
# Laboratory Safety Program Manual
# Chemistry

**Revised March 26, 2006 (jdo)**
**Revised July 17, 2008 (mwg)**

## CHEMISTRY DEPARTMENTAL INCIDENT RESPONSE AND REPORTING

### A. Initial Notification

## Article I. ANY EMERGENCY 404-413-3333

| | | |
|---|---|---|
| Hazmat Incident: | 404-413-3540, | 404-413-3551 |
| Chemical Waste: | 404-413-3535, | 404-413-3568 |
| Radiation: | 404-413-3540, | 404-227-7472 |
| Biological Safety: | 404-413-3510, | 404-379-2940 |
| Animals: | 404-413-3508 | 404-413-3553 |
| Physical Plant: | 404-413-0700 | |
| Computer Don Harden | 404-413 5555 | harden@gsu.edu |
| Report Injury: Stephanie Young | 404-413-5499 | chesey@langate.gsu.edu |

### B. After Incident Notification,

| | | |
|---|---|---|
| Dr. Baumstark (Chair) | 404-413-5516 | chealb@langate.gsu.edu |
| Stephanie Young | 404-413-5499 | chesey@langate.gsu.edu |

Principal Investigator of the facility the incident occurred in

The notification must include: Date, time, location, what happened, how it happened, what was done to solve the problem.

# I. INTRODUCTION

Georgia State University is committed to providing a safe and healthful environment for its faculty, staff, students and visitors and managing the University in an environmentally sensitive and responsible manner. We further recognize an obligation to demonstrate safety and environmental leadership by maintaining the highest standards and serving as an example to our students as well as the community at large.

All departments using hazardous materials shall have the opportunity develop an approved Department-Specific Laboratory Safety Plan (DSLSP) in accordance with this Manual. DSLSP's will include policies and procedures specific to its discipline. Adherence to this Manual will require following the policies and procedures contained in Section III as well as the DSLSP.

The goal of the University Laboratory Safety Manual is to minimize the risk of injury or illness to employees and students by ensuring that they have the training, information, support and equipment needed to work safely in University laboratories. Please note that the absence of a particular issue or procedure from this Manual does not necessarily indicate that the procedure or operation is safe. It is not possible to address all situations that may be encountered in a University laboratory. It is the responsibility of Department Chairs, Principal Investigators, and laboratory personnel to identify and address outstanding laboratory safety issues.

This manual will be reviewed annually in April in conjunction with Earth Day. As changes are made to this Manual updated versions will be available electronically on the ORI website (http://www.gsu.edu/research/index.html). Additionally, each Vice President, Dean, and Department Chair will be sent a notification email of the updated Manual to forward to all of the faculty and staff.

Comments and questions for improving the manual are welcome and encouraged. Please send comments to the Associate Vice President of Research Integrity, 216 Alumni Hall, or call 404-654-5835.

# II. RESPONSIBILITIES

## A. Laboratory Safety Committee (LSC)

Georgia State University's Laboratory Safety Committee (LSC) serves to advise the President and Provost on policies, procedures, and issues regarding Laboratory Health and Safety. Other responsibilities of the LSC include:

1. Establish and review laboratory safety policies and procedures which are designed to:

    a. Maintain compliance with Local, State, and Federal regulations regarding laboratory safety and the purchase**,** transportation, use, handling, storage and disposal of all hazardous materials.

    b. Protect and optimize safety for all faculty, staff, students, visitors and members of the public from hazardous materials.

    c. Establish procedures for monitoring the purchase, use, storage and disposal of hazardous materials.

2. Review and approve Department-Specific Laboratory Safety Plans (DSLSP's)

3. Review and advise on corrective actions recommended by the Laboratory Safety Staff from the Office of Research Integrity (ORI).

4. Recommend training programs on laboratory safety practices and procedures that will result in faculty, staff and students having a continuing awareness of safe laboratory practices and proper hazardous materials use, storage, and disposal.

5. Evaluate the various programs involved with laboratory safety compliance on an annual basis. A member of the Committee will be selected by the Committee Chair to perform the assessment. If another recognized committee is charged to annually assess a specific program (ie. Radiation Safety), the Chair may use that committee's assessment in lieu of their own. Results of all assessments will be made available to the Associate Vice President for Research Integrity, all members of the Committee, and the respective Vice President, Dean, and Department Chair.

6. Current Committee Members:

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|---|---|
| Dr. Markus Germann | (Chemistry) – Chair |
| Dr. Eric Gilbert | (Biology) |
| Mr. Abdul Momen | (Facilities) |
| Dr. Eriik Krogstad | (Geoscience) |
| Dr. Gordon Warren | (Physical Therapy) |
| Dr. Nikolaus Dietz | (Physics) |
| Dr. Donald Edwards | (Neuroscience Institute) |

| | |
|---|---|
| Dr. Pedro Vasquez | (Chemistry) |
| Dr. George Beasley | (Art) |
| Dr. Zhen Huang | (Chemistry) |
| Mr. Randy Rimes | (Facilities) |
| Dr. Jeff Rupp | (Physiology) |

**B. College Dean/Departmental Chairs**

College Deans and Department Chairs have the following responsibilities related to Laboratory Safety:

1. Ensure that prior to the initiation of research, each Principal Investigator using hazardous materials implements the University Laboratory Safety Manual and the Department-Specific Laboratory Safety Plan (DSLSP) within their respective laboratory space(s).

2. Ensure that all Principal Investigators, Laboratory Personnel, students and other authorized personnel allowed access to the laboratories where hazardous materials are used have received all necessary and required training in laboratory safety policies and procedures.

3. Ensure that appropriate facilities and safety equipment are available for research and teaching activities involving hazardous materials.

4. Provide leadership and support of laboratory safety.

C. **The Principal Investigator**

A Principal Investigator (PI) is a faculty member (assistant professor, associate professor, professor, or instructor including adjunct faculty), a research professional, an academic professional, or laboratory director or coordinator who is associated with or provides guidance to a laboratory or laboratories using hazardous materials. Graduate students and postdoctoral associates will not be considered a PI except under special circumstances and only at the discretion of the Departmental Chair or appropriate administrator.

Some disciplines do not have a PI, but rather a director, manager or unit supervisor that provides oversight of operations. Those individuals or positions also will be considered as a PI for all intents and purposes of this Manual.

Responsibilities of the PI related to laboratory safety include:

1. Ensuring that all laboratory personnel have the proper training before allowing them to work in a laboratory using hazardous materials. Training shall include (but not be limited to):

    a. Ensure that job specific safety protocols for laboratory equipment and hazardous materials are followed.

b. Ensure that laboratory personnel have the ability to locate and communicate knowledge and comprehension of the University Laboratory Safety Program Manual and Department-Specific Laboratory Safety Plan (DSLSP), and the information related to Material Safety Data Sheets (MSDS) and all safety and compliance training required by University policy.

c. Ensure that training records are readily available according to Section II, subsection H.

2. Ensure that all applicable safety and compliance records are maintained as required by Federal, State and Local regulations and University policy.

3. Because of the difficulty to remove and/or secure hazardous materials that may pose a health and/or safety risk under his/her control prior to maintenance personnel working on furnishings, equipment, or laboratory systems, maintenance personnel may only work in the lab according to the schedule of the PI.

## D. Laboratory Personnel

Laboratory Personnel can include faculty members, research professionals, Doctoral and Post Doctoral researchers, research assistants, academic professionals, laboratory directors, laboratory assistants, or students who are associated with a laboratory or laboratories using hazardous materials.

Responsibilities of Laboratory Personnel related to laboratory safety include:

1. Obtain training on protocols, hazard controls, specific hazards and emergency procedures before working in a laboratory or facility using hazardous materials.

2. Learn all job specific safety protocols for laboratory equipment and hazardous materials within the laboratory.

3. Complete all safety and compliance training that is required by University policy

4. Maintain current training records (i.e. keep the certificate within reach and remember to perform annual training in accordance to the Manual).

5. Ensure that all applicable safety and compliance records are maintained as required by Federal, State and Local regulations and University policy.

6. Comply with all policies and regulations regarding the proper procurement, storage, use, transportation and disposal of all hazardous materials being used.

7. Immediately inform the supervisor of any hazardous situation or situation that has the potential to become hazardous.

8. Follow all laboratory protocols and standard operating procedures.

9. Do not proceed with a process unless safety is addressed and is completely understood.

10. If personnel observe issues that pose a risk and have not been addressed, the supervisor and/or PI are to bring it to the attention of the Department Chair and ORI.

## E. Vice President for Research/Office of Research Integrity (ORI)

The Georgia State University Vice President for Research/Office of Research Integrity (ORI) provides and consultation to the LSC in the establishment of University policies and procedures for laboratories using hazardous materials. ORI will also advise and assist Department Chairs and Principal Investigators in complying with the policies and procedures of the University Laboratory Safety Manual.

Other responsibilities of ORI related to Laboratory Safety include:

1. Assist Departments and laboratories in developing Department-Specific Laboratory Safety Plans (DSSP) for approval by LSC for the use, storage, and disposal of hazardous materials and to assist with the training of laboratory workers, ensuring that those plans are compatible with University policy.

