Laboratory Safety Manual

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Contents

DEFINITIONS

Change control: The management process for requesting, reviewing, approving, and carrying out and controlling changes to agreed-upon deliverables or operational boundaries. It is sometimes referred to as "Change Management."

Chemical exposure hazard: A chemical for which there is evidence that acute (immediate) or chronic (delayed) health effects may occur in an exposed population. Exposure is related to the dose (how much), the duration and frequency of exposure (how long and how often), and the route of exposure (how and where the material gets in or on the body), whether through the respiratory tract (inhalation), the skin (absorption), the digestive tract (ingestion), or percutaneous injection through the skin (accidental needle stick). The resulting health effects can be transient, persistent,

or cumulative; local (at the site of initial contact with the substance), or systemic (after absorption, distribution, and possible biotransformation, at a site distant from initial contact with the substance).

Chemical Safety Levels (CSLs): Defined levels of hazard (1 through 4):

CSL Level 1: Minimal chemical or physical hazard. No concentrated acids or bases, toxics, carcinogens or teratogens. Less than 4 liters of flammable liquids. No fume hood required. Typical examples include science undergraduate teaching and demonstration labs, research lab with minor chemical usage, laser labs (below Class 2B), and microscopy rooms.

• **CSL Level 2:** Low chemical or physical hazard. Small amounts, less than 1 liter of concentrated acids or bases, possesses none or limited amounts of toxic or high hazard chemicals. Less than 40 liters of flammable liquids in use. May need a fume hood for some activities. Typical examples include: chemistry/biochemistry teaching and demonstration labs and standard biomedical research labs.

• **CSL Level 3:** Moderate chemical or physical hazard. Lab contains concentrated acids, bases, toxic, other high hazard chemicals, or cryogenic liquids. Carcinogens or reproductive toxins are handled. Corrosive, flammable, toxic compressed gases in cabinets or fume hoods. Larger volumes of flammable liquids in the lab. Special hazards in limited quantities may be in the lab with Environmental Health and Safety (EH&S) approval (for example, hydrofluoric acid, pyrophoric chemicals, or cyanides). Labs are fume hood or local exhaust intensive. Some uses of a glove box for air reactive chemicals or quality control. Examples include chemistry research, pharmacology, chemical engineering, and pathology labs, as well as other chemical-intensive research labs.

• **CSL Level 4:** High chemical or physical hazard. Work with explosives or potentially explosive compounds, frequent use or larger quantities of pyrophoric chemicals. Use of large quantities or extremely high hazard materials with significant potential for Immediately Dangerous to Life and Health (IDLH) conditions in the event of uncontrolled release or foreseeable incident. Use of glove box for pyrophoric or air-reactive chemicals.

Consequence: The most probable result of a potential incident.

Exposure: The concentration or amount of a particular agent (chemical, biological, electrical, electromagnetic field (EMF), or physical) that reaches a target organism, system or subpopulation in a specific frequency for a defined duration.

Failure modes and effects analysis (FMEA): An evaluation of the means that equipment can fail or be improperly operated and the effects the failures can have on the process.4

Fault tree analysis (FTA): A graphical model that illustrates combinations of failures that will cause one specific failure of interest. It is a deductive technique that uses Boolean logic symbols to break down the causes of an event into basic equipment and human failures.

Globally Harmonized System (of Classification and Labeling of Chemicals) [known commonly as GHS]: A worldwide initiative to promote standard criteria for classifying chemicals according to their health, physical, and environmental hazards. It uses pictograms, hazard statements, and the signal words “Danger” and “Warning” to communicate hazard information on product labels and safety data sheets in a logical and comprehensive way.

Hazard: A potential for harm. The term is often associated with an agent, condition, or activity (a natural phenomenon, a chemical, a mixture of substances, a process involving substances, a source of energy, or a situation or event) that if left uncontrolled, can result in an injury, illness, loss of property, or damage to the environment. Hazards are intrinsic properties of agents, conditions, or activities.

Hazard analysis: A term used to express the complete process of hazard identification, evaluation, and control.

Hazard control: A barrier, such as a device, measure, or limit, used to minimize the potential consequences associated with a hazard.

