

# LABORATORY SAFETY GUIDE/CHEMICAL HYGIENE PLAN

## I. GOAL

This manual applies to all employees and students in order to protect them from exposure to hazardous chemicals and situations that may endanger their health and safety. A conscious effort by all personnel to follow these guidelines is essential to achieve a safe work environment.

The science faculty and research staff serve as role models for their technical staff, students and other laboratory support personnel. They must insist that appropriate laboratory procedures be followed at all times. Support personnel working in proximity should also be informed about potential hazards and what to do in the event of an accident or emergency.

To ensure a safe work environment everyone involved in chemical/laboratory operations must be safety conscious. Safety becomes part of the work attitude through repeated discussions, meaningful in-service training and the demonstrated commitment of the College administration, faculty, support staff and students. It is in everyone's best interest to carry out chemical work in accordance with good health and safety practices.

The policy of the College of Environmental Science and Forestry is as follows: **NO EMPLOYEE, STUDENT, OR VISITING SCIENTIST SHALL CONDUCT ANY RESEARCH, INSTRUCTION, OR PROCEDURE IN A MANNER WHICH JEOPARDIZES THE HEALTH OR SAFETY OF ANY PERSON, OR THE ENVIRONMENT.**

The College also has a commitment to protecting the environment. Hence, all chemical waste must be disposed of in accordance with applicable laws and with environmentally sound procedures that minimize their potential harm. When appropriate, every effort shall be made to reduce, reuse, or recycle any chemicals to remove them from the waste stream.

Other occupational safety plans exist at the College and include a Bloodborne Pathogens Exposure Control Plan; Confined Space Entry; Respiratory Protection; Personal Protective Equipment; and Lead in Construction, Hot Work, and others. Contact the Office of Environmental Health & Safety for more information.

The most recent version of this manual is available at <http://www.esf.edu/ehs/lsg/guidea.htm>.

## II. ENSURING LABORATORY SAFETY

### A. Laboratory Director

The **Laboratory Director (LD)** shall be defined as:

1. the person in charge of an exclusive use laboratory or;
2. the person in charge of the instruction or project in a multiple use laboratory.

The **LD** shall ensure that:

1. appropriate safety and emergency procedures have been developed and are followed;
2. adequate emergency equipment is available and in working condition;
3. all personnel receive training in use of emergency equipment;
4. information on any special or unusual hazards in non-routine procedures is provided for any personnel;
5. the appropriate safety orientation has been given to all project participants.

## III. SAFE LABORATORY PRACTICES

### A. General Principles

Everyone in a laboratory should observe the following rules:

1. Understand and utilize the safety procedures that apply to the work being performed. Determine the potential hazards (physical, chemical, biological, or radiological), and the appropriate safety precautions to be followed, **before** beginning any task.
2. Be familiar with emergency procedures, the location and use of emergency equipment, and how to obtain help.
3. Be aware of types of protective equipment available. Use the proper type of personal protective equipment for the particular task.
4. Call attention to unsafe conditions or work practices so that appropriate corrections can be implemented.

5. Never consume food or beverages, or smoke near areas where chemicals are being used or stored. Do not apply cosmetics or insert contact lenses while in the laboratory or chemical storage area.
6. Always adhere to appropriate waste disposal procedures.
7. Be certain that all chemicals are correctly and clearly labeled. Post the designated warning signs or labels when specific hazards, such as radiation, flammable materials, biological hazards or other special hazardous conditions exist.
8. Check all burners and gas outlets to ensure that they are off before leaving the laboratory. Do not place gas burners by open windows or in a draft. No gas burner shall be left unattended while in operation.
9. Remain out of the area of a fire, chemical spill, or personal injury unless your assistance is required to help meet the emergency.
10. Use laboratory equipment only for its designated purpose.
11. Carefully position and secure equipment. Take the necessary steps to avoid the accidental jarring of an apparatus or piece of equipment. Use caution in handling hot objects.
12. Check all gas cylinders to ensure that they are securely fastened and that the straps are in good repair.
13. Keep laboratory doors closed to prevent escape of odors into hall.
14. **Think, Act, and Encourage Safety.**

## **B. Health and Hygiene**

The following practices should be observed:

1. Wear appropriate eye protection, such as safety glasses, goggles, and/or a face shield at all times. **Contact lenses should not be worn in the laboratory.** (See appendix H for ESF's Personal Protective Equipment Policy)

*In the event that a chemical is splashed into the eye, a contact lens may serve to trap and concentrate the chemical, thereby increasing the potential for eye damage. In some cases, the lens may dissolve or in some way become "glued" to the eye.*

*"Soft" contact lenses can absorb organic solvent vapors and thus potentially damage the eye.*

*There may be exceptional situations in which contact lenses must be worn for therapeutic reasons. In these situations, employees who MUST wear contact lenses MUST inform their supervisor so that appropriate safety precautions can be devised.*

