Chemical and Laboratory Safety Manual

Version 2016.2.1
EMERGENCY PHONE NUMBERS

UGA Police: 706-542-2200

Office of Research Safety: 706-542-5288

Fire/Ambulance: 911

Poison Control: 9-800-282-5846

St. Mary’s Hospital: 9-706-548-7581

Piedmont Athens Regional Hospital: 9-706-549-9977

Biosafety Office: 706-542-7265

Environmental Safety Division: 706-542-5801
Introduction

The University of Georgia (UGA) considers the safety of its faculty, staff, students, and visitors to be of paramount importance. Consistent with Academic Affairs Policy 6.01 and 6.02, the university implements a comprehensive Environmental Health & Safety Management System (EHSMS) to ensure that the UGA community, including all stakeholders, has a safe place to live, work, study, conduct research, and engage in public service and outreach activities.

As a component of the EHSMS, the Chemical & Laboratory Safety Manual provides detailed guidance and procedures outlining the safe operation of all research, teaching, and public service laboratories on the University of Georgia campuses. The manual defines roles and responsibilities, safe laboratory practices, and details the operational structures in place to maintain proper accountability and compliance with all federal, state, and local regulations.

The manual is maintained by the Research Safety Committee in cooperation with the Office of Research Safety and the Environmental Safety Division.
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SECTION 1. AUTHORITY, RESPONSIBILITIES, & DUTIES

I. Environmental Health & Safety Management System Committees

UGA’s Comprehensive Environmental Health and Safety Management System (EHSMS) was established in accord with Academic Affairs Policies 6.01 and 6.02 and is intended to govern how UGA manages all aspects of environmental health and safety. The EHSMS serves as an integrated set of processes and procedures for managing the day-to-day EHS compliance operations to enhance the level of compliance and to increase efficiency of operations in a comprehensive manner. The EHSMS shall use a process-driven approach to track information, identify safety risks, set safety goals, take action to ensure safety, assess results of those actions, and adjust processes as necessary to produce the intended results. As described below, the EHSMS is governed by oversight, steering, and other committees with execution by a variety of operational units.

A. Executive Committee

The EHSMS Executive Committee reviews and provides guidance on the design, development, and implementation of the EHSMS. The Executive Committee will also meet periodically to review and provide oversight on the EHSMS. In accordance with Academic Affairs Policy 6.02, the Executive Committee is also tasked with forming and charging standing and ad hoc committees as needed.

B. Academic/Research Steering Committee

The EHSMS Academic/Research Steering Committee guides the development and implementation of those aspects of the EHSMS that improve Environmental Health & Safety (EHS) programs and research compliance at UGA.

C. Administrative/Operations Steering Committee

The EHSMS Administrative/Operations Steering Committee guides the development and implementation of those aspects of the EHSMS that improve EHS programs and the compliance of administrative operations at UGA.

D. Research Safety Committee

The Research Safety Committee (RSC) is a standing committee within the EHSMS and is charged with guiding the development and implementation of campus-wide Environmental Health and Safety programs consistent with Academic Affairs Policies 6.01 and 6.02. Per Academic Affairs Policy 6.02, the RSC is appointed by the President of UGA through the EHSMS Executive Committee. The RSC will be advisory to the Vice President for Research (VPR), and work directly with the OVPR Office of Research Safety (ORS), the Environmental Safety Division (ESD), and their respective leaders.
The RSC is charged to review safety trends regarding chemical and laboratory safety and definitively address and mitigate unresolved issues of non-compliance. The RSC will work in collaboration with ad hoc working groups and the existing research compliance committees for Animal Care and Use, Biosafety, and Human Subjects. The RSC reports to the VPR through the Associate Vice President for Research Compliance. Also, consistent with Academic Affairs Policy 6.02, the RSC will keep the VPR and EHSMS Executive Committee informed of its findings, conclusions, actions or non-actions, and recommendations. Other responsibilities include:

1. Establishing and reviewing laboratory safety policies, procedures, and safety survey audit forms. Policies and procedures will be set forth in the UGA Chemical and Laboratory Safety Manual (CLSM) and other documents. No changes shall be made to the CLSM, appendices, or portions of the manual contained on the web site without RSC approval. The RSC shall approve all procedures used to evaluate laboratory safety and ensure accountability.

2. Designing policies to:
   a. Protect and ensure safety for all faculty, staff, students, visitors, and members of the public from hazardous agents
   b. Keep the University in compliance with local, state, and federal regulations regarding laboratory safety, the purchase, transportation, use, handling, storage, and disposal of all chemicals and hazardous agents

3. Recommending and providing oversight of training programs on laboratory safety practices that will result in faculty, staff, and students having a thorough awareness and application of safe laboratory practices, chemical storage, chemical use, and chemical disposal.

4. Reviewing and advising on corrective actions recommended by the ORS laboratory safety staff. During the review process, principal investigators can contact the RSC directly at: RSC@uga.edu.
   a. Principal investigators may appeal decisions made by ORS in the implementation of the laboratory safety program to the RSC. (See Appendix B, Unsafe Laboratory Closure Policy.)
   b. When laboratories fail to implement corrective actions and are non-compliant with the CLSM, the ORS, may bring these to the attention of the RSC for resolution as described in the Office of Research Compliance (ORC) Policy & Procedure for Responding to Allegations of Research Non-Compliance.
5. Notifying UGA administration through the EHSMS executive and steering committees of any problems that need to be addressed through institutional level administrative procedures or policies and advise them accordingly.

6. Closing any laboratory determined to be unsafe per the laboratory closure policy (see Appendix B) after informing the EHSMS executive and steering committee chairs. Any closed laboratory will be reopened for use only after a follow-up inspection from ORS and RSC review. A determination of the RSC to not close a laboratory reviewed for unsafe practices will also be reported to the EHSMS executive and steering committee chairs. The EHSMS executive committee has the authority to impose more stringent sanctions than those recommended by the RSC.

7. Investigating any incident that causes an excessive chemical, hazardous agent exposure or other non-compliance in accord with the ORC Policy & Procedure for Responding to Allegations of Research Non-Compliance and reporting outcomes to the EHSMS executive and steering committee chairs.

II. Programs for Research Environmental Health and Safety

The Programs for Research Environmental Health and Safety (PREHS) include all programs and services provided by the Office of Research Safety, located within the Office of the Vice President for Research, and the Environmental Safety Division, located within the Office of the Vice President for Finance and Administration.

A. Office of Research Safety (ORS)

The Associate Vice President (AVP) for Research has been designated by the Vice President for Research as the central point of coordination for Environmental Health & Safety (EHS) matters within research areas at UGA. They communicate to the EHSMS Executive Committee as needed regarding EHS matters. ORS staff report directly to the AVP for Research and provide guidance to UGA faculty, staff, and students on general laboratory safety and the safe use of chemical agents, radiation safety, and laser safety. The program is committed to safety, health, environmental protection, and compliance based on current government regulations, guidelines, and best practices. Responsibilities include:

1. Providing advice and consultation to the RSC which is solely responsible for establishing university policies for chemical and laboratory safety as presented in this manual.
2. Providing advice, consultation, and assistance to Principal Investigators (PIs) and laboratory personnel in complying with the policies and guidelines of this manual

3. Maintaining a level of expertise in designated EHS regulatory and program areas

4. Implementing the UGA Standard Operating Procedures for Laboratory Safety Inspections (See Appendix D)

5. Informing the RSC of continuing noncompliant or unsafe conditions in University laboratories using the guidelines and procedures provided for in the ORC Policy & Procedure for Responding to Allegations of Research Non-Compliance

6. Taking immediate and necessary action to protect the health and safety of University employees, the public, and the environment in those situations that pose an immediate threat to life and health. These actions shall be governed using the provisions and guidelines of the laboratory closure procedure (see Appendix B) and the ORC Policy & Procedure for Responding to Allegations of Research Non-Compliance

7. Inspecting university laboratories for compliance with the policies and provisions of this manual and appendices

8. Advising, as appropriate, PIs, deans, department/unit heads, and the RSC of problems found in individual laboratories

9. Providing technical assistance to laboratory personnel in establishing safety programs in their individual laboratories

10. Providing consultation on the safe design of chemical laboratories and their associated safety equipment

11. Responding to chemical emergencies, providing guidance, consultation, and appropriate assistance

12. Assisting ESD in the further development and maintenance of a central chemical container inventory system (Chematix)
13. Assisting departments and laboratories in developing plans for the use, storage, and disposal of hazardous chemicals and for the training of laboratory workers, ensuring that those plans are compatible with University policy.


B. Environmental Safety Division
The Associate Vice President for Environmental Safety has been designated by the President as the primary point of contact and communication both within non-research areas at the University of Georgia and with external environmental regulatory bodies. The Environmental Safety Division (ESD) reports directly to the AVP for Environmental Safety and provides guidance to UGA faculty, staff, and students in laboratories on engineered safety features and equipment, chemical exposure monitoring, respiratory equipment fit testing, fire and life safety, hazardous waste management, and worker right-to-know. Responsibilities include:

1. Providing advice and consultation to the RSC which is solely responsible for establishing University policies for chemical and laboratory safety as presented in this manual.

2. Advising, consulting with, and assisting PIs and laboratory personnel in complying with the policies and guidelines of this manual with regard to engineered safety features and equipment, chemical exposure monitoring, respiratory equipment fit testing, fire and life safety, hazardous waste management, and worker right-to-know.

3. Maintaining a level of expertise in designated EHS regulatory and program areas.

4. Implementing the UGA Standard Operating Procedures for Non-Chemical Laboratory Safety Inspections.

5. Informing the RSC of continuing noncompliant or unsafe conditions in University laboratories using the guidelines and procedures provided for in the ORC Policy & Procedure for Responding to Allegations of Research Non-Compliance.

6. Inspecting University laboratories designated as non-chemical Laboratories for compliance with the policies and provisions of this manual.
7. Inspecting University laboratories for compliance with State and Federal laws and standards for the management of hazardous waste

8. Advising, as appropriate, PIs, deans, department/unit heads, and the RSC of problems found in individual laboratories

9. Providing technical assistance to laboratory personnel in establishing safety and compliance programs in their individual laboratories

10. Providing consultation on the safe design of chemical laboratories and their associated safety equipment

11. Responding to chemical emergencies, providing guidance, consultation, and appropriate assistance

12. Taking immediate and necessary action to protect the health and safety of University employees, the public, and the environment in those situations that pose an immediate threat to life and health. These actions shall be governed using the provisions and guidelines of the laboratory closure procedure (see Appendix B) and the ORC Policy & Procedure for Responding to Allegations of Research Non-Compliance.

13. Providing testing and/or quality assurance control for proper operation of safety equipment in chemical laboratories (i.e., safety showers, eyewash stations, chemical fume hoods)

14. Providing programs for chemical exposure monitoring, respiratory equipment issuance and fit testing, right to know, and other relevant safety education

15. Providing pickup of hazardous and non-hazardous chemical waste from laboratories

16. Developing and maintaining a central chemical container inventory system (Chematix)

17. Assisting departments and laboratories in developing plans for the use, storage, and disposal of hazardous chemicals and for the training of laboratory workers, ensuring that those plans are compatible with University policy
18. Supporting the RSC in the developing, updating, and implementing the Chemical & Laboratory Safety Manual.

III. Academic and Research Units

A. Deans
   Responsibilities include:

   1. Ensuring that all research and activities in the college or school are conducted in compliance with all applicable EHS regulations and UGA policies and procedures

   2. Ensuring all laboratory and non-laboratory spaces under their direction are properly maintained while in use and closed appropriately and safely cleaned before transfer to a new occupant

   3. Remedying all non-compliance matters within all laboratory spaces that they oversee

B. Department Head/Center & Institute Director
   Responsibilities include:

   1. Ensuring that all research and activities in the department or Center/Institute are conducted in compliance with all applicable EHS regulations and UGA policies and procedures

   2. Ensuring all laboratory and non-laboratory spaces under their direction are properly maintained while in use and closed appropriately and safely cleaned before transfer to a new occupant

   3. Remedying all non-compliance matters within all laboratory spaces that they oversee and manage overall financial responsibility on such matters.

   4. Assuming accountability for any hazardous material left temporarily in any laboratory without proper supervision and assigning to a new PI or initiating disposition by ESD.

   5. In the event that hazardous materials are abandoned in any laboratory, the department head will immediately initiate disposition by ESD upon becoming aware of the situation.
C. **Principal Investigator (PI)**

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

1. The PI shall train or provide for the training of all new personnel before allowing them to work in a laboratory using hazardous materials. Training shall include the following:
   a. Reading of this manual including the Laboratory Specific Chemical Hygiene Plan
   b. Successful completion of all required laboratory safety and [hazardous waste management training](#)
   c. Job specific safety protocol for chemicals and equipment. See Appendix J for recommendations and guidelines for development of standard operating procedures.
   d. The proper use of job-specific personal protective equipment (PPE)
   e. **Right-to-Know training** required by the Georgia Public Employee Hazardous Chemical Protection and Right to Know Act of 1988 and the University right-to-know compliance plan
   f. Directions for notifying the proper authorities in the event of an emergency or accident
      i. University Police 2-2200
      ii. Office of Research Safety 2-5288
      iii. Environmental Safety Division 2-5801
      iv. Biosafety Office 2-7265
      v. Athens Regional Medical Center 9-706-549-9977
      vi. St. Mary’s Hospital 9-706-548-7581

2. The PI shall ensure that all laboratory personnel are entered into the Chematix database and this database is maintained and updated regularly.

3. The PI shall see that records are kept as required by this manual. (See sample laboratory safety survey form in Appendix D, which lists necessary records.)
4. The PI shall remove chemical and biological substances under his/her control that may pose a hazard prior to maintenance personnel working on furnishings, equipment, or laboratory systems.

5. When leaving the University, or terminating his/her PI position, the PI shall relinquish all hazardous chemicals in his/her possession by disposal or transfer to another principal investigator who has facilities capable of safely handling the material in question.

6. The PI on leave or absent more than 60 calendar days:
   a. May assign responsibility for his/her program to a temporary designee who will be in charge of the laboratory in his/her absence. This person will be: a faculty member, a laboratory director, a research professional, or an academic professional who agrees, in writing, to accept responsibility for the laboratory.
   
   b. If the PI does not choose the option listed above in 6.a., his/her laboratory will be placed under the temporary supervision of another faculty member, research professional, academic professional, or laboratory director selected by the department head.
   
   c. The departing PI will ensure that all door signs reflect the change in supervisory status.
   
   d. The temporary designee may not be utilized for a period exceeding 12 months without approval of the department head.

7. Upon PI retirement, with or without emeritus status, his/her status as principal investigator will terminate. The retiring PI must safely dispose of or transfer the chemicals and hazardous waste inventory prior to retirement per the laboratory closing procedures outlined in Appendix K. In the event that this is not possible, the PI may apply to the department head for continued principal investigator status until all chemicals and hazardous materials are safely disposed.

D. Laboratory Supervisor/Laboratory Coordinator
   Responsibilities include:
   
   1. Provide day-to-day supervision of research and activities in the laboratory ensuring that those activities comply with all applicable EHS regulations and UGA policies and procedures
2. Keep the PI informed of any potential compliance issues and assist the PI with all EHS matters.

E. Laboratory Personnel
Laboratory personnel are any persons who work, teach, or observe activities within a designated research or instructional laboratory or field environment. This includes students, visitors, teaching assistants, and instructors. Responsibilities include:

1. Conduct activities in compliance with all laboratory-specific procedures, applicable EHS regulations and UGA policies and procedures

2. Assist the PI or their designee with all EHS matters
SECTION 2. SAFE OPERATION OF LABORATORIES

I. Chemical Procurement, Distribution, and Storage

A. Procurement
The procurement of any chemical associated with on-campus research, science laboratories and academic units of the University must be made through Central Research Stores. The procurement of chemicals is governed by policy set forth by the Vice President for Research, the Director of Public Safety, and the Director of Central Research Stores (CRS).

B. Inventory
The Environmental Safety Division (ESD) is charged with setting up and maintaining a centralized inventory system of chemicals for campus units. The Associate Vice President-Environmental Safety is directed to ensure that the individual units’ inventory reporting practices are coordinated with the Chematix inventory system to ensure that all compliance requirements are met. CRS is responsible for barcode-labeling and entering initial chemical information into the Chematix database upon purchase by lab personnel.

C. Program Audits
ESD has the responsibility and authority for conducting internal audits of the centralized inventory system and filing the results of such audits.

D. Distribution
CRS will barcode-label, make a Chematix database entry for, and distribute purchased chemicals throughout campus.

E. Storage
Please use the chart below as a general guide for storage of chemicals by hazard class. This chart is not meant to be exhaustive. Safety Data Sheets should be consulted for detailed storage guidelines and chemical incompatibilities.
<table>
<thead>
<tr>
<th>Chemical Hazard Class</th>
<th>Storage Method</th>
<th>Chemical Examples</th>
<th>Incompatibles (see SDS in all cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compressed Gases – Flammable</strong></td>
<td>Store in a cool, dry area away from oxidizing gases; securely strap individual cylinders to a permanent structure such as a wall or benchtop.</td>
<td>Methane, Acetylene, Propane, Hydrogen</td>
<td>Oxidizing and toxic gases, oxidizing solids; Lecture-sized gas cylinders should not be stored with hazardous liquids.</td>
</tr>
<tr>
<td><strong>Compressed Gases – Oxidizing</strong></td>
<td>Store in a cool, dry area away from flammable gases; securely strap individual cylinders to a permanent structure such as a wall or benchtop.</td>
<td>Oxygen, Chlorine, Bromine</td>
<td>Flammable and toxic gases; Lecture-sized gas cylinders should not be stored with hazardous liquids.</td>
</tr>
<tr>
<td><strong>Compressed Gases – Poisonous</strong></td>
<td>Store in a cool, dry area away from flammable gases and liquids; securely strap individual cylinders to a permanent structure such as a wall or benchtop. Gases with an NFPA health rating of 3 or 4 must be kept in a continuously mechanically ventilated area.</td>
<td>Carbon Monoxide, Hydrogen Sulfide, Hydrogen Cyanide</td>
<td>Flammable and oxidizing gases. Lecture-sized gas cylinders should not be stored with hazardous liquids.</td>
</tr>
<tr>
<td><strong>Corrosives – Inorganic Acids</strong></td>
<td>Store in a lined acid storage cabinet or in deep corrosion resistant trays. Keep oxidizing acids separate from non-oxidizing acids. Do not store acids directly on metal shelves.</td>
<td>Non-oxidizing: Hydrochloric Acid, Hydrofluoric Acid, Phosphoric Acid</td>
<td>Flammable liquids, flammable solids, bases, oxidizers, and organic acids. Keep away from cyanides and sulfides and active metals such as sodium and potassium metal.</td>
</tr>
<tr>
<td><strong>Corrosives – Organic Acids</strong></td>
<td>Store in a lined acid storage cabinet or in deep corrosion resistant trays. Do not store acids directly on metal shelves</td>
<td>Acetic Acid, Trichloracetic Acid, Lactic Acid, Formic Acid</td>
<td>Flammable liquids, oxidizers, poisons, bases, and inorganic acids. Keep away from cyanides and sulfides, and active metals such as sodium and potassium metal.</td>
</tr>
<tr>
<td><strong>Corrosives – Bases</strong></td>
<td>Store in a lined bases storage cabinet or in deep corrosion resistant trays.</td>
<td>Ammonium hydroxide, sodium hydroxide, potassium hydroxide</td>
<td>Flammable liquids, oxidizers, poisons, and acids</td>
</tr>
<tr>
<td><strong>Explosives</strong></td>
<td>Store in a secure location away from all other chemicals and sources or ignition; store in an area where they would not be subject to shocks or falls.</td>
<td>Ammonium nitrate, nitro urea, sodium amide, Trinitrobenzene, Trinitrotoluene, Picric Acid, Sodium Azide</td>
<td>All other chemicals</td>
</tr>
<tr>
<td><strong>Flammable Liquids</strong></td>
<td>Store in a flammable storage cabinet</td>
<td>Acetone, Benzene, Diethyl Ether, Methanol, Hexanes, Toluene, Acetonitrile, Isopropanol, Formalin</td>
<td>Acids, bases, oxidizers, and poisons</td>
</tr>
<tr>
<td><strong>Flammable Solids</strong></td>
<td>Store in a dry cool area away from oxidizers and corrosives. Keep water and air from entering container</td>
<td>Lithium Aluminum Hydride, Calcium Hydride, Phosphorus, Sodium Borohydride</td>
<td>Acids, bases, oxidizers, and poisons</td>
</tr>
<tr>
<td><strong>Oxidizers</strong></td>
<td>Store in a spill containment tray separate from flammable or combustible materials and reducing agents</td>
<td>Peroxides, Perchlorates, Chlorates, Nitrates, Bromates, Superoxides</td>
<td>Reducing agents, flammables/combustibles, organic material, and corrosives</td>
</tr>
<tr>
<td><strong>Peroxide Forming Chemicals</strong></td>
<td>Store in air tight container in a cool dark area with flammable liquids. Label with a date of receipt and date of opening.</td>
<td>Diethy ether, THF, 1,4-Dioxane, 2-Propanol (See Appendix I of the Lab Safety Manual for more examples)</td>
<td>Acids, bases, oxidizers, and poisons</td>
</tr>
<tr>
<td><strong>Poisons/Toxic</strong></td>
<td>Store in cool, dry, ventilated area away from other hazard classes. Liquids should be in chemically resistant secondary containment</td>
<td>Cyanides, Cadmium, Mercury, Sodium azide Phenol</td>
<td>Most other hazard classes, particularly acids, bases, and oxidizers</td>
</tr>
<tr>
<td><strong>Water-Reactive Chemicals</strong></td>
<td>Store in a cool, dry area away from sources of water and protected from a sprinkler system if possible. Place a “Water Reactive Chemical” sticker on each container.</td>
<td>Sodium metal, potassium metal, Lithium metal, Sodium hydride, Thionyl Chloride</td>
<td>Separate from all aqueous solutions and oxidizers</td>
</tr>
<tr>
<td><strong>General Chemicals – non-reactive</strong></td>
<td>Store on general lab shelves</td>
<td>Agar, sodium chloride, sodium bicarbonate, citric acid</td>
<td>Consult SDS</td>
</tr>
</tbody>
</table>
F. General Storage
   1. All incoming containers of chemicals must have appropriate manufacturers’
      labels that are not missing or defaced.