Hazard evaluation: The qualitative and, wherever possible, quantitative description of the inherent properties of an agent or situation having the potential to cause adverse effects. (Adapted from the World Health Organization definition for “hazard characterization”)

Hazard identification: The identification of the type and nature of adverse effects that an agent, operation or equipment has as inherent capacity to cause in an organism, system or (sub) population.

Hazard operability (HazOp) analysis: A technique whereby a multidisciplinary team uses a described protocol to methodically evaluate the significance of deviations from the normal design intention.4

Job hazard analysis: A systematic approach to address hazards by looking at a task and focusing on the relationship between the laboratory worker, the task, the tools, and the work environment in order to identify the hazards and reduce risk.

Laboratory: A facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a nonproduction basis. For the purposes of this document, a laboratory can be any location where research occurs.

Laboratory scale: used to describe work with substances in which the containers used for reactions, transfers, and other substance handling are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory worker: Refers to career lab staff, PIs, undergraduate students, graduate students, postdoctoral researchers, volunteers, or visiting scholars.

Likelihood: The probability of occurrence, or how likely the complete sequence of events leading up to a consequence will occur upon exposure to the hazard. This term is often associated with descriptors such as almost certain, likely, possible, unlikely, and rare.

Management of change analysis: An evaluation of the potential safety consequences of planned changes to experimental apparatus, materials, procedure, location or other key parameters conducted prior to implementation of the proposed changes and how identified risks should be managed.

Near-miss: An event in which an injury or loss did not occur, but could have. The conditions of the event are often readily identified as precursors to an accident or loss. These are sometimes termed as ‘near-hit’. These events are indicators that the existing hazard controls, if any, may not be adequate and deserve more scrutiny.

Physical hazard: A class of hazards that include cold, ergonomics, explosions, fire, heat, high pressure, high vacuum, mechanical, nonionizing radiation, ionizing radiation, noise, vibration, and so forth.

Principal investigator (PI): The individual who has primary responsibility for performing or overseeing the research. In some instances, the PI is also referred to as the project manager for the research project.3

Risk: The probability or likelihood that a consequence will occur.

Standard Operating Procedures (SOPs): A written series of steps that can be followed to correctly and safely obtain a desired outcome. In laboratories, SOPs are typically developed for repetitive procedures which are known to have associated hazards where injury, property loss, or productivity loss could result if the steps are not followed precisely.

Structured what-if analysis (SWIF): The *Structured What-If Technique* (SWIFT) is a systems based risk identification technique that employs structured brainstorming, using pre-developed guidewords / headings (*e.g., timing, amount, etc.*) in combination with prompts elicited from participants (which often begin with the phrases “What if…” or “How could…”), to examine risks and hazards at a systems or subsystems level.5

What-if analysis: A creative, brainstorming examination of a process or operation.4

What-if/HazOp: A combination of what-if and HazOp techniques, deriving the benefits of both methods for a more comprehensive review.

What-if/HazOp/Checklist: A combination of what-if, HazOp, and checklist analysis techniques, deriving benefits from each methodology for a more comprehensive review.

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 to develop an approved Department-Specific Laboratory Safety Plan (LABORATORY SAFETY MANUAL) in accordance with this Manual. LABORATORY SAFETY MANUAL’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 LABORATORY SAFETY MANUAL.

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 on a regular basis. 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: 404-413-3517. **http://www.gsu.edu/research/full_directory.html**

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.

II. RESPONSIBILITIES

A. Laboratory Safety Committee (LSC)

The Laboratory Safety Committee integrates the process of identifying hazards, evaluating the risks presented by those hazards and managing the risks of hazards of the experiment to be performed into the experimental design process. This interaction is the basic elements of a hazards identification, evaluation, and control process.

