

University of Georgia

Chemical and Laboratory

Safety Manual

Previous Revision 1997

Last Revision 2002

EMERGENCY PHONE NUMBERS

UGA Police	2-2200
Environmental Safety	2-5801
Fire/Ambulance	9-911
Poison Control	9-800-282-5846
St. Mary's Hospital	9-548-7581
Athens Regional Hospital	9-549-9977
Biosafety Office	2-0112
Fire Safety	9-369-5706

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The back section of this manual "Laboratory Standard Operating Procedures (SOP)" is provided for laboratory supervisors to place their laboratory's SOPs. Within each section is a model SOP which may be modified to meet individual laboratory needs.

SECTION 1. Authority and Responsibility

I. Chemical and Laboratory Safety Committee (hereafter referred to as Committee)

A. Appointment of the Committee

1. The Committee is appointed by the president of the University of Georgia (UGA).
2. The Committee will report to the vice presidents for academic affairs, research, and business and finance. The aforementioned vice presidents shall serve as the administrative Committee to receive and act upon the Committee's findings, conclusions, and recommendations.

B. Membership

1. The voting members of the Committee will include (see [Appendix A](#) for current membership)
 - a. A minimum of 11 faculty members and laboratory directors from the Athens campus of UGA who are knowledgeable and active users of chemicals and laboratories and represent the diverse disciplines that use chemicals and laboratories
 - b. Representatives from the following off-campus facilities: Coastal Plain Station, Marine Extension Service, Skidaway Institute of Oceanography, Georgia Agricultural Experiment Stations, and Savannah River Ecology Laboratory
 - c. The associate vice president of Environmental Safety Division
 - d. The University manager of chemical and lab safety
 - e. The University director of Research Services
 - f. The University hazardous waste coordinator
2. The non-voting members of the Committee will include the vice president for legal affairs with others designated as necessary.
3. The Committee will choose a chair and vice chair from among the appointed faculty members or laboratory directors every three years.

4. The Committee will select a secretary from among its voting members.
5. A majority of the Committee eligible to vote will constitute a voting quorum.
6. A voting member of the Committee who cannot attend a meeting may designate a qualified alternate. This alternate will be a voting member of the Committee.
7. A Committee member may be replaced upon the recommendation of the chair to the president. The chair may also recommend the name(s) of qualified candidates for any vacancy.
8. Any Committee member wishing to resign his/her seat on the Committee is requested to submit the resignation in writing two meetings before the resignation is to take effect.
9. The chair may recommend the replacement of any Committee member who has missed two meetings during one calendar year.

C. Meetings

The Committee will meet, with at least a seven (7) calendar day notice, once each quarter during each academic year. Additional meetings may be called by the chair. The minutes of each meeting will be provided to the president, vice presidents for academic affairs, research, legal affairs, business and finance and to all members of the Committee.

D. Duties and responsibilities

1. The Committee shall establish and review laboratory safety policies, procedures, and safety survey audit forms. No changes shall be made to this Chemical and Laboratory Safety Manual, appendices, or portions of the manual contained on the web site without Committee approval. The Committee shall approve all procedures used to evaluate laboratory safety and evaluate compliance of laboratory supervisors.
2. The policies will be designed to:
 - a. Keep the University in compliance with local, state, and federal regulations regarding laboratory safety, the purchase, transportation, use, handling, storage, and disposal of all chemicals
 - b. Protect and optimize safety for all faculty, staff, students, visitors, and members of the public from hazardous agents

- c. Recommend and approve training programs on laboratory safety practices that will result in faculty, staff, and students having a continuing conscientious awareness of and for safe laboratory practices, chemical storage, chemical use, and chemical disposal
 3. The Committee will review and advise on corrective actions recommended by the laboratory safety staff from ESD. To facilitate this review, the Committee will maintain an e-mail site which laboratory supervisors can utilize to contact the Committee: clsc@esd.uga.edu.
 - a. Laboratory supervisors may appeal decisions to the Committee made by ESD in the implementation of the laboratory safety program. (See Appendix B, Unsafe Laboratory Closure Policy.)
 - b. ESD, through the associate vice president of ESD, may bring to the Committee for resolution, problems with laboratory supervisors whom they feel are not in compliance with the University of Georgia Chemical and Laboratory Safety Manual.
 4. The Committee will bring to the attention of UGA administration problems that need to be addressed by administrative procedures and advise them of options available and the desirability of various options.
 5. The Committee will have the authority, after informing the vice presidents for academic affairs, research, legal affairs, and business and finance, to close any laboratory determined to be unsafe per the laboratory closure policy (see Appendix B) or which is not storing, using or disposing of chemicals safely or according to University policy. Any closed laboratory will be reopened for use only after a review by the Committee that results in affirming that the practices in the laboratory have been modified to result in a safe environment for faculty, staff, and students.
- E. Investigation of incidents
 1. An incident that causes an excessive chemical or hazardous agent exposure will be investigated by ESD to determine the cause, and necessary remedial action will be recommended.
 2. At the discretion of the Committee, a Committee member may be appointed to examine the circumstances in conjunction with ESD.

3. In the event of a serious disagreement between ESD and a laboratory supervisor over the causes or circumstances of an incident, the Committee may designate one or more Committee members to review the situation and make recommendations to the full Committee.