2. Conduct routine scheduled evaluations of University laboratories for compliance with the policies and procedures of the University Laboratory Safety Manual.

3. Advise, as appropriate, Vice Presidents, College Deans, Department Chairs, Principal Investigators, and/or the LSC of issues found in individual laboratories.

4. Provide and/or facilitate testing for proper operation of safety equipment in laboratories where hazardous materials are present (e.g., safety showers, chemical fume hoods, etc.).

5. Provide consultation on the safe design of laboratories utilizing hazardous materials and their associated safety equipment.

6. Develop and present educational and training opportunities related to laboratory safety.

7. Respond to emergencies involving hazardous materials, providing guidance, consultation, and appropriate assistance.

8. Assist with and facilitate the proper disposal of hazardous wastes in compliance with existing regulations.

9. Assist in the development and maintenance of a hazardous materials inventory system.

# III. SAFETY POLICIES AND PROCEDURES

The following laboratory safety procedures must be followed by all University personnel where activities involve the storage and use of hazardous materials in a laboratory. A **hazardous material** is any item or agent (biological, chemical, physical) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

**Toxicity** is the capability of a chemical to produce injury. Almost any substance is toxic when taken in doses exceeding the "tolerable limits". **Hazard** is the probability that an injury will occur or rather the prospect that an individual will receive a toxic dose. It is incumbent upon the hazardous materials user to know the relative hazard of the materials in use.

Many items sold as consumer goods, office products, household utility products and cleaning supplies are not considered "hazardous". These products are exempted from certain labeling requirements; however, since Georgia State is classified as a Large Quantity Generator of hazardous waste the University is required to manage these and all other hazardous chemicals for proper disposal. Chemicals that have Health, Flammable, Reactive, or Specific Hazard ratings of 3 or 4 are generally the materials that are identifiable as "hazardous materials" and it is these chemicals which pose the greatest risk and should be managed first.

With regard to this Manual, a **Laboratory** is defined as any area where hazardous materials may be stored or used as a part of teaching and research and may include, but is not limited to:

- Science Laboratories - Chemistry, Biology, Psychology, Neuroscience, etc.
- Fine Art Studios - Painting, Sculpture, Ceramics, Wood/Metal Working, Jewelry, Textiles, etc.

A glossary of terms is included in **Appendix A** of this Manual.

## C. Hazardous Material Procurement, Inventory and Storage

1. Procurement and Delivery

    a. The Principal Investigator (PI) or a designee will perform the procurement and schedule the delivery of hazardous materials as defined in the DSLSP.

2. Inventory

    ORI will facilitate an inventory system for chemicals that complies with the requirements of the Georgia State University Right to Know Program. The Department Chair is responsible for ensuring that all faculty and staff within their department comply with the requirements of the Right to Know Program. Hazardous chemical inventories are to be reported to the University's Right to Know Coordinator biannually.

3. Storage

Due to the age of the facilities and buildings, employing the following means across the campus would be cost prohibitive. Thus consider applying the storage requirements to the highest risk chemicals first, and then ensure all newly installed casework and shelving meet the following.

a. General:

a. Chemicals shall be segregated by compatibility (acids, bases, flammable, reactives requiring separate and special storage, highly toxic compounds and general non-hazardous material storage shall be separated from one another.)

b. Use the higher shelves for containers of non-hazardous materials or for general supplies.

c. Shelves used for the storage of hazardous materials should be:

(a) Well anchored;

(b) Made of or covered with a chemical resistant material; and,

(c) Equipped with a protective lip.

d. Do not use work areas for long term storage.

e. Do not store glass chemical containers on the floor.

f. All incoming containers of chemicals must have appropriate labels that are not removed or defaced.

b. Flammable liquids: The total allowable quantities of flammable and combustible liquids (***including waste)*** in research and teaching laboratories shall be governed by Georgia Fire Codes as denoted in the National Fire Protection Association - NFPA 45 (Standard on Fire Protection for Laboratories Using Chemicals).

a. Twenty gallons (76 liters) are allowed per 100 square feet of a properly fire- separated laboratory unit. Ten gallons (38 liters) 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 (454 liters) in a single lab unit.

b. Up to 35 gallons (132 liters) of flammable solvents which are outside of flammable storage cabinets are allowed in a laboratory. Of this amount, 25 gallons (95 liters) must be contained in 2 gallon or smaller approved safety cans. The remaining 10 gallons (38 liters) may be kept in other containers such as the original 5 gallon (20 liter) shipping container, glassware and squeeze bottles.

c. No more than three 60 gallon (227 liter) capacity cabinets are allowed per laboratory unit.

d. Quantities allowed within an instructional laboratory unit should be restricted to ½ that allowed in a research laboratory unit.

e. Dispensing of flammable liquids from containers larger than 5 gallon (20 liter) capacity should:

   (a) Only be performed in a proper dispensing area per NFPA 30.

   (b) Be separated from the laboratory work area, per NFPA 45.

   (c) Be equipped with explosion proof lighting and outlets.

   (d) Have mechanically operated explosion proof ventilation with a fresh air supply. The minimum air flow is one cubic foot per minute for each square foot of floor space.

There are specific guidelines in NFPA 30 for five different types of flammable storage areas outside the laboratory: inside storage room, cutoff room, separate outside storage buildings, attached buildings and flammable liquid warehouses. If it is discovered that there is a need or requirement for one of these facilities, the ORI and the University Fire Safety Officer shall be contacted. Facility requirements will be dependent on the quantities of chemicals to be stored and the volume and frequency of their use.

No containers for dispensing or use of larger than 5 gallon (20 liter) capacity are allowed inside the laboratory area.

Storage of flammable liquids in refrigerators not specifically designed and approved for that use by a recognized testing agency, shall be strictly prohibited. Refrigerators must be UL or Factory Mutual approved for the storage of flammable liquids.

c. Pressurized gases

Remember that there are many pressurized gases that, while not toxic, are simple asphyxiants (i.e. nitrogen, carbon dioxide, helium, etc.). Frequently these are often overlooked. Consider that a cylinder closet, while not an OSHA-defined confined space, is a virtual confined space until it is ventilated prior to entry.

a. Storage of pressurized gas cylinders shall comply with Georgia Fire code as given in NFPA 45.

b. Cylinders shall be secured in an upright position at all times and valve caps shall be in place except when cylinders are in use.

c. Cylinders shall be dated upon receipt with a permanent marker on the outside of the cylinder. No cylinder shall be kept beyond its retention period.

d. Liquefied gases shall be stored in an upright position.

e. A racked storage area shall be provided for pickup and delivery of gas cylinders.

f. All cylinders should be labeled "Empty" when gas pressure equals ambient pressure.

g. Empty cylinders shall be segregated from cylinders which are full or in service.

h. All personnel who will be working in areas where compressed gases are used or stored shall receive instruction in methods of safe cylinder handling, emergency and evacuation procedures, the use of appropriate personal protective equipment, and steps to be taken in the event of a leak or fire in an adjacent area.

i. Cylinders and other containers shall not be stored near elevators, ventilating systems, or other openings through which gas may spread to other parts of a building if a leak should occur.

j. Suitable equipment shall be available for moving cylinders and other portable containers. Hand trucks shall be equipped with a clamp or chain to secure the container in place or they shall be specifically designed for container handling.

k. Always turn off gas cylinders at the main valve stem and never hit a gas cylinder with a metal instrument in an attempt to open or close the valve.

l. Cylinders shall be inspected regularly for corrosion or leaks. In case of a leak, the cylinder shall be removed promptly and in accordance with manufacturer's recommendations.

d. Flammable and Oxidizing Gasses

i. All areas where oxidizing gases are stored shall be identified with a sign stating the chemical name and the hazard associated with the gases which are being stored.

ii. Flammable gases must be separated a minimum of 20 ft. from oxidizing gases or a noncombustible barrier >5 ft. high with a fire resistance of ½ hour shall be constructed between the gases.

iii. Flammable gases must not be stored or used near open flames or hot surfaces. As with all flammable chemicals, flammable gases are to be stored in accordance with University policy.

e. Toxic Gases

i. Any gas with a Health Hazard (HH) rating of 3 or 4 must be kept in a continuously mechanically ventilated enclosure.

ii. No more than three cylinders with HH ratings of 3 or 4 shall be stored in a ventilated enclosure.

iii. Examples of some common toxic gasses are:

| | | |
|---|---|---|
| allene | dichlorosilane | nitric oxide |
| ammonia | dimethylamine | nitrogen dioxide |
| arsenic pentafluoride | disilane | nitrogen trifluoride |
| arsine | fluorine | phosgene |
| boron trichloride | fluorine mixtures | phosphine |
| boron trifluoride | germane ($GeH_4$) | phosphorous pentafluoride |
| bromine pentafluoride | hydrogen bromide | phosphorous trichloride |
| bromine trifluoride | hydrogen chloride | phosphorous trifluoride |
| 1,3 butadiene | hydrogen cyanide | silane ($SiH_4$) |
| carbon tetrafluoride | hydrogen fluoride | silicon tetrafluoride |
| carbon monoxide | hydrogen selenide | stibene ($SbH_3$) |
| carbonyl sulfide | hydrogen sulfide | sulfur tetrafluoride |
| chlorine | methyl bromide | sulfuryl fluoride |
| chlorine trifluoride | methyl chloride | tungsten hexafluoride |
| cyanogen | methyl silane | vinyl chloride |
| cyanogen chloride | monomethylamine | |
| diborane | nickel carbonyl | |

f. Acids and Bases

One issue to consider when procuring corrosives is the actual use of that chemical(s) in the period of one year.

i. Acids shall be separated from:

(a) Caustics and from active metals such as sodium, magnesium, and potassium.