   2. Each container should be labeled with the date it was received and the date
      it was opened, as some chemicals form peroxides or other unstable
      products/explosives when stored for relatively short periods of time (see
      Appendix I for a listing of peroxide forming chemicals).

   3. Chemicals in the laboratory shall be segregated by hazard class and
      compatibility. Acids, bases, flammables, reactives requiring separate and
      special storage, highly toxic compounds, and general non-hazardous
      chemical storage shall be separated from each other. The higher shelves shall
      be used for containers containing chemicals which present the lowest
      hazard.

   4. Open shelves used for the storage of hazardous chemicals shall be well-
      anchored, painted, or made of, or covered with, chemical- resistant
      materials.

   5. Work areas should not be used for long-term storage. Storage of glass
      chemical containers on the laboratory work area floor shall be strictly
      prohibited.

   6. Do not store hazardous chemicals (except cleaners) under sinks. Use
      approved flammable storage lockers, corrosive storage lockers, shelves or
      cabinets.

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

      a. Twenty gallons are allowed per 100 square feet of a properly fire-
         separated laboratory unit. Ten gallons are allowed per 100 square
         feet in non-fire separated lab units. This volume includes flammable
         liquids stored in safety cans and proper storage cabinets. The
         maximum allowable volume of flammable liquids is 120 gallons in a
         single laboratory unit.

      b. Up to 35 gallons of flammable solvents which are outside of
         flammable storage cabinets are allowed in a laboratory. Of this
         amount, 25 gallons must be contained in 2 gallon or smaller approved
safety cans. The remaining ten gallons may be kept in other containers such as the original five-gallon shipping container, glassware and squeeze bottles.

c. No more than two 60-gallon capacity cabinets are allowed per laboratory unit.

d. Quantities allowed within an instructional laboratory unit shall be restricted to one-half that allowed in a research laboratory unit.

2. Dispensing of flammable liquids from containers larger than five-gallon capacity shall only be performed in a proper dispensing area per National Fire Protection Association (NFPA) 30. The dispensing area, if also used for bulk storage, shall be separated from the laboratory work area, per NFPA 45. (Please consult ESD/Fire Safety for copies of applicable regulations.) Dispensing from larger containers can be arranged by contacting CRS.

3. No containers larger than five-gallon capacity are allowed for storage inside the laboratory area. Containers larger than five gallons used for dispensing shall be properly bonded and grounded to prevent a static discharge as an ignition source.

4. Storage of flammable liquids in refrigerators not specifically designed and approved for that use by a recognized testing agency shall be strictly prohibited (please consult ESD/Fire Safety for acceptable specifications). A flammable materials storage refrigerator/freezer has a spark proof interior that separates the contents from the compressor and motor. The explosion proof refrigerator/freezer is for the storage of volatile materials in areas away from possible spark hazards from electrical devices or other potential fire hazards.

5. Keep flammable liquids away from oxidizers and oxidizing acids.

H. Flammable and other pressurized gases
Storage of pressurized gas cylinders shall comply with NFPA 45 (see Appendix C for guidelines.)

I. Acids and bases
1. Acids shall be separated from bases and from active metals such as sodium, magnesium and potassium. Acids shall also be separated from chemicals that can generate toxic gases on contact, such as cyanides and sulfides.

2. Large bottles of acids shall be stored on lower shelves or in acid cabinets.
Oxidizing acids (chromic, nitric, perchloric, concentrated sulfuric) shall be separated from other acids (both organic and inorganic), flammables, and combustible materials.

3. Separation of oxidizing acids from other acids may be accomplished by placing in an unbreakable chemical resistant carrier (separate secondary containment).

4. Mild acids and bases such as citric acid and sodium bicarbonate may be stored with other low-hazard reagents.

5. Containers of acids and bases should be stored in chemical resistant secondary containment (pan or tray, e.g. nalgene).

J. Peroxide-forming chemicals
   1. Peroxide-forming chemicals shall be stored in a dark, cool, and dry place. Peroxide-forming chemicals shall be labeled with the date received and date opened (see Appendix I for lists of peroxide forming chemicals).

   2. It is recommended that opened containers not be kept longer than six months except when inhibitors are present (see manufacturer’s recommendations) unless bi-annual testing is performed to determine the absence or presence of peroxides. Peroxide test strips can be acquired from CRS and labels to annotate the test dates can be obtained from the Office of Research Safety (ORS). The Chematix chemical inventory system is designed to disseminate email notifications to both the laboratory PI and laboratory supervisor (and potentially other recipients) when peroxide-forming chemicals are approaching or have reached their expiration date. Specific actions and verifications are required to ensure the safety and stability of the chemical in question to stop receiving expiration notifications. The chemical in question can also be processed as waste to prevent further expiration notifications.

K. Water-reactive chemicals
   Water-reactive chemicals shall be kept in a cool and dry place separate from other hazard classes. Metal-specific class D fire extinguishers shall be made available in laboratories where one pound or greater of water-reactive materials are used or stored. See Appendix I and reference this list of common water reactive chemicals.

L. Oxidizers
   Oxidizers shall be stored away from flammables, combustibles, and reducing agents (e.g., zinc, alkali metals, alkaline earth metals).
M. Toxic Chemicals
Toxic chemicals shall be stored according to the nature of the chemical, with appropriate warnings and security.

II. Transportation and Shipment of Hazardous Chemicals
Personnel planning to ship hazardous chemicals while traveling abroad or from a location off of the UGA main campus, MUST follow the procedures outlined below in item A.

A. Contact ESD/Hazardous Materials Group (706-369-5706) for information concerning the transportation or shipment of any hazardous material to an off-site location which will require the services of any common carrier by ground or air. Please reference the Hazardous Material Group’s shipping procedures document, “A Guide to Relocating Hazardous Materials.”

B. Personal vehicles shall not be used to transport hazardous materials. Before transporting hazardous materials in a UGA vehicle, please contact the Hazardous Materials Group.

C. Any hazardous chemical transported by hand between laboratories or on-campus buildings is to be contained in a chemical-resistant unbreakable carrier capable of containing the entire volume of the chemical being transported. Hazardous wastes cannot be transported between labs.

D. When receiving gas cylinders or transporting them from a common storage area, ensure that they are secured to a hand truck. Never roll cylinders across the floor. Protective caps should be in place prior to transport. See “A Guide to Relocating Hazardous Materials.”

III. Safe Work Practices

A. Exposure Minimization

1. General precautions for handling all laboratory chemicals outlined in this manual should be adopted, along with specific guidelines for particular chemicals as needed. Exposure to hazardous chemicals should be minimized. For work with substances that present special hazards, special precautions shall be taken. One should assume that any mixture will be more hazardous than its most hazardous component and that all unknown substances are hazardous. Refer to the safety data sheet (SDS) for specific information about a chemical or product containing hazardous chemicals.

2. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of fume hoods and other local ventilation devices. All individuals handling hazardous chemicals in the laboratory shall be trained in the proper operation and use of fume hoods.
and other local ventilation devices (see Section 2.IV and Appendix F for guidelines on chemical fume hood use.)

3. Develop and encourage safe habits and avoid unnecessary exposure to chemicals by any route. Do not smell or taste chemicals. Vent any apparatus that may discharge particularly hazardous chemicals into local exhaust devices. Chemicals shall be properly stored and safely used in order to prevent exposure. Appropriate personal protective equipment (PPE) shall be provided to employees working in areas where hazardous substances are in use (see Section 2.VII. for PPE requirements.) Employees shall be trained in the safe use and maintenance of PPE provided in the laboratory. Test positive-pressure glove boxes for leaks before use. Do not allow release of toxic substances into any building area; only allow into an appropriate local exhaust device ducted to the outdoors.

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

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

D. Eating, Drinking, etc.
Eating, drinking, smoking, or application of cosmetics is not allowed in laboratories that use hazardous agents. Hands shall be washed before conducting these activities outside of the laboratory. No food or product intended for consumption shall be stored in areas where chemicals are stored. Glassware or utensils that are also used for laboratory operations shall not be used with food or beverages.

Food/drink storage may be approved on a case-by-case basis when all avenues for storage outside of the laboratory have been ruled out. These cases must be reviewed and approved by the Office of Research Safety. General guidelines are that the items will remain in storage and the storage area must be away from any working areas of the lab. There must be a physical barrier (i.e., walls and door) separating it from the lab. If such a barrier is a refrigerator, it must be designated as “For Human Consumption Only” and must be located away from work areas of the lab. Preparation and consumption of food and drink are not allowed in the laboratory under any circumstances.

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

F. Sharps and Needles

1. All sharps (needles, knives, scalpels, Pasteur pipettes, etc.) shall be placed in approved, impervious sharps containers (available from CRS). Sharps and sharps containers should never be disposed of in the general trash. Contact the UGA Biosafety Office (706-542-7265) for instructions regarding disposal methods.

2. Non-biohazardous or non-radioactive glassware whether broken or not should be disposed of in a cardboard glass disposal box.

3. Sharps containers shall not be overfilled. According to the UGA Biosafety Manual, they are considered full when they are at ¾ capacity.

4. Needles shall not be recapped but placed directly into an appropriate sharps container after each use.

5. Needles shall not be cut as a form of disposal.

G. Personal Hygiene

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

H. Visitors

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

I. Horseplay

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

J. Mouth Pipetting

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

K. Personal Apparel

Low-heeled, closed-toe shoes must be worn when in the laboratory. Also, to minimize skin exposure, shorts and short skirts are not allowed to be worn in the lab. Appropriate protective equipment, as described in Section 2.VII shall be worn when working with hazardous chemicals.
L. **Personal Housekeeping**
   Work areas shall be kept clean and uncluttered.

M. **Planning**
   Seek information and advice about hazards, plan appropriate protective
   procedures, and plan positioning of equipment before beginning any new
   operation. A dry run is highly recommended for new procedures or for personnel
   unfamiliar with the techniques.

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

O. **Working Alone**
   Working alone with hazardous chemicals in a laboratory is discouraged. Potentially
   dangerous operations should be noted on the lab door along with contact
   information for responsible lab personnel. (See Appendix D for recommended
   posting forms.)

P. **First Aid**
   Each laboratory facility should have a well-supplied first aid kit readily available
   and prominently displayed or location posted. The kit should be checked regularly
   and supplies replenished. It is recommended that any injury occurring in a
   laboratory be checked out by a physician (see Section 2.X).

Q. **Gas Cylinders**
   All gas cylinders shall be handled in accordance with NFPA procedures given in
   Appendix C.

IV. **Chemical Fume Hood Use**

A. **Purchasing**
   The purchase of all laboratory fume hoods shall follow Board of Regents’
   standards. The Facilities Management Division (FMD) is responsible for inspecting
   fume hoods after installation or modification to determine if they conform to these
   standards. It is recommended that FMD be consulted during the purchasing
   process.

B. **Airflow**
   Airflow into and within the fume hood shall not be excessively turbulent; fume
   hood face velocity shall be adequate as specified by the Board of Regents. Contact
   ESD for specific fume hood testing and certification parameters. Air disturbances
   at the face of the fume hood should be avoided. Bunsen burners and other open
   flames should not be used in a fume hood.

C. **Testing and Certification**
   Quality and quantity of hood performance shall be evaluated by UGA upon
installation and regularly certified (at least annually) or whenever a change in local ventilation devices is made.

D. Hood Sash
The fume hood sash should be closed when the hood is not in use. As much as possible, work in the hood should be performed with the sash at a maximum height of 10—12 inches.

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

Electrical receptacles or other spark sources shall be protected from flammable vapors. No permanent electrical receptacles shall be permitted inside the hood. No chemical fume hood shall be used for the storage of chemicals or equipment unless they are a component of the operation for which the hood is being used or the hood is for the sole purpose of storage. Hood sashes should be closed as much as possible. The slots in the hood baffle shall be kept free of obstruction by apparatus or containers. Measures should be taken to prevent Kimwipes, tissues, or other articles from being drawn up into the exhaust duct. Bench coat surface protectors or other materials shall not obstruct hood air foils.

Laboratory doors opening into main corridors shall be kept closed unless specifically designed and permitted by codes to be left open. The heating of perchloric acid (or other oxidizing acid) in any hood other than a special purpose perchloric acid hood shall be prohibited. No cutting of holes or other unauthorized alteration of a chemical fume hood or its duct work shall be performed. Hoods that are malfunctioning or posted with a Danger - Inadequate Air Flow sign shall not be used for any operation using hazardous chemicals.

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

V. Laminar Flow, Biosafety Cabinets
Bunsen burners and other open flames should not be used in a biosafety cabinet. Guidelines for proper use of laminar flow hoods and biosafety cabinets can be found in the UGA Biosafety Manual.

VI. Housekeeping, Maintenance, and Inspections

A. Work Spaces
Laboratory aisle spaces must be kept unobstructed and work stations uncluttered.

B. Inspections
ORS Inspectors will conduct laboratory inspections of the UGA research community. For workplace areas with no to minimal chemical reagent usage, the
inspections will be conducted by the ESD safety personnel. It is recommended that laboratory personnel conduct regular self-inspections. (See Appendix D for the current ESD laboratory safety survey form.)

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

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

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

F. Door Windows
Windows that are a part of exit doors that lead into exit corridors or exit hallways should not be covered or obscured in any way unless in the case of laser usage. The windows serve as a safety measure should lab personnel be overcome with vapors and become immobilized. Passersby will more likely notice a problem through the window and get assistance.

VII. Personal Protective Equipment (PPE)
A. Skin Absorption Protection

1. Personnel performing procedures that use chemicals that can irritate or be absorbed by the skin shall wear appropriate PPE.

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

1. All employees and students who participate in or observe any of the following functions shall be provided with and shall wear protection devices: chemical, physical, or combined chemical-physical operations involving caustic, toxic, irritant, or explosive materials, hot liquids or solids, injurious radiation, or any dispensing of hazardous chemicals. Ensure when ordering that the manufacturer of the eye protection specifies that it conforms to ANSI Z87.1.

2. Chemical splash goggles that have splash proof sides to fully protect the eyes or a face shield shall be worn when participating in or observing procedures using liquid hazardous chemicals which are corrosive or have a health hazard rating of 3 or 4.

3. Impact-resistant safety glasses with side shields must be worn when performing or observing procedures where powders, chips, or other flying particles are the primary hazard.

4. Eyewear should be cleaned before being issued to a different employee. It is recommended that contact lenses not be worn (even with additional eye protection) in environments involving chemical splash or vapor exposure.

C. Respiratory Protection

Advice regarding the purchase of respirators is available from ESD. Any laboratory operation in which respirators are provided must conform to the University’s respirator program (see Appendix E). All operations within a laboratory facility that involve the transfer or alteration of a hazardous chemical which may generate air contaminants at or above the appropriate TLV shall be carried out in a chemical fume hood appropriate for the work being performed. Contact ESD with any questions concerning respirator use.

VIII. Records

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

B. All laboratories using hazardous chemicals should develop chemical-specific standard operating procedures as provided for in the chemical-specific right-to-
know training implementation plan as part of the mandated University Right-to-Know Plan.

C. Signed documentation of annual chemical-specific right-to-know training, as required by the University’s right-to-know plan, shall be maintained by the principal investigator or laboratory supervisor. This does not include the human resources new employee orientation training. Check with your departmental or unit right-to-know coordinator for your department’s record keeping system. (See Appendix D for right-to-know training forms.)

IX. Signs and Labels

A. Laboratory corridor doors shall display approved CAUTION door signs (Click here to request signs and see Appendix D for instructions on How to Properly Complete a Caution Sign). All required laboratory emergency information shall be provided on the CAUTION sign. Laboratory CAUTION door signs and labels shall be updated as necessary or at least annually. Principal hazardous materials and their amounts shall be listed. Contact ORS for replacement caution signs.

B. All laboratory refrigerators, freezers, ovens, and microwaves shall be affixed with an approved “Notice - Laboratory Use Only” sign available from ORS. Only refrigerators specifically designed and approved by a recognized testing agency as “explosion-proof”, “explosion-resistant”, or “intrinsically-safe” shall be used for flammable storage. If the refrigerator is not explosion-proof or intrinsically safe, it shall be affixed with the approved label “Notice - Do Not Store Flammables in This Box,” available from ORS.

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

D. Primary chemical containers shall be affixed with a legible manufacturer label. These are the containers in which chemicals originally arrive from the manufacturer.

E. Secondary container labelling guidelines (squeeze bottles, etc.)

1. Secondary containers for non-hazardous chemicals shall be affixed with labels listing the identity of its contents.

2. All chemicals intended for use in less than one day by a single user should be labeled with at least the identity of the chemical.
3. Secondary containers for hazardous chemicals intended for storage and use for a period greater than one day shall be affixed with labels listing: the identity of the hazardous chemical, the date filled, & the hazard warning (see Appendix D for hazard warning designations and abbreviations).

4. Batches of vials or test tubes containing chemicals of the same hazard may have the hazard labels affixed to a common carrier or box. All other such secondary containers must be appropriately labeled as noted above.

5. The chemical identity given on a chemical label must be in plain English, and must list the chemical’s common name given on the SDS or manufacturer’s label, or be listed on the accepted UGA abbreviation and acronym list (see Appendix D for accepted abbreviations and acronyms).

6. The chemical’s hazard warning may be provided by use of either the National Fire Protection Association (NFPA) hazard warning system, Hazardous Materials Identification System (HMIS), or the UGA hazard warning abbreviation warning system (see Appendix D for full explanation of these systems).

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

X. Spills and Other Laboratory Accidents

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

B. Chemical Exposures

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

2. Ingestion: Contact the local poison control center or hospital and follow directions. (see the front cover of manual or Section 1.III.C.1f. for phone numbers).