II. Environmental Safety Division

A. Mission

1. Provide advice and consultation to the Committee which is solely responsible for establishing University policies for chemical and laboratory safety as presented in this manual
2. Provide advice, consultation, and assistance to laboratory supervisors in complying with the policies and guidelines of this manual
3. Advise the Committee as to unsafe conditions in University laboratories using the guidelines and procedures provided for in the laboratory closure policy ([see Appendix B](#))

B. Authority

1. The associate vice president of the Environmental Safety Division has been designated environmental coordinator for the University of Georgia in response to a Regents' directive to establish a central point of coordination for environmental matters. Therefore, any University unit receiving any communication from a regulatory agency regarding an environmental concern should immediately notify the associate vice president of Environmental Safety Division and the Office of Legal Affairs.
2. When the Environmental Safety Division determines that there is a serious violation of law, governmental regulation, or Committee policy in the control, use, or storage of hazardous materials, the cognizant vice president, the Office of Legal Affairs, and the Committee will be advised. In those instances where an investigation, either by the Environmental Safety Division or a governmental regulatory agency, is indicated, the cognizant vice president and the Committee will be advised of the investigation.
3. Once an investigation is complete and the circumstances surrounding the violation(s) have been determined, responsibility will be assigned for taking appropriate action to minimize the likelihood of recurrence. The Environmental Safety Division will initiate one of the following steps and inform the Committee of their action.

- a. If a legal issue is involved the Environmental Safety Division will consult with the Office of the Vice President for Legal Affairs; both offices will then jointly determine the next action to be taken.
 - b. If a legal issue is not involved, but internal action is needed, the Environmental Safety Division will refer the occurrence along with a copy of an audit or report of investigation to the cognizant vice president who will have responsibility for taking appropriate action to minimize the likelihood of recurrence. The Environmental Safety Division will be available to assist and advise. A copy of a referral will be sent to the president to whom a report of action will be filed by the cognizant vice president.
4. ESD has the responsibility and authority for conducting internal safety audits. These internal audits are governed by existing regulations and the policies set by the Committee which are contained in this manual. ESD shall provide a copy of the current Committee-approved survey form as part of this manual. These audits must be filed in a timely manner and as deemed necessary with the associate vice president of Environmental Safety Division/unit head. The response of the laboratory supervisor to these audits must be filed in a timely manner with the associate vice president of Environmental Safety Division and the unit head. (See [Appendix D](#) for a current copy of the laboratory safety survey form.)
 5. ESD has the responsibility and authority to take immediate and necessary action to protect the health and safety of University employees, the public, and the environment in those situations that pose an immediate threat to life and health. These actions shall be governed using the provisions and guidelines of the laboratory closure procedure ([see Appendix B](#)).
 6. ESD has the responsibility and authority for conducting internal audits of the centralized inventory system administered by the director of Central Research Stores (CRS) and filing results of such audits with the vice president for research, associate vice president of CRS, and the associate vice president of Environmental Safety Division.

C. Duties

1. Conduct surveys of University laboratories for compliance with the policies and provisions of this manual

2. Advise, as appropriate, laboratory supervisors, deans, department/unit heads, and the Committee of problems found in individual laboratories
3. Provide technical assistance to laboratory personnel in establishing safety programs in their individual laboratories
4. Provide testing for proper operation of safety equipment in chemical laboratories (i.e., safety showers, chemical fume hoods, and eye wash stations)
5. Provide consultation on the safe design of chemical laboratories and their associated safety equipment
6. Provide programs for chemical exposure monitoring, respiratory equipment issuance and fit testing, right to know, and other relevant safety education
7. Respond to chemical emergencies, providing guidance, consultation, and appropriate assistance
8. Dispose of known hazardous chemical waste in compliance with existing Hazardous Materials Treatment Facility (HMTF) regulations
9. Assist in the development and maintenance of a central inventory system
10. Assist departments and laboratories in developing plans for the use, storage, and disposal of hazardous chemicals and for the training of laboratory workers, ensuring that those plans are compatible with University policy
11. Ensure that there are appropriate safety manuals, approved by the Committee for all research and service laboratories and academic units. These manuals must address all relevant aspects of compliance including laboratory safety survey forms, receiving, shipping, disposal, and safety training

III. College dean, department or unit head

A. Responsibility

1. Each organizational head is responsible to the next higher administrator for the control, use, storage, and disposal of hazardous materials in laboratories under the program administration and control of all personnel, including laboratory supervisors, within the organizational unit for which each

respective head is responsible.

2. Any hazardous material left in any laboratory without a proper supervisor in attendance for a period of 60 or more calendar days will be made the responsibility of the unit. The department head will initiate disposition by HMTF.
3. In the event that a supervisor abandons hazardous material upon leaving the University as in [Section 1.IV.B.4](#) and fails to arrange for proper disposal or transfer of materials, the following course of action shall be taken:
 - a. Within 30 calendar days of the termination date of the laboratory supervisor, the department head, in consultation with staff members of ESD, will submit a plan of remediation to the appropriate vice president and inform the Committee.
 - b. After remediation, a final safety inspection shall be performed and a report sent to the Committee.

IV. The laboratory supervisor

A. Definition

A laboratory supervisor is defined as a faculty member (assistant professor, associate professor, professor, or instructor), a research professional, an academic professional, or laboratory director who is associated with or provides guidance to a laboratory or laboratories using hazardous agents. Graduate students and postdoctoral associates will not be considered a supervisor except under special circumstances at the discretion of the unit head.