(b) Chemicals that can generate toxic gases on contact, such as sodium cyanide and iron sulfide.

ii. Large bottles of acids shall be stored on lower shelves or in acid cabinets.

iii. Oxidizing acids (nitric, perchloric) shall be separated from:

(a) Organic acids

(b) Flammables

(c) Combustible materials

iv. Separate Nitric and Perchloric acids from other acids. This may be accomplished by placement in an unbreakable chemical resistant carrier.

v. Mild acids and bases (such as citric acid and sodium carbonate) may be stored with other low-hazard reagents.

vi. Opened containers of acids and bases should be stored in a chemical resistant secondary container unless stored in an approved acid cabinet.

vii. **Add acid to water. Never add water to acid.**

g. Peroxide-forming Chemicals

i. Peroxide-forming chemicals shall:

(a) Be stored in airtight containers in a dark, cool, and dry place.

(b) Be labeled with the date received and date opened (see **Appendix B** for lists of Peroxide forming chemicals).

(c) Used up or disposed of on or before the recommended storage time has expired as indicated by the manufacturer or the expiration date on the container.

h. 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 one pound or greater of water-reactive materials are used or stored.

i. Fire Extinguishers

Fire extinguishers may be recharged, replaced or upgraded to a specific use by calling the phone number on the yellow hang tag which is usually zip-tied to the pull pin.

j. Oxidizers

i. Oxidizers shall be stored away from:

(a) Flammable agents

(b) Combustible agents

(c) Reducing agents (zinc, alkaline metals)

k. Toxic Chemicals

Toxic chemicals shall be stored according to the nature of the chemical, with appropriate warnings and security employed.

## D. Security

Safeguarding University resources from unauthorized access, misuse or removal is the responsibility of all faculty and staff. In laboratories, this obligation rests primarily with the Principal Investigator; however, all laboratory personnel have a responsibility to take reasonable precautions against theft or misuse of materials, particularly those that could threaten public and environmental health. Laboratory security measures should be commensurate with the potential risks and imposed in a manner that does not unreasonably hinder research.

**ALL HAZARDOUS MATERIALS MUST BE SECURED OR UNDER CONSTANT SURVEILLANCE AT ALL TIMES. GSU Police shall be immediately notified of unauthorized, unknown persons in an area where hazardous materials are used or stored.**

At a minimum, the institution expects all laboratory personnel to comply with the following security procedures:

1. General Security Requirements

    a. Question the presence of unfamiliar individuals in laboratories and report all suspicious activity immediately to Campus Police by calling 1-2100. Additionally, follow up with the Department Chair and ORI.

    b. After normal business hours, all laboratories must be secured when not in use.

    c. Hazardous materials in storage (i.e. not being used) must be secured when the room in which it is stored is unoccupied. The required security may be accomplished by locking the room or area while unoccupied.

    d. Only authorized persons may have access to hazardous materials. Hazardous materials that are stored or used in areas common to both authorized and unauthorized personnel must be secured at all times from unauthorized personnel. All storage refrigerators/freezers must be secured.

    e. Corridors (hallways, elevator lobbies, and utility chases, etc.) are not secured areas. Therefore, the use and storage of hazardous materials in these areas are prohibited.

    f. All hazardous wastes are considered as hazardous materials. Hazardous wastes, including dry waste, liquid waste, medical pathological waste, and mixed waste, must be secured at all times.

    g. Laboratory personnel are accountable for the security of persons performing work in the area, such as engineering or maintenance personnel, contractors or commercial service representatives.

    h. Keys, cards and codes are not to be given to anyone without the expressed permission of the Departmental Chair or their authorized representative in charge of laboratory security.

    i. Written records must be maintained of all personnel issued keys or key cards/codes.

2. Other Authorized Personnel

    These are individuals who have a legitimate purpose to be in a University laboratory facility, but who are not students or employees for that particular area of the University. They can be custodial, maintenance or contractor employees.

    a. Other Authorized Personnel admitted into the laboratory or work area where hazardous materials are present must be accompanied at all times by authorized laboratory personnel.

    b. Other Authorized Personnel must not bring minors or pets into the laboratories where hazardous materials are present.

c. Other Authorized Personnel must be provided with protective eyewear and clothing if they are to observe or participate in any procedure involving a hazardous material or device.

d. Other Authorized Personnel are not to be given keys, cards or codes to enter a restricted area.

## E. Safe Work Practices

1. Exposure Minimization

a. Develop, train and use special precautions for hazardous materials.

b. Assume that any mixture will be more hazardous than its most hazardous component and that all substances of unknown hazard are hazardous.

c. Before using, refer to the Material Safety Data Sheet (MSDS) for specific information about a chemical or product containing hazardous materials.

d. Prevent exposure to airborne substances by use of fume hoods and/or other local ventilation devices.

e. Train all individuals handling hazardous materials in the laboratory in the proper operation and use of fume hood and other local ventilation devices.

f. Train employees in the safe use and maintenance of personal protective equipment provided in the laboratory.

g. Do not smell or taste hazardous materials.

h. Vent any apparatus that may discharge hazardous materials (*e.g.*, vacuum pumps, distillation columns) into local exhaust devices. Hazardous materials shall be properly stored and used to prevent exposure.

i. Use appropriate personal protective equipment (PPE) when working in areas where hazardous materials are in use (see sub-section V of this section for personal protective equipment requirements).

j. Do not allow release of hazardous materials into any building area, only into an appropriate local exhaust device ducted to the outdoors.

k. Test positive pressure glove boxes for leaks before use.

2. PELs, TLVs, or RELs

   The Permissible Exposure Limits (PELs) of OSHA, the Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists, and the Recommended Exposure Limits (RELs) of the National Institute for Occupational Safety and Health shall not be exceeded. These levels may be found on the MSDS or by contacting ORI. Occupational exposure concerns shall be addressed with the Laboratory Safety Staff of the ORI.

3. Chemicals Selection

   Use only those chemicals that are appropriate for use in the available ventilation system of the facility being used.

4. Sharps and Needles

   a. Razor blades, knives, needles and other sharps should be stored in puncture proof containers.

   b. Razor blades, knives, needles and other sharps should be put back into their proper storage containers IMMEDIATELY after use.

   c. Surgical needles shall not be recapped.

5. Minors

   Minors (individuals under the age of 18) are permitted to enter or have access to areas authorized for the use, storage or disposal of hazardous materials and/or equipment only if they are doing so as part of an established, supervised course of study or as an employee of Georgia State University. All other minors are not permitted in these areas.

   Those minors permitted in these areas but who will not work with hazardous materials or equipment shall be trained to recognize hazards in the area and on procedures to follow in the event of emergency.

6. Horseplay

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

7. Mouth Pipetting

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

8. Personal Apparel

    a. Low heeled, closed toed shoes and garments covering the legs shall be worn when handling hazardous materials.

    b. The following should not be worn in the laboratory when working with or in the direct vicinity of hazardous materials:

        i. shorts

        ii. sandals

        iii. short skirts (ankle length skirts may be acceptable under certain circumstances)

        iv. tank tops/open midriff tops

        v. dangling jewelry

    c. In areas where open flames are in use, it is recommended that apparel made of synthetic fibers not be worn, be limited in use, or covered with apparel (i.e. lab coat) made of non-synthetic material.

9. Personal Protective Equipment (PPE)

    a. Skin Absorption Protection (Gloves, Aprons, and Lab Coats)

        Persons performing procedures that use chemicals that can irritate or be absorbed by the skin shall wear the appropriate personal protective equipment. See **Appendix C** for examples of PPE.

        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 break through 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 areas where hazardous materials are handled or used. Laboratory coats used during the handling of hazardous materials should not be worn in other areas outside the laboratory such as offices, cafeteria, and library.

b. Eye Protection

All employees and students who participate in or observe any of the following functions shall be provided with and shall wear protective eyewear. Each user should have his or her own pair of eye protection.

i. Chemical, physical, or combined chemical-physical operations involving:

(a) caustic

(b) toxic

(c) irritant

(d) explosive materials

ii. Hot liquids or solids

iii. Injurious radiations

iv. Any dispensing of hazardous materials

CHEMICAL SPLASH GOGGLES which have splash proof sides to fully protect the eyes or a face shield should be worn when participating in or observing procedures using liquid hazardous materials which are corrosive or have a health hazard rating of 3 or 4.

IMPACT RESISTANT SAFETY GLASSES WITH SIDE SHIELDS should be worn as a minimum protection when in a chemical laboratory and must be worn when performing or observing procedures where powders, chips, and other flying particles are the primary hazard.

c. Respiratory Protection

Respirators are not authorized unless users first comply with recognized standard industry practices and requirements regarding respirators and submit the compliance documents to the ORI.

All operations within a laboratory facility 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.

