or one-quart (IB) shall be used.
- Multiple cans and/or bottles of any one specific flammable will not be permitted in open storage or storage cabinet if it represents more than a thirty-day supply of that flammable.
- Deviations from these guidelines may be granted in exceptional cases following approval by the University Safety Officer.
Gasoline must be stored and transported on campus in safety cans. The use of safety cans in laboratories is encouraged where practicable.

Class I liquids shall not be transferred between metal containers unless the containers are electrically interconnected by direct bonding or by indirect bonding through a common ground. The maximum impedance of the bond shall not exceed 6 ohms.

Storage Cabinets

Storage cabinets constructed to NFPA standards should be used when required to meet quantity limits. Storage cabinets are not permitted in hallways.

Inside Storage Rooms

A central storage room is preferable to storage cabinets in each laboratory. This central storage alternative should be considered especially by departments and schools which have centralized supply rooms.

Refrigerators

Flammable liquids must not be stored in domestic type refrigerators. Domestic type refrigerators should not be purchased for laboratory use, even if flammable storage is not contemplated, since future research needs may require the use of flammables. Safety refrigerators, which have the electrical contacts (door switch, light, thermostat, etc.) removed or exteriorized, are recommended for laboratory use. "Explosion Proof" refrigerators are not recommended except in unusual circumstances, such as in an inside storage room (for flammables) or in potentially hazardous atmospheres. Domestic type refrigerators currently in laboratories should be labeled "DANGER/UNSAFE FOR STORAGE OF FLAMMABLES".

Warning Signs

Bunsen burners and other open flames must not be used in the area where flammable liquids are being used. The area must be posted "NO SMOKING" and containers are to be labeled "DANGER-FLAMMABLE - KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAMES, KEEP CLOSED WHEN NOT IN USE."

Variances/Specialized Needs

Variations from these guidelines may be granted when chemical purity other considerations warrant. For further information, contact the University Safety Officer (7443).
General

To obtain authorization to possess radioactive materials or radiation producing machines faculty members must send an application form to the North Carolina Radiation Protection Division, Department of Environment Health and Natural Resources, P. O. Box 27687, Raleigh, North Carolina 27611, phone number (919) 733-4283. The Radiation Protection Division should be contacted directly to obtain the necessary forms and application procedure.

Individual License

A specific license will be issued for each application. The faculty member making the application will be the person responsible for the safety and disposal of the material and will be designated Radiation Protection Officer for the material or equipment.

Inspections

Inspections for compliance with the terms of the license will be periodically conducted by the Radiation Protection Division.

Safety & Risk Management

The Safety Office, (7443) will provide administrative support in obtaining regulated material or equipment and in maintaining compliance with Radiation Protection Standards. A copy of each license application and approved license should be forwarded to the Safety & Risk Management Office.

Lasers

Laser equipment is not required to be licensed by the Radiation Protection Division. However, room isolation shielding and warning signs are required to prevent accidental exposure to the eye and skin. Faculty members working with the laser equipment should contact the Safety Officer and formulate an individual Safety plan to control exposures to laser energy.

The hazards created by lasers are categorized into four main groups:

Class I: Exempt laser devices cannot create eye damage if viewed accidentally. This class has less than 0.001 milliwatt power.

Class II: Low-power lasers have fewer than 1 milliwatt outputs and, under certain conditions, can require eye protection.

Class III: Medium-power lasers have fewer than 0.5 watts of power and can exceed the eye injury level. Protection may be required.

Class IV: High-power lasers have greater than 0.5 watts of power and eye protection is required.
COMPRESSED GASES

Standards

The use of compressed gases on campus will be in accordance with recommendations published by the Compressed Gas Association.

The following rules summarize a few of the basic guidelines for the use and storage of compressed gases:

Support Required

Compressed gas cylinders must be supported at all times, whether full or empty. Acceptable methods of support include:

Wall mounted or bench mounted gas cylinder brackets.

Chains or belts anchored to walls or benches.

Free standing dollies or carts designed for gas cylinders and equipped with safety chains or belts.

Valve Protection Cover

A cylinder must have the valve protection cover in place except when in use.

The pressure regulator must be removed and valve protection cover replaced before moving cylinders even if the cylinders are secured to a dolly or hand truck, e.g., acetylene and oxygen cylinders used for cutting, brazing, etc., may not be transported with regulators attached to the cylinders.

Flammable Gases

Smoking is not permitted in the area where flammable gases are used or stored.

Flammable gas cylinders (acetylene, propane, hydrogen, etc.) must be stored separately from oxidizers (oxygen, chlorine, etc.).

Upright

Gas cylinders must be used in an upright position and clamped securely at all times. Due to the extreme hazards created by using certain cylinders in a horizontal position (e.g., acetylene liquid gases), approval must be obtained from the Health and Safety Office for use of cylinders in any position other than vertical, with the valve up.

Movement of Cylinders

Appropriate dollies or hand trucks must be used to move cylinders weighing more than 50 pounds. Movement by spinning, sliding, rolling, etc., is prohibited. For movement within shops and laboratories, cylinders weighing less than 50 pounds may be carried if desired.
Toxic and Poisonous Gases

Toxic and poisonous gases must be used only in fume hoods or other enclosures vented directly outdoors. Appropriate warning signs and information must be provided and clearly marked at room entrances.

Piping systems for flammable gases, toxic gases, and oxygen must be approved by the Health and Safety Office.

Pressure regulators and gauges must be compatible with the cylinder valves, i.e., the use of adapters is prohibited.

Oxygen

All oxygen valves, gauges, regulators, pipes and fittings must be scrupulously free of oil, grease, graphite, or any other oxidizable substance. Such pipes, gauges, fittings, etc., must at no time be exposed to come to an elevated temperature due to proximity to welding operations, burners, or other heat sources. Although oxygen is quite safe under normal temperatures and pressures, elevated temperatures and/or pressures, or contamination, may result in the rapid and violent oxidation of normally non-reactive materials. For example, a regulator used on oil-pumped nitrogen could produce a serious explosion if subsequently used for oxygen, due to the oil residue.
ORGANIC PEROXIDES

Safe Handling of Peroxidizable Compounds

Peroxide formation in solvents and reagents has caused many accidents. Every worker must learn to recognize and safely handle peroxidizable compounds. Peroxides form by the reaction of a peroxidizable compound with molecular oxygen through a process called autoxidation or peroxidation. Peroxidizable compounds are insidious. Under normal storage conditions they can form and accumulate peroxides, which may explode violently when subject to thermal or mechanical shock.