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

1. All laboratories that handle hazardous chemicals shall have an appropriate supply of spill cleanup kits prominently displayed or their location posted. The supply must be capable of containing or cleaning up small, known chemical releases. Laboratory personnel should not attempt to clean up a spill of hazardous chemicals if appropriate spill cleanup supplies and protective equipment are not available, or if the chemical or level of exposure hazard is unknown. In these cases, contact ORS for assistance.

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

XI. Electrical Safety

A. All electrical equipment and apparatuses must be double insulated or grounded. The following instructions are mandated by the State Fire Marshal. The use of extension cords should be avoided. When extension devices (an enclosure with multiple sockets) must be temporarily used, the wire gauge of the device must be equal to or larger than the cord on the item being operated. No extension device shall be attached to building surfaces (using staples, nails, etc.). Extension devices equipped with surge protectors may be permanently used with equipment that contains microprocessors (e.g., computer equipment). Surge protectors should not be used in areas subject to moisture, physical or chemical damage or flammable vapors. Surge protectors must be UL 1449, SPD-3 (Surge Protection Device), orTransient Voltage Surge Suppresser (TVSS) approved.

B. Any outlet located within six feet of a water source must be equipped with a ground fault circuit interrupter (GFCI).

XII. Mechanical Hazards

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

XIII. Synthesized Chemicals

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

XIV. Laboratory Decommissioning
The following procedures shall be carried out and a Laboratory Closing/Relocation Form (Click here for electronic form) must be completed before the responsible individual leaves the University or transfers to a different laboratory. Upon completion, the laboratory closing form shall be signed by all responsible parties.

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

B. Gas Cylinders
If gas cylinders are not returnable, contact ESD Hazardous Materials Group for assistance.

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

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

E. Radioactive Material
All personnel must notify the UGA Radiation Safety Office of your intention to leave the University or to change laboratories at least one month in advance and follow the instructions provided by the radiation safety officer.
F. **Equipment**
   If laboratory equipment is to be left for the next occupant, clean or decontaminate before departing the laboratory.

XV. **Hazardous Chemical and Waste Disposal**

   A. All hazardous chemicals and chemical waste shall be disposed of in accordance with the most current revision of the University of Georgia [Hazardous Materials Program Manual](#).

   B. See Appendix H for the University’s chemical waste minimization procedures. The waste minimization procedures include guidelines for bench top treatment of chemicals and procedures for surplus redistribution.

XVI. **Fire Safety**

   A. Appropriate fire extinguisher(s) should be available to occupied labs and placed no more than 75 feet from the furthest point in the lab. The fire safety office at ESD is responsible for maintaining annual inspections and monthly checks of fire extinguishers.

   B. Make sure the fire extinguisher is located near the exit and visible for use in case of emergency. The fire extinguisher should have an annual inspection tag affixed to it.
SECTION 3. THE LABORATORY FACILITIES

I. Minimum Design Provision

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

A. An appropriate general ventilation system with air intakes and exhausts located so as to avoid reentry of contaminated air.

B. Adequate chemical storage facilities having well-anchored chemical resistant shelving, appropriate approved flammable storage and dispensing areas for the volume of flammables to be used, and approved acid and special hazard storage cabinets appropriate for the hazards present.

C. Laboratory fume hoods appropriate for the hazards present (see Appendix F)

D. Sinks appropriate for hand washing and the cleaning of glassware and equipment

E. Plumbed eyewash stations which meet the requirements of ANSI Z358.1 shall be provided in the laboratory areas in a location that provides access within ten seconds from any point in the laboratory

F. Plumbed emergency showers which meet the requirements of ANSI Z358.1 shall be provided in new or newly-renovated laboratories, within the laboratory area; in existing laboratories, within a distance of no greater than 30.5 meters (100 feet) from the most remote area of the laboratory

G. Break areas physically separated from contamination of laboratory and chemical storage operations

H. Entrance doors to laboratories which meet fire separation requirements and shall not be used for ventilation purposes

I. Vision panels which meet separation requirements and shall not exceed 100 square inches

II. Construction and Renovation Review

Since ORS is charged with the responsibility of inspecting all laboratories to determine if they conform to the policies set forth in this manual, it is recommended that ORS be
consulted prior to construction and/or major renovation of any laboratory facility. In the event an agreement on safety issues cannot be attained, the issues will be addressed by the RSC. The parties have a right to appeal any RSC decision to a committee consisting of the Vice President for Research, the Vice President for Academic Affairs, and the Vice President for Business and Finance, or their representatives, for a final resolution.

III. General Laboratory Ventilation

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

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

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

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

IV. Other Ventilation Devices

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

B. UGA prohibits the use of ductless fume hoods.
C. Central vacuum pumps must be trapped and vented directly to the outside. Local vacuum pumps shall be trapped and appropriately filtered. Good maintenance of traps and filters is essential.

V. Exhaust Stacks
Chemical fume hood stacks shall extend above the building structure a minimum of seven feet and one duct diameter length above any parapet wall. Discharge velocity of hood stacks shall provide a minimum exit velocity of 2,500 fpm. These are minimum requirements. Greater heights or velocities may be required, due to building design or wind speed, to prevent reentry of contaminated air.
SECTION 4. PARTICULARLY HAZARDOUS SUBSTANCES

I. General Requirements

A. Definition

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

B. Designated Areas

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

C. Personal Protective Equipment (PPE)

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

D. Prevention of Spills and Accidents

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

E. Non-contamination/Decontamination

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

**F. Spills**
Assure that contingency plans, equipment, and materials to minimize exposures of people and property are available in case of accidents.

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

**II. Standard Operating Procedures for Particularly Hazardous Substances**
Prior to using any particularly hazardous substance (examples listed in Appendix I), a standard operating procedure should be developed for its safe storage, handling, and disposal (See Appendix J).
Appendix A

Committee Membership Rosters
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Appendix B

Procedures to Address Non-Compliance Concerns and Correction of Unsafe Laboratory Conditions
Procedures to Address Non-Compliance Concerns and Correction of Unsafe Laboratory Conditions

UGA Academic Affairs Policies 6.01 and 6.02 establish the basis for a Comprehensive Environmental Health and Safety Management System (EHSMS) that is intended to govern how UGA manages all aspects of environmental health and safety. The EHSMS shall use a process-driven approach to track information, identify safety risks, set safety goals, take action to ensure safety, assess results of those actions, and adjust processes as necessary to produce the intended results. The EHSMS supports and encourages a robust safety culture with personal accountability at all levels as a core value.

The Chemical and Laboratory Safety Manual (CLSM) is an operational extension of Policies 6.01 and 6.02, serving as a critical reference for the UGA research community. The CLSM establishes the principles, policies and best practices for laboratory safety. The Office of Research Safety (ORS) of the Office of the Vice President for Research provides professional support services and consultations to facilitate safe operation of UGA research laboratories. In addition, the ORS staff conducts campus-wide chemical and laboratory safety inspections to ensure activities comply with the CLSM and to facilitate the implementation of corrective actions when necessary.

The Research Safety Committee (RSC) has a central role in research safety oversight. Among other responsibilities, the RSC is charged to review safety trends regarding chemical and laboratory safety and definitively address and mitigate unresolved issues of non-compliance. Allegations of non-compliance are managed in a systematic manner described in the Office of Research Compliance Policy 1: Responding to Allegations of Research Non-Compliance and all outcomes of non-compliance investigations, whether there is a finding of non-compliance or not, are reported to the chairs of the EHSMS Executive and Steering Committees.

Institutional responses to a finding of non-compliance with the CLSM may include, but are not limited to, one or more of the following:

1. Requiring formal educational intervention
2. Requiring changes in research procedures or laboratory practices
3. Submitting a formal letter of concern, warning or reprimand to the respondent with escalating copies to institutional officials, depending on the nature of the non-compliance
4. Placing conditions upon ongoing research
5. Requiring enhanced monitoring of research
6. Recommending to the Institutional Official that the investigator may not use the data collected for publication
7. Suspending research activities
8. Suspending access to assigned laboratory space – laboratory closure

Per the Office of Research Compliance Policy 1: Responding to Allegations of Research Non-Compliance, allegations of non-compliance may be submitted by anyone to ORS Staff or the RSC chair verbally or in
writing. ORC Staff and RSC chair will protect the confidentiality of the person submitting the allegation (complainant) to the fullest extent possible should the complainant request anonymity.

Following laboratory safety inspections, unsatisfactory items are reported to the Principal Investigator for follow-up and corrective actions. The standard time for correction of unsatisfactory items is 2 weeks but longer correction deadlines can be negotiated with ORS if there is a good faith effort to address the unsatisfactory items. The ORS will always seek to facilitate correction of unsatisfactory items; however, the PI is ultimately accountable for correcting unsatisfactory inspection findings. Unjustified delays in correcting unsatisfactory items will be communicated to department heads and deans, as necessary, by ORS leadership. Subsequent failure to address unsatisfactory items in a timely fashion may be escalated at the discretion of the ORS leadership to the RSC as an allegation of non-compliance.

Unsatisfactory item determinations from laboratory inspections can be appealed to the RSC by contacting the director of the ORS or the RSC chair. The process for appealing findings of non-compliance by the RSC is described in Office of Research Compliance Policy 1: Responding to Allegations of Research Non-Compliance.
Appendix C

Flammable, Oxidizing, Dangerous, and Other Pressurized Gases
I. **Guidelines for Using and Storing Pressurized Gases**

The following guidelines shall be followed by all personnel using or storing pressurized gases.

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

B. Do not remove any labels or other form of identification from any gas cylinder.

C. Know how to detect the presence of leaks from any gas cylinder in your work area. Of particular importance are flammable and toxic gases. Contact the Office of Research Safety in the event of a cylinder or valve leak.

II. **Gas Cylinder Storage and Labeling**

A. When receiving a gas cylinder do not accept it until the following items are verified:

   1. The contents are identified either by labels or stencils
   2. It contains the appropriate DOT label
   3. It contains a valve protection cap (if so designed)

B. Store gas cylinders in a well-ventilated area away from direct heat. All cylinders must be stored in an upright position secured to a sturdy permanent structure to prevent the cylinder from falling or being knocked over. Remove regulators and place protective caps on those cylinders which are not in use. All cylinders should be anchored individually.

C. Gases should be stored in accordance with their physical and chemical properties. See individual safety data sheets (SDS) for specifics with regards to this information.

D. Close valves on empty gas cylinders and mark them empty. Empty cylinders should be removed from the lab as soon as possible. Store empty and full gas cylinders separately. Cylinders are considered empty if their pressure is less than 25 psig. All cylinders will be considered full if not properly identified.

E. Store flammable gases a minimum of 20 feet away from oxidizing gases, unless
separated by a fire wall. Flammable gases must be stored at least 10 feet away from an exit.

F. Do not store gas cylinders near elevators, ventilating systems, or other openings through which gas may spread to other parts of the building should a leak occur. Do not store cylinders where there is a risk of dropping them or having heavy objects fall on them.

G. Cylinders containing gases that are corrosive to cylinders or cylinder valves or that may become unstable while stored in the cylinder shall have a maximum retention period of six months, unless a shorter period is otherwise specified by the manufacturer.

H. Cylinders of all gases having a health hazard rating of 3 or 4 (refer to the SDS for rating) must be kept in a continuous mechanically ventilated storage hood or other continuous mechanically ventilated enclosure. There must be no more than three cylinders within the hood or other ventilated enclosure. Contact ORS if you have questions regarding the storage of cylinders in continuous mechanically ventilated enclosures/storage hoods.

I. The maximum volume size of a gas cylinder with a health hazard rating of 3 or 4 stored in a laboratory work area shall be limited to 0.1 cubic feet. These cylinders, when stored in a laboratory work area, shall be limited to no more than three maximum size cylinders or an equivalent volume (0.3 cubic feet) of smaller sized cylinders.

J. The maximum volume size of a flammable or oxidizing gas cylinder stored in a laboratory work area shall be limited to 2 cubic feet. Cylinders of flammable and/or oxidizing gases stored in a laboratory work area shall be limited to no more than six maximum sized cylinders or an equivalent volume (12 cubic feet) of smaller sized cylinders.

K. The maximum volume size of a liquefied flammable gas cylinder stored in a laboratory work area shall be limited to 0.6 cubic feet. Cylinders of liquefied flammable gas stored in a laboratory work area shall be limited to no more than three maximum sized cylinders or an equivalent volume (1.8 cubic feet) of smaller size cylinders.

L. Gas cylinders shall not be retained for more than ten years. Small, disposable,
empty, lecture cylinders may be discarded in the lab trash after the valve stem has been removed. Small disposable lecture cylinders that are not empty may be returned to the supplier or disposed of by a licensed gas cylinder disposal company. ESD shall be consulted prior to disposing of a cylinder using the preceding methods. Non-disposable cylinders must be returned to the supplier.

M. Cylinders and other containers stored outdoors shall be stored off the ground on a raised concrete pad and within a covered non-combustible rack. They shall not be stored where they are at risk of dropping, having heavy objects dropped on them or being struck by a vehicle.

III. Proper Handling of Gas Cylinders

A. Always open cylinder valves slowly. Never force the valve open. If the valve cannot be opened by the wheel or small wrench provided, return the gas cylinder. To shut down a system, close the cylinder valve and relieve the pressure from the entire system through a hose that is not being used.

B. Never interchange regulators and hose lines among different types of gases.

C. Always turn off cylinders from the main stem valve (not the regulator) when not in use. Turn off cylinders slowly.

D. Suitable equipment must be available for moving cylinders and other portable containers. Hand trucks must be equipped with a clamp or chain to secure the container in place or they must be specifically designed for container handling. Never drag, roll, or slide a cylinder in an attempt to move it.

E. Never drop cylinders; never permit cylinders to strike each other; and never strike cylinders with a metal instrument.

F. Inspect cylinders regularly for corrosion or leaks. In case of a leak, promptly remove the cylinder to the outside (in accordance with manufacturers’ recommendations) and call ESD for assistance. Any rusted, old or compromised cylinders must immediately be disposed of or returned to the manufacturer/supplier.

G. Do not use cylinders without a regulator.
H. Never attempt to refill a cylinder.

I. Never tamper with any part of a valve such as the safety nuts or packing nuts.
Appendix D

Signs, Forms & Labels
Laboratory Safety Signs, Forms and Labels
This appendix includes acceptable chemical labeling practices, laboratory postings, acceptable common abbreviations which may be used on chemical labels, and a copy of the laboratory safety evaluation form employed by ORS lab safety inspectors. Questions should be directed to ORS at 706-542-5288

I. Forms
   A. UGA Laboratory Inspection Survey Form: Page D-3
   B. Chemical Specific Right-to-Know Training Record: Page D-5

II. Postings
   A. Emergency Phone Numbers: Page D-6
   B. Unattended Laboratory Operations: Page D-6
   C. Caution/Hazard door sign: Page D-8
   D. Other postings and stickers can be requested from the Office of Research Safety by submitting the Request Signs & Stickers online form.

III. Labeling Systems
   A. Hazardous Chemical Container Labeling: Page D-12
   B. Acceptable Chemical Abbreviations for Secondary Container Labeling: Page D-14
Laboratory Inspection Survey Form

Department: ____________________ Principal Investigator: ____________________________
PI Phone: _____________________ Building: ____________________________
Address: ______________________ Laboratory_____________________
Lab Contact: ____________________________
Date: ________________ ORS Inspector: ____________________________

Section 1 - Laboratory Postings
A. Door signs
B. Emergency Phone Numbers
C. “Lab Use Only” Label

Section 2 - Chemical Storage
A. All chemicals properly labeled/stored
B. Chemicals stored by hazard compatibility
C. Acids & Bases in secondary containers
D. Appropriate refrigerator for flammables
E. Gas cylinders properly labeled/anchored
F. Lecture bottles properly labeled/anchored
G. No outdated peroxide formers present
H. Total flammable volume allowed in lab OK
I. Volume outside flammable cabinet
J. Waste containers properly closed
K. Waste containers properly labeled/stored

Section 3 – Safety Showers & Eye Wash Stations
A. Eye wash location posted
B. Eye wash tested/unobstructed
C. Safety shower location posted
D. Safety shower tested/unobstructed

Section 4 - Electrical Laboratory Equipment
A. Motors and pumps
B. Electrical cords not frayed
C. Equipment properly grounded
D. Extension cords/devices used temporarily
E. Fume hood
F. UL 1449, UL-TVSS, UL-SPD3 rated power strips employed
G. Outlet wiring correct

Section 5 - Laboratory Conditions
A. Aisles and exits
B. Hand washing facilities available
C. No eating/drinking near hazardous chemicals
D. Personal protective equipment observed/utilized
E. Sink conditions OK

Section 6 - Laboratory Records
A. Chemical inventory kept
B. Training records
C. SDS records maintained

Section 7 – Fire Extinguishers, First Aid Kits, Spill Kits
A. Fire extinguisher present/inspected
B. First aid kit present/location posted
C. Spill kit present/location posted

Additional Comments:

Within two weeks, please address any items noted as unsatisfactory on this form. Contact your laboratory inspector with any concerns or questions at:________________________@uga.edu
### Chemical Specific Right-to-Know Training Record

*Retain the original signed form in the employee’s personnel file.*

**Employee On-going Chemical Specific Right-to-Know Training Record**

Employee Name: _____________________________________________________________

Review Period: _________________ Work Location: ____________________________

Job Assignment: ________________ Supervisor: _______________________________


<table>
<thead>
<tr>
<th>Type of Training</th>
<th>Brief Description of Training Method</th>
<th>Date of Training</th>
<th>I acknowledge that I have been provided training covering the subject noted and that I understand the training. (Employee sign and date)</th>
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Appendix D-5
**Emergency Contact Numbers**

This posting should be placed on the inside of the main laboratory door at or near eye level. If a phone is present in the lab, then it is acceptable to post this sign near the phone. Durable, laminated copies of these contact numbers are available from ORS.

<table>
<thead>
<tr>
<th>Emergency Contact Numbers</th>
<th></th>
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<tbody>
<tr>
<td>UGA Police (from campus):</td>
<td>911</td>
</tr>
<tr>
<td>ACC Police (from cell):</td>
<td>911</td>
</tr>
<tr>
<td>Ambulance/Fire:</td>
<td>911</td>
</tr>
<tr>
<td>St. Mary’s Hospital:</td>
<td>(706) 389-3000</td>
</tr>
<tr>
<td>Athens Regional Medical Center:</td>
<td>(706) 475-7000</td>
</tr>
<tr>
<td>National Poison Center:</td>
<td>9-1 (800) 222-1222</td>
</tr>
<tr>
<td>OVRP Office of Research Safety</td>
<td>(706) 542-5288</td>
</tr>
</tbody>
</table>

**Unattended Laboratory Operations**

In the event that an experiment must be left unattended for anywhere from several hours to several days, the following notice must be placed on (or near) the experimental apparatus within the lab and on the outside of the laboratory door. Phone numbers listed should be 24-hour contact numbers.
!!!!! WARNING !!!

Unattended Laboratory Operations
Authorized Personnel Only

Chemical(s) Involved:

__________________________________________________________________________

In the event of an emergency contact:
Name/Phone#: ____________________________

or the Laboratory Principal Investigator:
Name/Phone#: ____________________________

or the Office of Research Safety at 706-542-5288
HOW TO PROPERLY COMPLETE A CAUTION SIGN

In order to bring greater uniformity to safety signs throughout the University and to reduce clutter on laboratory doors and hallways, the University of Georgia provides all laboratories with appropriate door caution signs. All standard safety warnings are concentrated on one 8.5 x 11-inch yellow and black caution placard. These placards must be posted on all laboratory entrances and in lab service areas where hazardous materials are used or stored. Lab door caution signs may be requested free of charge from ORS at 706-542-5288.

Marking the sign

All caution signs are laminated. Use a fine point permanent marker, such as a Sharpie®, to mark hazards, degree of hazard, quantities, contact information, date posted, etc. When the information on the sign needs updating, use isopropyl alcohol to erase the old information. DO NOT destroy or dispose of the sign. These placards are meant to be reused. If the lab is to be closed, please return the sign to ORS for reissue to another lab.