10. Working Alone and Unattended Operations

    Working alone in a laboratory where hazardous materials are present is generally discouraged and in certain circumstances is not permitted. Unattended operations must be addressed in the Department-Specific Laboratory Safety Plan.

    Necessary unattended operations should be noted in an appropriate place and how to contact responsible lab personnel.

11. First Aid

    Each laboratory should have a well supplied first aid kit readily available. The kit should be checked regularly and supplies replenished. It is recommended that any injury occurring in a laboratory should be checked out by a physician. Oral and topical medications should not be stocked in a first aid kit.

12. Space Heaters

    Space heaters and similar devices are prohibited in laboratories where hazardous materials are in storage or use.

## F. Transport and Shipment of Hazardous Materials On and Off Campus

1. Contact the ORI for information concerning the transport or shipment of any hazardous material to an offsite location or across any public highway PRIOR TO PLANNING A SHIPMENT. These activities are governed by federal regulations.

2. Personal vehicles shall not be used for the transport of hazardous materials.

3. Any hazardous material greater than a one liter container 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. This can be accomplished using am impact resistant bottle carrier-usually made of rubber. These may be purchased from any lab supply dealer.

4. 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.

5. All persons who transport, prepare for transport, or offer into transport Hazardous Materials must be trained according to DOT requirements. For training information, contact the ORI.

## G. Laboratory Safety Equipment

1. Chemical Fume Hoods

    a. Purchasing and Installation

    The purchase and/or installation or modification of laboratory fume hoods shall have prior review by ORI. Sufficient prior notice should be given to ORI for adequate evaluation of the requested equipment and its installation.

b. Testing and Certification

Chemical fume hood performance shall be evaluated by ORI upon installation, routinely certified (at least annually), and whenever a change in local ventilation devices is made.

c. General Use Rules

i. Fume hoods should be kept clean and uncluttered.

ii. Work within the hood should be carried out at least six inches back from the front opening

iii. Electrical receptacles or other spark sources shall be protected from flammable vapors.

iv. No permanent electrical receptacles shall be permitted in the hood.

v. No chemical use 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.

vi. Hood sashes should be closed as much as possible when in use.

vii. The slots in the hood baffle shall be kept free of obstruction by apparatus or containers. Measures should be taken to prevent chem wipes, tissues or other articles from being drawn up into the exhaust duct.

viii. Bench coat surface protectors or other materials shall not obstruct hood air foils.

ix. The heating of perchloric acid in any hood other than a special purpose perchloric acid hood shall be prohibited.

x. Hoods that are malfunctioning or posted with "Danger-Inadequate Air Flow" signage shall not be used for any operation using hazardous chemicals.

xi. Any signs of reduced flow or other problems shall be promptly reported to a supervisor. Additionally, take measures to move the operation to another hood and if that is not available stop work in the hood.

xii. Do not modify fume hoods or ducts by cutting, drilling or changing the design characteristics. No cutting of holes or other unauthorized alteration of a chemical fume hood or its duct work shall be performed.

xiii. 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.

d. Specific use rules

    i. Hoods must be used with the exhaust/normal mode switch in the exhaust mode position.

    ii. Sash stops must not be modified or removed.

e. Repair and Maintenance

    If, for any reason, you suspect the fume hood is operating improperly, immediately cease work with hazardous materials in the hood and call the Facilities Maintenance work center at 1-0700. Additionally, inform the Department Chair, PI and ORI to coordinate the process.

    If the hood need maintenance due to a burned out light bulb, stuck sash, sash that will not stay at a given height, broken sash glass or other maintenance problem not related directly to the airflow, put in a work order by calling 1-0700.

2. Other Ventilation Devices

    a. Questions concerning ventilated storage cabinets, canopy hoods and snorkels should be directed to ORI.

    b. Georgia State University prohibits the use of ductless fume hoods, in accordance with the Board of Regents for the University System of Georgia "Design Criteria for Laboratory Furniture and Fume Hoods" (See **Appendix D**).

3. Eyewashes

    a. All laboratories using hazardous materials MUST have at least one eyewash station.

    b. All eyewash stations should be located such that it provides access within 10 seconds from any point in the laboratory.

    c. All eyewash stations should use tepid water (i.e. NFPA defines tepid as being between 60 degrees f and 100 degrees).

    d. Eyewashes should be flushed at least weekly by laboratory personnel. If this is not performed, an additional hazard may be present (i.e. suspended particulates from the plumbing) and may cause additional harm to the eyes during an emergency.

4. Emergency Showers

    a. Plumbed emergency showers shall be provided for existing laboratories within 10 seconds of travel from any point in the laboratory and the water must be tepid.

b. In new or renovated facilities, emergency showers must be located within the laboratory.

c. Emergency showers must be kept clear of clutter, equipment and electricity.

d. Laboratory showers and eyewashes will be tested by ORI on a routine basis.

5. Laboratory Doors

Doors into laboratories shall be kept closed unless specifically designed and permitted by codes to be left open.

6. Laminar flow, Biosafety cabinets:

Refer to the Georgia State University Biosafety Manual for information regarding laminar flow/Biosafety cabinets.

## H. Laboratory Equipment and Apparatuses

1. General

a. Use every effort not to contaminate equipment. If it gets contaminated, remedy the situation, clean it and report it to your supervisor. Do not leave it for the next person.

b. Review the manufacturer's recommendations for operation and maintenance.

c. Use and service equipment according to the manufacturer's instructions.

d. Train personnel on equipment setup, usage maintenance and decontamination prior to allowing them to use the equipment. Document this training.

e. Users of scientific instrumentation should maintain log books.

f. Decontaminate equipment before it is sent out for repairs or discarded.

2. Electrical Equipment Safety

a. All electrical equipment and apparatuses shall be double insulated or grounded.

b. All cords must be checked for wear, fraying, crimping or damage. DO NOT USE damaged cords. They must be replaced IMMEDIATELY.

c. Heaters, stirrers, hot plates, heating mantels and devices that can spark must be unplugged when not in use.

d. Extension devices (extension cords, power strips):

    i. Extension devices are for temporary use only.

    ii. Extension devices shall not be used on equipment that must remain plugged in at all times.

    iii. When extension devices must be used, the wire gauge of the device must be equal to or larger than the cord on the item being operated.

    iv. Extension devices must be equipped with a circuit breaker.

    v. The extension device shall be unplugged when not in use.

    vi. Extension devices shall not be used in areas subject to moisture, physical or chemical damage or flammable vapors.

    vii. Do not "Daisy Chain" extension devices.

    viii. No extension device shall be attached to the building surfaces (staples, nails, etc.).

e. Surge Protectors:

    i. Computer components or laboratory devices having computer components should be connected to a surge protector.

    ii. Only surge protectors with UL rating 1449 are acceptable for use on the described electrical equipment.

    iii. Do not "Daisy Chain" surge protectors.

3. Autoclaves

a. Training

    i. Review and understand the owner's manual before using any autoclave for the first time and as needed thereafter.

    ii. Contact the manufacturer to request on-site training as needed. Ensure the owner's manual is readily available in case questions arise during operation.

    iii. Use only if you are properly trained and you understand the safety precautions

b. Maintenance

i. Autoclave maintenance is an important aspect of a properly functioning autoclave.

ii. Follow the manufacturer's recommendations for preventative maintenance and ensure all contractors are approved by the manufacturer.

iii. ORI will conduct efficacy tests of autoclaves with biological indicators on a monthly basis.

c. General Safety Practices

i. Be sure the autoclave is OFF and steam pressure is down before slowly opening the door, keeping head, face, and hands away from the opening.

ii. Always wait at least 30 seconds after opening the door before reaching or looking into the autoclave.

iii. Before using the autoclave, check inside the autoclave for any items left by the previous user that could pose a hazard (e.g. sharps).

iv. Clean the drain strainer before loading the autoclave.

v. Load the autoclave properly as per the manufacturer's recommendations.

vi. To prevent bottles from shattering during pressurization, the caps of containers with liquids must be loosened before loading.

vii. Use a tray with a solid bottom and walls to contain the contents and catch spills.

viii. Add 1/4 to 1/2 inch of water to the tray so the bottles will heat evenly.

ix. Check plastic materials to ensure they are compatible with the autoclave.

x. Individual glassware pieces should be within a heat resistant plastic tray on a shelf or rack and never placed directly on the autoclave bottom or floor.

xi. Make sure the door of the autoclave is fully closed (latched) and the correct cycle has been selected before starting the cycle.

xii. Wear heat-resistant gloves when opening the autoclave door after a cycle. If there is a sharps hazard (e.g. biological waste), wear heat AND cut resistant gloves.

xiii. Before removing autoclaved items, wait five minutes for loads containing only dry glassware, and 10 minutes for autoclaved liquid loads.

xiv. At a minimum, when removing items from an autoclave, a rubber apron, rubber sleeve protectors and heat-resistant gloves should be worn.

xv. For non-liquid loads, let the glassware cool for 15 minutes before touching it with ungloved hands.

xvi. For liquid loads, let liquids stand for a full hour before touching with ungloved hands. Be sure others in the area know a heat hazard is present.

xvii. Do not autoclave items containing corrosives (e.g. acids, bases, phenol), solvents or volatiles (e.g. ethanol, methanol, chloroform) or radioactive materials.