2. Use protective apparel, such as gloves, gowns, lab coats, and other special clothing or footwear as needed. Wearing shorts, tank tops, halters, sandals, or clothing that exposes a large amount of unprotected skin is **strictly prohibited**. It is imperative that the possibility of skin contact with chemicals be minimized.
3. Confine long hair and loose clothing when in the laboratory.
4. Do not use mouth suction to pipette chemicals or start a siphon. A pipette bulb, aspirator or vacuum-assisted pipette must be used.
5. Avoid exposure to gases, vapors, particulates, and aerosols. Use of fume hood whenever such exposure is likely. Appropriate safety equipment must be used when work is not conducted inside a fume hood.
6. Frequently and thoroughly wash hands during the day, immediately before eating and always before leaving the laboratory. When appropriate, a shower should be taken before leaving campus.
7. Avoid the use of solvents for washing the skin. They may remove the natural protective oils from the skin and can cause irritation. Some solvents can facilitate absorption of toxic chemicals or have their own potentially adverse health effects.
8. Do not attempt to identify chemicals by smell or taste.
9. Minimize your potential for exposure by protecting against inhalation, ingestion, injection and absorption of chemicals.

### **C. Food, Beverages, and Chemical Contamination**

The contamination of food, drink and smoking material is a potential route for exposure to hazardous chemicals. Food and beverages must be stored, handled and consumed in an area entirely free of hazardous chemicals. Smoking is prohibited in all buildings.

1. Well-defined areas must be established for storage and consumption of food and beverages. No food will be stored or consumed outside of this area.
2. Consumption of food or beverages, or smoking is not permitted in areas where laboratory operations are conducted or chemicals are handled.
3. Glassware or utensils used for laboratory operations must never be used to prepare or consume food or beverages. Laboratory refrigerators, ice chests, and cold rooms, are not to be used for food storage.

## D. Housekeeping

There is a definite relationship between safety performance and orderliness in the laboratory. Where housekeeping standards are lax, safety performance inevitably deteriorates. The work area must be kept clean, with chemicals and equipment properly labeled and stored.

1. Work areas must be kept clean and free from obstructions. Cleanup will follow the completion of any equipment, laboratory session, or as soon as possible.
2. Spilled chemicals must be cleaned immediately and disposed of properly. Disposal procedures must be followed and all laboratory personnel must be informed of them. Chemical accidents and spills are to be attended to promptly. Contact University Police (**x6666**) if the spill presents a health or safety risk, or is beyond your cleanup capabilities.
3. Unknown chemicals and chemical wastes are to be disposed of promptly using the appropriate procedures. Waste must be deposited in appropriate receptacles.
4. Floors are to be cleaned regularly and kept free of clutter. Keep aisles established for emergency egress.
5. Stairwells and hallways may not be used for storage.
6. Access to exits, emergency equipment, valves, controls, alarms, and electrical panels must not be blocked.
7. All glassware shall be properly disposed of in accordance with the appropriate procedure (See section F.8.)
8. **Bicycles, children and pets are not permitted** in any laboratories.
9. Used sharps such as needles, syringes, and razor blades, etc. must be stored in puncture-proof containers while awaiting disposal.

## E. Laboratory Equipment Maintenance

Improperly functioning equipment may provide a false sense of safety and create hazardous situations.

1. Equipment must be inspected and tested regularly. Service schedules depend on both the possibility and consequences of failure.
2. Maintenance plans must include a **lock out/tag out** procedure to ensure that a device cannot be restarted while repairs are being conducted. (**See Physical Plant Policy**)

## F. Glassware

Accidents involving glassware are a leading cause of laboratory injuries.

1. Careful handling and storage procedures must be used to avoid damaging glassware.
2. Damaged items are to be discarded or repaired.
3. Adequate hand protection must be used when inserting glass tubing into rubber stoppers or corks, when placing rubber tubing on glass hose connections, or when picking up broken glass.
4. Glass-blowing operations are not to be attempted unless proper annealing facilities are available.
5. Vacuum-jacketed glass apparatuses are to be handled with extreme care to prevent implosions.
6. Only glassware designed for vacuum work is to be used for that purpose.
7. Proper instruction must be provided in the use of glass equipment designed for specialized tasks.
8. Designated “**GLASS ONLY**” waste containers must be used to dispose of glass.

## G. Protective Apparel and Equipment

A variety of specialized clothing and equipment is available for use in the laboratory. The proper use of these items will minimize or eliminate exposure to the hazards associated with most laboratory procedures. All laboratory personnel must be familiar with the location and proper use of protective apparel, safety equipment and emergency procedures.

Each laboratory should include:

1. Protective apparel and equipment recommended for the substances being handled.
2. An accessible drench-type safety shower or means of providing flushing for corrosive chemical splashes as immediate first aid treatment.
3. An eyewash fountain or self-contained eyewash station for corrosive chemical splashes.
4. An accessible fire extinguisher appropriate for the types of fire hazards present. Combustible metals require **Class D fire extinguishers**.