The research laboratory is a unique, ever-changing environment. Research experiments change frequently and may involve a wide variety of hazards (for example, chemical, physical, biological, radiological, and so forth). The individuals or teams of people conducting the experiments can be at varying stages of their education and career. Their backgrounds and experiences will vary, but hazard identification, hazard evaluation, and hazard mitigation in laboratory operations are critical skills that need to be part of any laboratory worker's education. Furthermore, integrating these concepts into research activities is a discipline researchers must establish to ensure a safe working environment for themselves and their colleagues. (See Appendix Y for HAZARDS IDENTIFICATION AND EVALUATION (RISK ASSESSMENT)

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:

- Establish and review laboratory safety policies and procedures which are designed to:
    - Maintain compliance with Local, State, and Federal regulations regarding laboratory safety and the purchase**,** transportation, use, handling, storage and disposal of all hazardous materials.
    - Protect and optimize safety for all faculty, staff, students, visitors and members of the public from hazardous materials.
    - Establish procedures for monitoring the purchase, use, storage and disposal of hazardous materials.
- Review and approve Department-Specific Laboratory Safety Plans (LABORATORY SAFETY MANUAL's)
- Review and advise on corrective actions recommended by the Laboratory Safety Staff from the Office of Research Integrity (ORI).

- 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.
- 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 (eg. Radiation Protection Committee), 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.

For a list of current committee members go to: http://www.gsu.edu/research/43491.html

B. College Dean/Departmental Chairs

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

- 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 (LABORATORY SAFETY MANUAL) within their respective laboratory space(s).
- 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.
- Ensure that appropriate facilities and safety equipment are available and appropriate PPE is used for research and teaching activities involving hazardous materials,
- 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:

- 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):
    - Ensure that job specific safety protocols for laboratory equipment and hazardous materials are followed.
    - Ensure that laboratory personnel have the ability to locate and communicate knowledge and comprehension of the LABORATORY SAFETY MANUAL, and the information related to Safety Data Sheets (SDS) and all safety and compliance training required by University policy.
    - Ensure that training records are readily available according to Section II, subsection H.
- Ensure that all applicable safety and compliance records are maintained as required by Federal, State and Local regulations and University policy.
- 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 may 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:

- Obtain training on protocols, hazard controls, specific hazards and emergency procedures before working in a laboratory or facility using hazardous materials.
- Learn all job specific safety protocols for laboratory equipment and hazardous materials within the laboratory.
- Complete all safety and compliance training that is required by University policy.
- Maintain current training records (i.e. keep the certificate within reach and remember to perform annual training in accordance to the Manual).
- Ensure that all applicable safety and compliance records are maintained as required by Federal, State and Local regulations and University policy.
- Comply with all policies, regulations, and procedures regarding the proper procurement, storage, use, transportation and disposal of all hazardous materials being used.
- Immediately inform the supervisor of any hazardous situation or situation that has the potential to become hazardous.
- Follow all laboratory protocols and standard operating procedures.
- Do not proceed with a process unless safety is addressed and is completely understood.
- Wear the appropriate personal protective equipment and personal apparel which must include low heeled, closed toed shoes and garments covering the legs. Shorts, sandals, flip-flops, short skirts, tank tops/open midriff tops, and dangling jewelry are not allowed when working or in the direct vicinity of hazardous material.
- 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 and Economic Development /Office of Research Integrity (ORI)

The Georgia State University Vice President for Research and Economic Development/Office of Research Integrity (ORI) provides 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:

- Assist Departments and laboratories in developing Laboratory Safety Manuals 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.
- Conduct routine scheduled evaluations of University laboratories for compliance with the policies and procedures of the University Laboratory Safety Manual.
- Advise, as appropriate, Vice Presidents, College Deans, Department Chairs, Principal Investigators, and/or the LSC of issues found in individual laboratories.
- 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.).
- Provide consultation on the safe design of laboratories utilizing hazardous materials and their associated safety equipment.
- Develop and present educational and training opportunities related to laboratory safety.
- Respond to emergencies involving hazardous materials, providing guidance, consultation, and appropriate assistance.
- Assist with and facilitate the proper disposal of hazardous wastes in compliance with existing regulations.
- Assist in the development and maintenance of a hazardous materials inventory system.

III. Personnel Protective Equipment

Laboratory personnel apparel must include a low heeled, closed toed shoes and garments covering the legs when handling hazardous materials. Shorts, sandals, flip-flops, short skirts (ankle length skirts may be acceptable under certain circumstances), tank tops/open midriff tops, and dangling jewelry are not allowed when working or in the direct vicinity of hazardous material. 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. laboratory coat) made of non-synthetic material.