Peroxides in solution at concentrations up to about 1 percent do not normally present thermal or shock hazards. Such solutions may be safely disposed of or treated to remove peroxides. However, should crystals form in a peroxidizable liquid or discoloration occur in a peroxidizable solid, peroxidation may have occurred, and the product should be considered extremely dangerous and disposed of without opening the container.

Storage

Quantities of peroxidizable compounds should be purchased according to short-term needs. For instance, buy six (6) one pound cans of ether instead of the six pound can. Purchasing of package sizes corresponding to use requirements will also minimize exposure to air from multiple openings of the container. A tight cap on a nearly full bottle probably provides almost total protection against peroxide formation.

Peroxide accumulation can be held to very low levels by storage in reasonably full containers (25% maximum headspace) with TIGHT caps that are replaced promptly after use. Still more protection can be provided by inserting the headspace over peroxidizable cups by nitrogen flushing before reclosing the container.

Vinyl monomers containing certain inhibitors are exceptions to inserting. The use of oxidation inhibitors is especially important in the safe handling of peroxidizable materials. Hydroquinone, alkyl phenols, aromatic amines, or similar materials are recommended by the manufacturers as being effective in preventing peroxide formation during storage of peroxidizable compounds. These inhibitor selected should be compatible with use or purity requirements of the compounds. A program of periodic testing and replenishing inhibitor levels should be followed during storage of peroxidizable materials.

Each laboratory, as part of their Chemical Hygiene Plan, should maintain an inventory of peroxidizable compounds. This listing should be reviewed every semester and either test or discard those out of date.

In addition, each container of peroxide-forming chemicals should have the following dates written on the label.

- Date Received
- Date Opened
- Date to be Discarded
In some cases, where peroxides are chemically removed, then a notation on the label would indicate the new date.

Peroxide forming chemicals should be stored together in full, airtight opaque containers at temperatures below 30°C and in the dark. Use only refrigerators designated for flammable liquids.

Removal of Peroxides

Peroxide impurities in water insoluble solvents (ether, hydrocarbons) are easily purified by shaking with the following solution:

- 60 gr of ferrous sulfate
- 6 ml of concentrated sulfuric acid
- 110 ml of distilled water

Water is introduced by this method so post-drying will be required if a dry solvent is wanted.

Disposal

Immediately set aside and **DO NOT USE** any peroxide forming chemicals that have formed crystals, precipitates, solids or an oily viscous layer, or any rusted, damaged, undated or suspicious containers of peroxide forming chemicals.

Never attempt to force open a rusted or stock cap or a cap encrusted with scale on a container of peroxide forming chemicals. Never attempt to clean by scraping or rubbing glassware or other containers if an oily deposit or crusty residue is present.

Empty containers of ethers and other peroxide formers are to be flushed with water before discarding.

Distillation and Evaporation Precautions

Testing peroxidizable solvents for peroxides prior to distillation or evaporation should be routine. One common cardinal sin is the carrying out of a distillation too close to dryness - allow at least a 10% heel for safety sake. Never distill to a dry residue.

Safety Plan (See Section 1, #7)

The safety plan should include a review of possible hazards from the use of peroxidizable chemicals in the experiment. The safety plan should include the following factors:
The starting chemicals

The experimental procedure

The end products

If the plan indicates that peroxide may be present, then described procedures for handling, testing and removal should be followed.
- SPECIFIC PEROXIDIZABLE COMPOUNDS -

Some of the specific compounds that form peroxides during storage are included in list A, B, & C. Those that form peroxides that may explode even without being concentrated are in List A. List B includes chemicals that are dangerous when concentrated by distillation of evaporation. List C is vinyl monomers that can form peroxides that may initiated explosive polymerization of the monomers.

**TABLE II**

<table>
<thead>
<tr>
<th>List A - Red Label (Three Months) Peroxide Hazard on Storage</th>
<th>List B - Yellow Label (Twelve Months) Peroxide Hazard on Concentration</th>
<th>List C - Yellow Label (Twelve Months) Hazard Due to Peroxide Initiation of Polymerization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropyl</td>
<td>Ethyl ether</td>
<td>Styrene</td>
</tr>
<tr>
<td>Divinyl acetylene</td>
<td>Tetrahydrofuran</td>
<td>Butadiene</td>
</tr>
<tr>
<td>Vinylidene chloride</td>
<td>Dioxin</td>
<td>Tetrafluoroethylene</td>
</tr>
<tr>
<td>Potassium metal</td>
<td>Acetyl</td>
<td>Chlorotrifluoroethylene</td>
</tr>
<tr>
<td>Sodium amide</td>
<td>Methyl l-butyl ketone</td>
<td>Vinyl acetylene</td>
</tr>
<tr>
<td></td>
<td>Ethylene glycol</td>
<td>Vinyl acetate</td>
</tr>
<tr>
<td></td>
<td>dimethyl ether (glyme)</td>
<td>Vinyl pyridine</td>
</tr>
<tr>
<td></td>
<td>Vinyl ethers</td>
<td>Chlorobutadiene</td>
</tr>
<tr>
<td></td>
<td>Dicyclopentadiene</td>
<td>(Chloroprene)</td>
</tr>
<tr>
<td></td>
<td>Diacetylene</td>
<td>9,10 Dihydroanthracene</td>
</tr>
<tr>
<td></td>
<td>Methyl acetylene</td>
<td>Indene</td>
</tr>
<tr>
<td></td>
<td>Cumene</td>
<td>Dibenzocyclopentadiene</td>
</tr>
<tr>
<td></td>
<td>Tetrahydronaphthalene</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cyclohexene</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methylcyclopentane</td>
<td></td>
</tr>
<tr>
<td></td>
<td>t-Butyl alcohol</td>
<td></td>
</tr>
</tbody>
</table>

*When stored as a liquid, the peroxide-forming potential increases and certain of these monomers (especially butadiene, chloroprene, and tetrafluoroethylene) should then be considered as list A compounds.