5. A chemical spill kit for small spills.
6. Access to a fire alarm and telephone for emergency use.

## H. Cryogenic Hazards

The primary hazard associated with cryogenic materials is the extreme cold and potential for thermal burns. These burns can be severe.

1. Insulated gloves and a face shield are required when preparing and using dry ice or cold baths.
2. Neither liquid nitrogen nor liquid air will be used to cool a flammable mixture in the presence of air.
3. **NEVER** lower your head into a dry ice chest. Carbon dioxide is heavier than air and suffocation may result.
4. Recycled ice bath chemicals should be stored in metal containers and allowed to reach room temperature before sealing to prevent explosion.

## I. Systems Under Pressure

1. Reactions must only be conducted in apparatus that is designed to withstand pressures generated.
2. All pressurized apparatus **MUST** have an appropriate relief device.
3. Heat must never be added to apparatus that is not designed to withstand heating.
4. If a reaction system cannot be vented directly, an inert gas purge and bubbler system should be used to avoid pressure build up.

## J. Warning Signs and Labels

Laboratory areas that have specific hazards must be posted with warning signs.

1. Use standard signs and symbols that have been established for special situations (i.e., radioactivity hazard, biological hazard, fire hazard and laser operations).
2. Post signs that show location of emergency equipment.
3. Waste containers must be labeled to indicate the type of waste that can be safely deposited.
4. **Laboratory Directors** shall ensure that all chemicals under their control are labeled in accordance with the *ESF Hazardous Chemical Labeling Program*. **(See Appendix B)**
5. Each laboratory must post signs identifying the **Laboratory Director(s)**.
6. Chemical code sheets must be posted if cryptic codes are used for laboratory stock solutions. **(See Appendix C)**

## K. Unattended Operations

It may be necessary to conduct laboratory procedures over extended periods of time or to run equipment continuously.

1. Such unattended operations must be designed safely.
2. Contingency plans must provide for potential hazards that may result from interruptions of utilities, such as electricity or water.
3. Appropriate signs indicating that a particular laboratory operation is in progress **MUST** be posted with the name and phone number of the person to contact in an emergency.

## L. Working Alone

Avoid working alone in a laboratory. If this is not possible:

1. Arrange with a co-worker to check in with you periodically.
2. On nights, weekends, and holidays contact Campus University Police **(x6666)** and arrange for an officer on patrol to check in at your lab periodically.

3. Procedures known to be extremely hazardous may not be undertaken when working alone.
4. The **Laboratory Director(s)** will determine which procedures have need for special precautions to be taken.

### **M. Laboratory Security**

For the protection of employees, students, equipment, supplies, and the public, laboratories must be locked when unattended.

Security within the laboratory is also important. Locked storage cabinets are advised for sensitive or expensive supplies and equipment. Lockable storage areas or lockers for securing personal property are advised. Needles and syringes must be secured.

Computers, scientific equipment, and research data can be the object of theft, vandalism, or damage from fire or utility failure. Appropriate cabinetry designed to protect these items should be considered. Upon request, Campus University Police can assist laboratories with crime prevention surveys and recommendations.

If you observe suspicious persons or activities in your area, contact Campus University Police (**x6666**) and an officer will be sent to investigate. Report any thefts or other crimes immediately. Information from these reports is used to adjust patrol activities and may prevent further problems.

## IV. FACILITY AND OPERATIONAL SAFETY RULES

### A. Laboratory Fume Hoods

The best method to prevent the release of hazardous chemicals into the laboratory is to conduct all work inside a properly functioning fume hood. The following rule should be followed:

1. Airflow on all working fume hoods should be between 60 to 100-lfm minimum with the sash at 14"-20" above fully closed position.
2. Never store chemicals or other items in a fume hood that is also used for laboratory work.
3. Fume hoods that are not being used for laboratory work should have the sash fully closed.
4. All fume hoods should be equipped with a device to enable user to determine that the hood is properly functioning.
5. Equipment and chemicals should be placed as far from the hood face as practical to prevent emission from escaping.
6. Work should be performed with the hood sash in the lowest practical position.
7. Procedures involving **highly toxic substances** should be performed in a glove box-equipped hood.
8. Check inspection and restriction labels on hoods before using.
9. Never block the fume hood vents.
10. Do not alter any fume hood ventilation system.
11. Contact maintenance and Operations for repair or with alteration questions.
12. Always clean the hood when a procedure is completed.
13. **DO NOT** use **PERCHLORIC ACID** in **ANY FUME HOOD** unless it is a designated "perchloric acid use" hood.
14. Keep laboratory doors closed. This will minimize crosscurrents, enhance hood performance, and keep odors from spreading throughout the building.