B. Supervisor responsibility

1. The supervisor shall train or provide for the training of all new personnel before allowing them to work in a laboratory using hazardous materials. Training shall include the following:
 - a. Reading of this manual
 - b. Job specific safety protocol for chemicals and equipment. [See Appendix J](#) for recommendations and guidelines for development of standard operating procedures.
 - c. The proper use of job-specific personal protective equipment (PPE)

- d. All training required by the Georgia Public Employee Hazardous Chemical Protection and Right to Know Act of 1988 and the University right to know compliance plan
- e. Directions for notifying the proper authorities in the event of an emergency or accident
 - i. University Police 2-2200
 - ii. Athens Regional Medical Center 9-549-9977
 - iii. St. Mary's Hospital 9-548-7581
 - iv. Environmental Safety Division 2-5801
 - v. Biosafety Office 2-0112

- 2. The supervisor shall see that records are kept as required by this manual. (See sample laboratory safety survey form, [Appendix D](#), which lists necessary records.)
- 3. The supervisor shall remove chemical and biological substances under his/her control that may pose a hazard prior to maintenance personnel working on furnishings, equipment, or laboratory systems.
- 4. When leaving the University, or terminating his/her supervisory position, the supervisor shall relinquish all hazardous chemicals in his/her possession by disposal or transfer to another supervisor who has facilities capable of safely handling the material in question. (See [Section 2.XIII](#), laboratory decommissioning plan.)

C. Supervisor on leave or absent more than 60 calendar days

- 1. A supervisor on leave or absent for a period greater than 60 calendar days may assign responsibility for his/her program to a temporary supervisor who will be in charge of the laboratory in his/her absence.

This person will be: a faculty member, a laboratory director, a research professional, or an academic professional who agrees, in writing, to accept responsibility for the laboratory.

- 2. If the laboratory supervisor does not choose the option listed above, his/her laboratory will be placed under the temporary supervision of another faculty member, research professional, academic professional, or laboratory director selected by the

department head.

3. The departing supervisor will ensure that all door signs reflect the change in supervisory status.
4. The temporary supervisor may not be utilized for a period exceeding 12 months without approval of the department head.

D. Supervisor retirement

When a supervisor retires, with or without emeritus status, his/her supervisory status will terminate. The laboratory supervisor may apply to the department head for continued supervisory status. If the department head can ascertain that the laboratory supervisor will have adequate facilities to store and handle the hazardous materials safely and that the funds will be available, if needed, for disposal, the retired laboratory supervisor may be given the role of supervisor for a specific time period to be determined by the department head.

Section 2. Standard Operating Procedures

I. Chemical procurement, distribution, and storage

A. Procurement

The director of CRS is designated as the sole agent for submitting purchase requests for chemicals to the University procurement office, receiving, and distributing all chemicals to on-campus research and science laboratories and academic units of UGA.

B. Inventory

The director of CRS is charged with setting up and maintaining a centralized inventory system of chemicals for campus units. The associate vice president of Environmental Safety Division is directed to ensure that the individual units' inventory reporting practices are coordinated with the CRS inventory system to ensure that all compliance requirements are met.

C. Program audits

ESD has the responsibility and authority for conducting internal audits of the centralized inventory system and filing the results of such audits with the vice president for research, the associate vice president of ESD, and the director of CRS.

D. Distribution

CRS will distribute purchased chemicals throughout campus. Only personnel who have received chemical specific right to know training shall receive chemical shipments.

E. Storage

1. General

All incoming containers of chemicals must have appropriate manufacturers labels that are not removed or defaced. Each container should be labeled with the date it was received and the date it was opened, as some chemicals form peroxides or other unstable products/explosives when stored for relatively short periods (see [Appendix I](#) for a listing of peroxide forming chemicals.) Chemicals in the laboratory shall be segregated by hazard class and compatibility. Acids, bases, flammables, reactives requiring separate and special storage, highly toxic compounds, and general non-hazardous chemical storage shall be separated from each other. The higher shelves shall be used for

containers containing chemicals which present the lowest hazard. Open shelves used for the storage of hazardous chemicals shall be well-anchored, painted, or made of, or covered with, chemical-resistant materials. (See [Appendix J - Short List of Incompatible Materials](#)) Work areas should not be used for long-term storage. Storage of glass chemical containers on the laboratory work area floor shall be strictly prohibited. Also see [chemical storage definitions](#) for additional information.

2. Flammable liquids

The total allowable quantities of flammable liquids, including waste, in research laboratories which are separated from non-laboratory areas according to existing fire codes, shall be the following:

- a. Twenty gallons are allowed per 100 square feet of a properly fire separated laboratory unit. Ten gallons are allowed per 100 square feet in non-fire separated lab units. This volume includes flammable liquids stored in safety cans and proper storage cabinets. The maximum allowable volume of flammable liquids is 120 gallons in a single laboratory unit.
- b. Up to 35 gallons of flammable solvents which are outside of flammable storage cabinets are allowed in a laboratory. Of this amount, 25 gallons must be contained in 2 gallon or smaller approved safety cans. The remaining ten gallons may be kept in other containers such as the original five-gallon shipping container, glassware and squeeze bottles.
- c. No more than two 60-gallon capacity cabinets are allowed per laboratory unit.
- d. Quantities allowed within an instructional laboratory unit shall be restricted to one-half that allowed in a research laboratory unit.
- e. Dispensing of flammable liquids from containers larger than five-gallon capacity, shall only be performed in a proper dispensing area per National Fire Protection Association (NFPA) 30. The dispensing area, if also used for bulk storage, shall be separated from the laboratory work area, per NFPA 45. (Please consult ESD for copies of applicable regulations.) Dispensing from larger containers can be arranged by contacting CRS.

- f. No containers larger than five-gallon capacity are allowed for storage inside the laboratory area. Containers larger than five gallons used for dispensing shall be properly bonded and grounded to prevent a static discharge as an ignition source.
- g. Storage of flammable liquids in refrigerators not specifically designed and approved for that use by a recognized testing agency shall be strictly prohibited (please consult ESD for acceptable specifications). A flammable materials storage refrigerator/freezer has a spark proof interior that separates the contents from the compressor and motor. The explosion proof refrigerator/freezer is for the storage of volatile materials in areas away from possible spark hazards from electrical devices or other potential fire hazards.