Hazards section

The Hazards section of the door caution sign is divided into GHS Ratings and Specific Hazards and is used to indicate that a chemical hazard with a degree of hazard 1 through 4 (see definitions below under the NFPA Diamond section) is present in the laboratory. Each hazard is listed by type (health, flammable, reactive, corrosive, or gas cylinder). Place a dark check mark in the appropriate box to the left of the hazard symbol to indicate that a hazard is present. Next, indicate the quantity of the hazard present by listing the approximate amount in the space provided to the right of the hazard symbol. An exact amount is not required and quantities may be estimated. For example, acetone is used in the lab and is ordered in a 20-liter container. Acetone is a flammable hazard 3, so a check mark is placed in the box to the left of the flammable symbol. In the space to the right of the symbol place the quantity normally found in the lab; i.e., 20 liters. If compressed gas cylinders are present, check the box to the left and indicate the number of cylinders by product in the space to the right of the hazard symbol. For example, three cylinders of carbon dioxide would be written as 3-CO₂. If there is not enough space to list all the types of gases present, then list the most hazardous gas(es).

The degree of hazard for many commonly used lab chemicals can be found on the manufacturer’s label, on the safety data sheet (SDS), in the manufacturer’s catalog or at
Each substance is rated on a scale of 0 (non-hazardous) to 4 (extremely hazardous) for each category:

- **Health Hazard** - the danger or toxic effect of a substance if inhaled, ingested or absorbed.
- **Flammable Hazard** - the tendency of the substance to burn.
- **Reactive Hazard** - the potential of a substance to explode or react violently with air, water or other substances.
- **Corrosive Hazard** – the tendency of a substance to cause severe damage to surfaces or living tissue upon contact.

If your laboratory employs biohazard materials, a biohazard label must be placed in the space provided to the right of the white hazard boxes. Please call the Biosafety Office at 706-542-2697 to have the biosafety level in your laboratory assessed and to obtain the appropriate biohazard label for your caution sign.

- **Biohazard** - the biosafety level assigned by the biosafety officer/committee. Check the box to the left of each Specific Hazard (laser radiation, magnetic fields, air/water reactive or ultraviolet light).

If your laboratory employs radioisotopes, all radioisotopes listed on the laboratory license must also be listed in the space entitled “Other Hazards” on the caution sign. Additionally, a rad sticker must be placed on the door sign in the space provided to the right of the white hazard boxes. Please call ORS at 706-542-5288 to obtain a rad sticker.

**The NFPA Diamond**

The NFPA (National Fire Protection Association) diamond, located on the right hand side of the door caution sign, is used to record the Degree of Hazard (0 - 4) of all hazardous substances in the lab. The diamond gives a quick visual determination of the highest level of hazards present in a given laboratory. The NFPA diamond is divided into four sections with the following designations:

- Blue – Health rating
- Red – Flammability rating
- Yellow – Reactivity rating
White – Special warnings such as air or water reactive substances

Each of the first three sections should be filled in with a number from 0 to 4 to indicate the highest level of hazard found in your lab. For instance, if the most flammable substance in your laboratory has an NFPA flammability rating of 3, a large 3 should be placed in the red box of the NFPA diamond. If the most reactive substance in your lab has a rating of 2, a large 2 should be placed in the yellow reactivity box. Many reagent bottles labels contain NFPA diamonds indicating the associated hazards. In this instance, NFPA ratings are easily determined. If the ratings are not on the bottle, consult safety data sheets (SDS) or NFPA rating charts to get the appropriate ratings. Also, see http://esd.uga.edu/chemical-lab-safety/right-know/msds-access for NFPA listings of many chemicals commonly found in the laboratory. The level of hazard associated with each numerical rating is found below:

<table>
<thead>
<tr>
<th>Health (Blue)</th>
<th>Flammability (Red)</th>
<th>Reactivity (Yellow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - Normal Material</td>
<td>0 - Will not burn</td>
<td>0 - Stable</td>
</tr>
<tr>
<td>1 - Slightly Hazardous</td>
<td>1 - Flash Point above 200 F</td>
<td>1 - Unstable if heated</td>
</tr>
<tr>
<td>2 - Hazardous</td>
<td>2 - FP between 100 &amp; 200 F</td>
<td>2 - Violent change</td>
</tr>
<tr>
<td>3 - Extreme danger</td>
<td>3 - FP below 100 F</td>
<td>3 – Shock/heat may detonate</td>
</tr>
<tr>
<td>4 - Deadly</td>
<td>4 - FP below 73 F</td>
<td>4 - May detonate</td>
</tr>
</tbody>
</table>

The white section or “Special Warnings” would contain the symbol A, W or OX indicating that air or water reactive or oxidizing chemicals are present in the laboratory.

**Contact Information**

In this section, list two people that may be contacted in case of an emergency in the laboratory. The first name recorded should be that of the professor who is the primary researcher for the laboratory. His/her department, office room number, home phone number should be recorded (this is preferably a 24-hour contact number). A second name (usually the laboratory supervisor) should be listed in the same manner in the event that the primary researcher cannot be contacted during an emergency. The second person listed should be someone who regularly works in the laboratory and can make responsible decisions in the event of an emergency. DO NOT record the telephone number of ESD, UGA Police Department or 911 in this space.
**Date Posted**

Place the month followed by the year that the sign is posted to the right of this field. The placard and its contents should be reviewed annually. If any changes are made during the year, the sign should be updated to indicate current laboratory conditions. The date that the sign was updated should be indicated in the date posted section by placing the corresponding month followed by the year.

All information contained on the caution sign is helpful to emergency personnel responding to a reported fire, spill or injury in the lab. An example of a caution sign that is properly filled out is given below. If you have any questions concerning your caution sign, please call ORS at 706-542-5288.
**Hazardous Chemical Container Labeling**

The following pages detail guidelines for labeling secondary containers (squeeze bottles, vials, etc.) including acceptable chemical abbreviations. Secondary containers refer to containers to which a chemical is transferred or the container in which a new chemical/reagent is created and/or stored.

Immediate use containers are secondary containers which are intended to last one work shift and be under control of the person who filled them for the duration of their use. These containers must be labeled with at least the chemical name; these labels may be temporary (such as tape and a Sharpie® marker).

Extended use containers are intended to be used for more than one shift and may also be in use by multiple laboratory personnel. Labels for these containers must meet the requirements of the Georgia Right-to-Know law in that they must be permanent, have the chemical name written in English, and display either a properly completed NFPA diamond or HMIS hazard label available from CRS (see below).

For vials or test tubes, it is acceptable to place the label on the rack or container holding them instead of labeling each individual container provided that the chemical hazard(s) present in each vial/test tube are the same.

---

**NFPA Rating System**

- Flammability (Red)
- Health (Blue)
- Reactivity (Yellow)
- Special (White)

**HMIS Rating System**

- Health (Blue)
- Flammability (Red)
- Reactivity (Yellow)
- Personal Protection

<table>
<thead>
<tr>
<th>Number</th>
<th>Hazard Rating</th>
<th>NFPA and HMIS Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Minimal or None</td>
<td>Numbers are placed in the appropriate boxes (Health, Flammability, or Reactivity) to indicate the hazard rating.</td>
</tr>
<tr>
<td>1</td>
<td>Slight</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Serious</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Severe</td>
<td></td>
</tr>
</tbody>
</table>
## Acceptable Abbreviations for Primary Hazards, and Examples of In-House Secondary Container Labels

<table>
<thead>
<tr>
<th>Flammable</th>
<th>Corrosive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(FLA.)</td>
<td>(Cor.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toxic</th>
<th>Reactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogen (Car.)</td>
<td>Air (A)</td>
</tr>
<tr>
<td>Mutagen (Mut.)</td>
<td>Water (W)</td>
</tr>
<tr>
<td>Teratogen (Ter.)</td>
<td>Oxidizer (Oxid.)</td>
</tr>
<tr>
<td>Irritant (Irr.)</td>
<td>Explosive (Exp.)</td>
</tr>
<tr>
<td>Poison (Pois.)</td>
<td></td>
</tr>
</tbody>
</table>

95 % Methanol
FLA./ Pois.
1/22/97

### Examples of In-house Labels:

- 1 N HCL
  - Cor.
  - 3/17/97

- Sodium Metal
  - 1/2/97

### Hazard Labels available through Central Research Stores

CRS # 848525

CRS # 848510, 848512

- Health
- Flammability
- Reactivity
- Personal Protection

Lab Safety Supply Inc.  Reorder No. 706
<table>
<thead>
<tr>
<th>Accepted Chemical Abbreviations for Chemical Secondary Container Labeling</th>
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</thead>
<tbody>
<tr>
<td>Acetic Acid: C$_2$H$_4$O$_2$</td>
</tr>
<tr>
<td>Benzene: C$_6$H$_6$</td>
</tr>
<tr>
<td>Calcium Chloride: CaCl$_2$</td>
</tr>
<tr>
<td>Carbon Tetrachloride: CCl$_4$</td>
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<tr>
<td>Chloroform: CHCl$_3$</td>
</tr>
<tr>
<td>Cupric Chloride CuCl$_2$</td>
</tr>
<tr>
<td>Ethylene Diamine Tetraacetic Acid: EDTA</td>
</tr>
<tr>
<td>Ethanol: EtOH</td>
</tr>
<tr>
<td>Water: H$_2$O</td>
</tr>
<tr>
<td>Hydrogen Peroxide: H$_2$O$_2$</td>
</tr>
<tr>
<td>Sulfuric Acid: H$_2$SO$_4$</td>
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<tr>
<td>Hydrochloric Acid HCl</td>
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<tr>
<td>Perchloric Acid: HClO$_4$</td>
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<tr>
<td>Hydrofluoric Acid: HF</td>
</tr>
<tr>
<td>Nitric Acid: HNO$_3$</td>
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<tr>
<td>Potassium Chloride: KCl</td>
</tr>
<tr>
<td>Potassium Chlorate: KClO$_3$</td>
</tr>
<tr>
<td>Potassium Nitrite: KNO$_2$</td>
</tr>
</tbody>
</table>
Appendix E

Respiratory Protection Program
I. Introduction

It is the policy of the University of Georgia to provide employees with a safe and healthy working environment. This is accomplished by utilizing facilities and equipment that have all feasible safeguards incorporated into their design. When effective engineering controls are not feasible, or when they are being initiated, care shall be used to ensure personnel protection.

This program does not apply to contractors as they are responsible for providing their own respiratory protection programs and respiratory protective equipment.

II. Responsibilities

A. Respiratory Protection Program Manager

At UGA, the manager of Industrial Hygiene and Occupational Safety (IHOS) at the Environmental Safety Division, is responsible for establishing and maintaining a respiratory protection program consistent with the goal of protecting personnel. This Respiratory Protection Program is designed and organized to ensure respirators are properly selected, used, and maintained by UGA personnel, and to reflect federal regulatory standards (29 CFR 1910.134) and industry accepted standards (ANSI).

IHOS is also responsible for evaluating those tasks for which respiratory protection is thought to be necessary, determine the degree of hazard posed by the potential exposure, determine whether engineering or administrative controls are feasible, and will specify which respiratory protection device is to be used at each task. In addition, IHOS will train personnel in the selection and use of respiratory protective devices, conduct qualitative and quantitative fit testing as necessary, and assist in the purchase of necessary respiratory protection devices.

B. Supervisors

Supervisors will ensure each employee under his or her supervision using a respirator has received appropriate training in its use and a prefitting medical evaluation. Supervisors will ensure the availability of appropriate respirators and accessories, provide adequate storage facilities, and encourage proper respirator equipment maintenance. Supervisors must be aware of tasks requiring the use of respiratory protection, and ensure all employees engaged in such work use the appropriate respirators at all times.

C. Respirator Wearers

It is the responsibility of each respirator wearer to wear his/her respirator when and where required and in the manner in which they were trained. Respirator wearers must report any
malfunctions of the respirator to his/her supervisor immediately. The respirator wearer must also guard against mechanical damage to the respirator, clean the respirator as instructed, and store the respirator in a clean, sanitary location.

D. **Others**

Personnel, such as employees, inspectors, and visitors, who must enter an area where the use of respiratory protective equipment is required, regardless of how brief their stay time in the area may be, shall be provided with and use appropriate equipment, including instructions regarding use and limitations. Personnel shall be fit tested and medically qualified to wear the respirator being issued prior to entry to the site.

Contractors are required to develop and implement a respiratory protection program for their employees who must enter into or work in areas where exposure to hazardous materials cannot be controlled or avoided. This program must meet OSHA regulations and include issuance of respirators, medical evaluations, fit testing and training.

**III. Medical Evaluation**

The Occupational Physician, Occupational Health Clinic, initially, and periodically thereafter, makes a determination as to whether or not an employee can wear the required respirator without physical or psychological risk. Based on the overall health of the individual and special medical tests (pulmonary function studies, EKG, etc.) as appropriate, the examining physician determines whether or not the individual will be restricted from wearing respiratory protective equipment. If a medical restriction is applied, the employee, his/her supervisor, and the IHOS are formally notified of the restriction.

Specific medical tests and procedures will be determined by the Occupational Health Physician and will be in accordance with OSHA medical surveillance requirements and/or NIOSH recommendations.

**IV. Selection and Use of Respiratory Protective Devices**

A. **Respirator Use**

Respiratory protection is authorized and issued for the following personnel:

1. Workers in areas known to have contaminant levels requiring the use of respiratory protection or in which contaminant levels requiring the use of respiratory protection may be created without warning (e.g., emergency purposes such as hazardous material spill responses).
2. Workers performing operations documented to be health hazardous and those unavoidably required to be in the immediate vicinity where similar levels of contaminants are generated.

3. Workers in suspect areas or performing operations suspected of being health hazardous but for which adequate sampling data has not been obtained.

B. Respirator Use for Biohazards
Respirators for use in areas where biohazards are used or stored must be selected based on a review of the laboratory procedures, protocols, biohazardous agents proposed for use, etc. The Office of Biosafety will conduct a risk assessment and determine the appropriate Biosafety Level for the laboratory and the corresponding level of personal protective equipment required.

C. Respirator Selection
Selection of the proper respirator(s) to be used in any work area or for operations at UGA will be made after a determination has been made as to the real and/or potential exposure of employees to harmful concentrations of contaminants or the presence of biological materials in the workplace atmosphere.

This evaluation will be performed prior to the start of any routine or non-routine tasks requiring respirators. Respiratory protective devices will be selected by the IHOS, using ANSI Z88.2, NIOSH Certified Equipment List, and/or the NIOSH Respirator Selection Decision Logic as a guide. The following items will be considered in the selection of respirators:

1. Effectiveness of the device against the substance of concern;
2. Estimated maximum concentration of the substance in the work area;
3. General environment (open shop or confined space, etc.);
4. Known limitations of the respiratory protective device;
5. Comfort, fit, and worker acceptance; and
6. Other contaminants in the environment or potential for oxygen deficiency.

Supervisors shall contact IHOS (706-542-5801) prior to non-routine work which may expose workers to hazardous substances or oxygen deficient atmospheres. Examples of work which may require the use of respirators includes, but are not limited to:

1. Asbestos abatement activities
2. Abrasive blasting
3. Cutting or melting lead or stripping lead-based paints from surfaces
4. Welding or burning
5. Painting, especially with epoxy or organic solvent coatings
6. Using solvents, thinners, or degreasers
7. Any work which generates large amounts of dust
8. Working in a confined space
9. Using formaldehyde to decontaminate a space

Assistance should also be obtained from the Office of Biosafety if employees are at risk of exposure to biological agents.

D. Types of Respirators

1. Air-Purifying Respirator
   These respirators remove air contaminants by filtering, absorbing, adsorbing, or chemical reaction with the contaminants as they pass through the respirator canister or cartridge. This respirator is to be used only where adequate oxygen (19.5 to 23.5 percent by volume) is available. Air-purifying respirators can be classified as follows:

   a. Particulate removing respirators, which filter out dusts, fibers, fumes and mists and can be either single-use, disposable respirators or respirators with replaceable filters. **NOTE: Surgical masks do not provide protection against air contaminants. They are never to be used in place of an air-purifying respirator. They are for medical use only.**

   b. Gas- and vapor-removing respirators, which remove specific individual contaminants or a combination of contaminants by absorption, adsorption or by chemical reaction. Gas masks and chemical-cartridge respirators are examples of gas- and vapor-removing respirators.

   c. Combination particulate/gas- and vapor-removing respirators, which combine the respirator characteristics of both kinds of air-purifying respirators.

2. Supplied-Air Respirators
   These respirators provide breathing air independent of the environment. Such respirators are to be used when the contaminant has insufficient odor, taste or irritating warning properties, or when the contaminant is of such high concentration
or toxicity that an air-purifying respirator is inadequate. Supplied-air respirators, also called air-line respirators, are classified as follows:

a. Demand
   This respirator supplies air to the user on demand (inhalation) which creates a negative pressure within the facepiece. Leakage into the facepiece may occur if there is a poor seal between the respirator and the user's face.

b. Pressure-Demand
   This respirator maintains a continuous positive pressure within the face piece, thus preventing leakage into the facepiece.

c. Continuous Flow
   This respirator maintains a continuous flow of air through the facepiece and prevents leakage into the facepiece.

3. Self-Contained Breathing Apparatus (SCBA)
   This type of respirator allows the user complete independence from a fixed source of air and offers the greatest degree of protection but is also the most complex. Training and practice in its use and maintenance is essential. This type of device will be used in emergency situations only.

E. Identification of Respirator Cartridges and Gas Mask Canisters
   Respirator cartridges and canisters are designed to protect against individual or a combination of potentially hazardous atmospheric contaminants, and are specifically labeled and color coded to indicate the type and nature of protection they provide.

   The NIOSH approval label on the respirator will also specify the maximum concentration of contaminant(s) for which the cartridge or canister is approved. For example, a typical label may indicate:

   "DO NOT WEAR IN ATMOSPHERES IMMEDIATELY DANGEROUS TO LIFE. MUST BE USED IN AREAS CONTAINING AT LEAST 20 PERCENT OXYGEN. DO NOT WEAR IN ATMOSPHERES CONTAINING MORE THAN ONE-TENTH PERCENT ORGANIC VAPORS BY VOLUME. REFER TO COMPLETE LABEL ON RESPIRATOR OR CARTRIDGE CONTAINER FOR ASSEMBLY, MAINTENANCE, AND USE."

F. Warning Signs of Respirator Failure

   1. Particulate Air-Purifying
When breathing difficulty is encountered with a filter respirator (due to partial clogging with increased resistance), the filter(s) must be replaced. Disposable filter respirators must be discarded. Disposable respirators used in labs in which biologicals are use can only be used once.

2. Gas or Vapor Air-Purifying
   Respiratory users must promptly leave the area of exposure if, when using a multiple use respirator (chemical cartridge or canister), any of the warning properties (e.g., odor, taste, eye irritation, or respiratory irritation) occur, check the following:
   
   a. Proper face seal
   b. Damaged or missing respirator parts
   c. Saturated or inappropriate cartridge or canister

   If no discrepancies are observed, replace the cartridge or canister. If any of the warning properties appear again, the concentration of the contaminants may have exceeded the cartridge or canister design specification. When this occurs an airline respirator or SCBA is required.

3. Service Life of Air-Purifying Respirator Canisters and Cartridges
   The canisters or cartridges of air-purifying respirators are intended to be used until filter resistance precludes further use, or the chemical sorbent is expended as signified by a specific warning property, e.g., odor, taste, etc. New canisters, cartridges or filters shall always be provided when a respirator is reissued. When in doubt about the previous use of the respirator, obtain a replacement canister or cartridge.

4. Supplied Air Respirator
   When using an airlines respirator, leave the area immediately when the compressor failure alarm is activated or if an air pressure drop is sensed. When using an SCBA leave the area as soon as the air pressure alarm is activated.

V. Respirator Training
   Respirator users and their supervisors will receive training on the contents of the CDC/ATSDR Respiratory Protection Program and their responsibilities under it. They will be trained on the proper selection and use, as well as the limitations of the respirator. Training also covers how to ensure a proper fit before use and how to determine when a respirator is no longer providing the protection intended.
IHOS provides training of respirator wearers in the use, maintenance, capabilities, and limitations of respirators is initially upon assignment of personnel to tasks requiring the use of respirators. A medical evaluation is completed every other year with retraining given annually.