## V. HANDLING CHEMICALS IN THE LABORATORY

The laboratory chemicals found within this College are as varied as the purposes for which they are used. For this reason, general precautions for handling categories of chemicals are more appropriate than specific guidelines for each separate chemical. Nevertheless, all laboratories have available Material Safety Data Sheets (MSDS) for all chemicals used, handled and stored within the work area. They are readily available to all employees and students by contacting the **Chemical Hygiene Officer** or accessing on the Internet.

The **Laboratory Director** will supply the **Chemical Hygiene Officer** with a chemical inventory, which will be updated as changes occur. Further, all laboratories will post a chemical code sheet for the stock solutions and mixtures utilized within the work area. **(See Appendix C)**

### A. Acute and Chronic Exposure

Recommendations for handling procedures for chemicals begin with the admonition that, even for substances with no known significant hazards, it is prudent to observe universal safe laboratory practices. Minimize exposure by working in a laboratory fume hood, wearing eye and hand protection, and laboratory coat or apron.

The toxicity of a substance is determined by its ability to damage or interfere with the structure or function of living tissue. An acute exposure is one that can cause damage as the result of a single or short duration exposure.

Chronic exposure is one that causes damage after repeated or long duration exposure, or becomes evident only after a long period of latency.

**With any chemical, it is imperative that the Material Safety Data Sheet be consulted before it is used. The MSDS will list precautions for proper handling and limits for exposure.**

## B. Procurement

1. Before a substance is received, information on its proper handling, storage and disposal should be known.
2. Chemicals donated to SUNY ESF must be received in accordance with administrative policy (see <http://www.esf.edu/au/pp/donated-chem-procedure.pdf>), and the appropriate form completed (see <http://www.esf.edu/au/pp/donated.chem.ship.form.pdf> )
3. No containers will be accepted without a proper identifying label.
4. Whenever possible, a less hazardous or toxic chemical should be substituted.
5. Chemicals should be purchased in a container size that will result in complete use of the material in a reasonable amount of time. The acquisition of containers of hazardous chemicals greater in size than 5-gallons requires approval of the Environmental Health & Safety Office to ensure all applicable regulations are met.

## C. Transport

Transporting hazardous chemicals from one location to another within the College can be safely accomplished when:

1. Unbreakable containers or glass bottles, protected with bottle carriers, are used for flammable or corrosive liquids.
2. The lids for such containers are periodically inspected to ensure their integrity.
3. Leaking containers are not transported without secondary containment.

Central Supply will not release a hazardous substance to any laboratory that does not provide a safe and suitable means for their transport.

## D. Storage

The correct storage of chemicals has become increasingly important to maintain a safe working environment, particularly when the number of chemicals in use increases and their toxicity becomes known.

Problems related to chemical storage can be significantly reduced by following the principles of **LIMITING** and **SEGREGATING**.

1. Toxic substances should be segregated from other chemicals in a well-defined area with local exhaust ventilation.
2. Chemicals that are considered highly toxic, carcinogenic, or otherwise hazardous should be placed in an unbreakable secondary container and properly labeled.
3. Stored chemicals should be examined at least on an annual basis for deterioration, container integrity, and possible replacement.
4. The amount of chemicals stored should be as small as practical.
5. Storage on bench tops and in laboratory hoods is prohibited, unless the hood has been designated as a storage area and is not used to conduct laboratory work.
6. Do not store bottles on the floor or on carts.
7. Avoid exposure of chemicals to heat and direct sunlight.
8. A periodic chemical inventory should be conducted with unneeded chemicals given to the **Chemical Hygiene Officer** for recycling or disposal.

#### **E. Designated Area**

Laboratories working with carcinogens, reproductive toxins, or acutely toxic substances must establish a **Designated Area**. A **Designated Area** may be any part of a laboratory, a device such as a laboratory hood, or the entire laboratory.

The purpose of the **Designated Area** is to focus attention on the particularly hazardous substance that is being used and to ensure that all persons in the vicinity observe the necessary protective measures.

**Designated Areas** must be identified by appropriate signs, and the **Laboratory Director** must inform the lab occupants of the hazard and emergency procedures.

#### **F. Approval**

Prior approval must be obtained from the appropriate source (**Chemical Hygiene Officer, Laboratory Director(s), Radiological Safety Committee, or Biohazard Committee**) before laboratory procedures can be undertaken involving the following:

1. A newly introduced hazardous chemical substance of moderate chronic or high acute toxicity.

## 2. Working with substances of known chronic toxicity.

Prior consultation can ensure that appropriate measures are taken to establish safety protocols, minimize exposure, and establish proper waste disposal procedures.

## VI. CHEMICAL HAZARDS

A number of routine procedures in a laboratory involve the use of hazardous chemicals. They must be appropriately labeled to indicate the hazards. **Read the labels** and **observe the precautions**.

Hazardous chemicals may be grouped as follows:

**Corrosive or Caustic:** Acids and alkalis may cause burns of the skin, mouth, lungs, or eyes and irreversible damage to equipment and storage areas. The US EPA defines corrosive as having a pH less than 2 or greater than 12.5.