3. Flammable and other pressurized gases

Storage of pressurized gas cylinders shall comply with NFPA 45 (see [Appendix C](#) for guidelines.)

4. Acids and bases

Acids shall be separated from caustics and from active metals such as sodium, magnesium and potassium. Acids shall be separated from chemicals that can generate toxic gases on contact, such as sodium cyanide and iron sulfide. Large bottles of acids shall be stored on lower shelves or in acid cabinets. Oxidizing acids (nitric, perchloric) shall be separated from organic acids, flammable, and combustible materials. Separation of nitric and perchloric acid from other acids may be accomplished by placing in an unbreakable chemical resistant carrier. (See [Appendix J](#) for specific precautions for perchloric acid use.) Mild acids and bases such as citric acid and sodium carbonate may be stored with other low-hazard reagents. Opened containers of acids and bases should be stored in a chemical resistant secondary container (pan or tray), i.e., nalgene. H_2SO_4 should be kept separate (separate secondary containers) from HCL.

5. Peroxide-forming chemicals

Peroxide-forming chemicals shall be stored in a dark, cool, and dry place. Peroxide-forming chemicals shall be labeled with the date received and date opened (see [Appendix I](#) for lists of peroxide forming chemicals.) It is recommended that opened containers not be kept longer than six months except when inhibitors are present (see manufacturers recommendations).

6. Water-reactive chemicals

Water-reactive chemicals shall be kept in a cool and dry place. Metal specific class D extinguishers shall be made available in laboratories where on pound or greater of water-reactive materials are used or stored. See Appendix J and reference this list of Common Water Reactives.

7. Oxidizers

Oxidizers shall be stored away from flammable, combustible, and reducing agents (e.g., zinc, alkaline metals).

8. Toxic chemicals

Toxic chemicals shall be stored according to the nature of the chemical, with appropriate warnings and security. Toxic chemicals shall not be stored with flammable chemicals, i.e., chloroform, etc.

II. Transportation and shipment of hazardous chemicals on- and off-campus. If you plan on shipping hazardous chemicals while traveling abroad or from a location off of the UGA main campus, you MUST follow the procedures outlined below in subset A.

- A. Contact ESD Hazardous Material Treatment Facility for information concerning the transportation or shipment of any hazardous material to an off-site location which will require the services of any common carrier by ground or air. Please reference the HM Shipping procedures.
- B. Personal vehicles shall not be used to transport hazardous materials. When transporting hazardous materials in a UGA vehicle, [please follow these instructions](#).
- C. Any hazardous chemical transported by hand between laboratories or on-campus buildings is to be contained in a chemical-resistant unbreakable carrier capable of containing the entire volume of the chemical being transported.
- D. When receiving gas cylinders or transporting them from a common storage area, ensure that they are secured to a hand truck. Never roll cylinders across the floor. Protective caps should be in place prior to transport. See “A Guide to Relocating Hazardous Materials”.

III. Safe work practices

A. Exposure minimization

- 1. General precautions for handling all laboratory chemicals outlined in this manual should be adopted, along with specific guidelines for particular chemicals as needed.

2. Exposure to hazardous chemicals should be minimized. For work with substances that present special hazards, special precautions shall be taken. One should assume that any mixture will be more hazardous than its most hazardous component and that all substances of unknown hazard are hazardous. Refer to the material safety data sheet (MSDS) for specific information about a chemical or product containing hazardous chemicals. (MSDS are available at <http://www.esd.uga.edu/rtk/msds.htm>)
3. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of fume hoods and other local ventilation devices. All individuals handling hazardous chemicals in the laboratory shall be trained in the proper operation and use of fume hoods and other local ventilation devices (see Section 2.IV, chemical fume hood use.)
4. Develop and encourage safe habits and avoid unnecessary exposure to chemicals by any route. Do not smell or taste chemicals. Vent any apparatus that may discharge particularly hazardous chemicals into local exhaust devices. Chemicals shall be properly stored and used to prevent exposure. Appropriate personal protective equipment (PPE) shall be provided to employees working in areas where hazardous substances are in use (see Section 2.VI. for PPE requirements.) Employees shall be trained in the safe use and maintenance of PPE provided in the laboratory. Test positive pressure glove boxes for leaks before use. Do not allow release of toxic substances into any building area, only into an appropriate local exhaust device ducted to the outdoors.

B. PELs, TLVs, or RELs

The permissible exposure limits (PEL) of the Occupational Safety and Health Administration, the threshold limit values (TLV) of the American Conference of Governmental Industrial Hygienists, and the recommended exposure limits (REL) of the National Institute for Occupational Safety and Health shall not be exceeded. These levels may be found on the MSDS of any hazardous chemical or by contacting ESD. ESD will address any occupational exposure concerns.

C. Chemical selection

Use only those chemicals that can be used safely in the available ventilation system of the facility being used.

D. Eating, etc.

Eating, drinking, smoking, or application of cosmetics is not allowed in

laboratories that use hazardous agents. Hands shall be washed before conducting these activities outside of the laboratory. No food or product intended for consumption shall be stored in areas where chemicals are stored. Glassware or utensils that are also used for laboratory operations shall not be used with food or beverages.

E. Glassware

Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware. Use extra care with Dewar flasks and other evacuated or pressurized glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur.