Skin Absorption Protection

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 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. Laboratory coats are intended to prevent contact with potential chemical splashes and spills encountered in a laboratory.

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.

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

- Caustic
- Toxic
- Irritant
- explosive materials
- Hot liquids or solids
- Injurious radiations
- Any dispensing of biological, chemical, or radiological 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 recombinant or synthetic nucleic acids, powders, chips, and other flying particles are the primary hazard.

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.

IV. Hazardous Material Inventory

Hazardous Material includes biological, chemical and radiological material.

- The Principal Investigator (PI) or a designee will perform the procurement and schedule the delivery of hazardous materials as defined in the Laboratory Safety Manual.
- Chematix® Inventory system for chemicals 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.
- Due to the diversity of the facilities and buildings, employing the following means for Hazardous Material Storage are applied as appropriate
    - 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.)
    - Use the higher shelves for containers of non-hazardous materials or for general supplies.
    - Shelves used for the storage of hazardous materials should be well anchored; made of or covered with a chemical resistant material; and, equipped with a protective lip.
    - Do not use work areas for long term storage.
    - Do not store glass chemical containers on the floor.
    - All incoming containers of chemicals must have appropriate labels that are not removed or defaced.
- All Hazardous Material must be secured at all times. The Principal Investigator must immediately report any thief, loss or release of Hazardous Material to the Laboratory Safety Committee or the Biosafety Officer (404-413-3540). Other

reporting requirements may include immediately reporting to local, state, and federal agencies including the CDC, NIH, DOT, DOE, and USEPA.

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

V. Flammable Liquids

Flammable liquids are hazardous material. 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).

Flammable Liquids in Research Laboratories

For Research Laboratories:

- 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.
- 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.

Flammable Liquids in Teaching Laboratories

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

- Ten gallons (35 liters) are allowed per 100 square feet of a properly fire-separated laboratory unit.

- Five gallons (20 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 60 gallons (225 liters) in a single lab unit.
- Up to 15 gallons (60 liters) of flammable solvents which are outside of flammable storage cabinets are allowed in a laboratory. Of this amount, 12 gallons (45 liters) must be contained in 1 gallon or smaller approved safety cans. The remaining 5 gallons (20 liters) may be kept in other containers such as the original 2.5 gallon (10 liter) shipping container, glassware and squeeze bottles.

Dispensing Large Volumes of Flammable Liquids

The Laboratory Safety Committees recommends that Principal Investigators should not purchase chemicals in volumes greater than 5 gallons (20 liters). However, if dispensing of flammable liquids from containers larger than 5 gallon (20 liter) capacity should:

- Only be performed in a proper dispensing area per NFPA 30.
- Be separated from the laboratory work area, per NFPA 45.
- Be equipped with explosion proof lighting and outlets.
- 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.

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

Flammable Cabinets

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

Explosion Proof Refrigerators

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.

Flammable Storage Areas

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.

VI. Acids and Bases

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

Mild acids and bases (such as citric acid and sodium carbonate) may be stored in a secondary container next to other low-hazard reagents.

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

Acids and Bases will oxidize Flammable Cabinets and cause them to quickly rust. Therefore, acids and bases should never be stored in Flammable Cabinets.

Acids shall be separated from:

- Caustics and from active metals such as sodium, magnesium, and potassium.
- Chemicals that can generate toxic gases on contact, such as sodium cyanide and iron sulfide.

Notice: Never add water to acid. Always add acid to water.

Oxidizing Acids

Oxidizing acids (nitric, perchloric) shall be separated from Organic acids, Flammables, and Combustible materials.

Nitric Acid and Perchloric Acid

Separate nitric and perchloric acids from other acids. This may be accomplished by placement in an unbreakable chemical resistant carrier or separate secondary containers.

VII. Peroxide-forming 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.

Peroxide-forming chemicals shall:

- Be stored in airtight containers in a dark, cool, and dry place.
- Be labeled with the date received and date opened (see Appendix B for lists of Peroxide forming chemicals).
- 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.

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

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

VIII. 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.

IX. Pressurized gases

Remember that there are many pressurized gases that, while not toxic, are simple asphyxiant (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.