The training program will include the following:

A. Nature and degree of respiratory hazard
B. Respirator selection, based on the hazard and respirator capabilities and limitations
C. Donning procedures and fit tests including hand's-on practice
D. Care of the respirator, e.g., need for cleaning, maintenance, storage, and/or replacement
E. Use and limitations of respirator

Respirator training will be properly documented and will include the type and model of respirator for which the individual has been trained and fit-tested.

VI. Respirator Fit Testing

A fit test shall be used to determine the ability of each individual respirator wearer to obtain a satisfactory fit with any air-purifying respirator. Both quantitative and qualitative fit tests will be performed. Personnel must successfully pass the fit test before being issued an air-purifying respirator.

No employee is permitted to wear a negative-pressure respirator in a work situation until he or she has demonstrated that an acceptable fit can be obtained. Respirator fitting is conducted initially upon assignment to a task requiring use of a respirator. Refitting is conducted annually thereafter upon successful completion of the respirator training.

Fit testing will be conducted by the IHOS and the test results will be the determining factor in selecting the type, model, and size of negative-pressure respirator for use by each individual respirator wearer.

A. Fit Checking

Each time a respirator is donned, the user will perform positive and negative pressure fit checks. These checks are not a substitute for fit testing. Respirator users must be properly trained in the performance of these checks and understand their limitations.

1. Negative Pressure Check
   Applicability/Limitations: This test cannot be carried out on all respirators; however, it can be used on facepieces of air purifying respirators equipped with tight-fitting
respirator inlet covers and on atmosphere supplying respirators equipped with
breathing tubes which can be squeezed or blocked at the inlet to prevent the passage
of air.

Procedure: Close off the inlet opening of the respirator's canister(s), cartridge(s), or
filter(s) with the palm of the hand, or squeeze the breathing air tube or block its inlet
so that it will not allow the passage of air. Inhale gently and hold for at least 10
seconds. If the facepiece collapses slightly and no inward leakage of air into the
facepiece is detected, it can be reasonably assumed that the respirator has been
properly positioned and the exhalation valve and facepiece are not leaking.

2. Positive Pressure Check
   Applicability/Limitations: This test cannot be carried out on all respirators; however,
   respirators equipped with exhalation valves can be tested.

   Procedure: Close off the exhalation valve or the breathing tube with the palm of the
   hand. Exhale gently. If the respirator has been properly positioned, a slight positive
   pressure will build up inside the facepiece without detection of any outward air leak
   between the sealing surface of the facepiece and the face.

B. Qualitative Fit Testing

   Federal regulations (29 CFR 1910.1001) require qualitative fit tests of respirators and
describe step-by-step procedures. This test checks the subject's response to a chemical
introduced outside the respirator facepiece. This response is either voluntary or involuntary
depending on the chemical used. Several methods may be used. The two most common are
the irritant smoke test, and the odorous vapor test.

   1. Irritant Smoke
      The irritant smoke test is an involuntary response test. Air purifying respirators must
      be equipped with a high efficiency particulate air (HEPA) filter for this test. An irritant
      smoke, usually either stannic chloride or titanium tetrachloride, is directed from a
      smoke tube toward the respirator. If the test subject does not respond to the irritant
      smoke, a satisfactory fit is assumed to be achieved. Any response to the smoke
      indicates an unsatisfactory fit.

      The irritant smoke is an irritant to the eyes, skin, and mucous membranes. It should
      not be introduced directly onto the skin. The test subject must keep his or her eyes
      closed during the testing if a full facepiece mask is not used.
2. **Odorous Vapor**

The odorous vapor test is a voluntary response test. It relies on the subject's ability to detect an odorous chemical while wearing the respirator. Air purifying respirators must be equipped with an organic cartridge or canister for this test. Isoamyl acetate (banana oil) is the usual test. An isoamyl acetate-saturated gauze pad is placed near the facepiece-to-face seal of the respirator of the test subject's skin. If the test subject is unable to smell the chemical, than a satisfactory fit is assumed to be achieved. If the subject smells the chemical, the fit is unsatisfactory.

If the subject cannot smell the chemical, the respirator will be momentarily pulled away from the subject's face. If the subject is then able to smell the chemical, a satisfactory fit is assumed. If the subject cannot smell the chemical with the respirator pulled away from the face, this test is inappropriate for this subject, and a different test will be used.

This test is limited by the wide variation of odor thresholds among individuals and the possibility of olfactory fatigue. Since it is a voluntary response test it depends upon an honest response.

C. **Quantitative Fit Testing**

Quantitative fit testing, using the Portacount Plus fit test system, is generally performed on both full-face and half-face negative pressure respirators. Fit factors are determined by comparing the particle concentration outside the respirator with the concentration inside the respirator facepiece. An acceptable fit is achieved when the respirator wearer successfully completes a series of six programmed exercises (normal breathing, deep breathing, moving head up and down, moving head side to side, reading, and normal breathing) with a fit factor of 100 or more.

1. **Special Problems**

   a. **Facial Hair**

      No attempt is made to fit a respirator on an employee who has facial hair which comes between the sealing periphery of the facepiece and the face, or if facial hair interferes with normal functioning of the exhalation valve of the respirator.

   b. **Glasses and Eye/Face Protective Devices**

      Proper fitting of a respiratory protective device facepiece for individuals wearing corrective eyeglasses or goggles, may not be established if temple bars or straps extend through the sealing edge of the facepiece. If eyeglasses,
goggles, face shield or welding helmet must be worn with a respirator, they must be worn so as not to adversely affect the seal of the facepiece. If a full-facepiece respirator is used, special prescription glasses inserts are available if needed.

c. Recordkeeping
Respirator fit-testing shall be documented and shall include the type of respirator, brand name and model, method of test and test results, test date and the name of the instructor/tester.

VII. Maintenance and Issuance of Respirators

A. Maintenance
The maintenance of respiratory protective devices involves a thorough visual inspection for cleanliness and defects (i.e., cracking rubber, deterioration of straps, defective exhalation and inhalation valves, broken or cracked lenses, etc.). Worn or deteriorated parts will be replaced prior to reissue. No respirator with a known defect is reissued for use. No attempt is made to replace components, make adjustments or make repairs on any respirator beyond those recommended by the manufacturer. Under no circumstances will parts be substituted as such substitutions will invalidate the approval of the respirator. Any repair to reducing or admission valves, regulators, or alarms will be conducted by either the manufacturer or a qualified trained technician.

B. Cleaning of Respirators
All respirators in routine use shall be cleaned and sanitized on a periodic basis. Respirators used non-routinely shall be cleaned and sanitized after each use and filters and cartridges replaced. Routinely used respirators are maintained individually by the respirator wearer. Replacement cartridges and filters are obtained by contacting OHS.

Cleaning and disinfection of respirators must be done frequently to ensure that skin-penetrating and dermatitis-causing contaminants are removed from the respirator surface. Respirators maintained for emergency use or those used by more than one person must be cleaned after each use by the user.

The following procedure is recommended for cleaning and disinfecting respirators:

1. Remove and discard all used filters, cartridges, or canisters.
2. Wash facepiece and breathing tube in a cleaner-disinfectant solution. A hand brush may be used to remove dirt. Solvents which can affect rubber and other parts shall not be used.
3. Rinse completely in clean, warm water.
4. Air dry in a clean area in such a way as to prevent distortion.
5. Clean other respirator parts as recommended by the manufacturer.
6. Inspect valves, headstraps, and other parts to ensure proper working condition.
7. Reassemble respirator and replace any defective parts.
8. Place in a clean, dry plastic bag or other suitable container for storage after each cleaning and disinfection.

C. Issuance of Respirators
Respiratory protective equipment shall not be ordered, purchased, or issued to personnel unless the respirator wearer has received respirator training and a fit test. New employees who require respiratory protective equipment, must be placed into the respirator program before being issued equipment.

IHOS provides at least five types of devices: MSA Comfo II, MSA Ultravue, Survivair half-mask, Survivair full-face, and RACAL powered air-purifying respirators. These facepieces have a variety of canisters that may be worn with them; hence, the canisters and facepieces are packaged separately. At the time of issue the appropriate canister is determined, based on the user’s needs, and is issued with the appropriate facepiece. In addition, disposable respirators with filter ratings N-95 and N-100 ratings are available for use under appropriate conditions.

D. Storage
After inspection, cleaning, and any necessary minor repairs, store respirators to protect against sunlight, heat, extreme cold, excessive moisture, damaging chemicals or other contaminants. Respirators placed at stations and work areas for emergency use shall be stored in compartments built for that purpose, shall be quickly accessible at all times and will be clearly marked. Routinely used respirators, such as half-mask or full-face air-purifying respirators, shall be placed in sealable plastic bags. Respirators may be stored in such places as lockers or tool boxes only if they are first placed in carrying cases or cartons. Respirators shall be packed or stored so that the facepiece and exhalation valves will rest in a normal position and not be crushed. Emergency use respirators shall be stored in a sturdy compartment that is quickly accessible and clearly marked.

VIII. Program Surveillance
The ANSI Z88.2-1980 document entitled "Practices for Respiratory Protection" specifies:
"Section 3.5.15 Respirator Program Evaluation. An appraisal of the effectiveness of the respirator program shall be carried out at least annually. Action shall be taken to correct defects found in the program."

The evaluation of the Respirator Program will include investigating wearer acceptance of respirators, inspecting respirator program operation, and appraising protection provided by the respirator. Evidence of excessive exposure of respirator wearers to respiratory hazards will be followed up by investigation to determine why inadequate respiratory protection was provided. The findings of the respirator program evaluation will be documented, and this documentation will list plans to correct faults in the program and set target dates for the implementation of the plans. These evaluations will be conducted at least annually.

**Table 4-1 Respirator Selection and Use**

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<tr>
<th>HAZARD</th>
<th>RESPIRATOR TYPE</th>
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<tbody>
<tr>
<td>Asbestos</td>
<td>Half-mask, air-purifying respirator with HEPA filters</td>
</tr>
<tr>
<td></td>
<td>Full-face, air-purifying respirator with HEPA filters</td>
</tr>
<tr>
<td></td>
<td>Full-face, powered air-purifying respirator with HEPA filters</td>
</tr>
<tr>
<td>Epoxy- or Oil-based Paints</td>
<td>Half-face, air-purifying respirators with organic vapor filters</td>
</tr>
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<td></td>
<td>Full-face powered air-purifying respirator with organic vapor filters</td>
</tr>
<tr>
<td>Lead-based Paint removal</td>
<td>Half-face, air-purifying respirators with HEPA filters</td>
</tr>
<tr>
<td></td>
<td>Full-face, air-purifying respirators with HEPA filters</td>
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<tr>
<td></td>
<td>Full-face, powered air-purifying respirators with HEPA filters</td>
</tr>
<tr>
<td>Use of Pesticides, Herbicides, and Rodenticides</td>
<td>Full-face, air-purifying respirator with combination particulate and pesticide cartridges</td>
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<td></td>
<td>Full-face, powered air-purifying respirator with combination particulate and pesticide cartridges</td>
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<tr>
<td>Use of Formaldehyde</td>
<td>Full-face, air-purifying respirator with organic vapor or specific formaldehyde cartridges</td>
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<tr>
<td></td>
<td>Full-face, powered air-purifying respirator with organic vapor or specific formaldehyde cartridges</td>
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<tr>
<td></td>
<td>Type C supplied air respirator with pressure-demand mode</td>
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</table>
RESPIRATOR TRAINING CERTIFICATION

I hereby certify that I have been trained in the proper use and limitations of the respirator issued to me. The training included the following:

1. Instruction on putting on, fitting, testing and wearing the respirator.
2. Instruction on inspection, cleaning, and maintaining the respirator.
3. Explanation of dangers related to misuse.
4. Instructions on emergency situations

I further certify that I understand the use, care, and inspection of the respirator and have tested and worn the unit.

Date: ________________________________

Signed:___________________________________

Respirator Type Issued: ____________________________

Training Coordinator: _____________________________________
FIT TEST WORKSHEETS

QUALITATIVE RESPIRATOR FIT TEST

Name: ____________________________________

Clean Shaven? __Yes __No

Spectacle Kit? ___Yes ___No

Manufacturer/Model _____________________________ Size: ___S ___M ___L

Irritant Smoke ___Pass ___Fail

Isoamyl Acetate ___Pass ___Fail

Manufacturer/Model______________________________ Size: ___S___M___L

Irritant Smoke ___Pass ___Fail

Isoamyl Acetate ___Pass ___Fail

Examiner ________________________________

Date_______________________________

Employee ________________________________ Date

_______________________________

QUANTITATIVE RESPIRATOR FIT TEST REPORT

LAST NAME _______________________________

FIRST NAME_______________________________

ID NUMBER________________________________

NEXT TEST DUE____________________________

OPERATOR NAME__________________________

RESPIRATOR MODEL________________________

• SIZE__________________________

Appendix E-15
• MANUFACTURER_________________
• APPROVAL NUMBER______________________
NOTES________________________________
TEST DATE____________________________
TEST TIME_____________________________

TEST DATA

Fit Factor Pass Level: 100

<table>
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<th>Mask (Part/cc)</th>
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<td>NB</td>
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</table>

OVERALL FIT FACTOR = _________________

Operator _____________________________ Date _______________________________

Subject_______________________________ Date _______________________________
Appendix F

Fume Hood Standards
# Fume Hood Face Velocity Standards

This standard will be applied to all existing fume hoods not covered under the Board of Regents Guidelines Design Criteria for Laboratory Furniture and Fume hoods adopted on November 1, 2013. Certain individual fume hoods may be exempted from this standard only by the direction of the Research Safety Committee. Reference the current revision at Board of Regents Guidelines Design Criteria for Laboratory Furniture and Fume hoods.

<table>
<thead>
<tr>
<th>FUME HOOD CLASSIFICATION</th>
<th>AVG. FACE VELOCITY</th>
<th>MAJOR STRUCTURAL CHARACTERISTICS</th>
<th>FOR USE WITH:</th>
<th>NOT-FOR USE WITH:</th>
</tr>
</thead>
</table>
| **General Purpose**      | SASH OPEN 18 inches | - Interior and work surface to be constructed of solid resin (chemical resistant)  
- Airflow construction | - Medium concentration acid fumes  
- Mildly toxic vapors  
- Organic solvents | - Hot Perchloric Acid  
- High concentration acid fumes  
- Hot Nitric Acid |
| **Perchloric**            | Standard bypass 90 – 110 FPM  
Variable air volume (VAV)  
80-120 FPM  
High Performance  
60-100 FPM | - Stainless steel lining and duct system; washdown system in duct work  
- Airflow construction | - Perchloric Acid  
- Nitric Acid | - sulfuric acid, acetic acid  
organic solvents  
Any combustible material and water-reactive materials |
| **Radiation**            | Standard bypass 90 – 110 FPM  
Variable air volume (VAV)  
80-120 FPM  
High Performance  
60-100 FPM | - Stainless steel lining  
- HEPA filter in exhaust system  
- Airflow construction | - Radioactive material ($\leq 50$ mC)  
- Cold acid fumes  
- Organic solvents  
- Toxic vapors | - Hot Perchloric Acid  
- Hot acid fumes  
- Highly toxic and unstable explosive materials |
Rating Fume Hood Performance

Fume hoods will be certified and rated according to average face velocity and balance. All average face velocities should be 100 FPM for conventional chemical hood and at least 60 FPM for high performance chemical hoods (for 18 inches sash open). The variance from the average should not exceed 20% for traditional and 10% for high performance of the average of more than 2 measurements. Any fume hood operating outside of these parameters are to be repaired.

Fume hoods are to be rated as follows:

Post certified sign - fume hood rated Ok on the form

Standard bypass

- Average Airflow between 90 and 110 FPM and;
- Not more than two readings are outside +20% of the average

VAV

- Average Airflow between 80 and 120 FPM and;
- Not more than two readings are outside +20% of the average

High performance hood

- Average Airflow between 60 and 100 FPM and;
- Not more than two readings are outside +10% of the average

Post caution sign - fume hood rated “caution” on the form

Standard bypass

- More than two readings are outside +20%;
- Average airflow is > 120 FPM (on sign write: “airflow too high, use caution”);
- Average airflow is less than 90 FPM but greater than 80 FPM

VAV

- More than two readings are outside +20%;
- Average airflow is > 120 FPM (on sign write: airflow too high, use caution);
- Average airflow is less than 100 FPM but greater than 80 FPM
High performance hood

- More than two readings are outside $\pm 10\%$;
- Average airflow is $>120$ FPM (on sign write: airflow too high, use caution);
- Average airflow is less than $100$ FPM but greater than $60$ FPM

Only use low concentrations of cold acid fumes and organic solvents until the fume hood is repaired and recertified as velocity ok. Do not use Perchloric acid or create concentrated acid fumes, toxic fumes or explosive fumes.

Post danger sign - fume hood is rated “danger” on the form

Standard bypass and VAV hoods

- Average airflow is less than $80$ FPM; or
- any measurement is less than $30$ FPM; or
- Hood not working at all; or
- Average airflow $>160$ FPM

High performance hood

- Average airflow is less than $60$ FPM; or
- any measurement is less than $30$ FPM; or
- Hood not working at all; or
- Average airflow $>160$ FPM

Hazardous chemicals are not to be used until the fume hood is repaired and recertified.
Appendix G

Chemical Hygiene Template

Beginning in 2017, a laboratory specific chemical hygiene plan (CHP) will be required for each laboratory/work space that uses or stores hazardous chemical reagents. The CHP will serve as Appendix G of the safety manual for the space. The CHP is designed to help communicate and document how to correctly handle and store hazardous reagents and waste as well as other procedures for safe operation of the space. The development and maintenance of the CHP will be the responsibility of the principle investigator, faculty member, or instructor to whom the space is assigned. CHP templates will be provided online to facilitate creation of the plans. The Office of Research Safety at (706) 542-5288 will provide assistance with CHP. A faculty task force charged by the Environmental Health and Safety Management System Executive Committee is currently developing the details for required content and workflow for CHP creation and review.
Appendix H

Waste Minimization
I. Introduction
The University of Georgia is divided into zones each classified as either conditionally exempt, small quantity generator or large quantity hazardous waste generator status as recognized by the Georgia Environmental Protection Division and the U.S. Environmental Protection Agency. These agencies enforce the Resource Conservation and Recovery Act of 1984 and certify that an entity has a program in place to reduce the volume and toxicity of waste generated to the extent economically practical. Waste minimization is necessary to reduce present and future risks to human health and the environment. The UGA Waste Minimization Plan presents guidelines that can be used by University personnel and organizations to reduce the amount and toxicity of wastes generated at the University of Georgia.

II. Waste Minimization
It is important that every member of the University community be aware of the environmental and financial impacts related to the disposal of hazardous wastes and help to minimize the volumes that are generated. Areas on campus that generate hazardous wastes and materials include laboratories, maintenance, garages, machine shops, art studios, and many more. It is important that proper waste management be an integral part of all operating procedures.

This Plan has been designed to assist waste generators in operating their areas with waste minimization in mind. General examples of waste minimization activities are presented below, and further information can be obtained by contacting the Environmental Safety Division (ESD). Using this plan, principal investigators or lab managers can adopt specific minimization procedures that are applicable to their particular situations. There are three general methods of waste minimization: source reduction, recycling, and treatment.

A. Source Reduction
Changing practices and processes to reduce or eliminate the generation of hazardous wastes and materials is referred to as source reduction. Some source reduction methods include process modification, chemical substitution, and improved operating procedures. Here are some examples of reducing chemical waste generation at the source.

1. Implement waste minimization procedures and train all personnel in those procedures.
2. Do not mix hazardous and non-hazardous waste.
3. Maintain sound chemical hygiene practices to reduce waste.
4. Carefully weight and transfer chemicals to minimize spills.
5. Seal and contain processes to prevent the escape of fumes or leaks to the environment.

Appendix H-2
6. Use heat guns to remove paint rather than chemical solvents.