F. Sharps and needles

1. All sharps (needles, knives, scalpels, broken glassware, Pasteur pipettes, etc.) shall be placed in approved, impervious sharps containers (available from CRS). Sharps and sharps containers should never be disposed of in the general trash. Contact the UGA Biosafety Office for instructions regarding disposal methods.
2. Sharps containers shall not be overfilled.
3. Needles shall not be recapped but placed directly into an appropriate sharps container after each use.
4. Needles shall not be cut as a form of disposal.

G. Personal hygiene

Thoroughly wash hands immediately after working with chemicals. Liquid rather than bar soap and paper towels, appropriately protected from contamination, are to be supplied at hand washing areas.

H. Visitors

No unsupervised children under 16 years of age shall be allowed into any laboratory or unseparated office space. No pets shall be allowed into the laboratory. Visitors should be warned of hazards present in the laboratory.

I. Horseplay

Practical jokes or other behavior that might confuse, startle, or distract another worker shall be prohibited in laboratories.

J. Mouth pipetting

Mouth suction for pipetting or starting a siphon shall not be allowed.

K. Personal apparel

Low-heeled, closed-toe shoes shall be worn when handling hazardous chemicals. Appropriate apparel, as described in [Section 2.VI](#) shall be worn when working with hazardous chemicals.

L. Personal housekeeping

Work areas shall be kept clean and uncluttered.

M. Planning

Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation. A dry run is highly recommended for new procedures or for personnel unfamiliar with the techniques. (See [Appendix J](#) for guidelines and recommendations for formulating protocols.)

N. Vigilance

Be alert for unsafe conditions and notify the appropriate supervisor if a problem is detected.

O. Working alone

Working alone with hazardous chemicals in a laboratory is discouraged. Potentially dangerous operations should be noted on the lab door and how to contact responsible lab personnel. (See [Appendix D](#) for recommended posting forms.)

P. First aid

Each laboratory facility should have a well supplied first aid kit readily available and prominently displayed or location posted. The kit should be checked regularly and supplies replenished. It is recommended that any injury occurring in a laboratory be checked out by a physician (see [Section 2.IX.A](#)).

Q. Gas cylinders

All gas cylinders shall be handled in accordance with NFPA procedures given in [Appendix C](#).

IV. Chemical fume hood use

A. Purchasing

The purchase of all laboratory fume hoods shall follow Board of Regents' standards. ESD is responsible for inspecting fume hoods after installation or modification to determine if they conform to these standards. It is recommended that ESD be consulted during the purchasing process.

B. Airflow

Airflow into and within the fume hood shall not be excessively turbulent; fume hood face velocity shall be adequate as specified by the Board of Regents, namely averaging 100 linear feet per minute at full open sash with no greater than a $\pm 20\%$ variation across the open face of the hood. Air disturbances at the face of the fume hood should be avoided.

C. Testing and certification

Quality and quantity of hood performance shall be evaluated by ESD on installation, regularly certified (at least annually) and whenever a change in local ventilation devices is made.

D. Hood sash

The fume hood sash should be closed when the hood is not in use. As much as possible, work in the hood should be performed with the sash open 10 – 12 inches.

E. Use

Fume hoods should be kept clean and uncluttered. Work within the hood should be carried out at least six inches back from the front opening. Electrical receptacles or other spark sources shall be protected from flammable vapors. No permanent electrical receptacles shall be permitted in the hood. No chemical fume hood shall be used for the storage of chemicals or equipment unless they are a component of the operation for which the hood is being used or the hood is for the sole purpose of storage. Hood sashes should be closed as much as possible. The slots in the hood baffle shall be kept free of obstruction by apparatus or containers. Measures should be taken to prevent Kimwipes, tissues, or other articles from being drawn up into the exhaust duct. Bench coat surface protectors or other materials shall not obstruct hood air foils. Laboratory doors opening into main corridors shall be kept closed unless specifically designed and permitted by codes to be left open. The heating of perchloric acid in any hood other than a special purpose perchloric acid hood shall be prohibited. No cutting of holes or other unauthorized alteration of a chemical fume hood or its duct work shall be performed. Hoods that are malfunctioning or posted with a *Danger - Inadequate Air Flow* sign shall not be used for any operation using hazardous chemicals.

Any signs of reduced flow or other problems shall be promptly reported to a supervisor.

- F. Laminar flow, biosafety cabinets

Please refer to UGA Biosafety Manual

V. Housekeeping, maintenance, and inspections

- A. Work spaces

Laboratory aisle spaces must be maintained unobstructed and work stations uncluttered.

- B. Inspections

Inspections (audits) will be conducted by ESD laboratory safety personnel. It is recommended that laboratory personnel conduct regular self inspections. (See [Appendix D](#) for the current ESD laboratory safety survey form.)

- C. Maintenance

Emergency showers and eyewash stations shall be tested annually for functionality by ESD with a record of testing attached. Make sure each emergency shower and eyewash has a test tag attached to it. If not, please contact Environmental Safety for testing. Eyewash stations should be flushed on a weekly basis by laboratory personnel. It is recommended that an eyewash testing log be kept. Other safety equipment (e.g., gloves, guards, goggles, glasses, carriers, etc.) should be inspected by lab personnel prior to use.

- D. Passageways

Stairways and hallways shall not be used as storage areas. Access to exits, emergency equipment, and utility controls shall never be blocked or obstructed.

- E. Exit doors

Doors that open into exit corridors or enclosures must be kept closed unless permitted by fire codes to be kept open.