All Pressurized Gas Cylinders

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

- Cylinders shall be secured in an upright position at all times and valve caps shall be in place except when cylinders are in use.
- 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.
- Liquefied gases shall be stored in an upright position.
- A racked storage area shall be provided for pickup and delivery of gas cylinders.
- All cylinders should be labeled “Empty” when gas pressure equals ambient pressure.
- Empty cylinders shall be segregated from cylinders which are full or in service.
- 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.
- 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.
- 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.
- 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.
- 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.

Flammable and Oxidizing Gasses

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. 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. 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.

Toxic Gases

Any gas with a Health Hazard (HH) rating of 3 or 4 must be kept in a continuously mechanically ventilated enclosure. No more than three cylinders with HH ratings of 3 or 4 shall be stored in a ventilated enclosure. (See Appendix Z for: Examples of some common toxic gasses)

X. Extremely Hazardous Chemicals

An extremely hazardous chemical is defined as a chemical:

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

The following chemicals are considered extremely hazardous chemicals:

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

XI. Security

Thief, Loss, or Release of Hazardous Material

All Hazardous Material must be secured at all times. The Principal Investigator must immediately report any thief, loss or release of Hazardous Material to the Laboratory Safety Committee or the Biosafety Officer (404-413-3540). Other reporting requirements may include immediately reporting to local, state, and federal agencies including the CDC, NIH, DOT, DOE, and USEPA.

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.

Building Security

Georgia State University Policy requires faculty, staff, and students to carry a PantherCard I.D. to enter the Science Buildings after hours. However, a Government Issue I.D. may be used to enter the Science Building during regular operational hours once the person has signed-in with the Security Guard.

Laboratory Security

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

- Question the presence of unfamiliar individuals in laboratories and report all suspicious activity immediately to Campus Police by calling 404-413-3333 or the PSC or NSC Security Guards. Additionally, follow up with the Department Chair and ORI.

- After normal business hours, all laboratories must be secured when not in use.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Written records must be maintained of all personnel issued keys or key cards/codes.

GSU 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 affiliated employees.

- GSU Authorized Personnel admitted into the laboratory or work area where hazardous materials are present must be accompanied at all times by authorized laboratory personnel.
- GSU Authorized Personnel must not bring minors or pets into the laboratories where hazardous materials are present. Individuals under the age of 16 are not permitted into laboratories (See Policy).
- GSU 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.

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

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.

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 by the Principle Investigator and the Laboratory Safety Plan.
- Necessary unattended operations should be noted in an appropriate place and how to contact responsible laboratory personnel.

Horseplay

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

XII. Laboratory Safety Equipment

Laboratory Work Space

Laboratory's aisle spaces shall be maintained unobstructed and work stations uncluttered. Stairways and hallways shall not be used as storage areas. Access to exits, emergency equipment, and utility controls shall never be blocked or obstructed.

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.

Hands shall be washed before conducting these activities.

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

Thoroughly wash hands immediately after working with chemicals.

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

Work areas shall be kept clean and uncluttered.

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. Any concerns contact fire safety

Chemical Fume Hoods

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. 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.

Fume hoods should be kept clean and uncluttered. Work within the hood should be carried out at least six inches back from the front opening.

Electrical receptacles or other spark sources shall be protected from flammable vapors. No permanent electrical receptacles shall be permitted in the hood.

Chemical use fume hoods shall not be used for the storage of chemicals or equipment unless they are a component of the operation for which the hood is being used or the hood is for the sole purpose of storage.

Hood sashes should be between 10 and 18 inches above the air foil when in use, unless otherwise specified in the manufacturer’s manual. The fume hood sash should be closed when the hood is not in use.