7. Consider the use of micro-scale laboratory experiments.

8. Consider pre-weighed or pre-measured reagent packets where waste generation is high.

9. Minimize your inventory (buy less, store less, use less).

10. Purchase chemicals in quantities that will be used in the near future. A significant amount of campus hazardous waste is a result of poor purchasing practices, (i.e. buying too much and having it go bad before it’s used).

11. Date all chemical product containers when received so that older products will be used first.

12. Keep all chemical product containers labeled to prevent accumulation of unknown products.

13. Centralize purchasing of chemicals and products within the department or laboratory to prevent order duplications.

14. Substitute computer simulations/modeling, videos or demonstrations for wet laboratory experiments, when possible.

15. Evaluate procedures to see if a less hazardous or a non-hazardous reagent can be substituted. Some examples include:

<table>
<thead>
<tr>
<th>Hazardous Chemical</th>
<th>Safer Substitute</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetamide</td>
<td>Stearic Acid</td>
<td>Freezing point depression</td>
</tr>
<tr>
<td>Benzene</td>
<td>Xylene or hexane</td>
<td>Many solvent uses</td>
</tr>
<tr>
<td>Benzoyl Peroxide</td>
<td>Lauryl Peroxide</td>
<td>Some polymer catalysis</td>
</tr>
<tr>
<td>Carbon Tetrachloride</td>
<td>Cyclohexane</td>
<td>Qualitative test for halides</td>
</tr>
<tr>
<td>Formaldehyde (Formalin)</td>
<td>Ethanol</td>
<td>Specimen storage</td>
</tr>
<tr>
<td>Halogenated Solvents</td>
<td>Non-halogenated solvents</td>
<td>Some extractions and other solvent uses</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>------------------------</td>
<td>--------------------------</td>
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</tr>
<tr>
<td>Sodium Dichromate</td>
<td>Sodium Hypochlorite</td>
<td>Some oxidation reactions</td>
</tr>
<tr>
<td>Sulfide ion</td>
<td>Hydroxide ion</td>
<td>Qualitative test for heavy metals</td>
</tr>
<tr>
<td>Toluene-based</td>
<td>Non-ignitable Scintillation Cocktail</td>
<td>Studies using radioactive materials</td>
</tr>
<tr>
<td>Scintillation Cocktail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromic acid solution</td>
<td>Ultrasonic baths, Alconox or similar detergents, Pierce RBS-35 or similar detergents</td>
<td>Cleaning laboratory glassware</td>
</tr>
<tr>
<td>Mercury thermometers</td>
<td>Alcohol (red liquid), digital or thermocouple thermometers</td>
<td>Temperature</td>
</tr>
<tr>
<td>Solvents</td>
<td>Detergent and hot water</td>
<td>Parts cleaning</td>
</tr>
<tr>
<td>Oil-based paint</td>
<td>Latex paint</td>
<td>Painting operations</td>
</tr>
</tbody>
</table>

### B. Recycling

Another method of waste minimization is recycling. Recycled materials are used for another purpose, treated and reused for the same purpose, or reclaimed for another use, rather than being discarded as waste. Some examples include:

1. Distilling used-solvents (stringent standard operating procedures should be developed for recovering solvents since solvents can be extremely flammable or explosive; recovering some solvents like ethers should be avoided).

2. Collecting and reusing acetone or ethanol, used for drying glassware, several times before disposal.

3. Purchasing or renting gas cylinders (including lecture bottles) from manufacturers who will accept the return of the empty or partially used cylinders. All purchases should be made through CRS.

4. Returning excess pesticides to the distributor, or donating them to another organization. (Contact ESD before returning or donating pesticides.)

5. Recovering silver from photographic waste with silver recovery units.

6. Contacting ESD for collection of used oil, hazardous batteries, solvent soaked rags, fluorescent lamps and ballasts, which are all sent to outside vendors for recycling. (If at all possible, do not contaminate used oil with heavy metals or solvents.)

7. Reclaiming metallic mercury.
8. Returning unused pharmaceuticals to a reverse distribution company.

9. Returning used or defective toner cartridges for reclamation or reuse.

10. Re-circulating unused, excess chemicals within your department or unit.

C. Treatment

The last technique for waste minimization is treatment of waste. Wastes that are neutralized or detoxified and managed at the source can reduce environmental risks that might occur during transportation and handling. ESD encourages in-lab chemical management, such as neutralization of acids or bases and chemical treatment of toxic chemicals as the final step of the experiment. These steps either decrease or eliminate toxicity or help to reduce the volume of waste. It should be noted that if treatment is not a part of the end step and is done separately from the experiment, it is considered hazardous waste treatment, which cannot be done without a treatment permit from the State. Contact ESD before initiating treatment procedures. The following are some examples:

1. Neutralize acids and bases.

2.Inject gels directly with ethidium bromide to eliminate large volumes of liquid waste.

3. Precipitate metals out of solution to reduce volume of waste.

4. Polymerize acrylamide solutions

5. Oxidize cyanide salts and ethidium bromide solutions with bleach.

6. Convert osmium tetroxide into a less hazardous form.

Numerous reference resources are available that describe a wide variety of other, helpful in-lab chemical treatment procedures, some of the best of which include:


III. Managing Wastes Efficiently

In many cases, waste can be minimized, but it cannot always be eliminated. Waste is a natural product of research, teaching, testing and many other operations. It is prudent to manage all wastes as efficiently as possible. The management of chemical waste is most efficient when waste types are properly segregated, which also helps to reduce disposal costs.

The importance of proper separation of chemical wastes into various groupings cannot be over emphasized. The University of Georgia disposes of large quantities of the waste streams shown below. In most circumstances, the volumes and types of wastes, rather than the concentrations of wastes, determines the costs of disposal. As a result, ESD requests that areas generating waste make an effort not to dilute their wastes any more than necessary. **Do not mix hazardous chemical waste with non-hazardous waste, and never mix hazardous chemical waste with radioactive waste.** For more information on specific waste disposal procedures contact ESD.

The following sections are meant to give waste generators some information on how to minimize waste volumes and disposal costs of some of the more common waste streams generated at UGA. In some situations, these suggestions may be difficult or impractical to implement. In such cases, consult with ESD to determine the best method for collection and disposal.

A. Flammable Liquids

Examples: methanol, acetone, ethyl acetate, xylene, toluene, acetonitrile

Flammable liquid wastes are typically burned as fuel in waste disposal incinerators, and as a result, disposal is relatively easy and inexpensive. For this reason, the lower the water content in the waste-the less expensive the costs of disposal. Solvents contaminated with materials not permitted for incineration will require alternative, costly treatment methods. Some suggestions for waste minimization include:

1. Minimize water content of waste by minimizing any unnecessary dilutions.

2. If possible, keep separate from wastes that contain heavy metals, pesticides, cyanides, or acute hazardous "P-listed" wastes. These wastes tend to drive up the costs of disposal due to the need for more complex waste treatment.

3. Recycle or redistill solvents.

4. Investigate the use of nonflammable or biodegradable alternative solvents.

5. Replace solvent based inks in printing operations with soy-based inks.

6. Use cleaning solutions multiple times before disposing of them.
B. Flammable/Corrosive Mixtures
Examples: trifluoroacetic acid & acetonitrile, phenol & chloroform, potassium hydroxide & methanol, methanol & hydrochloric acid

Flammable liquids and alkaline / acidic mixtures are difficult to dispose of due to their corrosive nature. This waste can cost at least four times more to dispose of than other flammable liquids. Some suggestions for waste minimization include:

1. Minimize unnecessary dilution of wastes.
2. Do not mix unnecessarily with other solvents.
3. Keep acidic and alkaline wastes separate to minimize the risk of reactions.
4. Minimize the volume of these wastes by keeping separate from other waste streams.
5. If possible, keep separate from wastes that contain heavy metals, pesticides, cyanides, or acute hazardous "P-listed" wastes. These wastes tend to drive up the costs of disposal due to the need for more complex waste treatment.

C. Acids and Bases
Examples: hydrochloric acid, sulfuric acid, phosphoric acid, potassium hydroxide, and sodium hydroxide.

If not contaminated with other hazardous wastes (i.e. heavy metals, listed hazardous wastes, etc.) most acids and bases can be neutralized and then drain disposed. Neutralization of acids and bases reduces disposal costs. Some acids and bases, such as chromic acid or barium hydroxide, cannot be made non-hazardous by neutralization due to their heavy metal content. Diluting acids or bases with water is not neutralization and is not allowed. Neutralization must be accomplished by carefully mixing an acid with a base or vice versa and must be included as part of the end step of an experiment (See Appendix H, Section II.C). The resulting solution must be as close to pH 7 as possible before pouring down the drain. Some acids, such as hydrofluoric and perchloric acid, are quite dangerous and it is not recommended that they be neutralized in the lab. Contact the Environmental Safety Division – Hazardous Waste Program for assistance with disposing of these corrosives. Some suggestions for waste minimization include:

1. Minimize unnecessary dilution of wastes.
2. Neutralize waste if possible
3. Do not mix unnecessarily with other waste streams.
D. **Halogenated Solvents**

Examples: methylene chloride, chloroform, trichloroethane, perchloroethylene, carbon tetrachloride.

Not only are many halogenated solvents (solvents containing “Cl”, “F”, “Br”) carcinogenic, but they are also difficult to dispose of, and can cost three times more to dispose of as compared to non-halogenated solvents. An effort to keep halogenated and non-halogenated waste in separate containers will help to reduce disposal costs. Some suggestions for waste minimization include:

1. Minimize unnecessary dilution of wastes.
2. Keep separate from acidic or alkaline waste streams.
3. Keep halogenated wastes separate from non-halogenated wastes.
4. Substitute non-halogenated solvents in place of halogenated solvents
5. If possible, keep separate from wastes that contain heavy metals, pesticides, cyanides, or acute hazardous "P-listed" wastes. These wastes tend to drive up the costs of disposal due to the need for more complex waste treatment.
6. Recycle or redistill solvents.
7. Investigated the use of alternative non-halogenated solvents.

E. **Chromerge & Chromium-Bearing Waste**

The University of Georgia discourages the use of Chromerge® (potassium dichromate and sulfuric acid) for the cleaning of laboratory glassware because chromium ions are highly toxic to the environment and potential human carcinogens. Alternative solutions are available, such as Alconox®, Pierce RBS 35® and PCC-54 Detergent Concentrates®, and NoChromix®, which are safer to use and more eco-friendly. Researchers, who use chromium as part of a procedure in their laboratory, should investigate the viability of alternative procedures or chemicals. Some suggestions for waste minimization (if chromium-bearing materials must be used) include:

1. Minimize the volume of waste generated by unnecessary dilution.
2. If possible, keep separate from wastes that contain heavy metals, pesticides, cyanides, or acute hazardous "P-listed" wastes. These wastes tend to drive up the costs of disposal due to the need for more complex waste treatment.

F. **Formalin & Formaldehyde Solutions**

Formaldehyde is a suspected human carcinogen, toxic; very irritating to the eyes, throat and breathing passages; and can cause dermatitis. Formaldehyde is also a sensitizer, so the more a
person is exposed to it, the smaller a dose it takes to have an effect on that person. Some suggestions for reducing disposal costs include:

1. Minimize the volume of waste generated by eliminating any unnecessary dilution.

2. Do not mix with any other waste streams.

3. Substitute ethanol, or a commercial fixative like Carosafe® or Formaltemate® in place of formaldehyde for storage of biological specimens.

G. Aqueous Metals

Treatment and disposal of metal solutions such as barium, cadmium, lead, copper, selenium, silver, cobalt, mercury, etc. varies, depending on the type and concentration of the metal present in the waste. ESD recommends the substitution of less hazardous metals for those procedures that involve heavy metals. Some suggestions for waste minimization include:

1. Keep heavy metal solutions separate from other wastes.

2. Keep mercury free from all other waste streams including other metal waste.

3. Minimize the volume of waste by eliminating any unnecessary dilution.

4. Consider using micro-scale techniques

5. Substitute less hazardous metals

6. Eliminate metal catalysts in chemical procedures and allow more time for the completion of reactions

7. Consider precipitating out metals from solution

8. Treatment of waste must be incorporated into the experiment to avoid regulatory problems.

9. Contact ESD for assistance before initiating any treatment process

10. Silver recovery units can be used to reclaim silver from photo waste solutions.

H. Oil-based Paints & Solvents

Unusable oil-based paints and solvents are hazardous wastes due to their flammable
and/or toxic natures. These types of waste paint materials must be disposed of in accordance with ESD hazardous waste disposal procedures. Some suggestions for waste minimization include:

1. Do not contaminate usable paint and always reseal the containers (allows for recycling).

2. Use latex paint when possible.

3. Minimize the volume by reducing any unnecessary dilution.

4. Clean out stockpiles of old paints

5. Minimize inventories of paints. Order only enough to satisfy short-term needs.

I. **Latex Paints**
Latex paints are not considered hazardous wastes; however, unusable latex paint cannot be disposed of in the normal trash unless completely solidified. Liquid latex paints must be collected and disposed of by properly by ESD. Some suggestions for waste minimization include:

1. Do not contaminate useable paint, and always reseal the container (allows for recycling).

2. Do not mix latex with non-latex paints or any other hazardous materials.

3. Minimize the volume by reducing any unnecessary dilutions.

4. Clean out stockpiles of old paints

J. **Used Oil**
Used oil is not considered a hazardous waste; however, it must be collected in a container that can be closed, and labeled "Used Oil." Used oil must be recycled. Recycling is simple as long as water contamination is minimal and the oil is not contaminated with PCBs or any other hazardous substances. Contact ESD for pickup of used oil for recycling. Some suggestions for waste minimization include:

1. Minimize the volume of waste by reducing any unnecessary dilution or addition of water.

2. Avoid contamination with hazardous materials. If the oil has been contaminated or exposed to heavy metals, solvents, antifreeze and/or chemicals, it is potentially hazardous, and must be disposed of in accordance with hazardous waste disposal procedures.

Appendix H-10
3. Contact ESD for disposal or recycling of used oil.

K. Unknown Chemicals
The generation of unlabeled and unidentified chemicals results in an expensive waste disposal challenge. The number of unknown chemicals can be significantly reduced by simply making a concerted effort to label all containers. Unknown chemicals can cost up to ten times more to dispose of than properly labeled chemicals. Original chemical and product labels should be retained on containers until the chemicals/products are completely used and the containers no longer have any hazards related to its contents. When transferred to secondary containers chemicals/products should be labeled at a minimum with the chemical/product name and the primary hazard (i.e. flammable, poison, etc.). Some suggestions for waste minimization include:

1. Prevent generation of unknown chemicals/products by keeping all containers labeled.

2. Do not let old chemicals and products accumulate; clean out stockpiles of old chemicals and products before they become "unknowns." Contact ESD for disposal.

3. Before a laboratory researcher or graduate student leaves UGA, all samples and chemical formulations generated by that person must be clearly labeled as to their content.

4. Chemicals must be transferred to another individual or properly disposed of prior to the individual's departure. Contact ESD for additional information regarding proper laboratory close-out procedures.

L. Unused or Excess Chemicals
The American Chemical Society (ACS) estimates that 40% of the chemical waste generated by labs consists of unused chemicals. As a result, ESD encourages departments/laboratories to purchase chemicals only in amounts that will be used within the budget year. Bulk purchases may be cheaper (price per unit) for laboratories; however, if these chemicals are unused, disposal costs will far outweigh any savings. Some suggestions for waste minimization include:

1. Redistribute usable/unwanted chemicals within your department.

2. Do not stockpile large quantities of chemicals. Clean out old chemicals periodically, saving only those that are needed. Contact ESD for disposal assistance.

3. Do not accept chemicals from outside organizations or companies.
M. Mercury Compounds & Mercury Containing Devices
Mercury is corrosive, toxic and extremely difficult to clean up in entirety, especially when spills occur on porous surfaces. Mercury vapor from only trace amounts of residual mercury is continuously emitted and may be inhaled for an extended period of time by those who are unaware of its presence (the vapor is invisible to the naked eye and can only be detected through the use of a mercury vapor analyzer or ultraviolet light. Mercury-containing wastes also require special treatment, making disposal very expensive. ESD recommends: Some suggestions for reducing disposal costs:

1. Do not mix mercury-containing wastes with any other waste streams

2. Mercury thermometers and manometers should be replaced with non-mercury-containing instruments.

3. Containerize metallic mercury, so it can be recycled by ESD.

4. If mercury is spilled contact ORS at (706-542-5288) for cleanup guidance.

5. Due to the high toxicity and disposal costs of certain mercury compounds use alternative procedures whenever possible.

6. Use mercury free catalysts or simply let reactions run longer.

7. Fluorescent lamps also contain mercury, and must be recycled. UGA has several departments that collect and recycle lamps.

N. Compressed Gas Cylinders
Compressed gas cylinders pose both physical and health hazards. Physical hazards include flammability (depending on the gas) and hazards associated with high pressures and cylinder ageing. Health hazards include inhalation of toxic or corrosive gases, chemical asphyxiation, or asphyxiation associated with oxygen displacement. Some suggestions for reducing disposal costs

1. Use a supplier that recycles empty gas cylinders. This can be accomplished by renting the cylinders instead of purchasing them.

2. Limit the purchase of specialized gas cylinders (lecture bottles), since these are difficult to recycle. If lecture bottles must be purchased, use a supplier that will recycle the empty or partially filled bottles.

3. Before purchasing gas cylinders, check with your department or for existing cylinders that may be available for use.
4. Call ESD if you have any questions about cylinder handling or disposal.

O. Batteries
Many batteries contain one or more hazardous chemical components, and therefore must be recycled. The following battery types are considered hazardous and must be recycled by ESD.

1. Lead Acid (car batteries can also be recycled by the transportation department)
2. Mercury
3. Silver
4. Lithium
5. Nickel Cadmium (NiCd)
6. Nickel Metal-Hydride (NiMH)

Nickel-Zinc (NiZn) batteries are now becoming commercially available. These batteries are being marketed as "non-toxic", eco-friendly alternatives to NiCd batteries. Although comparatively less toxic, they should also be recycled.

Common alkaline batteries (Duracell or Energizer batteries), which are not rechargeable are exempt, and may be disposed of in the regular trash. Direct any questions concerning the type or nature of batteries found in the work area to ESD.

P. Fluorescent Light Bulbs
The UGA Facilities Management Department (UGA-FMD) collects and recycles used fluorescent light bulbs. Note: Many retailers are now offering "green" fluorescent bulbs that they claim will not be hazardous waste when disposed, but many of these still contain low levels of mercury. Although more eco-friendly and preferable, “green” fluorescent bulbs must also be collected and recycled.

Q. Ballasts
Ballasts control the starting and operating voltages, and regulate the current passing through fluorescent lights. Some ballasts contain polychlorinated biphenyls (PCBs) that must be removed and disposed of as hazardous waste; others may contain DEHP (di (2-ethylhexyl) phthalate) which is classified by EPA as a hazardous substance. Ballasts must not be disposed in the trash. The UGA-FMD department is generally responsible for the collection and recycling of all ballasts.

R. Ink and Toner Cartridges
Ink or toner cartridges, used under normal circumstances until empty, can shipped to the vendor or manufacturer for reclamation or reuse. Whenever possible, unused or defective
cartridges should be returned to the supplier for replacement or credit. This practice minimizes the amount of unused cartridges needing disposal. Contact ESD for assistance if you are uncertain of how to properly dispose of any ink or toner cartridges.

S. Shop Towels and Rags
Shop towels and rags can be sent to an approved laundering service for cleaning and reuse, rather of disposing them as waste. The service will reuse the towels until their useful life is reached or until they are contaminated beyond the vendor's ability to clean them, in which case they are typically incinerated. By using a shop towel service, the number of contaminated towels that need to be shipped as waste can be greatly reduced. Contact ESD for further information.

T. Electronic Devices
Electronic devices (computers, monitors, TVs, etc.) may contain hazardous materials and must be recycled. These types of equipment may also contain a UGA property control tag; therefore, contact the Surplus Property Office at 706-542-6983 for pickup and recycling.