4. Glassware

   a. Handle and store laboratory glassware with care to avoid damage.

   b. Do not use damaged glassware.

   c. Use extra care with Dewar flasks and other evacuated or pressurized glass apparatus.

   d. Shield or wrap evacuated or pressurized glass to contain chemicals and fragments should implosion occur.

   e. Glassware or utensils that are also used for laboratory operations shall not be used with food or beverages.

   f. Mechanical devices (i.e. forceps) should be used or puncture resistant gloves should be worn when handling BROKEN GLASS.

5. Centrifuges

   a. General Centrifuge Safety Procedures

      i. Read carefully (and re-read if it's been a long time between uses) the manufacturer's instructions for use and care of each rotor you use.

      ii. Make sure you understand the applications and limitations of each individual rotor.

      iii. Visually inspect each rotor for any signs of damage, corrosion, or weakness before using it, every time it is used.

      iv. Be careful to keep the rotor chamber or swinging bucket pairs correctly balanced, and make absolutely sure that the rotor cover is attached correctly.

      v. Lids shall be closed at all times during operation.

vi. Check glass and plastic centrifuge tubes for stress lines, hairline cracks and chipped rims before use.

vii. Use unbreakable tubes whenever possible.

viii. Avoid filling tubes to the rim.

ix. Use caps or stoppers on centrifuge tubes. Avoid using lightweight materials such as aluminum foil as caps.

x. The operator shall not leave the centrifuge until full operating speed is attained and machine appears to be running safely without vibration.

xi. If vibration occurs the centrifuge should be stopped immediately and load balances checked. Swing-out buckets should be checked for clearance and support.

xii. Rooms where potentially hazardous biological, radioactive materials, toxic or other hazardous materials are centrifuged must be identified by the appropriate warning signs.

xiii. Nitrocellulose tubes should be used only when transparent and flexible (fresh). They must never be heated because of explosive possibility.

xiv. Rotors and cups should be cleaned and disinfected after each use with non-corrosive cleaning solutions (mild detergent and distilled water are recommended). Test tube brushes must not be used for cleaning the cup cavities. All traces of detergents should be removed prior to air drying.

xv. Immediately clean up any spills that occur anywhere on the ultracentrifuge or rotor and dry the rotor before oxidation can occur.

b. Emergency Procedures

i. Turn off centrifuge, notify others in laboratory and evacuate if necessary.

ii. Post temporary Hazard Warning Sign to indicate a problem and disconnect power source.

iii. Notify the Supervisor and the ORI.

iv. Refer to the Department-Specific Laboratory Safety Plan.

c. Additional Requirements for High Speed Centrifuges and Ultrafuges

i. Connect the vacuum pump exhaust to a trap.

ii. Record each run in a logbook: keep a record of speed and run time for each rotor.

iii. Install a HEPA filter between the centrifuge and the vacuum pump when working with biohazardous material.

iv. Never exceed the specified speed limitations of the rotor.

v. Discard Plastic centrifuge tubes after one cycle.

6. Electrophoresis

a. General Precautions

i. The following areas must be checked prior to use, correcting any identified deficiencies:

(a) Insulation on the high voltage leads for signs of deterioration (e.g. exposed wires, cracks or breaks, etc.)

(b) All safety interlock features

(c) System alarms, for proper functioning

(d) Buffer tanks for cracks or leaks, exposed connectors, or missing covers

b. Follow manufacture's instructions.

c. Do not touch any cooling apparatus connected to a gel.

d. Do not run electrophoresis equipment while unattended.

e. If electrophoresis buffer is spilled or leaks from the gel box, stop the run and clean up the bench top immediately.

7. Vacuum Pumps

a. General

i. Vacuum pump belt guards must always be in place.

ii. Some types of pumps have traps that are Glass Dewars. Those must be wrapped or shielded.

iii. Liquids siphoned unintentionally into the vacuum system must be reported immediately to the Safety Coordinator or the teaching assistant.

iv. Waste gases generated during operation of the membrane vacuum pump must always be conducted into a fume hood.

v. Glass desiccators under vacuum must be stored in metal guards or shielded.

vi. Pumps used with hazardous materials must be decontaminated prior to sending for repair.

vii. Pumps are only to be repaired by authorized service technicians.

b. Central Building Vacuum Systems

i. All central building vacuum systems must be appropriately trapped, filtered, and vented to the outside.

ii. Condensation collectors should be checked and emptied regularly and the pumps themselves should be monitored regularly for defects.

iii. Only rotary evaporators may be permanently connected to a central vacuum pump.

iv. Suction filtration or similar use of the vacuum supply is allowed for only brief periods, only after provided that the users who need a good vacuum capacity are informed. Before any other operations it is necessary to check whether instruments connected to the same system suffer a vacuum loss.

v. It is strictly forbidden to allow liquids (even small amounts) to be siphoned directly into the central membrane vacuum pump lines!

vi. Safety trap to collect liquids must be inserted between vacuum consumer and vacuum module.

vii. Flammable and toxic liquids must not be siphoned with the central vacuum system.

viii. Equipment containing radioactive material will NOT be connected to any central vacuum system.

c. Local Vacuum Pumps

Local vacuum pumps shall be trapped and appropriately filtered. Good maintenance of traps and filters is essential.

8. Refrigerators and Freezers

a. Flammable liquids may only be stored or cooled in refrigerators or freezers that are suitable, listed, and signed for such use. Look for an “Explosion Proof” sign.

b. A “Non-Explosion Proof” label should be placed on ordinary refrigerators and freezers.

c. Freezers should be defrosted regularly.

d. Refrigerators and Freezers that store chemicals that become unstable at room temperature must have a temperature alarm to indicate failure of the unit.

9. Ultraviolet Light Sources

a. Never turn the light from a short/long wavelength ultraviolet (UV) lamp towards you.

b. Also be careful of the reflection of the UV light from around the side of your eye-shielding and into your eye.

c. Avoid working in a biological safety cabinet while the germicidal lamp is on. If possible, close the sash while lamp is on.

d. Do not use a Crosslinker if the door safety interlock is not working properly.

e. Use the manufacturer’s recommended eye protection or wear a polycarbonate face shield stamped with the ANSI Z87.1-1989 UV certification to protect the eyes and face when in an area where non-laser, UVC generating devices are used.

## I. Laboratory Hygiene

1. Work Spaces

Laboratory's aisle spaces shall be maintained unobstructed and work stations uncluttered.

2. Passageways

a. Stairways and hallways shall not be used as storage areas.

b. Access to exits, emergency equipment, and utility controls shall never be blocked or obstructed.

3. Hygiene

a. Eating, drinking, smoking, smokeless tobacco, chewing gum or application of cosmetics shall be allowed only in rooms where hazardous materials are not used, stored or disposed.

b. Hands shall be washed before conducting these activities.

c. No food or product intended for consumption shall be stored in areas where hazardous materials are stored.

d. Glassware or utensils that are also used for laboratory operations shall not be used with food or beverages.

e. Thoroughly wash hands immediately after working with chemicals.

f. Pets are not allowed in the laboratory where hazardous materials are present.

g. Work areas shall be kept clean and uncluttered.

**J.Records**

The PI is responsible for providing resources and opportunities to complete training.

1. The PI shall provide access to the Department-Specific Laboratory Safety Plan (DSLSP).

   All laboratories using hazardous materials shall develop a Laboratory-Specific Safety Plan and Standard Operating Procedures in accordance with the respective Departmental Plan.

2. The PI is responsible for maintaining training documentation as it applies to lab area activity. Much of the following can be accomplished by requiring the lab personnel to maintain training records. See the ORI website for details on training requirements.

   a. Basic and Chemical-Specific Right to Know Training

   b. Department-Specific Safety Plan Training

   c. Specific Laboratory Equipment and Apparatus Training

   d. Hazardous Waste Training

   e. Radiation Safety, Laser Safety, and Biosafety Training

   f. Bloodborne Pathogen Training

3. Laboratory personnel must demonstrate ability to access records and the Safety Manual in a reasonable amount of time.

**K. Signs and Labels**

1. Laboratory Refrigerators. All laboratory refrigerators, freezers, and microwaves shall be affixed with a sign that identifies the proper use. Remember commingling chemicals with food is not safe.

2. Ordinary refrigerators and freezers should be labeled “Non Explosion Proof.”

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

4. Secondary containers containing hazardous materials shall be affixed with labels that include the following information (See **Appendix E** for sample secondary container labels):

    a. Identity of the hazardous material, its common name given on its MSDS

    b. Date filled

    c. Hazard warnings (see **Appendix E** for hazard warning designations)

    d. Small containers such as test tubes, vials, and beakers may be labeled with the chemical identity and date. Batches of test tubes or vials containing chemicals of the same hazard may have labels affixed to a common carrier, test tube rack, or box.

    e. Use of Abbreviations: If abbreviations are used to identify chemicals in a lab a list of the terms and their meaning are to be posted in the lab.