**Toxic Chemicals:** Almost any substance in sufficient quantity can be considered toxic. Toxic chemicals are those that damage biological structure and function through exposure or accumulation in tissues. Usually, this involves relatively small amounts of the toxin.

For these purposes, a **poison** will be defined as a substance that may cause death or serious health effects if relatively small amounts are inhaled, ingested or absorbed by the skin. Poisons may be gas, liquid or solid.

Specific authoritative sources such as the Registry of Toxic Effects of Chemical Substances (RTECS), 29 CFR Part 1910 Sub-part Z, the National Toxicology Program (NTP) Annual Report on Carcinogens, the US EPA, and the International Agency for Research on Cancer (IARC) monographs serve as primary sources of toxic chemical information.

**Flammables:** Materials that may easily ignite, burn and serve as fuel for a fire. The US EPA defines flammable as having a flash point less than 140 degrees Fahrenheit.

**Reactives:** Materials that may release large amounts of energy under special circumstances. Readily undergoes violent change; forms explosive mixtures or toxic gases with water; capable of detonation.

## A. Caustics and Corrosives

Contact with the skin or eyes represents the greatest risk when dealing with corrosives. Match the hazard presented by the material with which you are working with the protective equipment recommended by the MSDS. Always wear resistant gloves and eye protection when dealing with corrosives. In some cases, respiratory protection may be desirable (contact the Environmental Health & Safety Office for information on the **Respiratory Protection Plan**).

### 1. Handling

- a. Be aware of the nearest eyewash station and safety shower for your work location.
- b. When acids or alkalis are used, some form of containment to control spills must be employed. Included among these methods are bench top spill diapers and resistant trays.
- c. Do not pipette by mouth. Use a mechanical or vacuum-assisted pipette aid.
- d. When diluting, **always add ACID to WATER, never add water to acid**. Allow the acid to run down the inside of the container and mix slowly by gentle rotation.
- e. Be aware of the methods, materials and procedure for cleaning corrosive spills. In the event of a spill beyond your immediate ability to control, notify University Police (x6666). **(See Appendix E)**

### 2. Storage

- a. Store corrosives in a cool, dry and well-ventilated area away from direct sunlight.
- b. Use storage materials that are resistant to corrosion.
- c. Store caustic and corrosive materials near, but not on the floor to minimize danger of bottles falling from shelves.
- d. Large amounts of corrosive chemicals require a dedicated corrosive storage cabinet.
- e. Segregate acids from bases. Store chemicals according to their primary hazard classification.

Isolate corrosives from the following:

1. organics
2. flammables
3. toxic materials

Separate containers to facilitate handling. Organic acids are to be store separately from strong oxidizing agents to prevent interaction of fumes and corrosion of storage cabinets.

- f. Acid bottle carriers must be used for containers over one quart in size.

### **General First Aid Considerations for Corrosives**

In the event that a corrosive contacts the skin, immediately remove any contaminated clothing and flush the area with copious amounts of water. Use care not to rub or damage the skin. Notify your supervisor and seek medical attention.

In the event that a corrosive chemical contacts the eyes, immediately flush the eyes with large amounts of clean water, including under the eyelids for at least 15 minutes. Seek immediate medical attention.

### **DO NOT WEAR CONTACT LENSES WHEN WORKING WITH CORROSIVE MATERIALS!**

If a corrosive material is ingested, DO NOT induce vomiting. Seek immediate medical attention.

## **B. Toxic Chemicals**

1. Handling and Storage
  - a. Isolate, segregate, and clearly label all toxic chemicals.
  - b. Adequate room ventilation must be provided at the work site area. A fume hood must be used whenever possible.
  - c. The appropriate personal protective equipment must be worn as directed by the label or MSDS. If in doubt, contact the **Chemical Hygiene Officer**.
  - d. Limit exposure time.
  - e. Practice good personal hygiene.
    - hand washing
    - wearing a lab coat

## Mercury

Special consideration must be given to this poison that is used in many laboratories at the College.

Use care to avoid spills of elemental mercury.

CLEAN UP SMALL GROSS spills with a pipette or "Sweeper." Ventilate area well to remove mercury vapors. Large spills (>1 ml) should be referred to the Environmental Health & Safety Office. **(x6666)**

Chronic exposure and absorption of mercury may lead to a metallic taste in mouth, a gray line around gums and neurological problems.

Do not place elemental mercury waste in drains. Contact the **Chemical Hygiene Officer** for proper disposal.

Due to its toxicity and difficulty of disposal, the purchase of mercury and mercury containing items is restricted. (See appendix A)

## C. Carcinogens

Carcinogens are hazardous chemicals capable of increasing the risk of cancer(s) through exposure, usually over time. Teratogens are hazardous chemicals capable of causing an increased risk of birth defects in children of exposed workers.

Prudent practices need to be used in dealing with known or suspected carcinogens and teratogens. Reduce your exposure to these chemicals to the lowest possible level through good work habits and common sense.