U. Pharmaceuticals
Pharmaceutical waste includes expired, recalled, damaged, overstocked, unwanted, or contaminated drugs, vaccines, supplements and vitamins. Expired, recalled, damaged or overstocked pharmaceutical products can be collected by a reverse distribution service for credit, rather than disposing as waste. The reverse distribution service returns pharmaceuticals that have residual value directly to the manufacturer.
IV. Summary Procedure for Hazardous Waste Pickup
Satellite accumulation areas (research laboratories or classrooms) may accumulate up to 55 gallons of hazardous waste or one quart of acutely hazardous waste at a location under the direct supervision of a principal investigator without any restrictions on accumulation time. Before the maximum amount of waste has been accumulated, use the following procedure to arrange for pick-up.

A. Procedure:


2. To prepare a container for storage of hazardous waste materials:
   a. Select a clean container, which is compatible with the hazardous waste, with a tight fitting cap or lid.
   b. Remove or deface all existing labels on the container.
   c. Label the container with the words “Hazardous Waste” and other words that identify the contents of the container such as the chemical name(s).
   d. Using the Chematix system, (https://chematix.uga.edu) create and print appropriate waste cards for each waste container. For detailed assistance with the Chematix system, contact ESD.
   e. Attach the Chematix Waste Card to the container with a rubber band. On large consolidation containers, attach a glassine sticky-backed envelope or an envelope of your own. Please do not use tape to attach waste cards to the containers.
   f. Notes:
      i. Keep containers closed at all times, except when adding hazardous waste.
      ii. Do not overfill containers. Keep at least 2 inches of empty space above the liquid.
      iii. Ensure that containers are in good condition (e.g. free of leaks,
iv. If you have a large number of containers to dispose of, please call the Hazardous Materials Program prior to creating Chematix Hazardous Waste Cards.

3. Creating the Chematix “Hazardous Waste” card for partially used hazardous chemical wastes in original containers

a. Login to Chematix (https://chematix.uga.edu) using your UGA MyID login and password information, select the Waste tab.

b. Click on the Create Waste Card link under the sub-header Manage your Laboratory Waste – if the link is not available, you must update your annual hazardous waste training.

c. Click the link Pure Chemicals in Individual Containers

d. On the next page
   i. Select your lab location from the drop-down list provided.
   ii. Scan or type-in each Chematix UGACxxxxxx and/or #xxxxxx inventory bar code into the bar code field (one per line).
   iii. If no Chematix inventory barcode is present, manually search for the chemical using the Search Chemical button.
   iv. Click Generate Waste Card.

e. On the next page
   i. Click Print Waste Card.
   ii. Print the waste card that appears. Note: If more than one bar code was entered on the previous page, a multi-page PDF will appear, print all pages.
   iii. Click Finished.
   iv. See section below for pickup request procedure.

4. Creating the Chematix “Hazardous Waste” card for hazardous chemical waste in secondary containers

a. Login to Chematix (https://chematix.uga.edu) using your UGA MyID login and password information.

b. Select the Waste tab.

c. Click Create Waste Card link – link will not be available if your annual waste training is out of date.

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d. Chose the **Waste Card** type – Chemical Mixture by Percentage for a mixture of compatible chemicals in a single container (for example, in a carboy).

e. Enter all requested information at the top and each chemical constituent and its respective percentage at the bottom (please use your best estimate for percentages).

f. Click **Generate Waste Card**.

g. Print the Waste Card and adhere it to the waste container using a plastic pouch. Plastic pouches are available for purchase from Central Research Stores, (706) 542-2411, and catalog number 848519 (25ct).

h. Repeat this process for each chemical container even if you have multiple containers with identical constituents.

5. Hazardous waste pickup request

   a. Login to Chematix ([https://chematix.uga.edu](https://chematix.uga.edu)) using your UGA MyID login and password information.

   b. Select the **Waste** tab.

   c. Click **Create Pickup Worksheet**.

   d. Select your lab location from the drop-down list provided; previously created waste cards will then be displayed.

   e. Checkbox (or click **Toggle** to select all) each waste card to be picked up by hazmat staff.

   f. Click **Add Selection(s) to Worksheet**, and then click **Save & Submit for Pickup**.

   g. Once the pickup request has been submitted, HMTF staff will prepare a hazardous waste manifest.

   h. The HMTF staff will contact the principal investigator or other listed contact person to schedule a suitable pick-up date/time.

   i. Each lab must have a knowledgeable person on site at the time of pick-up.
Appendix H

up to assist with the identification of containers and sign the required manifests.

V. Conclusion
All members of the University community should make waste minimization an active and ongoing component of their operations. On campus, that means taking responsibility for the byproducts of your operations and the waste that is generated. Because the actual generators are most familiar with their work and the materials they use, they are the best source for new ideas to prevent pollution and to minimize waste; therefore, the success of the UGA Waste Minimization Program is dependent on the willing and active participation of the entire University community.

Any questions, comments or suggestions concerning waste minimization can be directed to the ESD Hazardous Materials Program at 706-542-5801.

Hazardous Materials Program Contact Information:

The University of Georgia
Hazardous Materials Program
Environmental Safety Division
240 Riverbend Rd.
Athens, GA 30602
Phone: (706) 542-5801
Fax: (706) 542-0108

Brian K. Adams, Hazmat Facilities Coordinator, bkadams@uga.edu

Jeffrey H. Shirey, Hazardous Materials Specialist, shirey1@uga.edu
Appendix I

Particularly Hazardous Substances
I. Introduction
Many chemicals that are employed in UGA research laboratories may be hazardous to either lab personnel or the environment. The following section provides a brief introduction to properties of some of the more hazardous substances. Before employing any chemical, workers are highly encouraged to fully investigate the hazardous properties. Numerous references are available online including toxicological profiles and safety data sheets (SDS). Additionally, the American Toxic Substances and Disease Registry (ATSTR) website contains medical management guidelines for a wide variety of chemical substances, and is an excellent source of detailed information on the treatment of exposures.

II. Peroxide-Forming Chemicals
Organic peroxide forming chemicals are some of the most potentially hazardous substances handled in laboratories. Organic peroxides are sensitive to shock, sparks, friction, and accidental ignition. They are more shock-sensitive than most common explosives such as TNT. If you notice the formation of crystals on or within a solvent bottle:

- DO NOT MOVE OR OPEN THE CONTAINER
- Alert others in lab as to the potential hazard
- Post a sign warning others not to disturb the container
- Contact the ESD Hazardous Materials Group at (706) 542-5801 for disposal assistance.

In order to stabilize peroxide forming chemicals and to increase the permissible storage length, inhibitors are often added. However, because distillation of such a stabilized liquid will remove the inhibitor, the end product must be stored with care as a potential peroxide-former. Peroxide levels should be checked regularly and a log of test results maintained.

Distillation of solvents may act to concentrate peroxides to explosive levels. **Distillation of peroxide forming solvents must not be carried out until the liquid has been tested and proven to be peroxide free.**

Please note: peroxide may form on the surface of alkali metals and their amides. Since they are water reactive, standard peroxide tests should not be performed on these materials. Alkali metals & their amides should be purchased in small quantities and used up as soon as possible.

Georgia Fire Code requires that all peroxide forming chemicals be dated upon opening. It is also prudent to date these chemicals upon receipt.

Types of Compounds Known to Auto oxidize to Form Peroxides:
- Aldehydes
- Ethers, especially cyclic ethers and those containing primary and secondary alkyl groups
- Compounds containing benzylic hydrogens
- Compounds containing allelic hydrogens (C=CCH) including most alkenes, vinyl and vinylidene compounds
- Compounds containing a tertiary CH group (e.g. decalin, 2,5-dimethylhexane)
III. **Classes of Chemicals That Can Form Peroxides:**

**Class I:** Unsaturated materials, especially those of low molecular weight that may polymerize violently and hazardously due to peroxide initiation.

**Safe storage period:** If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first. After opening, chemicals with inhibitors should not be stored for longer than 12 months; chemicals without inhibitors should be discarded as hazardous waste as soon as possible after the container is opened.

- Acrylic acid
- Acrylonitrile
- Butadiene
- Chloroprene
- Chlorotrifluoroethylene
- Methyl methacrylate
- Styrene
- Tetrafluoroethylene
- Vinyl acetate
- Vinyl acetylene
- Vinyl chloride
- Vinyl pyridine
- Vinylidene chloride

**Class II:** The following chemicals are a peroxide hazard upon concentration (distillation/evaporation).

**Safe Storage period:** If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first. After opening, materials should be discarded or evaluated for peroxides within 12 months. If crystals are visible in the solvent or around the cap, call the ESD hazardous materials group (706) 542-5801 immediately to schedule removal of the container from lab.

- Acetal
- Cumene
- Cyclohexene
- Cyclooctene
- Cyclopentene
- Diacetylene
- Dicyclopentadiene
- Diethylene glycol dimethyl ether
- Diethyl Ether
- Dioxane (p-dioxane)
- Ethylene glycol dimethyl ether
- Furan
- Isopropanol
- Methyl acetylene
- Methyl cyclopentane
- Methyl-I-butyl ketone
- Tetrahydrofuran
- Tetrahydronaphthlene
- Vinyl ether

**Class III:** Peroxides derived from the following compounds may explode without concentration.

**Safe storage period:** If unopened, up to 18 months or stamped expiration date, whichever comes first. After opening, it is recommended that these chemicals be discarded or evaluated for peroxides no more than 3 months after opening.
### Appendix I-4

#### Organic
- Divinyl ether
- Isopropyl ether
- Divinyl acetylene
- Vinlydene chloride

#### Inorganic
- Potassium metal
- Potassium amide
- Sodium amide (sodamide)

### IV. Peroxide Level Testing

If test strips are to be employed to determine peroxide levels, they should cover the range from 0 – 100 ppm. The following peroxide levels should be used to determine activities that are deemed safe.

- **0 – 25 ppm**  
  Material is safe to use or distill

- **25 – 100 ppm**  
  Material is safe to use, but should not be distilled

- **Above 100 ppm**  
  Material should be disposed of and not used in lab

If a peroxide forming chemical is found to be more than one year out of date for either storage or testing (3 months out of date for opened Class III peroxide formers), notification will be sent to the P.I. of record for the laboratory via their laboratory inspection report. P.I.s will also be notified that they have two weeks to either test the material and verify that peroxide levels are below 100 ppm or dispose of the material properly. Failure to comply with this request may result in the material being removed for disposal. If the receipt date or opening date cannot be determined, then testing is not recommended. Please dispose of as hazardous waste.

#### Reference


### V. Specific Chemical Hazards

#### A. Active Metals – sodium/potassium

Hazards:
- Water reactive, corrosive to skin, flammable
- These metals react violently with water and may spontaneously ignite. Toxic vapors are given off upon combustion.

Fire Extinguishing Media:
- Class D fire extinguisher (Dry Chemical or Sodium Carbonate)

Personal Protective Equipment:
- Face shield, splash goggles, lab coat, apron, nitrile gloves

Storage Requirements:
Store in oil or kerosene in a cool, dry area away from water and oxidizers.

B. **Air Reactive (pyrophoric) Substances.**
A list of air reactive substances is provided toward the end of this appendix

Hazard:
Reacts with air, flammable
Substances react with air producing toxic vapors and flames

Fire Extinguishing Media:
Class D fire extinguisher (Dry Chemical or Sodium Carbonate), Powdered Lime

Personal Protective Equipment:
Lab coat, apron, nitrile gloves

Storage Requirements:
Do not expose to oxygen or moisture. Store in a dry box under an inert atmosphere, or in an oxygen free environment.

C. **Benzene**

Hazard:
Carcinogen, highly flammable, vapors are toxic
Vapors irritate the eyes. High concentrations inhaled can cause unconsciousness and death. Prolonged breathing of vapors may cause severe or fatal blood disease. Swallowing and absorption through the skin could result in major residual injury

Fire Extinguishing Media:
Class B (Carbon Dioxide, Foam or Dry Chemical)

Personal Protective Equipment:
Splash goggles, certified fume hood, lab coat, Viton gloves

Storage Requirements:
Store with flammables in an approved flammables storage cabinet.

D. **Benzoyl Peroxide (dry)**

Hazard:
Explosive hazard by shock, friction or ignition source, corrosive
Benzoyl peroxide has been reported to explode spontaneously. It is an extreme fire hazard and is also a strong oxidizer. Do not get the materials in the eyes or on the skin.

Fire Extinguishing Media:
Large volumes of water

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Personal Protective Equipment:
Splash goggles, certified fume hood, laboratory coat, apron, face shield, nitrile gloves

Storage Requirements:
Store in a cool place away from direct sunlight. It is best stored alone separated from all other chemicals and combustible materials.

E. Carbon Disulfide

Hazards:
Extremely flammable, poison, highly volatile, corrosive to skin. Carbon Disulfide is the most flammable and explosive of all common solvents. Its vapors can be ignited by contact with an ordinary lightbulb. It is toxic and major residual injury may result from overexposure in spite of prompt treatment. Mixtures of carbon disulfide in air in the presence of rust can explode.

Fire Extinguishing Media:
Class B (Dry chemicals, foam or Carbon Dioxide). DO NOT USE WATER.

Personal Protective Equipment:
Splash goggles, a certified fume hood, lab coat, face shield, Viton gloves

Storage Requirements:
Store with flammable liquids in an approved flammables storage cabinet.

F. Carbon Tetrachloride

Hazards:
Poison, carcinogen
Avoid breathing the vapor. Small swallowed doses may result in death. Repeated low level exposures are likely to cause liver damage.

Fire Extinguishing Media:
Use appropriate extinguisher for surrounding fire

Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, certified fume hood, PVA or Viton gloves

Storage Requirements:
Store with other Blue labeled toxins away from alkali metals, chemically active metals, Oxidizers, bases, allyl alcohol, and dimethyl formamide.

G. Ethers

See “Peroxide Forming Chemicals”
H. **Formaldehyde (37% solution)**

Hazards:
Corrosive, highly toxic, flammable, sensitizer
Toxic through inhalation, ingestion or exposure to the liquid. May be fatal if inhaled or swallowed. Limit exposures and prevent the inhalation of the vapors.

Fire Extinguishing Media:
Use extinguishing media appropriate for the surrounding fire. If water is to be used, apply in flooding quantities from as great a distance as possible.

Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, certified fume hood, nitrile, neoprene or PVC gloves

Storage Requirements:
Store in secondary containment in an approved flammables cabinet with other flammable solvents

I. **Hydrofluoric Acid**

Hazards:
Extremely corrosive, highly toxic, severe contact hazard
May be fatal if absorbed or swallowed. Vapors can cause severe burns. Prevent the inhalation of the vapors. Will react with water, liberating heat.

Fire Extinguishing Media:
Use extinguishing media appropriate for the surrounding fire. If water is to be used, apply in flooding quantities form as great a distance as possible. Do not use a water stream.

Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, certified fume hood, butyl rubber gloves

Storage Requirements:
Store with mineral acids in an approved acids storage cabinet or in a chemical resistant tray inside a low cabinet. Do not store in glass containers.

If you employ HF in your laboratory, it is a good idea to keep calcium gluconate lotion on hand. For more information, contact the Laboratory Safety group with the Office of Research Safety.

J. **Mercury (elemental)**

Hazards:
Highly toxic; emits poisonous vapors. The vapor pressure of mercury at room temperature is 0.002 mm Hg which is sufficient to produce concentrations of about 200 times the permissible exposure limit (0.1 mg/m$^3$). Although this concentration is not likely to occur with small spills in a well ventilated laboratory, every effort should be made to avoid mercury spills and to promptly clean up spills that do occur. Mercury spill kits that can handle small (thermometer sized) spills are available through CRS. Larger spills can be handled by the ORS PREHS (Hazmat) team which has specialized equipment for this purpose. Never employ a household vacuum to clean up mercury spills.

Fire Extinguishing Media:
Use extinguishing media appropriate for the surrounding fire

Personal Protective Equipment:
Splash goggles, lab coat, certified fume hood, nitrile gloves

Storage Requirements:
Store in an air tight container with Blue label toxins

K. Dimethyl mercury (organo-mercury compounds)

Hazards:
Extremely toxic, flammable, may be fatal if inhaled or absorbed through skin

Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, silver shield gloves, silver shield sleeve protectors, certified fume hood.
Note: As little as one or two drops absorbed through the skin can prove fatal. Latex, neoprene and butyl rubber gloves do not provide adequate protection from this material.

Storage Requirements:
Store in a locked cabinet with other highly toxic materials. Do not store with oxidizers, or in a flammables cabinet.

L. Nitric Acid

Hazards:
Strong oxidizer, contact with combustible materials may cause fire; extremely corrosive, causes severe burns
Nitric acid forms flammable and explosive compounds with many materials. Spills should be absorbed with inert materials such as absorbent clay. The use of paper towels to clean up spill could cause a fire.

Fire Extinguishing Media:
Use large amounts of water.
Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, nitrile gloves, certified fume hood

Storage Requirements:
Store with oxidizers away from organics in a corrosives cabinet or in corrosive resistant trays.
Store on lower cabinet shelves.

M. Perchloric Acid

Hazards:
Strong Oxidizer, keep away from flammables and combustible material
Spills should be absorbed with inert materials such as absorbent clay. The use of paper towels to clean up spill could cause a fire.

Fire Extinguishing Media:
Use large amounts of water.

Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, nitrile gloves, certified perchloric acid fume hood

Storage Requirements:
Store with oxidizers away from organics in a corrosives cabinet or in corrosive resistant trays.
Store on lower cabinet shelves.

N. Phenol

Hazards:
Flammable, toxic, corrosive, contact hazard, inhalation hazard, suspect carcinogen

Fire Extinguishing Media:
Water

Personal Protective Equipment:
Splash goggles, face shield, lab coat, apron, Neoprene, natural rubber, or PVC gloves, certified fume hood

Storage Requirements:
Store in an approved area with other flammable solids.

O. Phosphorus (White/Yellow)

Hazards:
Spontaneously flammable in air, creates toxic fumes in air
Phosphorus is extremely toxic and exposure via any route is likely to cause residual injury
despite prompt medical attention.

Fire Extinguishing Media:  
Water

Personal Protective Equipment:  
Splash goggles, face shield, lab coat, apron, nitrile gloves, certified fume hood

Storage Requirements:  
Store in water in an air tight container. Store the container in a cool place separate from other laboratory chemicals.

P. Picric Acid

Hazards:  
Risk of explosion by shock, friction, fire, or other sources of ignition when dry, forms very sensitive explosive metallic compounds, toxic, corrosive.

Picric acid crystals that are fully hydrated appear bright yellow. Picric acid that has dried out appears to be a tan color. When a container of picric acid dries out, explosive, shock sensitive crystals will form. Dry Picric Acid must not be handled, moved or opened. Call the Environmental Safety Division’s Hazardous Materials Group at (706) 542-5801 for disposal assistance.

Fire Extinguishing Media:  
Water spray

Personal Protective Equipment:  
Splash goggles, face shield, lab coat, apron, nitrile gloves, certified fume hood

Storage Requirements:  
Store in a cool, dry place away from metals, salts, sparks and flames. Store with other RED label chemicals.