Peroxide accumulation is a balance between the rate of peroxide formation and the rate of peroxide degradation for the particular substance under the environment of the sample. For example, certain highly reactive compounds, such as organometallic, accumulated peroxide at low temperatures because the peroxide degradation rate is slowed relative to the formation rate. In contrast, less reactive compounds, such as hydrocarbons or ethers, are usually best kept at low temperatures.

The more volatile the peroxidizable compound, the easier it is to concentrate the peroxides. One should also remember that pure compounds are more subject to peroxide accumulation because impurities may inhibit peroxide formation or catalyze their slow decomposition.
HAZARDOUS WASTE

General

As a generator of small amounts of Hazardous Waste the University is required to comply with Federal Standards promulgated under the Resource Conservation and Recovery Act (RCRA). These regulations cover the storage, handling and documentation of transfer of hazardous waste from the point of generation to final disposal.

Definition

Hazardous waste is a chemical, a solid, liquid, fuel or gas, which is either ignitable, corrosive, reactive or toxic and is no longer useful and is intended to be discarded. Within this definition, a second more limited category of hazardous waste is Acutely Hazardous waste which are extremely hazardous materials. These materials are specifically listed in the Federal Code of Regulations.

Waste Reduction

The most significant impact that individual departments can have on hazardous waste costs is to reduce the volume of waste required to be handled. Faculty and supervisors are encouraged to consider ways of reducing the volume of waste or preserving the reuse of the materials through the redesign of experiments and work processes. Recyclable materials should be kept separate from other waste. Efforts should be made to decontaminate, detoxify, neutralize, or otherwise render the waste nonhazardous. Different waste materials should be kept segregated whenever possible.

Disposal Methods

Hazardous waste materials must be handled by means of one of the following:

- Treatment by the originating laboratory to render the waste non-hazardous.
- Recycled for energy recovery or other uses.
- Exchanged as a useful material for other industry or laboratories.
- Packaged for pick-up and incineration by a licensed hazardous waste firm.

It is unlawful to discharge any chemical product into storm sewers, creeks or on the ground or to discharge hazardous chemicals such as strong corrosives, reactives, oils, varnishes, kerosene, gasoline insecticides etc. into the sanitary sewer. Also hazardous chemicals should not be placed in the ordinary trash for pick-up by Facilities Management.

General Rules

- EPA considers laboratories to be “satellite accumulation sites” this means that the waste containers must be near and under the control of the person responsible for the process generating the waste.
Make sure every container labeled “waste” or which has the appearance of waste is in good condition, compatible with the contents, is labeled as to contents and capped. This means that you cannot leave funnels in bottles or leave them open.

There is a 10 gallon per laboratory limit on flammables on the open bench including the fume hood. This includes waste flammables and non-waste flammables.

There is a one quart limit of “Acutely Hazardous” waste.

Quantity Limits

The University is currently classified by the EPA as a "conditionally exempt small quantity" generator, which allows it to be excluded from some of the more cumbersome recordkeeping and training aspects of the law. To maintain this classification, the university must never generate more than 100 kg (220 lbs.) of hazardous waste in a month and never store more than 1000 kg (2200 lbs.) of hazardous waste.

PROCEDURES FOR SPECIFIC WASTES

1. Individual Waste Streams - A waste stream generated from a laboratory procedure or shop process should not be combined with other chemical wastes. The fewer the number of chemicals associated with a waste, the more economical is the disposal method for that waste. If this is not practical, the Safety & Risk Management Office should be consulted about which wastes can be combined.

2. Non-Halogenated Flammable Solvents – Non-halogenated flammable solvents are sent to an incinerator or recycler and must be free of heavy metals and reactive materials, e.g. sodium metal.

3. Halogenated Solvents - Halogenated solvents are disposed of separately and must not be combined with flammable non-halogenated solvents. Examples of halogenated solvents include methylene chloride, chloroform, and carbon tetrachloride.

4. Acids and Bases - Acids with a pH of greater than five can be diluted and discharged to the sanitary sewer. Small volumes of bases can be discharged to the sanitary sewer, but followed by flushing with copious volumes of water. Acids and bases containing heavy metals must not be disposed to the sewer system.

5. Hydofluoric Acid – Presents a special hazard and is to be kept in Teflon containers or original containers.

6. Oils - Oil is sent to a recycler. Only trace quantities of oils associated with cleaning and washing operations should be released to the sanitary sewer. Oil wastes from vacuum pumps, transformers, motors, etc., should be accumulated for pick-up. Oily rags should be sent to a cleaning service.
7. Biocides - Concentrated solutions are not to be released to the sanitary sewer. Disposal is to be limited to one gallon of “working strength” solution per laboratory per day. This applies primarily to germicides and occasional disposal of pesticides. Chemicals, which are persistent in the environment, should be released only in trace quantities.

8. Toxic, Carcinogenic, Oxidizer, and Explosive Waste - Are picked up for disposal.

9. Compressed Gas Cylinders - Containing hazardous gas should be shipped back to the vendor.

10. Needles and Syringes - Must not be put in the regular trash. They should be accumulated in plastic leak proof containers, labeled "Biohazard". Needles and syringes contaminated with infectious agents must be autoclaved or otherwise decontaminated.

11. Infectious and Radioactive Waste - These guidelines do not apply to infectious or radioactive waste. Consult the Safety & Risk Management Office for these types of waste.

**DRAIN DISPOSAL OF CHEMICALS**

Chemicals that may be permissible for sewer disposal include aqueous solutions that readily biodegrade and low-toxicity solutions of inorganic substances. Water-miscible flammable liquids are prohibited from disposal in the sewer system. Water-immiscible chemicals should never go down the drain.