## L. Laboratory Incident Response and Reporting

1. All life-threatening injuries shall be immediately reported by calling 9-911. All incidents (unplanned occurrence which result or could have resulted in an injury) are to be reported to ORI and the respective Department Chair using a University Incident/Accident report form. In addition, the following procedures should be followed as indicated:

    a. All employee (employee = anyone receiving a pay check from Georgia State University) workplace accidents/injuries should be reported via the established Workers' Compensation Protocols. For further information, the Georgia State University Occupational Health and Safety Officer should be contacted (404-651-4316). Additionally, the respective Department Chair shall be notified.

    b. All student accidents/injuries should be reported to the Georgia State University Risk Manager.

2. Hazardous Material Exposures

    a. Eye Contact: Promptly flush eyes with water for a prolonged period (at least 15 minutes) and immediately seek medical attention.

    b. Ingestion: Contact the local Poison Control Center or local hospital and follow directions.

c. Skin Contact: Promptly flush the affected area with copious amounts of water and seek medical attention if the problem is not resolved or the injured is still experiencing difficulty. Remove any clothing that may have chemical contamination to prevent further exposure.

3. Uncontrolled Release or Spill

   a. All laboratories which handle hazardous materials shall have an appropriate supply of spill cleanup kits.

   b. The supply must be capable of containing or cleaning up small known chemical releases.

   c. Laboratory personnel should not attempt to clean up a spill of certain hazardous materials:

      i. Having a health or hazard rating of 3 or 4; or

      ii. If appropriate spill clean up supplies and protective equipment are not available; or

      iii. If the material or level of exposure hazard is unknown.

**M. Synthesized Chemicals**

1. If 50 grams or more of a previously undiscovered or unknown chemical is synthesized, please contact the ORI for regulatory guidance.

2. If hazardous material substances are developed in the laboratory for in-house use, appropriate training shall be given to personnel as with any other hazardous material.

3. If the chemical produced is a by-product whose composition is not known, it shall be assumed that the substance is hazardous.

4. Synthesized chemicals and their known by-products shall be identified and stored by chemical class and shall be labeled in accordance with University policy.

## N. Laboratory Decommissioning

The following procedures shall be carried out and completed when the responsible individual leaves the University or transfers to a different laboratory. Upon completion, the Principal Investigator will contact the responsible Departmental Chair and the Associate Vice President for Research Integrity for final checkout.

1. Chemicals

   The investigator shall assure 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. (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 Georgia State University waste disposal program. All fume hood surfaces and counter tops shall be washed off and cleaned. The respective Departmental Chair is to be notified when the laboratory has been cleared and cleaned.

2. Gas Cylinders

   If cylinders are not returnable, contact ORI for advice.

3. Animal and Human Tissue/Specimens

   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 by rendering fixed tissue, 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 Departmental Chair.

4. 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 Departmental Chair.

5. 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. If radioisotopes where ever used in the laboratory, The Radiation Safety Officer must first decommission the laboratory with regards to radioisotopes **before any other decommissioning procedures take place.**

6. Equipment

   If laboratory equipment is to be left for the next occupant, clean or decontaminate before departing the laboratory. Equipment with chemical residue or hazardous material constituents such as mercury or waste oil or hazardous materials must not be taken to surplus property.

## O. Hazardous Waste Disposal

All hazardous wastes shall be disposed of in accordance with the most current revision of Georgia State University's Hazardous Materials Program Manual, Radiation Safety & Regulatory Compliance Manual, Biological Safety Manual, Select Agents Policies and Controlled Substance Policies.

# APPENDIX A

## GLOSSARY OF TERMS

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| **Action level** | A concentration for a specific substance, calculated as an eight (8) hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance. Typically it is one-half that of the PEL for that substance. |
| **ACGIH** | The American Conference of Governmental Industrial Hygienists is a voluntary organization of professional industrial hygiene personnel in government or educational institutions. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices. |
| **Acute Exposure** | Single exposure episodes which occur over a short time period. |
| **ANSI** | The American National Standards Institute is a voluntary membership organization (run with private funding) that develops consensus standards nationally for a wide variety of devices and procedures. |
| **ASHRAE** | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| **Asphyxiant** | A chemical (gas or vapor) that can cause death or unconsciousness by suffocation. Simple asphyxiants such as nitrogen, either use up or displace oxygen in the air. They become especially dangerous in confined or enclosed spaces. Chemical asphyxiants, such as carbon monoxide and hydrogen sulfide, interfere with the body's ability to absorb or transport oxygen to the tissues. |
| **Biohazard Wastes** | Discarded materials "that are biological agents or conditions (as an infectious organism or unsecure laboratory condition) that constitutes a hazard to man or his environment." This definition includes "any and all substances which contain materials to which organisms may cause injury or disease to man or his environment, but which are not regulated as controlled industrial waste." |
| **BSC** | Biological Safety Cabinet |
| **BSO** | Biological Safety Officer |
| **Carcinogen** | Any substance that causes the development of cancerous growths in living tissue, either those that are known to induce cancer in man or animals or experimental carcinogens that have been found to cause cancer in animals under experimental conditions. |
| **C.A.S. Number** | Identifies a particular chemical by the Chemical Abstracts Service, a service of the American Chemical Society that indexes and compiles abstracts of worldwide chemical literature called "Chemical Abstracts". These numbers are always contained in brackets. |
| **CDC** | Centers for Disease Control |
| **CFR** | Code of Federal Regulations |

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| **Chemical Hygiene Plan** | A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular work place and meets the requirements of 29 CFR 1910.1450(e). |
| **CHP** | See Chemical Hygiene Plan |
| **Chemical Reaction** | A change in the arrangement of atoms or molecules to yield substances of different composition and properties. (See Reactivity). |
| **Chronic Exposure** | A series of exposures occurring over a longer period of time. |
| **Combustible** | A combustible liquid or an "Ordinary Combustible" such as wood, paper, etc. |
| **Combustible Liquid** | Any liquid having a flashpoint at or above 100 $^{O}$F (37.8 $^{O}$C), but below 200 $^{O}$F (93.3 $^{O}$C), except any mixture having components with flashpoints of 200 $^{O}$F (93.3 $^{O}$C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture. |
| **Corrosive** | Any gas, liquid, or solid that causes destruction of human tissue or a liquid that has a severe corrosion rate on steel. Generally, a substance that has a very low or a very high pH. |
| **Decomposition** | The breakdown of a chemical or substance into different parts or simpler compounds. Decomposition can occur due to heat, chemical reaction, decay, etc. |
| **Designated Area** | An area which may be used for work with "select carcinogens, reproductive toxins, or substances which have a high degree of acute toxicity." A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood. A designated area shall be placarded to reflect the designated hazard. |
| **Dose** | The concentration of a substance and the time period during which the exposure occurs. The dose received links hazard and toxicity. |
| **DOT** | The United States Department of Transportation is the federal agency that regulates the labeling and transportation of hazardous materials. |
| **Emergency Spills** | Accidental chemical discharges that present an immediate danger to personnel and/or the environment. Under these circumstances, leave the spill site immediately and send for help. Management of these spills is the responsibility of specially trained and equipped personnel. Contact the campus police at 911 for response. They will notify the appropriate persons/departments. (See Section 1.1 - "Chemical Spills") |
| **Employee** | An individual employed in a laboratory work place who may be exposed to hazardous materials in the course of his or her assignments. |
| **EPA** | The Environmental Protection Agency is the governmental agency responsible for administration of laws to control and/or reduce pollution of air, water, and land systems. |

**EPA Number** The number assigned to chemicals regulated by the Environmental Protection Agency (EPA).

**Fires**

**Class A** Fires in ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics.

**Class B** Fires in flammable liquids, oils, greases, tars, oil-base paints, lacquers and flammable gases.

**Class C** Fires that involve energized electrical equipment where the electrical conductivity of the extinguishing medium is of importance; when electrical equipment is de-energized, extinguishers for class A or B fires may be safely used.

**Class D** Fires in combustible metals such as potassium, sodium, lithium, magnesium, titanium, sirconium.

**Flammable** Any substance which may be classified as a flammable aerosol, flammable gas, flammable liquid or flammable solid.

**Flammable Aerosol** An aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.

**Flammable Gas** A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider that 12 percent by volume, regardless of the lower limit.

**Flammable Liquid** Any liquid having a flashpoint below 100$^{o}$F (37.8$^{o}$C), except any mixture having components with flashpoints of 100$^{o}$F (37.8$^{o}$C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

**Flammable Solid** A solid, other than a blasting agent or explosive, that is liable to cause fires through friction, absorption of moisture, spontaneous chemical change, retained heat from processing, or which can be ignited readily, and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

**Hazard** The possibility that exposure to a substance will cause injury when a specific quantity is used under certain conditions.