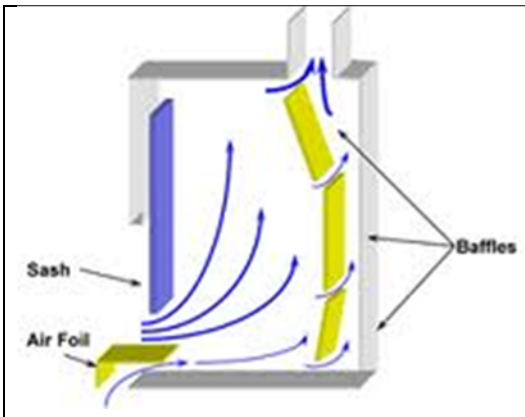

Figure A: Air Flow in Chemical Fume Hood with sash 10 to 18 inches above air foil. (https://www.phoenixcontrols.com/en-US/solutions/PublishingImages/fume_hood_flow.gif)

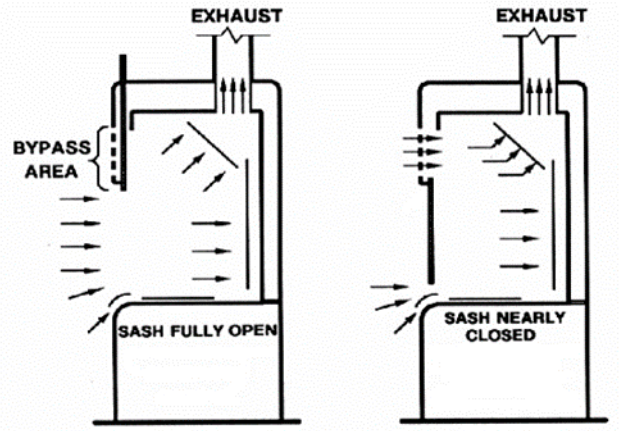

Figure B: Air Flow in Chemical Fume Hood Fully Open and Closed. (http://www.sciencemadness.org/talk/files.php?pid=365314&aid=35144)

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

Bench coat surface protectors or other materials shall not obstruct hood air foils. The heating of perchloric acid in any hood other than a special purpose perchloric acid hood shall be prohibited.

Hoods that are malfunctioning or posted with "Danger-Inadequate Air Flow" signage shall not be used for any operation using hazardous chemicals. Any signs of reduced flow or other problems shall be promptly reported to a supervisor. Additionally, take measures to move the operation to another hood and if that is not available stop work in the hood. 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.

Chemical Fume Hood 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 400-413-0700. Additionally, inform the Department Chair, PI and ORI to coordinate the process.

If the hood needs 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, place a work order by calling 404-413-0700.

The University System of Georgia Board of Regents requires all chemical fume hoods to be tested and inspected annually. Georgia State University provides a qualified third party vendor to conduct the fume hood testing. GSU Facilities Management is responsible for the repair and maintenance of the fume hoods. Research and Environmental Safety (RES) is the liaison for the fume hood testing procedures, ensuring that the appropriate signage is posted and records are kept and shared with the appropriate parties. The procedures below are followed to comply with te Board of Regents requirement.

1. Annual fume hood testing at Georgia State University occurs during late April to mid-May annually. Fume hoods in the teaching and research labs in Petit Science Center (PSC), Natural Science Center (NSC), Kell Hall, Arts & Humanities (A&H), Sports Arena, and Science Annex will be tested and inspected. A consultant from a qualified third party vendor will be contracted to test and inspect all fume hoods. The airflow rate will be tested while the fume hood sash opening is maintained at 18 inches. Face velocity must be at 100 linear feet per minute (LFPM) ± 20%. Any fume hood with a face velocity that is outside this range will be marked with a sign by RES cautioning users that the fume hood is in need of further inspection and possibly repair or adjustment. RES will also notify GSU Facilities Management of all fume hoods that are in need of repair.

2. GSU Facilities Management is responsible for repairs and/or adjustments to any fume hoods that tested outside of the above range. GSU Facilities Management will keep RES updated on the status of fume hood repairs/adjustments. RES and GSU Facilities Management will both work to keep fume hood users abreast of any status changes when necessary.

3. If any fume hoods have been taken out of service for failed component, decommissioned for long term, or if temporarily unused due to an unoccupied laboratory, a RES representative will place an "Out of Service” sign on the fume hood. Prior to the restoration of fume hood operations, laboratory PIs must contact RES and fume hood use can be restored after approval from Facilities Management and RES recertifies the fume hood.

Failed fume hoods should be restored to a properly functioning order within a week of Facilities Management being notified of the failure. Facilities Management will notify

RES of the status of fume hood repairs. RES will be responsible for recertifying any failed hoods and removing any cautionary signage from the fume hoods.