VI. Personal protective equipment (PPE)

- A. Skin absorption protection (gloves, aprons, and lab coats)

1. Personnel performing procedures that use chemicals that can irritate or be absorbed by the skin shall wear appropriate PPE.
2. PPE such as gloves and aprons resistant to the chemical to be used shall be provided to workers when the potential for skin absorption exists. Check manufacturer's specifications to determine breakthrough time for the specific glove and chemical. Laboratory coats are intended to prevent contact with the minor chemical splashes and spills encountered in a laboratory. Laboratory coats which do not significantly resist penetration by organic liquids shall be removed immediately when they become contaminated. Laboratory coats shall be worn in the immediate areas where hazardous chemicals are handled or used. Laboratory coats used during the handling of hazardous chemicals, biologicals, or radioactive substances should not be worn in other areas outside the laboratory such as offices, cafeterias, or libraries.

B. Eye protection

All employees and students who participate in or observe any of the following functions shall be provided with and shall wear protection devices: chemical, physical, or combined chemical-physical operations involving caustic, toxic, irritant, or explosive materials, hot liquids or solids, injurious radiation, or any dispensing of hazardous chemicals. Ensure when ordering that the manufacturer of the eye protection specifies that it conforms to ANSI Z 87.1.

1. Chemical splash goggles which have splash proof sides to fully protect the eyes or a face shield shall be worn when participating in or observing procedures using liquid hazardous chemicals which are corrosive or have a health hazard rating of 3 or 4.
2. Impact-resistant safety glasses with side shields must be worn when performing or observing procedures where powders, chips, or other flying particles are the primary hazard.
3. Eyewear should be cleaned before being issued to a different employee. It is recommended that contact lenses not be worn (even with additional eye protection) in environments involving chemical splash or vapor exposure.

C. Respiratory protection

Advice regarding the purchase of respirators is available from ESD. Any laboratory operation in which respirators are provided must conform to the University's respirator program ([see Appendix E](#)). All operations within a laboratory facility that involve the transfer or alteration of a

hazardous chemical which may generate air contaminants at or above the appropriate TLV shall be carried out in a chemical fume hood appropriate for the work being performed. Contact ESD with any questions concerning respirator use.

VII. Records

A. Inventory

A hazardous chemical list for each laboratory will be maintained by the lab supervisor, updated periodically and made accessible to laboratory personnel. The list should include CAS number, hazard class, NFPA hazard rating, if available, and storage codes. The chemical inventory database maintained by CRS will provide information regarding chemicals purchased and delivered to the labs and should serve as the basis for the hazardous chemical list. Contact CRS for details on accessing and modifying this database. (See [chemical storage definitions](#))

B. All laboratories using hazardous chemicals should develop specific chemical standard operating procedures as provided for in the chemical-specific right to know training implementation plan as part of the mandated University right to know plan. (See Appendix J for sample operating procedures which must be kept as part of this manual and which may be expanded based on individual laboratory operating procedures.)

C. Signed documentation of annual chemical-specific right to know training, as required by the University's right to know plan, shall be maintained by the laboratory supervisor. This does not include the human resources new employee orientation training. Check with your departmental or unit right to know coordinator for your departments record keeping system. (See Appendix D for right to know training forms.) Online training is offered at <http://www.esd.uga.edu/rtkcs>.

VIII. Signs and labels

A. Laboratory corridor doors shall display approved CAUTION door signs (see [Appendix D](#) for request form and [Appendix J](#) for instructions on "How to Properly Complete a Caution Sign). All required laboratory emergency information shall be provided on the CAUTION sign. Laboratory CAUTION door signs and labels shall be updated as necessary and at least annually. Principal hazardous materials and their amounts shall be listed. Requests for [Caution door signs](#).

B. Laboratory refrigerators and microwave ovens

All laboratory refrigerators, freezers, and microwaves shall be affixed with an approved *Notice - Laboratory Use Only* sign available from

ESD. Only refrigerators specifically designed and approved by a recognized testing agency as explosion-proof or explosion-resistant shall be used for flammable storage. If the refrigerator is not explosion-proof or intrinsically safe, it shall be affixed with the approved label "**Notice-Do Not Store Flammables in This Box,**" available from ESD.

C. Laboratory work areas

Telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers should be posted by a central phone. Areas where hazardous materials are stored should be posted with proper hazard warning signs. (See Appendix D for examples of recommended work area signs and posting.) A list of emergency phone numbers is included in the appendices and is on the cover of this manual.

D. Primary chemical containers shall be affixed with a legible manufacturer label.

E. Secondary containers containing

1. Non-hazardous chemicals shall be affixed with labels listing the identity of its contents
2. All chemicals intended for use in less than one day by a single user do not need to be labeled
3. Hazardous chemicals intended for storage and use for a period greater than one day shall be affixed with labels listing
 - a. the identity of the hazardous chemical
 - b. the date filled
 - c. the hazard warning (see Appendix D for hazard warning designations and abbreviations)
4. Batches of vials or test tubes containing chemicals of the same hazard may have the hazard labels affixed to a common carrier or box. All other such secondary containers must be appropriately labeled as noted above.
5. The chemical identity given on a chemical label must be in plain English, and must list the chemical's common name given on the MSDS or manufacturer's label, or an accepted UGA abbreviation or acronym (see Appendix D for accepted abbreviation or acronyms).
6. The chemical's hazard warning may be provided by use of either

the National Fire Protection Association (NFPA) hazard warning system, Hazardous Materials Identification System (HMIS) hazard warning system or the UGA hazard warning abbreviation warning system (see [Appendix D](#) for full explanation of these systems).

7. If abbreviations are used on any chemical labeling all abbreviation and acronyms used must be posted in the lab (see [Appendix D](#) for appropriate postings).

IX. Spills and other laboratory accidents

A. The laboratory supervisor should see that all serious injuries which require medical attention shall be reported by calling 9-911. All incidents that result in an injury or property damage are to be reported using a University Incident/ Accident Report form which should be available in the offices of department or division heads.