**Hazardous Material** Any item or agent (biological, chemical, physical) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

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| **Health Hazard** | A substance for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. This term includes carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes. |
| **IDLH** | Immediately dangerous to life or health concentrations represent the maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe eye irritation) or irreversible health effects. |
| **Ignitable** | A solid, liquid, or compressed gas that has a flashpoint of less $140^{O}$F. Ignitable material may be regulated by the EPA as a hazardous waste, as well. |
| **Incompatible** | The term applied to two substances to indicate that one material cannot be mixed with the other without the possibility of a dangerous reaction. |
| **Ingestion** | Taking a substance into the body through the mouth as food, drink, medicine, or unknowingly as on contaminated hands or cigarettes, etc. |
| **Inhalation** | The breathing in of an airborne substance that may be in the form of gases, fumes, mists, vapors, dusts, or aerosols. |
| **Laboratory** | Area where hazardous materials may be used as a part teaching or research including but not limited to: science laboratories, fine art studios for; painting, sculpture, ceramics, wood/metal working, jewelry, textiles, etc and other areas of operations at the University. |
| **Lethal Concentration$_{50}$** | The concentration of an air contaminant that will kill 50 percent of the test animals in a group during a single exposure. (**$LC_{50}$)** |
| **Lethal Dose$_{50}$** | The dose of a substance or chemical that will kill 50 percent of the test animals in a group within the first 30 days following exposure. (**$LD_{50}$)** |
| **Lower Explosive Limit** | (Also known as Lower Flammable Limit.) The lowest concentration of a substance that will produce a fire or flash when an ignition source (flame, spark, etc.) is present. It is expressed in percent of vapor or gas in the air by volume. Below the LEL or LFL, the air/contaminant mixture is theoretically too "lean" to burn. (See also UEL.) |
| **Minor Spills** | Small chemical leaks that usually are detected early and present no immediate danger to personnel or the environment. These are spills that can be safely corrected with the advice of knowledgeable laboratory or supervisory personnel. |
| **MSDS** | Material Safety Data Sheet |
| **NFPA** | The National Fire Protection Association is a voluntary membership organization whose aims are to promote and improve fire protection and prevention. NFPA has published several volumes of codes known as the National Fire Codes. |

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| **NIH** | National Institute of Health |
| **NIOSH** | The National Institute for Occupational Safety and Health is a federal agency that among its various responsibilities trains occupational health and safety professionals, conducts research on health and safety concerns, and test and certifies respirators for work place use. |
| **Odor Threshold** | The minimum concentration of a substance in the air at which a majority of test subjects can detect and identify the substance's characteristic odor. |
| **OSHA** | The Occupational and Safety Health Administration is a federal or state agency under the Department of Labor that publishes and enforces safety and health regulations for most businesses and industries in the United States. |
| **Oxidizer** | A substance such as chlorate, permanganate, inorganic peroxide, nitrocarbonitrate, or a nitrate that yields oxygen readily to stimulate the combustion of organic matter. |
| **Oxygen Deficiency** | An atmosphere having less than the normal percentage of oxygen found in normal air. Normal air contains approximately 21% oxygen at sea level. |
| **Permissible Exposure Limit** | An exposure limit that is published and enforced by OSHA as a legal standard. PEL may be either a time-weighted-average (TWA) exposure limit (8 hour), a 15-minute short term exposure limit (STEL), or a ceiling (C). The PELs are found in Tables Z-1, Z-2, or Z-3 of 29 CFR 1910.100. This level of exposure is deemed to be the maximum safe concentration and is generally the same value as the threshold limit value (TLV). |
| **Personal Protective Equipment** | Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are respirators, gloves, and chemical splash goggles. |
| **Physical Hazard** | A substance which is a compressed gas, explosive, flammable, organic peroxide, oxidizer, pyrophoric, unstable or water reactive. |
| **Polymerization** | A chemical reaction in which two or more small molecules combine to form larger molecules that contain repeating structural units of the original molecules. A hazardous polymerization is the above reaction with an uncontrolled release of energy. |
| **Reactivity** | A substance's susceptibility to undergoing a chemical reaction or change that may result in dangerous side effects, such as explosion, burning, and corrosive or toxic emissions. The conditions that cause the reaction, such as heat, other chemicals, and dropping, will usually be specified as "Conditions to Avoid" when a chemical's reactivity is discussed on a MSDS. |
| **Respirator** | A device which is designed to protect the wearer from inhaling harmful contaminants. |
| **Respiratory Hazard** | A particular concentration of an airborne contaminant that, when it enters the body by way of the respiratory system or by being breathed into the lungs, results in some bodily function impairment. |

| | |
|---|---|
| **Sensitizer** | A substance that may cause no reaction in a person during initial exposures, but afterwards, further exposures will cause an allergic response to the substance. |
| **Sharps** | Hypodermic needles, syringes, (with or without the attached needle), pasteur pipettes, scalpel blades, suture needles, blood vials, needles with attached tubing, and culture dishes (regardless of presence of infectious agents). Also included are other types of broken or unbroken glassware that were in contact with infectious agents, such as used slides and cover slips. |
| **Short Term Exposure Limit** | Represented as STEL or TLV-STEL, this is the maximum concentration to which workers can be exposed for a short period of time (15 minutes) for only four times throughout the day with at least one hour between exposures. |
| **STEL** | See Short Term Exposure Limit |
| **Threshold Limit Value** | Airborne concentrations of substances devised by the ACGIH that represents conditions under which it is believed that nearly all workers may be exposed day after day with no adverse effect. TLVs are advisory exposure guidelines, not legal standards, that are based on evidence from industrial experience, animal studies, or human studies when they exist. There are three different types of TLV's: Time Weighted Average (TLV-TWA), Short Term Exposure Limit (TLV-STEL) and Ceiling (TLV-C). (See also PEL.) |
| **Time Weighted Average** | (TLV-TWA, Threshold Limit Value-Time Weighted Average) The time weighted average airborne chemical concentration for a normal eight hour work day and a 40 hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. |
| **Toxic** | Substances such as carcinogens, irritants, or poisonous gases, liquids, and solids which are irritating to or affect the health of humans. |
| **Toxicity** | The potential of a substance to exert a harmful effect on humans or animals and a description of the effect and the conditions or concentrations under which the effect takes place. |
| **Unstable Liquid** | A liquid that, in its pure state or as commercially produced, will react vigorously in some hazardous way under shock conditions (i.e., dropping), certain temperatures, or pressures. |
| **Upper Explosive Limit** | Also known as Upper Flammable Limit. Is the highest concentration (expressed in percent of vapor or gas in the air by volume) of a substance that will burn or explode when an ignition source is present. Theoretically above this limit the mixture is said to be too "rich" to support combustion. The difference between the LEL and the UEL constitutes the flammable range or explosive range of a substance. (See also LEL.) |
| **Vapor** | The gaseous form of substances which are normally in the liquid or solid state (at normal room temperature and pressure). |
| **Water Reactive** | Substances that react violently when in contact with water. They can be either flammable solids or corrosives. |

# APPENDIX B

## Management of Potentially Reactive/Explosive Hazardous Chemicals

A number of relatively common chemicals and reagents can become explosive when stored improperly for excessive periods of time. The following provides a list of the most common of the potentially reactive/explosive hazardous chemicals and provides information on how to prevent explosive hazards.

### Picric Acid and other Polynitroaromatic Compounds

Picric Acid is commonly used in labs and is relatively safe in the form which it is sold. It is ordinarily sold with 10% water added for stabilization. However, picric acid can become explosive when it is allowed to dry out or when it forms certain metal salts. The following steps should be taken to safely store picric acid:

STEP 1: Never allow picric acid to be stored in containers with metal caps or come in contact with any metal.

STEP 2: Check Picric Acid frequently to ensure it remains damp. Add water if needed.

STEP 3: Never attempt to open a bottle of old or very dry picric acid.

Contact ORI for handling and storage information if other polynitroaromatic compounds are used in your laboratory.

### Tollen's Reagent

Tollen's Reagent (ammoniacal silver nitrate) can form highly explosive silver fulminate over time after it has been used. To avoid this problem, add dilute nitric acid to Tollen's Reagent immediately after use and contact ORI for disposal.

### Sodium Azide

Sodium Azide may form highly explosive heavy metal azides if contaminate or used improperly. Disposal of sodium azide solutions to the sanitary sewer may cause the formation of lead or copper azide in the plumbing which could potentially cause a serious explosion. Sodium Azide should never be heated rapidly or stored in containers with metal components.

### Peroxide Forming Chemicals

A variety of chemicals can form highly explosive peroxide compounds as impurities when exposed to air over a period of time. This problem is most common in ethers, but also occurs in a variety of other organic compounds as well as in some alkali metals and amides. As a result, great care must be taken to prevent the formation of peroxides in these chemicals.

Preventing the formation of peroxides is dependent on careful inventory control of peroxide forming chemicals. Most peroxide forming chemicals are sold commercially with inhibitors to prevent the formation of the peroxides. These are effective until the container is first opened. After a container is opened, the chemical comes in contact with air and may begin to form peroxides. Therefore, there are two steps to prevent the hazards of peroxide formation.

The first step in preventing the formation of peroxides is to date all containers of peroxide forming chemicals with the date the container was first opened.

The second step is to test for peroxides or dispose of the peroxide forming chemicals within six months of the date the container was first opened. Manufacturers often state warnings on their peroxide forming chemicals. In this case, the chemicals should be dated and disposed of in accordance with manufacturers recommendations.