The greatest potential harm is a result of repeated or prolonged exposure to these chemicals in excess of the acceptable limits.

Other behaviors such as diet and smoking can contribute to the synergistic or antagonistic effects of carcinogenic materials.

Plan ahead for problems with carcinogenic compounds. A protocol should exist for handling, storing, disposal and emergency procedures to be followed.

## D. Flammables

Flammable chemicals represent a major safety concern at the College because of the immediate physical danger that these materials present to all employees. Our primary interest is in reducing the chance of fire involving these materials. Also, many flammable chemicals have associated health risks.

### 1. Handling and Storage

- a. Use small volumes of solvents/flammables (100 ml or less) when performing routine tasks. Store larger amounts in approved flammable containers. Never store flammables with reactive chemicals or oxidizers.
- b. Transfer solvents/flammables in a working laboratory hood or well-ventilated area. Smoking, open flames, and other sources of ignition are not permitted around solvents.
- c. Use solvents at temperatures 10 to 15 degrees below their flashpoint, if possible.
- d. Grounding must be provided on all large drums used for storage or dispensing of solvents. All containers must be labeled.
- e. Note the location and type of fire fighting equipment available for the particular need. Flammable liquid fires are Class B fires. Extinguishers that are effective on class A, B, & C fires are available throughout the College.
- f. Remember that flammable liquids may have other health consequences as well. Prudent practices need to be observed in storing and disposing of flammable liquids.
- g. Quantities of more than one gallon must be stored in a safety can. If a reagent must be stored in glass for purity, the glass container should be placed in a bottle carrier to lessen the danger of breakage.
- h. Small quantities (working amounts) may be stored on open shelves, but bulk storage (more than one gallon) must be in a designated flammable storage area.
- i. Approved flammable storage cabinets will be needed for laboratories with a large inventory (10 gallons or more) of flammable chemicals.

### 2. Refrigeration and Cooling Equipment

The use of domestic refrigerators for the storage of solvents and flammables presents a significant hazard to the laboratory work area. This practice is prohibited at the College of Environmental Science and Forestry.

**Only FM or UL approved “explosion-proof” or “laboratory safe” refrigeration equipment may be used for flammable materials.** Explosion-proof refrigeration equipment is designed to protect against ignition of flammable vapors both inside and outside the refrigeration compartment. “Laboratory Safe” provides protection only on the inside.

Every laboratory refrigerator must be clearly labeled to indicate whether or not it is acceptable for storage of a flammable material. The required labels are available through the **Chemical Hygiene Officer**.

## **F. Reactives**

Reactive chemicals are characterized by their tendency to release large amounts of energy under certain conditions. Since the catalyst for these reactions frequently is found in the normal environment, special precautions need to be observed to safely use and store these materials. Included in this category are explosives, water reactive materials, air sensitive materials, and mixtures of oxidizing and reducing agents.

### 1. Handling and Storage

- a. Know the specific properties of the materials prior to initiating the work.
- b. Ensure adequate protection against shock, extremes in temperature, other reactive chemicals, and potential sources of ignition.
- c. Segregate oxidizers from reducers. Store reactive chemicals according to their primary hazard classification.
- d. Isolate reactive chemicals from toxic materials and flammables.
- e. Use adequate personal protective equipment. Many reactive chemicals liberate toxic fumes or gases. Small, easily managed amounts must be used in a ducted fume hood.

## **VII. BREAKS AND SPILLS**

### **A. Reporting**

1. Report all spills that present a health or safety risk, or are beyond your cleanup capabilities. Call University Police **(x6666)**.
2. Be prepared to name the chemical, the amount, and the location of the affected area.
3. Evacuate the area and let the Environmental Health & Safety Office evaluate the proper procedure for cleaning the spill. **(See Appendix E)**

### **B. Personal Safety**

1. Skin, eye or mouth contact: flush the affected area immediately with copious amounts of fresh clean water for at least 15 minutes, then seek medical attention.
2. Chemical contamination of clothing: immediately remove the clothing to avoid soaking through to the skin.
3. Contain chemical spills with sand or an absorbent material. After clean up, wash the contaminated area thoroughly. Collect and store contaminated materials in suitable containers for disposal.

## **VIII. COMPRESSED GASES**

Compressed gases used at ESF range from flammable to toxic to cryogenic. Each can pose particular and unique problems if not handled properly.

### **A. Handling and Storage**

1. All gas cylinders must be firmly secured using straps, chains, or clamps.
2. Compressed gas cylinders must be located away from traffic areas.
3. All cylinders must be labeled to identify contents.
4. Transport only on approved cart or hand truck.
5. Check all cylinders for leakage.
6. Shut off cylinder when not in use.
7. Store cylinders only in well ventilated areas.
8. Label empty cylinders "EMPTY."
9. Use only returnable/refillable cylinders.