B. Chemical exposures

1. Eye contact

Promptly flush eyes with water from an emergency eyewash or other suitable eye irrigation method for a prolonged period (15 minutes is recommended by hospitals) and seek medical attention.

2. Ingestion

Contact the local poison control center or hospital and follow directions (see front cover of manual or [Section 1.IV.B.1e.](#) for phone numbers).

3. Skin contact

Promptly flush the affected area with copious amounts of water from safety shower, sink or other appropriate source, and seek medical attention. Remove any clothing that may have chemical contamination to prevent further exposure.

C. Uncontrolled release or spill

1. All laboratories that handle hazardous chemicals shall have an appropriate supply of spill cleanup kits prominently displayed or location posted. The supply must be capable of containing or cleaning up small, known chemical releases. Laboratory personnel should not attempt to clean up a spill of hazardous chemicals if appropriate spill cleanup supplies and protective

equipment are not available, or if the chemical or level of exposure hazard is unknown. In these cases, contact ESD for assistance. (See Appendix J.)

2. Laboratory sinks should be periodically inspected for leaks, and traps kept full of water to prevent drain vapors from entering the laboratory.

X. Electrical safety

All electrical equipment and apparatuses must be double insulated or grounded. The following instructions are mandated by the State Fire Marshal. The use of extension cords should be avoided. When extension devices (an enclosure with multiple sockets) must be temporarily used, the wire gauge of the device must be equal to or larger than the cord on the item being operated. No extension device shall be attached to building surfaces (using staples, nails, etc.) Extension devices equipped with surge protectors may be permanently used with equipment that contain microprocessors (e.g., to connect computer equipment). Surge protectors should not be used in areas subject to moisture, physical or chemical damage or flammable vapors. Surge protectors must be UL 1449 or Transient Voltage Surge Suppressor (TVSS) approved.

XI. Mechanical hazards

Mechanical hazards in the laboratory shall be evaluated by the supervisor and appropriate safety precautions implemented. Safety precautions shall be adopted in accordance with equipment manufacturer's recommendations. Mechanical hazards shall be minimized by guarding exposed moving mechanisms such as belts, pulleys, and blades, or placing equipment in areas which protect workers from moving mechanisms. If flying particles may be produced, shatter resistant safety glasses shall be provided and worn (see Section 2.VI.B). Hearing protection may also be required if 85 dB is exceeded for any 8-hour period; if so, a hearing conservation program shall be implemented (contact ESS for information). Standard operating procedures should be developed for any equipment that may represent mechanical hazards (see Appendix J for guidelines or contact ESD).

XII. Synthesized chemicals

If hazardous chemical substances are developed in the laboratory for in-house use, appropriate training shall be given to personnel as with any other hazardous chemical. If the chemical produced is a by-product whose composition is not known, it shall be assumed that the substance is hazardous. Synthesized chemicals and their known by-products shall be identified and stored by chemical class and shall be labeled in accordance with Section 2.VIII.

XIII. Laboratory decommissioning

The following procedures shall be carried out and a Laboratory Decommissioning ([Procedure for Closing a Laboratory](#)) Form must be ([see Appendix D](#)) completed when the responsible individual leaves the University or transfers to a different laboratory. Upon completion, the laboratory closing form shall be signed by all responsible parties. For personnel leaving the University this form must be attached to the Human Resources check-out form and a copy sent to Human Resources.

A. Chemicals

The supervisor shall ensure that all containers of chemicals are labeled with the name of the contents. All containers are to be securely closed. Beakers, flasks, dishes, etc., shall be emptied and cleaned. (Check all refrigerators, freezers, fume hoods, and cabinets.) Determine which materials are usable and transfer the surplus to another user who is willing to take charge of them. If a user cannot be found, it shall be disposed of through the UGA waste disposal program. All fume hood surfaces and counter tops shall be washed off. The respective department head is to be notified when the laboratory has been cleaned.

B. Gas cylinders

If gas cylinders are not returnable, contact ESD for advice.

C. Animal and human tissue

If tissue is held in a liquid preservative, tissue and liquid shall be separated. Contact the University biosafety officer for instructions regarding proper disposal of human tissue. Animal tissue can be disposed of by incineration or by placing in a biohazard bag for proper treatment. Defrost and clean refrigerators and freezers if they are empty. If samples are to be saved, locate an appropriate person to take responsibility for them and notify the department head. The liquid preservative should be disposed of as a chemical waste.

D. Microorganisms and cultures

Decontaminate culture containers by autoclaving. Decontaminated plastic containers can be disposed of in regular trash. Clean incubators and refrigerators. If samples are to be saved, locate an appropriate person to take responsibility for them and notify the department head. If questions arise, address them to the UGA biosafety officer.

E. Radioactive materials

Notify the University radiation safety office of intention to leave the

University or to change laboratories at least one month in advance and follow the instructions provided by the radiation safety officer.

F. Equipment

If laboratory equipment is to be left for the next occupant, clean or decontaminate before departing the laboratory.

XIV. Hazardous chemical and waste disposal

- A. All hazardous chemicals and chemical waste shall be disposed of in accordance with the most current revision of the University of Georgia Hazardous Materials Program Manual. (See [Appendix G](#) for the University's hazardous chemical waste summary procedures, and [Appendix H](#) for the University's chemical waste minimization procedures.) The waste minimization procedures includes guidelines for bench top treatment of chemicals and procedures for surplus redistribution.