Important Contacts:

Safety Plus, LLC PO Box 2549 Chattanooga, TN 37409-0549 (Current Vendor)	GSU Facilities Management 34 Broad Street, Suite 1200 Atlanta, GA 30303 (404)413-0700	GSU Office of Research & Environmental Safety 30 Courtland St, SE Atlanta, GA 30303 (404)413-3540

Other Ventilation Devices

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

Sharps and Needles

Razor blades, knives, needles and other sharps should be stored in puncture proof containers. Razor blades, knives, needles and other sharps should be put back into their proper storage containers IMMEDIATELY after use. Surgical needles with biological and radiological material shall not be recapped.

Mouth Pipetting

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

First Aid

Recommendation: 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.

Space Heaters

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

Eyewashes

All laboratories using hazardous materials MUST have at least one eyewash station accessible within 100 feet. All eyewash stations should be located such that it provides access within 10 seconds from any point in the laboratory. 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.

Emergency Showers

Plumbed emergency showers shall be provided for existing laboratories within 10 seconds of travel (or 100 ft) from any point in the laboratory. In new or renovated facilities, emergency showers must be located within the laboratory. Emergency showers must be accessible (within 100 ft) and clear of clutter, equipment and electricity. Laboratory showers and eyewashes will be tested by ORI on a routine basis.

Laboratory Doors

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

Laminar flow, Biosafety cabinets

Refer to the Georgia State University Biosafety Manual for information regarding laminar flow/Biosafety cabinets. Contact 404-413-3540 for questions about laminar flow hood or biosafety cabinets.

Laboratory Equipment and Apparatuses

Review the manufacturer's recommendations for operation and maintenance. Use and service equipment according to the manufacturer's instructions. Decontaminate equipment (eg. refrigerator, freezer, etc.) before it is sent out for repairs or being discarded.

Electrical Equipment Safety

All cords must be checked for wear, fraying, crimping or damage. DO NOT USE damaged cords. They must be replaced IMMEDIATELY. Heaters, stirrers, hot plates, heating mantels and devices that can spark must be unplugged when not in frequent use.

Extension devices extension cords/ power strips

Extension cords are for temporary use only. Extension devices shall not be used on laboratory equipment that must remain plugged in at all times. Extension devices shall not be used in areas subject to moisture, physical or chemical damage or flammable vapors. Never “Daisy Chain” extension devices. No extension device shall be attached to the building surfaces (staples, nails, etc.).

Surge Protectors

Computer components or laboratory devices having computer components should be connected to a surge protector. Only approved surge protectors with UL rating 1449 are acceptable for use on the described electrical equipment. Never “Daisy Chain” surge protectors.

Autoclaves

Follow the manufacturer’s recommendations for preventative maintenance and ensure all contractors are approved by the manufacturer as directed by the onsite training.

Glassware

Do not use damaged glassware. Use extra care with other evacuated or pressurized glass apparatus. Shield or wrap evacuated or pressurized glass to contain chemicals and fragments should implosion occur.

Centrifuges

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. Make sure you understand the applications and limitations of each individual rotor. Visually inspect each rotor for any signs of damage, corrosion, or weakness before using it, every time it is used. Be careful to keep the rotor chamber or swinging bucket pairs correctly balanced, and make absolutely sure that the rotor cover is attached correctly. Lids shall be closed at all

times during operation. Check glass and plastic centrifuge tubes for stress lines, hairline cracks and chipped rims before use. Use unbreakable tubes whenever possible. Avoid filling tubes to the rim. Use caps or stoppers on centrifuge tubes. Avoid using lightweight materials such as aluminum foil as caps. The operator shall not leave the centrifuge until full operating speed is attained and machine appears to be running safely without vibration. If vibration occurs the centrifuge should be stopped immediately and load balances checked. Swing-out buckets should be checked for clearance and support. Rooms where potentially hazardous biological, radioactive materials, toxic or other hazardous materials are centrifuged must be identified by the appropriate warning signs. Nitrocellulose tubes should be used only when transparent and flexible (fresh). They must never be heated because of explosive possibility. 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. Immediately clean up any spills that occur anywhere on the ultracentrifuge or rotor and dry the rotor before oxidation can occur.