Waste should be disposed of in drains that flow to a POTW (Publicly Owned Treatment Works), never into a storm drain. Waste should be flushed with at least a 100-Fold excess of water, and the facility’s wastewater effluent should be checked periodically to ensure that concentration limits are not being exceeded.

Quantities should be limited to 100 grams or milliliters.
BIOHAZARDS AND RECOMBINANT DNA

Control Practices

Planning and implementation of control practices for the prevention of laboratory acquired infections and for the protection of the general environment are to be included in all research programs involving biohazardous agents and Recombinant DNA.

Definitions

Biohazardous agents are infectious microorganisms, or their toxins, which cause or may cause human disease.

Recombinant DNA is molecules, which are constructed outside living cells by joining natural or synthetic DNA segments to DNA Molecules that can replicate in a living cell, or DNA Molecules that result from the replication.

Applicability

These requirements apply (1) to microorganisms and viruses listed by the CDC/NIH, in Biosafety in Microbiological and Biomedical Laboratories; (2) to DNA Molecules listed in NIH Guidelines for Research Involving Recombinant DNA; and (3) to HIV and HBV as defined in OSHA 1910.1030 "Bloodborne Pathogens".

Registration

Prior to initiation of work with a biohazardous agent, or recombinant DNA the principal investigator is to notify the Safety & Risk Management Office of the agents used and the location of the laboratory. Higher risk (See NIH classes of experiments) recombinant DNA projects will also require review by the Institutional Biosafety Committee (IBC).

Class 3 or 4 Viruses, HIV or HBV

There are no facilities on campus appropriate for working with dangerous class 3 or 4 viruses or for concentrated HIV or HBV so work involving these agents is prohibited

Principal Investigator

Each principal investigator is responsible for assuring that laboratory personnel are trained in safe practices; reporting exposures, potential exposures, to these biohazardous agents to the Safety & Risk Management Office; and submitting a Safety Plan for research under his/her direction to the Safety & Risk Management Office.

Safety Plan

The Safety Plan is to describe the procedures that will be used to insure the safe handling of biohazardous agents, an assessment of the potential risks, the need for medical surveillance, procedures for handling accidental spills and waste disposal methods.
Grant Applications

Proposed research projects involving biohazardous agents should be reviewed with the Safety & Risk Management Office to ensure that the budget includes consideration of any specialized requirements to insure the safe conduct of the research.

Accidental Exposures

All overt accidental exposures of personnel to biohazardous agents, such as exposure to a concentrated contaminated aerosol from research procedures, accidental spills, or accidental inoculation with a contaminated needle, should be reported to the Safety & Risk Management Office.

Safety Standards


Recommended Safety practices for Recombinant DNA research is given in the Guidelines for Research Involving Recombinant DNA, NIH Federal Register May 7, 1986.

Safety Standards for working with HIV or HBV is given in OSHA 1910.1030.

These publications are available in the Safety & Risk Management Office.
Exposure Determination

The following classifications of employees of the University are at risk of exposure to human body fluids. (Category I)

Clinical Laboratory Science Faculty and Student Laboratory Assistants
Clinical Laboratory Technician
Emergency Medical Technician
Emergency Medical Care Faculty and Student Laboratory Assistants
University Health Services Housekeeper
Physician/Physician Assistant
Physical Therapist (PT) and PT Laboratory Assistant
Registered Nurse, Nurse Faculty
Athletic Trainer and Assistant

The tasks involving exposure to employees are:

Clinical Laboratory Science Faculty, Student Laboratory Assistants, Clinical Laboratory Technician:

Phlebotomy, pipetting of body fluids, handling of body fluid specimens, custodial chores of the laboratory, maintenance of instruments.

Emergency Medical Care Faculty, Student Laboratory Assistants, SECT Team:

Phlebotomy, initiation of intravenous solutions, administration of injections, wound care and dressings, catheritization, assistance in minor surgery, endotracheal incubation, assessment of body systems minimal custodial duties.

Handling of open wounds in emergency situations, dealing with upset and at time emotionally disturbed individuals in poor control of their actions.

Housekeeper (Health Services):

General housekeeping chores, i.e.: cleaning of areas contaminated by body fluids, removal of trash containing bodily fluids in appropriate containers from work areas.

Physician/Physician Assistant:

Evaluation of wounds and wound closure; minor surgery, i.e.; incision and drainage of abscesses, and excisional biopsy; pelvic and rectal examinations; sexually transmitted disease screening and evaluation.
Physical Therapist (PT) and PT Laboratory Assistant:

Handling of fixed human tissues during dissection, custodial chores of the laboratory, removal of contaminated wastes to be autoclaved, cleaning of instruments used in dissection

Registered Nurse:

Administration of injections, wound care and dressing changes, assisting in minor surgery, catherization, administration of enemas and suppositories, cleaning and sterilization of instruments, minimal custodial chores in absence of housekeeper.

Athletic Trainer and Assistant:

Handling of open wounds, wound closure, cleaning of areas contaminated with body fluids, cleaning and sterilization of instruments.

The following classifications of employees are not ordinarily at risk of exposure to human body fluids but could occasionally encounter body fluids: (Category II)

Police Officer, Housekeeper (Facilities Management, Housing, NCCAT, RAC, UC, Food Service)

The tasks involving potential exposure are:

Police Officer:

Dealing with disruptive individuals, crime scene search, cleaning contaminated surfaces of police equipment.

Housekeeper:

Picking up trash with unauthorized needles and sharps, cleaning bathrooms or other potentially contaminated areas.

Plumbers:

Cleaning out sewer drains, repairing toilets and drain pipes.

Developmental Evaluation Personnel:

Working with emotionally disturbed individuals.

**Hepatitis B Vaccination**

The University will provide hepatitis B vaccinations for all employees in Category I and Category II job classifications and for all employees who have had an exposure incident. The vaccination is voluntary.