**(See Appendix G)**

## IX. RADIOACTIVE HAZARDS

Radioactive materials are used at ESF for teaching and research.

The **Radiation Safety Committee** is responsible for the development of policies that ensure a safe work environment and comply with federal and state guidelines for the proper acquisition, use and disposal of radioactive materials. The **Radiation Safety Officer (RSO)** is responsible for overseeing and enforcing these policies, for licensing designated users, monitoring the use of radioisotopes, record keeping, reports, training, radioactive emergencies, and overseeing the disposal of radioactive materials.

**Laboratory Directors** must ensure that the entrances to all laboratories using radioactive materials are properly labeled with a radioactive hazard sign, and that all operations that use radioactive materials are clearly labeled. The **Laboratory Director** is responsible to ensure that the personnel within their laboratory are made aware of the hazards associated with radioactive materials.

All personnel who use radioactive materials must be familiar with the procedures contained in the Radiation Safety Manual for the College of Environmental Science and Forestry. The RSO has the authority to identify and act on all violations or deficiencies found with respect to the College's radiation policy. Contact the **Radiation Safety Officer** for additional information.

**(See Radiation Safety Manual)**

## X. BIOLOGICAL HAZARDS

The United States Environmental Protection Agency and the New York State Department of Environmental Conservation have regulations for the management of medical waste. In accordance, this material must be separated from other trash. (For a list of regulated medical wastes, see **appendix I**). For detailed instructions on how to collect, label, and dispose of the regulated medical waste you generate, contact the Office of Environmental Health & Safety.

Regulated medical waste that is radioactive must also be handled and disposed of in a manner that is approved by the **Radiation Safety Officer**.

Any research that involves the use of recombinant DNA must be submitted for approval to the College's **Biosafety Committee** prior to initiating the work. The Biosafety Committee has the authority to ensure that all National Institutes of Health, government and College of Environmental Science and Forestry guidelines are followed. (**See Appendix I**)

The use of vertebrates in both lab and field studies must be reported to the College's **Animal Use and Care Committee**. Contact Dr. Brian Underwood at phone x6820; [hbunderw@syr.edu](mailto:hbunderw@syr.edu). The use of Controlled Substances must be done in coordination with the **Controlled Substance Officer** at x6848.

## **XI. LABELING**

### **A. Labeling Requirements**

Every hazardous chemical received at ESF is labeled with the following information:

1. the identity of the hazardous chemical
2. the appropriate hazard warnings
3. the name and address of the manufacturer
4. the date received
5. the identification of the purchaser

**DO NOT remove or deface the original label.**

### **B. Chemical Waste Labeling Requirements**

Chemical waste that is a "Hazardous Waste" must be labeled:

1. "Hazardous Waste"
2. Specific contents (ex. Ethyl ether, acetone)

**For complete instructions on how to identify, store, label, and submit hazardous waste for disposal, see Appendix L.**

### **C. Transfer of Chemicals**

When hazardous chemicals are transferred from their original containers, the new container must be labeled with:

1. the name of the chemical and manufacturer
2. the appropriate hazard warning
3. the date of original container
4. the name of person responsible for the chemicals

### **C. Exceptions to Labeling Requirement**

1. Portable containers intended for same day use, solely by the person performing the transfer.
2. Laboratory-use-only containers such as test tubes, flasks, beakers, and Petri plates

Laboratory stock solutions may be marked with cryptic codes but they must be logged on the **Chemical Code Sheet. (See Appendix C)**

**Laboratory Directors** are designated to ensure that all hazardous chemicals used in their laboratories are properly labeled.

## XII. FIRE PREVENTION, CONTROL, AND REPORTING

### A. Prevention

1. Be aware of potential ignition sources including open flames, heating elements and electrical sources.
2. Smoking is prohibited in all buildings.
3. Do not use flammable liquids in the presence of ignition sources.
4. Do not store any flammable materials in non-explosion proof refrigerator. Store non-refrigerated flammables in approved flammable storage cabinet.
5. Do not store flammable liquids in areas exposed to direct sunlight.

### B. Priorities in Case of Fire

1. Contain the fire. Exit the room and close the door to prevent the spread of smoke and flame.
2. Activate the fire alarm system by **pulling** the **nearest fire alarm box**.
3. **Evacuate** the building. Evacuation shall be immediate, and by the nearest safe exit. All occupants of a building must evacuate during an alarm. Check the floor evacuation chart. Do not return to your office for personal items.
4. When you have arrived at a safe location, **call University Police at x6666 or use a Help Phone**. Give all information --- building, floor, room number, and any other information valuable to an emergency responder. Remain on the phone until told to hang up.
5. All evacuated personnel shall **assemble outside of the building** to determine if all have exited. In the event someone is not accounted for, notify University Police or firefighters at the scene.

**Note:** In all but the most minor of fires, it is the policy of SUNY ESF that employees and students shall evacuate rather than to attempt to fight the fire.