The following list is composed of potentially reactive/explosive peroxide forming chemicals:

Acetal
Acrolein
Acrylic Acid
Acrylonitrile
Aldehydes
Allyl ethyl ether
Allyl phenyl ether
Anhydrous Ether
Benzyl ether
Benzoyl-n-butyl ether
Bromophenetole
Butadiene
p-Chloroanisole
Chloroprene
Chlorotriflouroethylene
Cumene
Cyclohexene
Cyclooctene
Cyclopentene
Decahydromnapthalene
Diacetylene
Dibutyl Ether
Dicyclopentadiene
Diethyl ether
Diethylene glycol
Diethylene glycol diethyl ether
Diethylene glycol mono-o-butyl ether
Diisopropyl ether
Dimethyl ether
Dimethyl isopropyl ether
1,4 Dioxane
p-Dioxane
Divinyl ether
Divinylacetylene
Ethyl Methyl ether
Ethylene Glycol Dimethyl Ether
Ethylene Glycol Ethers
Furan
Isopropyl ether
Methyl isobutyl ketone
Methyl acetylene
o-Methylanisole
Methyl Methacrylate
m-Methylphenetole Phenetole
Organic ethers >1 year old
Perchloric Acid
Tetrahydrofuran
Potassium Amide
Potassium Metal
Sodium Amide
Styrene
Tetrafluoroethylene
Tetrahydronapthalene
Vinyl Acetate
Vinyl Chloride
Vinyl Ethers
Vinyl Pyridine
Vinylidene Chloride
Vinylidene Dichloride

# APPENDIX C

## General Guidelines for Choosing Personal Protective Equipment

### 1. Description and Use of Eye/Face Protectors

a. **Safety Glasses.** Protective eyeglasses are made with safety frames, tempered glass or plastic lenses, temples and side shields which provide eye protection from moderate impact and particles encountered in job tasks such as carpentry, woodworking, grinding, scaling, etc. Safety glasses are also available in prescription form for those persons who need corrective lenses.

b. **Single Lens Goggles.** Vinyl framed goggles of soft pliable body design provide adequate eye protection from many hazards. These goggles are available with clear or tinted lenses, perforated, port vented, or non-vented frames. Single lens goggles provide similar protection to spectacles and may be worn in combination with spectacles or corrective lenses to insure protection along with proper vision.

c. **Face Shields.** These normally consist of an adjustable headgear and face shield of tinted/transparent acetate or polycarbonate materials, or wire screen. Face shields are available in various sizes, tensile strength, impact/heat resistance and light ray filtering capacity. Face shields will be used in operations when the entire face needs protection and should be worn to protect eyes and face against flying particles, metal sparks, and chemical/biological splash.

**Eye and Face Protection Selection Chart**

| Source | Assessment of Hazard | Protection |
|---|---|---|
| **IMPACT** - Chipping, grinding, machining, drilling, chiseling, riveting, sanding, etc. | Flying fragments, objects, large chips, particles, sand, dirt, etc. | Spectacles with side protection, goggles, face shields.<br>For severe exposure, use face shield over primary eye protection. |
| **CHEMICALS** - Acid and chemicals handling | Splash<br><br><br>Irritating mists | Goggles, eyecup and cover types.<br>For severe exposure, use face shield over primary eye protection<br>Special-purpose goggles |
| **DUST** - Woodworking, buffing, general dusty conditions | Nuisance dust | Goggles, eyecup and cover types. |

## 2. Hand Protection

Skin contact is a potential source of exposure to toxic materials; it is important that the proper steps be taken to prevent such contact. Most accidents involving hands and arms can be classified under four main hazard categories: chemicals, abrasions, cutting, and heat. There are gloves available that can protect workers from any of these individual hazards or any combination thereof.

Gloves should be replaced periodically, depending on frequency of use and permeability to the substance(s) handled. Gloves overtly contaminated should be rinsed and then carefully removed after use.

Gloves should also be worn whenever it is necessary to handle rough or sharp-edged objects, and very hot or very cold materials. The type of glove materials to be used in these situations include leather, welder's gloves, aluminum-backed gloves, and other types of insulated glove materials.

The following is a guide to the most common types of protective work gloves and the types of hazards they can guard against:

a. **Disposable Gloves**. Disposable gloves, usually made of light-weight plastic, can help guard against mild irritants.

b. **Fabric Gloves**. Made of cotton or fabric blends are generally used to improve grip when handling slippery objects. They also help insulate hands from mild heat or cold.

c. **Leather Gloves**. These gloves are used to guard against injuries from sparks or scraping against rough surfaces. They are also used in combination with an insulated liner when working with electricity.

d. **Metal Mesh Gloves**. These gloves are used to protect hands form accidental cuts and scratches. They are used most commonly by persons working with cutting tools or other sharp instruments.

e. **Aluminized Gloves**. Gloves made of aluminized fabric are designed to insulate hands from intense heat. These gloves are most commonly used by persons working molten materials.

f. **Chemical Resistance Gloves**. These gloves may be made of rubber, neoprene, polyvinyl alcohol or vinyl, etc. The gloves protect hands from corrosives, oils, and solvents. The following table is provided as a guide to the different types of glove materials and the chemicals they can be used against. When selecting chemical resistance gloves, be sure to consult the manufacturers' recommendations, especially if the gloved hand will be immersed in the chemical.

# Glove Chart

| Type | Advantages | Disadvantages | Use Against |
|---|---|---|---|
| Natural rubber | Low cost, good physical properties, dexterity | Poor vs. oils, greases, organics. Frequently imported; may be poor quality | Bases, alcohols, dilute water solutions; fair vs. aldehydes, ketones. |
| Natural rubber blends | Low cost, dexterity, better chemical resistance than natural rubber vs. some chemicals | Physical properties frequently inferior to natural rubber | Same as natural rubber |
| Polyvinyl chloride (PVC) | Low cost, very good physical properties, medium cost, medium chemical resistance | Plasticizers can be stripped; frequently imported may be poor quality | Strong acids and bases, salts, other water solutions, alcohols |
| Neoprene | Medium cost, medium chemical resistance, medium physical properties | NA | Oxidizing acids, anilines, phenol, glycol ethers |
| Nitrile | Low cost, excellent physical properties, dexterity | Poor vs. benzene, methylene chloride, trichloroethylene, many ketones | Oils, greases, aliphatic chemicals, xylene, perchloroethylene, trichloroethane; fair vs. toluene |
| Butyl | Speciality glove, polar organics | Expensive, poor vs. hydrocarbons, chlorinated solvents | Glycol ethers, ketones, esters |
| Polyvinyl alcohol (PVA) | Specialty glove, resists a very broad range of organics, good physical properties | Very expensive, water sensitive, poor vs. light alcohols | Aliphatics, aromatics, chlorinated solvents, ketones (except acetone), esters, ethers |
| Fluoro- elastomer (Viton) ™ * | Specialty glove, organic solvents | Extremely expensive, poor physical properties, poor vs. some ketones, esters, amines | Aromatics, chlorinated solvents, also aliphatics and alcohols |
| Norfoil (Silver Shield) | Excellent chemical resistance | Poor fit, easily punctures, poor grip, stiff | Use for Hazmat work |

*Trademark of DuPont Dow Elastomers

# APPENDIX D

## University System of Georgia Board of Regents Laboratory Design Criteria

http://www.usg.edu/ehs/guidelines/fume_design.phtml

# APPENDIX E

## Georgia State University Hazardous Waste Manual

# APPENDIX F
# EXTREMELY HAZARDOUS CHEMICALS

1. Definition

For the purpose of the Appendix F, an extremely hazardous chemical is defined as a chemical:

A. that requires special handling protocols,
B. that requires safety precautions outside of those normally provided for in a chemical laboratory,
C. requiring engineering controls outside of those normally provided for in a chemical laboratory or
D. that has specific regulatory, safety and/or security requirements.

The following chemicals are considered extremely hazardous chemicals:

Acetone cyanohydrin,
Acrolein
Boron tribromide
Bromine pentafluoride
Bromine trifluoride
Butyl Lithium Compounds
Calcium phosphide
Chloroacetyl chloride
Chlorosulfonic acid
Hydrofluoric Acid
Lithium nitride
Magnesium phosphide
Methyldichlorosilane
Phosphorus oxychloride
Phosphorus pentasulfide
Phosphorus trichloride
Potassium phosphide
Sodium phosphide
Strontium phosphide
Sulfuryl chloride
Titanium tetrachloride
Trichlorosilane

Though this list is specific, it is not all inclusive and many other chemicals not listed meet the definition of an extremely hazardous chemicals and require that the requirements of this section be met.

2. Training

All personnel who will work directly with or could be directly exposed to an extremely hazardous chemical must receive chemical specific training on each individual chemical so defined. This training must meet the requirement of the Georgia Right to Know law and must include instruction on:

A. Proper Use
B. Proper Storage
C. The research protocol
D. Proper Disposal
E. Safety precautions in addition to those normal to a chemical laboratory.

Records of this training is to be maintained by the Principal Investigator.

3. Research Protocols and Standard Operating Procedures (SOP)

The principal investigator must maintain a written protocols and/or standard operating procedures defining

A. Personnel training,
B. The use of the chemical,
C. Storage of the chemical,
D. Safety Procedures to be used when handling the chemical,
E. Emergency Procedures,
F. Inactivation or Waste Handling Procedures,
G. Security procedures to ensure against misuse or theft,
H. Emergency and/or spill procedures.

Written copies of the protocols and SOPs must be maintained in the laboratory and be freely available to all lab members.