The vaccination may be obtained from the University Health Service and is charged to the employees department. All employees must review the vaccination information sheet in Appendix A and either take the vaccination (See consent from Appendix B) or sign a declination form (Appendix C).
Exposure Control Plan - Category I

Universal precautions shall be observed with all human body fluids. According to the concept of Universal precautions, all human blood and certain body fluids are treated as if known to be infectious for Human Immunodeficiency Virus and Hepatitis B Virus and other bloodborne pathogens.

1. Use non-sterile gloves when handling blood, body fluid, secretions or excretions.

   Disposable gloves must be replaced as soon as practical when contaminated.

   Utility gloves may be decontaminated for reuse if the integrity of the glove is not compromised. (See paragraph 4 in this section).

   Gloves will be changed after contact with each patient and before touching environmental surfaces.

2. Gowns or lab coats must be worn if soiling of clothes with blood or other body fluids is anticipated. Masks are not necessary. Eyewear is necessary only when splatter of body fluids is anticipated.

3. Needles, syringes, and other sharp objects should be disposable and should be disposed of in rigid puncture-resistant, leak-proof containers. Further, needles should not be recapped, nor should they be removed from a disposable syringe because needle stick injuries are most likely to happen during these activities. The use of needle cutting devices is not recommended for needles attached to disposable syringes but may be practical for vacationer systems when on disposable jackets are used or when intravenous sets are withdrawn. All needles shall be considered contaminated. Broken glassware, which may be contaminated, must not be picked up directly with the hands. Use a brush, dustpan, tongs, forceps, etc.

4. Instruments, work areas, and non-disposable contaminated with blood or body fluids should be safely decontaminated with 1:10 dilution of 5.25% sodium hypochlorite (Clorox) and water or tuberculocidal disinfectants. (e.g., osyl or septicol).

5. Reusable containers shall not be handled or cleaned manually.

6. Mouth pipetting of all liquids, body fluid or specimens in the laboratory must not be allowed. Mechanical pipetting devices must be used.

7. Procedures having a high potential for creating aerosols or infectious droplets (centrifugation, vending, sonicating, vigorous mixing, and harvesting of tissue from animals or embryonated eggs) should be done in a "biological safety cabinet (Class II)."

8. There will be no eating, drinking, applying of lip balm, manipulation of contact lenses, or smoking in laboratory or potential exposure areas. There will be no storage of food in laboratory or work areas.
9. At present, commercially obtained laboratory reagents or controls derived from blood products should be treated as potentially contaminated specimens.

10. Infectious waste shall be "red bagged" in leak proof containers which are labeled with the "Biohazard" symbol and autoclaved properly before discarding in the trash.

11. All personnel should wash their hands following the completion of laboratory activities, after removal of gloves and protective clothing, and before leaving the laboratory or contaminated work area. If hand-washing facilities are not available antiseptic hand cleansers are to be used. Hands are to be washed as soon as feasible.

12. In the event of an exposure to eyes, mouth, mucus membrane, non-intact skin or parenteral contact, the area contacted should be washed with soap and water immediately. A medical evaluation should be performed immediately and the Safety Officer notified.

13. Contaminated materials (non-regulated Medical waste): paper towels, sponges, etc; should be double bagged and tagged for disposal in the county landfill.

14. Contaminated laundry shall be handled wearing gloves and placed in "Biohazard" marked, orange or red bags immediately after use. It should be handled minimally and not separated in the work area.

**Exposure Control Plan - Category II**

1. Utility gloves have been provided and should be used in all situations where contact with body fluids is possible.

2. Utility gloves, which have been used and have contacted body fluids should be placed in a double plastic bag and taken to the Infirmary for disposal or decontamination.

3. There is always a possibility that trash bags/cans could contain a hypodermic syringe/needle. If these type items are encountered they should not be removed. Place the trash bag in a box and contact the Safety Officer.

4. Flush waste drains if possible before servicing, use gloves, goggles and boots for major sewer line work. If sharps are encountered use a tool to remove the pieces.

5. If body fluids are involved in a cleaning job use 10 parts water and 1 part bleach to decontaminate. If broken glass is present do not pick it up with your hands use a broom and dust pan.

6. Should accidental contact with body fluids or a needlestick occur, the area contacted should be washed with soap and water as soon as feasible. The employee must be evaluated at the Infirmary as soon as possible after the incident and a report should be filed with the University Safety Office at the Facilities Management for Worker's Compensation record keeping purposes.

7. If fluids contact personal clothing or equipment, these items should be washed thoroughly in 10 parts water and 1 part chlorine bleach.
Post-Exposure Evaluation and Follow up

In the event of exposure to body fluids occurs during work the exposed employee should report this immediately to the University Health Service. The following steps should be taken:

1. Documentation of the route(s) of exposure, and the circumstances under which the exposure incident occurred.

2. Identification and documentation of the source individual, unless the employer can establish that identification is infeasible or prohibited by state or local law.
   - The source individual's blood shall be tested as soon as feasible and after consent is obtained in order to determine HBV and HIV infectivity. If consent is not obtained, the employer shall establish that legally required consent cannot be obtained.
   - When the source individual is already known to be infected with HBV or HIV, testing for either is not required.
   - Results of the source individual's testing shall be made available to the exposed employee, and the employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

3. Collection and testing of the exposed employee's blood for determining HIV and HBV serologic status.
   - The exposed employee's blood shall be collected as soon as feasible and tested after consent is obtained.
   - If the employee consents to baseline blood collection, but does not give consent at that time for HIV serologic testing, the sample shall be preserved for at least 90 days. If, within 90 days of the exposure incident, the employee elects to have the baseline sample tested, such testing shall be done as soon as feasible.

4. Post-exposure prophylaxis will be administered when medically indicated.

5. Counseling on the immediate and long-term effects of potential infectious agents will be discussed with the exposed individual.

6. The exposed employee will be encouraged to report all related diseases and problems to some one on the physician staff of the Health Services for follow-up.