### **C. Fire Control Methods**

1. The College has provided ABC fire extinguishers in all locations except where special needs prevail. These ABC extinguishers are appropriate for all fires except as noted below.
  - Flammable metals - Class "D" extinguishers provided
  - Computer rooms – CO<sub>2</sub> extinguishers provided
  - Chemical Storage Building - Automatic CO<sub>2</sub> system provided
  - Sprinkler systems - provided in various locations

Be aware of the location and methods of use of the fire safety equipment in the laboratory, and keep all fire doors closed.

## XIII. WASTE DISPOSAL

### A. Disposing of Waste Chemicals

Chemical waste disposal is a costly problem. Every effort must be made to safely and legally handle this process. The responsibility for identifying and assuring the proper handling of waste lies with each person generating the waste, the **Laboratory Director**, and lastly the **Chemical Hygiene Officer**.

1. The **Laboratory Director** must plan for waste disposal before starting any project.
2. Waste must be labeled promptly and properly. It must be labeled with the words "Hazardous Waste", and must have the specific contents listed. (ex. Toluene, ethyl acetate)
3. **DO NOT mix chemical wastes.**
4. Priorities for limiting of excess chemicals are:
  - a. reduce
  - b. reuse
  - c. recycle
  - d. reclaim
  - e. treat
  - f. destroy
  - g. dispose
5. Limit the amount of chemicals ordered to the amount needed.
6. Whenever possible, reuse the chemicals on hand.
7. Reclaim used chemicals by distilling or precipitation.
8. Consider forms of treatment, such as precipitation to reduce waste volume.
9. Contact **Chemical Hygiene Officer at x6964** to arrange for disposal of all surplus chemicals and chemical waste.

**Appendix L** provides details on SUNY ESF Chemical Waste Management, and illustrates the form that is to be completed and submitted for surplus/waste chemical pickup.

## **XIV. INSPECTIONS, AUDITS AND REPORTS**

Periodic laboratory inspections are conducted by the **Environmental Health and Safety Officer, with the assistance of the Laboratory Director**. The laboratory inspection checklist will be used and all results will be shared with the concerned parties and the Unit Chair for appropriate corrective action when needed. **(See Appendix J)**

## **XV. TRAINING AND INFORMATION**

### **A. All laboratory personnel shall:**

1. have access to a copy of the Laboratory Safety Guide/Chemical Hygiene Program.
2. be informed of OSHA standard 1910.1450 - occupational exposure to hazardous chemicals in laboratories.
3. receive information about Permissible Exposure Limits (PEL) and symptoms of exposure for any regulated chemicals to which they are exposed.

### **B. Laboratory Directors shall:**

1. review the Laboratory Safety Guide/Chemical Hygiene Program with their laboratory personnel.
2. arrange for any additional information or specific training for their laboratory personnel.
3. contact **Chemical Hygiene Officer** for assistance as needed.

### **C. Training shall:**

1. be conducted when personnel are first assigned to a laboratory.
2. be conducted when new hazardous chemicals or procedures are introduced into a laboratory.
3. be conducted at least annually.
4. be conducted in compliance with 29CFR 1910.1200 (e).  
**(See Appendix K)**

## **XVI. MEDICAL EXAMINATION**

Any ESF employee who is exposed to hazardous chemicals has the right to a medical examination and follow-up treatment, if the physician deems it necessary, under the following circumstances:

1. If symptoms develop that are associated with the hazardous chemical(s) to which they were exposed.
2. When air monitoring reveals an exposure level routinely above the action or permissible exposure level.
3. Whenever an event such as a spill, leak, explosion, or fire occurs which results in the likelihood of a hazardous chemical exposure.

**Exposed employees must notify their supervisor as soon as possible and an Incident/Injury Report should be filed promptly.**

## **XVII. ELECTRICAL SAFETY**

### **A. General Instructions**

1. All 110-volt outlets in the laboratories must provide ground circuit.
2. All AC-powered electrical devices used in the laboratories must either have grounded power cord and plug or be marked “double insulated” by the manufacturer.
3. Frayed or damaged cords must be replaced; **DO NOT** tape or splice them.
4. Electrical equipment may not be used when in a damaged condition.
5. Turn the equipment’s power switch to the “off” position before connecting to or disconnecting from an electrical outlet.
6. Always unplug equipment by pulling on the plug, not the cord.
7. Do not handle electrical equipment with wet hands or when standing on a wet surface.
8. Locate electrical equipment to minimize the possibility of water or chemical contact
9. Ground-fault circuit interrupters must be used in all instances where electrical equipment is within six feet of a water source.

### **B. Static Electricity and Sparks Hazards**

Static electricity or sparks can ignite flammable vapors. Protect against this possibility by grounding and bonding containers and equipment.

Some common sources of sparks and electrostatic discharges are:

1. metal tanks and containers
2. plastic laboratory aprons
3. high pressure gas cylinders upon discharge
4. brush motors
5. areas with low relative humidity and fiber carpeting