XV. Fire Safety

- A. Appropriate fire extinguisher(s) should be available to occupied labs and placed 75 feet apart. The fire safety office at Environmental Safety is responsible for maintaining annual inspections and monthly checks of fire extinguishers. Make sure the fire extinguisher is located near the exit and visible for use in case of emergency. The fire extinguisher should have an annual inspection tag on it. (See [Appendix J](#))

Section 3. The Laboratory Facilities

I. Minimum design provision

Laboratories shall be constructed in accordance with NFPA 45 and the University System of Georgia Board of Regents' standards. All laboratory facilities shall have the following minimum provisions:

- A. An appropriate general ventilation system with air intakes and exhausts located so as to avoid reentry of contaminated air
- B. Adequate chemical storage facilities having well-anchored chemical-resistant shelving, appropriate approved flammable storage and dispensing areas for the volume of flammables to be used, and approved acid and special hazard storage cabinets appropriate for the hazards present
- C. Laboratory fume hoods appropriate for the hazards present ([see Appendix F](#))
- D. Sinks appropriate for hand washing and the cleaning of glassware and equipment
- E. Plumbed eyewash stations which meet the requirements of ANSI Z358.1 shall be provided in the laboratory areas in a location that provides access within ten seconds from any point in the laboratory
- F. Plumbed emergency showers which meet the requirements of ANSI Z358.1 shall be provided in new or newly-renovated laboratories, within the laboratory area; in existing laboratories, within a distance of no greater than 30.5 meters (100 feet) from the most remote area of the laboratory
- G. Break areas physically separated from contamination of laboratory and chemical storage operations
- H. Entrance doors to laboratories which meet fire separation requirements and shall not be used for ventilation purposes
- I. Vision panels which meet separation requirements and shall not exceed 100 square inches

II. Construction and renovation review

Since ESD is charged with the responsibility of inspecting all laboratories to determine if they conform to the policies set forth in this manual, it is recommended that ESD be consulted prior to construction and/or major renovation of any laboratory facility. In the event an agreement on safety issues

cannot be attained, the issues will be addressed by the Committee. The parties have a right to appeal any Committee decision to a committee consisting of the vice president for research, the vice president for academic affairs, and the vice president for business and finance, or their representatives, for a final resolution.

III. General laboratory ventilation

A. Purpose and use

This system shall provide a source of air for breathing and for input to local ventilation devices; it should ensure that laboratory air is continually replaced, preventing increase of air concentration of toxic substances during the day; direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building; and it should not be relied on for protection from toxic substances released into the laboratory.

B. Modifications

Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate.

C. Performance

Six to twelve room air changes per hour are normally adequate general ventilation, if local exhaust systems such as fume hoods are used as the primary method of control. Doors to the laboratory opening onto corridors shall be kept closed to ensure correct air flow unless specifically designed to be kept in the open position.

D. Quality

General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or stagnant air.

IV. Other ventilation devices

A. Questions concerning ventilated storage cabinets, canopy hoods, and snorkels should be directed to ESD (2-5801). Approved ventilated storage cabinets can be obtained from CRS.

B. UGA prohibits the use of ductless fume hoods.

C. Central vacuum pumps must be trapped and vented directly to the outside. Local vacuum pumps shall be trapped and appropriately filtered. Good maintenance of traps and filters is essential.

V. Exhaust stacks

Chemical fume hood stacks shall extend above the building structure a minimum of seven feet and one duct diameter length above any parapet wall. Discharge velocity of hood stacks shall provide a minimum exit velocity of 2,500 fpm. These are minimum requirements. Greater heights or velocities may be required, due to building design or wind speed, to prevent reentry of chemical exhaust into the building.

Section 4. Particularly Hazardous Substances

I. General requirements

A. Procedures and practices

1. Definition

“Particularly hazardous substances” as termed by OSHA include “select carcinogens,” reproductive toxins, and substances that have a high degree of acute toxicity. A substance of high acute toxicity is one for which acute or short-term toxicity characterizes the response (e.g., fast-acting substances, or irritants, and narcosis-producing substances). Any substances having an oral LD₅₀ in mammals of 50 mg or less per kilogram of body weight, an inhalation LC₅₀ in mammals of 100 parts per million (ppm), or a dermal LD₅₀ in mammals of 50 mg or less per kilogram of body weight is considered highly toxic. (See Appendix I for lists of peroxide forming and cancer causing chemicals.)

2. Designated areas

Conduct all work and transfers with these substances in a “designated area” (a restricted access fume hood, glove box, or portion of a laboratory designated for use of highly toxic substances,) for which all people with access are aware of the substances being used and necessary precautions. Use and store these substances only in areas of restricted access with special warning signs.

3. Personal protection

Always avoid skin contact by wearing the proper gloves, laboratory coat, and any other appropriate apparel. Always wash hands immediately after working with these materials.

4. Prevention of spills and accidents

Be prepared for accidents and spills. Assure that at least two people are present at all times if a compound in use is highly toxic or of unknown toxicity. Store breakable containers of these substances in chemical resistant trays. Work and mount apparatus above such trays, or cover work and storage surfaces with removable, absorbent, plastic backed paper. If a major spill occurs outside the fume hood, evacuate the area and contact ESD.

5. Non-contamination/decontamination

Protect vacuum pumps against contamination with scrubbers, or HEPA filters. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the fume hood before moving them from the designated area. Decontaminate the designated area before normal work is resumed. Material used during decontamination shall be considered as hazardous waste and disposed of appropriately.

6. Spills

Assure that contingency plans, equipment, and materials to minimize exposures of people and property are available in case of accident.

7. Storage

Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemical resistant, secondary containers.

II. Standard operating procedures for particularly hazardous substances

Prior to using any particularly hazardous substance (defined in [Appendix I](#)), a standard operating procedure should be developed for its safe storage, handling, and disposal. (See [Appendix J](#) for sample standard operating procedures [perchloric acid].)