7. All information should be recorded on the flow sheet.
   (Appendix D)

**Training:** Each employee in Category I and II are required to attend initial and annual training in bloodborne pathogens. The Safety & Risk Management Office and the University Health Service provides this training.
APPENDIX A

HEPATITIS

Information Sheet

I understand that viral Hepatitis B (also called serum hepatitis) is severe liver disease of adults and children and accounts for about one-half of all hepatitis cases in the United States. It is spread between human beings by contaminated needles, by intimate contact with an infected person, and by blood transfusions. Acute Hepatitis B is characterized by fever, loss of appetite, nausea, vomiting, abdominal pain, enlargement of the liver, jaundice (yellow skin) and occasionally by rash and pain in the joints. About 0.1% of persons die with the acute disease. About 10% of people do not recover from their infection but become carriers of the virus throughout their lifetime. This carrier state is associated closely with the development of cirrhosis of the liver, which can be fatal, and the development of liver cancer understand that no specific treatment of Hepatitis B is available.

Female personnel who are pregnant or who are nursing mothers should consult their health care providers, who must give written authorization prior to the vaccine being administered.

Personnel who have any known cardio-pulmonary compromise should consult their health care providers, who must give written consent prior to the vaccine being administered. Individuals who have well documented allergic reactions to formalin (formaldehyde) or thimerosal (mercury derivative) or yeast should receive special consultation from Health Service personnel prior to the administration of the vaccine.

There is one type of vaccine available. This is synthetic. The vaccine is generally well tolerated. No serious adverse reactions attributable to the vaccination have been reported for the vaccine. As with any vaccine, there is the possibility that broad use of the vaccine could reveal rare adverse reaction not observed in the clinical trials. Of the reported reactions, approximately half of them were injection site soreness. Low grade fever, less than 101 F, occurs occasionally and is usually confined to the 48-hour period following vaccination. Systemic complaints including malaise, fatigue, headache, nausea, dizziness, myalgia, and arthralgia are infrequent and have been limited to the first few days following vaccination.

Adult individuals who are not dialysis patients or immunocompromised should receive 3 one ml doses of the vaccine intramuscularly in the deltoid muscle of the arm. The first dose is given at the elected date, the second dose is given one month later and the third dose is given six months after the first dose. The duration of the protective effect of the vaccine is unknown at present.

ALTHOUGH THE VACCINE PROTECTS AGAINST HEPATITIS B, IT DOES NOT PROTECT ONE FROM OTHER INFECTIONS SUCH AS HEPATITIS A OR C WHICH CAN BE TRANSMITTED BY BLOOD AND OTHER BODY FLUIDS. FOR THIS REASON, TECHNIQUES FOR CAREFUL HANDLING OF THESE FLUIDS CANNOT BE RELAXED.
CONSENT FOR HEPATITIS B VACCINATION

I have read and understood the HEPATITIS B INFORMATION SHEET, which describes both the clinical course of the disease and its risks and hazards, and the vaccination and its usual and most frequent risks and hazards. I have discussed any concerns or questions with Employee Health Service personnel. To the best of my knowledge I am not pregnant. If I am pregnant I have consulted my private physician and obtained written authorization for vaccination.

I understand that there is no guarantee that vaccination will be effective or that the vaccine will be free of side effects. I understand that my participation in the hepatitis B vaccination program is entirely voluntary. I have opted to receive the HEPATITIS B VACCINE (synthetic). I hereby consent to the administration of the HEPATITIS B VACCINE at the University Health Services in 3 doses over the next 6 months.

#1

Date _______________

Lot# _______________

Work Phone: ______________________________________

Signature of Employee: _____________________________

Signature of UHS Staff Person: ______________________

Vaccine to be charged to: Department

Employee

Other

Charge #

Date of Charge
APPENDIX C

HEPATITIS B VACCINE DECLINATION

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself. However, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

________________________________________________
Employee Signature   Date

Check one

___yes or ____ no  Are you declining because you have already received the hepatitis B vaccine?
APPENDIX D

POST-EXPOSURE FLOW SHEET

Exposed employee: _________________________  SS# _____________________________
Time of exposure:___________________________   Date of exposure: _________________
Supervisor: _________________  Department:  ______________________
Detail of incident of exposure: __________________________________________________
_____________________________________________________________________________
Source individual:__________________________________    SS#______________________
HIV status:_______     HBV status: _________
Did source refuse determination of HIV and/or HBV serologic status?

Release of source individual HIV and HBV status to exposed employee:
Date:  _____________________________________________
Counseled on source individual's confidentiality rights:

Exposed individual's HIV status:_______     HBV status: _______
Is serum being held for 90 days period?  Yes  or  NO
Date of expiration of 90 day waiting period: ______________________________

Post exposure prophylaxis: ____________________________________________
Dates:  HBV Vaccination: ______________________________________________
HBV Immune globulin :________________________________________________
Other: ______________________________________________________________

Counseling on acute and long term effects of exposure to human body fluids:     ________
_____________________________________________________________________________

Follow of illnesses:  __________________________________________________________
_____________________________________________________________________________
INFECTION WASTE

DEFINITIONS

(1) "Blood and Body Fluids" means liquid blood, serum, plasma, other blood products, emulsified human tissue, spinal fluids, and pleural and peritoneal fluids. Dialysates are not blood or body fluids under this definition.

(2) "Microbiological Waste" means cultures and stocks of infectious agents, including but not limited to specimens from medical, pathological, pharmaceutical, research, and laboratories.

(3) "Pathological Waste" means human tissues, organs and body parts; and the carcasses and body parts of all animals that were known to have been exposed to pathogens that are potentially dangerous to humans during research, were used in the production of biological or in vivo testing of pharmaceuticals, or that died with a known or suspected disease transmissible to humans.

(4) "Regulated Medical Waste" means blood and body fluids in individual containers in volumes greater than 20 ml, microbiological waste, and pathological waste that have not been treated.

(5) "Sharps" means and includes needles, syringes with attached needles, capillary tubes, slides and cover slips, and scalpel blades.