Emergency Procedures: Turn off centrifuge, notify others in laboratory and evacuate if necessary. Post temporary Hazard Warning Sign to indicate a problem and disconnect power source. Notify the Supervisor and the ORI.

Electrophoresis

Check the insulation on the high voltage leads for signs of deterioration (e.g. exposed wires, cracks or breaks, etc.). Follow manufacturer's instructions. Do not touch any cooling apparatus connected to a gel.

Vacuum Pumps

Vacuum pump belt guards must always be in place. Some types of pumps have traps that are Glass Dewars. Those must be wrapped or shielded. Liquids siphoned unintentionally into the vacuum system must be reported immediately to the Safety Coordinator or the teaching assistant. Waste gases generated during operation of the membrane vacuum pump must always be conducted into a fume hood. Glass desiccators under vacuum must be stored in metal guards or shielded. Pumps used with hazardous materials must be decontaminated prior to sending for repair. Pumps are only to be repaired by authorized service technicians.

Central Building Vacuum Systems

It is strictly forbidden to allow liquids (even small amounts) to be siphoned directly into the central membrane vacuum pump lines! Safety trap to collect liquids must be inserted between vacuum consumer and vacuum module. Flammable and toxic liquids must not be siphoned with the central vacuum system. Equipment containing radioactive material will NOT be connected to any central vacuum system.

Refrigerators and Freezers

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. A “Non-Explosion Proof” label should be placed on ordinary refrigerators and freezers. Freezers should be defrosted regularly. Refrigerators and Freezers that store chemicals that become unstable at room temperature must have a temperature alarm to indicate failure of the unit.

Ultraviolet Light Sources

Never turn the light from a short/long wavelength ultraviolet (UV) lamp towards you. Also be careful of the reflection of the UV light from around the side of your eye-shielding and into your eye. Avoid working in a biological safety cabinet while the germicidal lamp is on. If possible, close the sash while lamp is on. Do not use a UV Crosslinker if the door safety interlock is not working properly. 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.

XIII. Transport and Shipment of Hazardous Materials On and Off Campus

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.

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

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.

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.

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.

XIV. Records

The Principal Investigator (PI) is responsible for providing resources and opportunities to complete training. The PI shall provide access to the Department-Specific Laboratory Safety Plan (LABORATORY SAFETY MANUAL). 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 laboratory personnel to maintain training records. See the ORI website for details on training requirements.

- Basic and Chemical-Specific Right to Know Training
- Specific Laboratory Equipment and Apparatus Training
- Hazardous Waste Training
- Radiation Safety, Laser Safety, and Biosafety Training
- Bloodborne Pathogen Training

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

XV. Signs and Labels

All laboratory refrigerators, freezers, and microwaves shall be affixed with a sign that identifies the proper use. Ordinary refrigerators and freezers should be labeled “Non Explosion Proof.” Primary chemical containers shall be affixed with a legible manufacturer label.

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

- Identity of the hazardous material, its common name given on its SDS
- Date filled

- Hazard warnings (see Appendix E for hazard warning designations)

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.

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

Synthesized Chemicals

If 50 grams or more of a previously undiscovered or unknown chemical is synthesized, please contact the ORI for regulatory guidance, writing a SDS, and labeling requirements. 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. If the chemical produced is a by-product whose composition is not known, it shall be assumed that the substance is hazardous. Synthesized chemicals and their known by-products shall be identified and stored by chemical class and shall be labeled in accordance with University policy.

XVI. Laboratory Incident Response and Reporting

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:

- 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 (404-413-9545). Additionally, the respective Department Chair shall be notified.
- All student accidents/injuries should be reported to the Georgia State University Risk Manager.

Hazardous Material Exposures

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

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

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.

Uncontrolled Release or Spill: All laboratories which handle hazardous materials shall have an appropriate supply of spill cleanup kits. The supply must be capable of containing or cleaning up small known chemical releases.

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

- Having a health or hazard rating of 3 or 4;
- If appropriate spill clean up supplies and protective equipment are not available; or
- If the material or level of exposure hazard is unknown.

XVII. 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.

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.

Gas Cylinders

If cylinders are not returnable, contact ORI for advice.

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.

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.

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.

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.

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.