DECONTAMINATION METHODS

General

Infectious waste is to be treated to change its biological character so as to reduce or eliminate its potential for causing disease. The most commonly used effective treatment method for the laboratory is steam sterilization (autoclaving). Steam sterilized liquid wastes may be discharged directly to the sanitary sewer. Procedures for disposal of solid wastes following steam sterilization are given under "Steam Sterilization Procedures." Laboratories with infectious wastes not specifically addressed by this document (such as waste with multiple hazards, e.g. carcinogens, radioactive infectious waste) should consult with the Safety & Risk Management Office for treatment and disposal methods.

Blood and Body Fluids

Since most laboratories have access to autoclaves blood and body fluids are to be steam sterilized prior to disposal. If this is not feasible the Safety & Risk Management Office should be consulted for alternate disposal methods. Both the CDC and EPA permits disposal of blood and body fluids down the sanitary sewer. When this is done care is to be taken to avoid splash and the drains are to be flushed with generous amounts of water. The Safety & Risk Management Office is to be contacted for approval of disposal methods other than autoclaving.
Microbiological Waste

Cultures and stocks of infectious agents, and items contaminated with cultures are to be steam sterilized prior to disposal. Liquids may be poured down the sanitary sewer after steam sterilization.

Pathological Waste

Pathological Waste must be incinerated (Harris Regional Hospital).

Contaminated Sharps

Contaminated glass and sharps are to be steam sterilized prior to disposal. Needles and syringes are to be placed directly into closeable, leak proof, puncture resistant rigid plastic containers, and steam sterilized. To prevent needlestick injuries, needles are not to be recapped, purposely bent, broken, or otherwise manipulated by hand. After autoclaving, containers of sharps are to be disposed of in a cardboard box lined with a plastic bag, clearly marked with the "GLASS and SHARPS" label.

Storage Prior to Decontamination

1. Regulated medical waste shall be stored in a manner that prevents leakage of the contents of the package.

2. Regulated medical waste shall be stored in a manner that maintains the integrity of the packaging at all times.

3. The labeling and marking of the package shall be maintained at all times.

4. Regulated medical waste shall not be stored longer than 7 calendar days from the date of generation unless the regulated medical waste is refrigerated at an ambient temperature between 35 and 45 degrees Fahrenheit.

5. Only authorized personnel shall have access to areas used to store regulated medical waste.

6. All areas used to store regulated medical waste shall be kept clean. Vermin and insects shall be controlled.

7. All floor drains shall discharge directly to an approved sanitary sewage system. Ventilation shall be provided and shall discharge so as not to create nuisance odors.

Transportation of Regulated Medical Waste

1. Regulated medical waste shall be packaged in a minimum of one 160-lb. burst strength polyethylene or equivalent bag, and placed in a rigid fiberboard box or drum in a manner that prevents leakage of the contents.
2. Regulated medical waste shall be stored in a manner that maintains the integrity of the packaging at all times.

3. Each package of regulated medical waste shall be labeled with a water resistant universal biohazard symbol.

4. Each package of regulated medical waste shall be marked on the outer surface with the following information.
   - The generator's name, address, and telephone number
   - The transporter's name, address, and telephone number
   - Storage facility name, address, and telephone number, when applicable.
   - Treatment facility name, address and telephone number
   - Date of shipment
   - "INFECTIOUS WASTE" OR "MEDICAL WASTE"

5. All loads containing regulated medical waste shall be covered during transportation.

6. The universal biohazard symbol shall be displayed on all transportation vehicles, in accordance with Department of Transportation Standards and 49 CFR 172 Subpart F.

7. Regulated medical waste shall be delivered to a permitted storage or treatment facility within seven calendar days of the date of generation.

8. Refrigeration at an ambient temperature between 35 and 45 degrees Fahrenheit shall be maintained for regulated medical waste that will not be delivered for treatment within seven calendar days.

9. A contingency plan shall be prepared and maintained in each vehicle used in the transporting of regulated medical waste. The operator of each vehicle shall be knowledgeable of the plan.

10. Vehicles used for the transportation of regulated medical waste shall be thoroughly cleaned and disinfected with a microbacteriocidal disinfectant before being used for any other purpose and in the event of leakage from packages.

11. While transporting regulated medical waste, vehicles are prohibited from transporting any material other than solid waste and supplies related to the handling of medical waste.
STEAM STERILIZATION PROCEDURES

1. Infectious wastes are to be accumulated in durable leak proof containers lined with red or orange autoclave bags. The outer container must be of such a design so as not to be mistaken by Grounds as regular trash. Glass items must be autoclaved separately and then placed in the glass and sharps container. Plastic pipets are to be containerized to prevent bag puncture. The universal biological hazard symbol must be displayed on the bags and outer container. Since the outer container may also be contaminated, both the bag and the outer container should be autoclaved. Transfer of heat is more efficient when smaller waste loads are autoclaved and when stainless steel containers are used rather than polypropylene. Waste materials that are to be decontaminated at a site away from the laboratory are to be transported in closed containers.

2. The autoclave is to be operated at 121°C (250°F) or higher for 45 minutes. Some autoclaves are equipped to operate at higher temperatures, which would allow for shorter exposure times.

3. For effective treatment, the critical factor is the degree of steam penetration. For steam to penetrate throughout the waste load, the air must be completely displaced from the treatment chamber. To facilitate steam penetration, bags are to be opened and bottle caps and stoppers loosened before placement in the steam.

4. After autoclaving, the bags are to be sealed with tape. The bags are to be labeled as having been autoclaved, by placing heat sensitive tape over the biohazards symbol prior to autoclaving. The heat sensitive tape is to be of the type where the word "autoclaved" appears after treatment.

5. The autoclaved wastes are then to be placed in a cardboard box Biohazard bags placed in the cardboard containers and marked with the heat sensitive tape, as indicated above, will signal to Grounds that the waste can be removed from the trash can. Each department is responsible for providing these containers.

6. Waste bags with universal biohazard symbols are to be used only for infectious waste that will be autoclaved before disposal.

7. Housekeeping is not to remove or otherwise handle waste in biohazard bags.

8. Contaminated materials are not to be left in hallways or other public spaces prior to autoclave decontamination.
References


DISPOSAL OF HYPODERMIC SYRINGES, NEEDLES AND GLASS

To prevent injuries to Housekeeping personnel, sharps must not be discarded in trash receptacles intended for ordinary trash. Sharps include such items as broken glass, pipettes, razor blades, serrated metal and any other item capable of protruding through a trash bag and puncturing skin. The appropriate method of disposal depends on the item and nature of materials with which it is, or may be contaminated.

Broken Glass and Other Sharps

Non-Contaminated and or sterilized glassware and sharps are to be placed in a plastic bag within a cardboard box. The box will be picked up by Housekeeping.

Hypodermic Syringes and Needles

Metal or rigid plastic containers must be used for accumulation and disposal of hypodermic syringes and needles. The containers must be labeled with a biohazard symbol or color-coded. Glass bottles are not recommended because they may break during compaction and present a hazard to sanitation workers. **NOTE**: Syringes and needles contaminated with a biological hazard must be steam sterilized (autoclaved) before disposal.

Broken glass, needles and other sharps contaminated with trace carcinogens or radioactive material are to be placed in special the containers provided for those waste streams. Contact the Safety Officer for disposal of these items.
Most laboratories handle hazardous materials whether radioactive or chemical which can generate harmful concentrations of aerosols, fumes, vapors, etc. within fume hood exhaust air and which can contaminate the surfaces of laboratory equipment. It is essential for the safety of those required to repair fume hoods, fans, motors equipment, etc. that appropriate precautions to prevent exposure to air contaminants be taken and that laboratory equipment be decontaminated. Whenever work is performed on roof vent fans, within fume hood enclosures or on laboratory equipment the following procedures must be followed.

Roof Fans

Prior to starting work laboratory personnel must certify that all sources of harmful aerosols, fumes, vapors, etc. are contained or removed from the hood being serviced and the hoods with roof fans that are adjacent to the one serviced.

All work within the duct air stream enclosure shall be performed with neoprene gloves.

Switches operating the hood fan shall be tagged by the maintenance employee during work.

Hood Enclosures

Prior to starting work all materials must be removed from the hood enclosure and contaminated surfaces (if any) shall be cleaned by laboratory personnel.

Laboratory Equipment

Prior to starting work all containers of hazardous materials must be removed and all potentially contaminated surfaces cleaned by laboratory personnel. A radiation survey is to be done for equipment, which has been used with radioactive materials.

Plumbing

Chemicals containers stored around plumbing drains or fixtures must be removed by laboratory personnel. If possible flush the drains with plenty of water. Maintenance employees must wear neoprene gloves and chemical goggles.
HAZARDOUS MATERIAL RELEASE PROCEDURES

Emergency Response Notification

Persons discovering a fire, smoke, gas leak, chemical spill or other emergency are to first notify the following agencies and personnel in accordance with the nature of the emergency:

**FIRE ALARM ONLY** – UNIVERSITY POLICE – 911
(no evidence of fire)

**FIRE** – CULLOWHEE FIRE DEPARTMENT – 911

**CHEMICAL SPILL/GAS LEAK** – UNIVERSITY POLICE – 911

**MEDICAL EMERGENCY** – SECT – 911
SUMMER – 911

The following information should be provided:

- Callers name and the telephone number in which the caller can be reached.
- Location and nature of emergency, and special considerations (if known) i.e., hazardous chemicals, radiation, injured person, etc.
- The Campus Police will dispatch an officer to the scene of the report and will notify Facilities Management who will also dispatch personnel to the scene.
- The caller or other person knowledgeable in the area where the emergency occurs should meet the responding Police Officer.

Hazardous Materials Incidents

The scope of this section is limited to incidental spills or releases of chemicals or gases which can be safely corrected at the time of the release by either personnel in the work area or by maintenance personnel.

For spills and releases beyond the control of employees at the scene, university personnel will evacuate the release area and call for help from outside emergency responders. Designated Facilities Management workers will attempt to contain the release from a safe distance, keep it from spreading and prevent exposure.

Management of chemical spills and gas leaks usually requires the technical support of the supervisor or faculty member responsible for the material and/or the campus safety officer.
Campus Police Officers and/or the SECT team may be the first to arrive at the site. However, they should not enter spill or gas leak areas without knowledge of the material hazards and protective equipment required.

The following activities should be conducted prior to actual clean up or leak correction:

- Determine the exact physical location of the release (e.g. in a room, hallway, or the floor, in a hood, storage room, on a table etc.) and the quantity.
- Isolate the spill or release as much as possible. Exhaust ventilation should be established if possible.
- Evacuate all personnel from the spill or release area and attend to persons who may have been contaminated.
- Obtain the Material Safety Data Sheet (MSDS) or consult the person responsible for the material to identify the material, its chemical and physical properties, hazards presented and the types of protective equipment needed.
- If the material is highly flammable attempt to turn off ignition sources if safe to do so.
- Clean up personnel must wear protective clothing and equipment in accordance with the hazards of the material.

Spills of Chemicals:

Confine the spill material as much as possible.

Use clay - Safety absorbent or diatomaceous solid absorbent to absorb any liquid.

Note: A neutralizing agent may be used on inorganic acids and bases but only under the supervision of a laboratory faculty member or the Safety Officer.

If the material is volatile let it evaporate and be exhausted by the mechanical exhaust system if safe to do so.

Carefully pick up cartons or bottles and place in a solid wall box.

Place the absorbed liquid or solid in a plastic or metal container and label the container.

Dispose of residue according to Hazardous Waste Policies.
Gas Leaks

In cases involving highly flammable or toxic gases immediately dangerous to life the building should be evacuated.

Maintain the mechanical exhaust system if safe to do so.

Gas which is immediately life threatening should be shut off using a self contained breathing unit and full body protection for highly toxic gases.

Leaks, which are not immediately life threatening may be localized with soapy water or a gas, leak detector. For chlorine a squeeze bottle of Aqueous ammonia should be used.

The supplier should be contacted for all leaks that cannot be remedied by a simple act such as tightening a valve gland or packing nut.