Q. Water Reactive Chemicals

Hazards:  
Flammable, reacts with moisture, may liberate toxic and flammable gases

Fire Extinguishing Media:  
Class D Fire Extinguisher

Personal Protective Equipment:  
Splash goggles, face shield, lab coat, apron, nitrile gloves, certified fume hood
Storage Requirements:
Store with other reactive substances in a flammables cabinet. Do not store near sink.
**Known or Suspected Carcinogens**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-alpha-C(2-Amino-9H-pyrido[2,3-b]indole)</td>
<td>Betel quid with tobacco</td>
</tr>
<tr>
<td>Acetaldehyde</td>
<td>Bis (2-chloroethyl) ether</td>
</tr>
<tr>
<td>Acetamide</td>
<td>N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornapazone)</td>
</tr>
<tr>
<td>Acetochlor</td>
<td>Bis[chloroethyl nitrosourea (BCNU) (Carmustine)</td>
</tr>
<tr>
<td>2-Acetylaminofluorene</td>
<td>Bis[chloromethyl]ether</td>
</tr>
<tr>
<td>Acifluorfen</td>
<td>Bitumens, extracts of steam-refined &amp; air refined</td>
</tr>
<tr>
<td>Acrylamide</td>
<td>Bromodichloromethane</td>
</tr>
<tr>
<td>Acrylonitrile</td>
<td>Bromoform</td>
</tr>
<tr>
<td>Actinomycin D</td>
<td>1,3-Butadiene</td>
</tr>
<tr>
<td>Adriamycin (Doxorubicin hydrochloride)</td>
<td>1,4-Butanediol dimethanesulfonate (Busulfan)</td>
</tr>
<tr>
<td>AF-2;(2-(2-furyl)-3-{5-nitro-2-furyl}) acrylamide</td>
<td>Butylated hydroxyanisole beta-Butyrolactone</td>
</tr>
<tr>
<td>Aflatoxins</td>
<td>Cadmium and cadmium compounds</td>
</tr>
<tr>
<td>Alcohol, beverages, when assoc. w/alcohol abuse</td>
<td>Caffeic acid</td>
</tr>
<tr>
<td>Aldrin</td>
<td>Captafol</td>
</tr>
<tr>
<td>Allyl chloride</td>
<td>Captan</td>
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<tr>
<td>Aminoanthraquinone</td>
<td>Carbon tetrachloride</td>
</tr>
<tr>
<td>p-Aminoazobenzene</td>
<td>Carbon-black extracts</td>
</tr>
<tr>
<td>ortho-Aminoazotoluene</td>
<td>Ceramic fibers (airborne particles of respirable size)</td>
</tr>
<tr>
<td>4-Aminobiphenyl (4-aminodiphenyl)</td>
<td>Certain combined chemotherapy for lymphomas</td>
</tr>
<tr>
<td>Amino-9-ethylcarbazole hydrochloride</td>
<td>Chlorambucil</td>
</tr>
<tr>
<td>1-Amino-2-methylantraquinone</td>
<td>Chloramphenicol</td>
</tr>
<tr>
<td>2-Amino-5-{(5-nitro-2-furyl)-1,3 ,4-thiadiazole}</td>
<td>Chlordane</td>
</tr>
<tr>
<td>Amitrole</td>
<td>Chlorocide (Kepone)</td>
</tr>
<tr>
<td>Analgesic mixtures containing phenacetin</td>
<td>Chlormethane</td>
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<tr>
<td>Aniline</td>
<td>Chlorimideform</td>
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<td>ortho-Anisidine</td>
<td>Chloroacid</td>
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<td>ortho-Anisidine hydrochloride</td>
<td>Chlorinated paraffins</td>
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<td>Antimony oxide (Antimony trioxide)</td>
<td>p-Chloroaniline (Average chain length, C12; approx. 60 % chlorine by weight)</td>
</tr>
<tr>
<td>Aramite</td>
<td>Chlorodibromomethane</td>
</tr>
<tr>
<td>Arsenic (inorganic arsenic compounds)</td>
<td>Chloroethane (Ethyl chloride)</td>
</tr>
<tr>
<td>Asbestos</td>
<td>1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea</td>
</tr>
<tr>
<td>Auramine</td>
<td>1-(2-Chloroethyl)-3-(4-methylcyclohexyl)- (CCNU) (Lomustine)</td>
</tr>
<tr>
<td>Azaserine</td>
<td>1-nitrosourea (Methyl-CCNU)</td>
</tr>
<tr>
<td>Azathioprine</td>
<td>Chloroform</td>
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<tr>
<td>Azacitidine</td>
<td>Chloromethyl methyl ether (technical grade)</td>
</tr>
<tr>
<td>Azobenzene</td>
<td>3-Chloro-2-methylpropene</td>
</tr>
<tr>
<td>Benz[a]anthracene</td>
<td>4-Chloro-ortho-phenylenediamine</td>
</tr>
<tr>
<td>Benzene</td>
<td>p-Chloro-o-toluidine</td>
</tr>
<tr>
<td>Benzidine [and its salts]</td>
<td>Chlorothalonil</td>
</tr>
<tr>
<td>Benzidine-based dyes</td>
<td>Chlorozotocin</td>
</tr>
<tr>
<td>Benzo[b]fluoranthene</td>
<td>Chromium (hexavalent compounds)</td>
</tr>
<tr>
<td>Benzo[j][jl]fluorantheneBenzo[k]fluoranthene</td>
<td>Chrysene</td>
</tr>
<tr>
<td>Benzo[fl]fluoranthene</td>
<td>C.I. Acid Red 114</td>
</tr>
<tr>
<td>Benzo[a]pyrene</td>
<td>C.I. Basic Red 9 monohydrochloride</td>
</tr>
<tr>
<td>Benzotrichloride</td>
<td>Ciclosporin (Cyclosporin A; Cyclosporine)</td>
</tr>
<tr>
<td>Benzyl chloride</td>
<td>Cinnamyl anthranilate</td>
</tr>
<tr>
<td>Benzyl chloride</td>
<td></td>
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<tr>
<td>Benzy1 violet 4B</td>
<td></td>
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<tr>
<td>Beryllium and beryllium compounds</td>
<td></td>
</tr>
</tbody>
</table>

Appendix I-12
Cisplatin
Citrus Red No. 2
Cobalt metal powder
Cobalt [II] oxide
Coke oven emissions
Conjugated estrogens
Creosotes
para-Cresidine
Cupferron
Cycasin
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
D&C Orange No. 17
D&C Red No. 8
D&C Red No. 9
D&C Red No. 19
Dacarbazine
Daminozide
Dantron (Chrysazin; 1,8-
Dihydroxanthraquinine)
Daunomycin
DDD (Dichlorodiphenyldichloroethane)
DDE (Dichlorodiphenyldichloroethylene)
DDT (Dichlorodiphenyltrichloroethane)
DDVP (Dichlorvos)
N,N'-Diacetylbenzidine
2,4-Diaminoanisole
2,4-Diaminoanisole sulfate
4,4'-Diaminodiphenyl ether (4,4'-Oxydianiline)
2,4-Diaminotoluene
Diaminotoluene (mixed)
Dibenz[a]acridine
Dibenz[a]icridine
Dibenz[a]anthracene
7H-Dibenzo[c,g]carbazole
Dibenzo[a,e]pyrene
Dibenzo[a,h]pyrene
Dibenzo[a,l]pyrene
1,2-Dibromo-3-chloropropane (DBCP)
2,3-Dibromo-1-propanol
p-Dichlorobenzene
3,3'-Dichlorobenzidine
1,4-Dichloro-2-butene
3,3'-Dichloro-4,4'-diaminodiphenyl ether
1,1-Dichloroethane
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
1,3-Dichloropropene
Dieldrin
Dienestrol
Diepoxybutane
Diesel engine exhaust
Di(2-ethylhexyl)phthalate
1,2-Diethylhydrazine
Diethyl sulfate
Diethyldithiobistrol
Diglycidyl resorcinol ether (DGRE)
Dihydrosafrole
Diisopropyl sulfate
3,3'-Dimethoxybenzidine (ortho-Dianisidine)
3,3'-Dimethoxybenzidine dihydrochloride
(ortho-Dianisidine dihydrochloride)
Dimethyl Sulfate
4-Dimethylaminoazobenzene
trans-2-[(Dimethylamino)methyl]iminoo]-5-[2-(5-
nitro-2furyl)vinyl]-1,3, 4-oxadiazole
7,12-Dimethylbenz[a]anthracene
3,3'-Dimethylbenzidine (ortho-Tolidine)
3,3'-Dimethylbenzidine dihydrochloride
Dimethylcarbamoyl chloride
1,1-Dimethylhydrazine (UMDH)
1,2-Dimethylhydrazine
Dimethylvinylchloride
1,6-Dinitropyrene
1,8-Dinitropyrene
2,4-Dinitrotoluene
1,4-Dioxane
Diphenylhydantoin (Phenytoin)
Diphenylhydantoin (Phenytoin), sodium salt
Direct Black 38 (technical grade)
Direct Blue 6 (technical grade)
Direct Brown 95 (technical grade)
Disperse Blue 1
Epichlorohydrin
Erionite
Estradiol 17
Estrone
Ethynylestradiol
Ethyl acrylate
Ethyl methanesulfonate
Ethyl-4,4'-dichlorobenzilate
Ethylene dibromide
Ethylene dichloride (1,2-Dichloroethane)
Ethylene oxide
Ethylene thiourea
Ethyleneimine
Folpet
Formaldehyde (gas)
Furan
Furazolidone
Furmecyclox
Gasoline engine exhaust (condensates/extracts)
Glasswool fibers (airborne particles of respirable size)
Glu-P-1 (2-Amino-6-methylpyrido[1,2-a:3’,2’-d]
imidazole)
Glu-P-2 (2-Aminodipyrido [1,2-a:3’,2’-d]
imidazole)
Glycidaldehyde
Glycidol
Griseofulvin
Gyromitrin (Acetaldehyde methylformylhydrazone)
HC Blue 1
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorocyclohexane (technical grade)
Hexachlorodibenzodioxin
Hexachloroethane
Hexamethylphosphoramide
Hydrazine
Hydrazine sulfate
Hydrazobenzene (1,2-Diphenylhydrazine)
Indeno [1,2,3-cd]pyrene
IQ (2-Amino-3-methylimidazol[4,5-f]quinoline)
Iron dextran complex
Isosafrole
Lactofen
Lasiocarpine
Lead acetate
Lead and lead compounds
Lead phosphate
Lead subacetate
Lindane and other hexachlorocyclohexane isomers
Mancozeb
Maneb
Me-A-alpha-C (2-Amino-3-methyl-9H-pyrido[2,3-b] indole)
Medroxyprogesterone acetate
MelIQ (2-Amino-3,4-dimethylimidazo[4,5-f]quinoline)
MelIQ x (2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)
Melphalan
Merphalan
Mestranol
8-Methoxypsoralen with ultraviolet A therapy
5-Methoxypsoralen with ultraviolet A therapy
2-Methylaziridine (Propyleneimine)
Methylzoxymethanol
Methylzoxymethanol acetate
3-Methylcholanthrene
5-Methylchrysene
4,4’-Methylene bis(2-chloroaniline)
4,4’-Methylene bis (N,N-dimethyl) benzenamine
4,4’-Methylene bis(2-methylaniline)
4,4’-Methylenedianiline
4,4’-Methylenedianiline dihydrochloride
Methylhydrazine and its salts
Methyl iodide
Methyl methanesulfonate
2-Methyl-1-nitroantraquinone (of uncertain purity)
N-Methyl-N’-nitro-N-nitrosoguanidine
N-Methylolacrylamide
Methylthiouracil
Metiram
Metronidazole
Michler’s ketone
Mirex
Mitomycin C
Monocrotaline
5-(Morpholinomethyl)-3-[(5-nitrofururylidene)-
amino]-2-oxalolidi none
Mustard Gas
Nafenopin
1-Naphthylamine
2-Naphthylamine
Nickel and certain nickel compounds
Nickel carbonyl
Nickel refinery dust from pyrometallurgical process
Nickel subsulfide
Niridazole
Nitrilotriacetic acid
Nitrilotriacetic acid, trisodium salt monohydrate
5-Nitroacenaphthene
5-Nitro-o-anisidine
o-Nitroanisole
4-Nitrobiphenyl
6-Nitrochrysene
Nitrofen (technical grade)
2-Nitrofluorene
Nitrofurazone
1-[(5-Nitrofururylidene)-amino]-2-imidazolidinone
N-[4-{5-Nitro-2-furyl}-2-thiazoly]acetamide
Nitrogen mustard (Mechlorethamine)
Nitrogen mustard
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)
Nitrogen mustard N-oxide
Nitrogen mustard N-oxide hydrochloride
2-Nitropropane
1-Nitropyrene
4-Nitropyrene
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine
p-Nitrosodiphenylamine
N-Nitrosodiphenylamine
N-Nitroso-N-ethylurea
3-(N-Nitrosomethylamino) propionitrile
4-(N-Nitrosomethylamino)-1-(3-pyridyl)1-butaneone
N-Nitrosomethyleneimine
N-Nitroso-N-methyleurea
N-Nitroso-N-methylurethane
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Norethisterone (Norethindrone)
Ochratoxin
Oil Orange SS
Oral contraceptives, combined
Oral contraceptives, sequential
Oxadiazon
Oxymetholone
Oxazepam
Panfuran S
Pentachlorophenol
Phenacetin
Phenazopyridine
Phenazopyridine hydrochloride
Phenesterin
Phenobarbital
Phenoxybenzamine
Phenoxybenzamine hydrochloride
Phenyl glycidyl ether
Phenylhydrazine and its salts
o-Phenylenophenate, sodium
PhiP (2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine)
Polybrominated biphenyls
Polychlorinated biphenyls
Polychlorinated biphenyls (containing > 60% chlorine by molecular weight)
Polychlorinated dibenzo-p-dioxins
Polychlorinated dibenzofurans
Polygeenan
Ponceau MX
Ponceau 3R
Potassium bromate
Procarbazine
Procarbazine hydrochloride
Procymidone
Progesterone
1,3-Propane sultone
Propargite
beta-Propiolactone
Propylene oxide
Propylthiouracil
Radionuclides
Reserpine
Residual (heavy) fuel oils
Saccharin
Saccharin, sodium
Safrole
Selenium sulfide
Shale-oils
Silica, crystalline (airborne particles of respirable size)
Soots, tars, and mineral oils (untreated and mildly treated oils and used engine oils)
Sterigmatocystin
Streptozotocin
Styrene oxide
Sulfallate
Talc containing asbestiform fibers
Terrazole
Testosterone and its esters
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
1,1,2,2-Tetrachloroethane
Tetrachloroethylene (Perchloroethylene)
\( p_-, \), -Tetrachlorotoluene
Tetranitromethane
Thioacetamide
4,4'-Thiodianiline
Thiourea
Thorium dioxide
Tobacco, oral use of smokeless products
Tobacco, smoke
Toluene diisocyanate
ortho-Toluidine
ortho-Toluidine hydrochloride
para-Toluidine
Toxaphene (Polychlorinated camphenes)
Treosulfan

Appendix I-15
Trichlormethine (Trimustine hydrochloride)
2,4,6-Trichlorophenol
Triphenyltin hydroxide
Trichloroethylene
Tris (aziridinyl)-para-benzoquinone
(Triaziquone) Tris(1-aziridinyl)phosphine sulfide
(Thiotepa) Tris(2-chloroethyl)phosphate
Tris(2,3-dibromopropyl)phosphate
Trp-P-1 (Tryptophan-P-1)
Trp-P-2 (Tryptophan-P-2)
Trypan blue (commercial grade)
Unleaded gasoline (wholly vaporized)
Uracil mustard
Urethane (Ethyl carbamate)
Vinyl bromide
Vinyl chloride
4-Vinyl-1-cyclohexene diepoxide
(Vinyl cyclohexene dioxide)
Vinyl trichloride (1,1,2-Trichloroethane)
2,6-Xyline (2,6-Dimethylaniline)
Zineb
### Chemicals Known to Cause Reproductive Toxicity

**Developmental Toxicity**

<table>
<thead>
<tr>
<th>Chemical</th>
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<td>Aspirin</td>
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<td>Benomyl</td>
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<td>Benzphetamine hydrochloride</td>
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<td>Bis(chlorethyl) nitrosourea (BCNU) (Carmustine)</td>
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<td>Chloridecone (Kepone)</td>
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<td>Diazepam</td>
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<td>Ethyl alcohol in alcoholic beverages</td>
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<td>Lorazepam (CCNU) (Lomustine)</td>
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<td>Lovastatin</td>
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Medroxyprogesterone acetate
Megestrol acetate
Melphalan
Menotropins
Meprobamate
Mercaptopurine
Mercury and mercury compounds
Methacycline hydrochloride
Methimazole
Methotrexate
Methotrexate sodium
Methyl bromide as a structural fumigant
Methyl mercury
Methyltestosterone
Midazolam hydrochloride
Minocycline hydrochloride (internal use)
Misoprostol
Mitoxantrone hydrochloride
Nafarelin acetate
Netilmicin sulfate
Nicotine
Niomycin sulfate (internal use)
Nitrogen mustard (Mechlorethamine)
Nitrogen mustard hydrochloride
Norethisterone (Norethindrone)
Norethisterone acetate (Norethindrone acetate)
Norethisterone (Norethindrone)/ Ethinyl estradiol
Norethisterone (Norethindrone)/Mestranol
Norgestrel
Oxaxepam
Oxytetracycline (internal use)
Oxytetracycline hydrochloride (internal use)
Paramethadione
Penicillamine
Pentobarbital sodium
Phenacetamide
Phenprocoumon
Pipobroman
Plicamycin
Polybrominated biphenyls
Polychlorinated biphenyls
Procabazine hydrochloride
Propylthiouracil
Retinol/retinyl esters
Ribavirin
Secobarbital sodium
Streptomycin sulfate
Tamoxifen citrate
Temazepam
Testosterone cypionate
Testosterone enanthate
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)
Tetracycline (internal use)
Tetracycline hydrochloride (internal use)
Tetracyclines (internal use)
(Mechlorethamine hydrochloride)
Thalidomide
Thioguanine
Tobacco smoke (primary)
Tobramycin sulfate
Toluene
Triazolam
Trilostane
Trimethadione
Uracil mustard
Urethane
Urofollitropin
Valproate (Valproic acid)
Vinblastine sulfate
Vincristine sulfate
Warfarin
Female Reproductive Toxicity

Aminopterin
Anabolic steroids
Aspirin
Carbon disulfide
Cocaine

Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
Ethylene oxide
Lead
Tobacco smoke (primary)

Male Reproductive Toxicity

Anabolic steroids
Benomyl
Carbon disulfide
Colchicine
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)
1,2-Dibromo-3-chloropropane (DBCP)
m-Dinitrobenzene
o-Dinitrobenzene
p-Dinitrobenzene

Dinoseb
Ethylene glycol monoethyl ether
Ethylene glycol monomethyl ether
Ethylene glycol monoethyl ether acetate
Ethylene glycol monomethyl ether acetate
Hexamethylphosphoramide
Lead
Nitrofurantoin
Tobacco smoke (primary)
Uracil mustard

Pyrophoric Chemicals List

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<th>acetic acid bromide</th>
<th>bis-trifluoromethyl phosphine</th>
<th>cesium amide</th>
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<td>acetic acid chloride</td>
<td>boron</td>
<td>cesium arsenic alloy</td>
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<td>acetyl bromide</td>
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<td>bromoethyne</td>
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<td>Name</td>
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<td>( \text{C}_2\text{H}_4\text{Zn} )</td>
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<td>digermane</td>
<td>( \text{Ge}_2 )</td>
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<td>( \text{B}_6\text{H}_8 )</td>
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<tr>
<td>diisobutyl aluminum chloride</td>
<td>( \text{C}<em>8\text{H}</em>{16}\text{AlCl} )</td>
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<tr>
<td>diisobutyl aluminum hydride</td>
<td>( \text{C}<em>8\text{H}</em>{16}\text{AlH} )</td>
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<td>diisopropylberyllium</td>
<td>( \text{Be}_2\text{AlH}_2 )</td>
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</tr>
<tr>
<td>dimethyl allyl arsine</td>
<td>( \text{C}<em>6\text{H}</em>{12}\text{As} )</td>
<td>Organoarsine compound</td>
</tr>
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<td>dimethyl arson</td>
<td>( \text{C}<em>6\text{H}</em>{12}\text{As} )</td>
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<tr>
<td>dimethyl beryllium</td>
<td>( \text{BeH}_2 )</td>
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<tr>
<td>dimethyl cadmium</td>
<td>( \text{C}<em>6\text{H}</em>{12}\text{Be} )</td>
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<tr>
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<td>( \text{C}<em>6\text{H}</em>{12}\text{SiCl}_2 )</td>
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<td>dimethyl dimethyl phosporamidate</td>
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<tr>
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<td>( \text{C}<em>6\text{H}</em>{12}\text{Mg} )</td>
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<tr>
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<tr>
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<td>( \text{C}<em>6\text{H}</em>{12}\text{P} )</td>
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<tr>
<td>di- ( n )-propyl zinc</td>
<td>( \text{C}<em>6\text{H}</em>{12}\text{Zn} )</td>
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<tr>
<td>di- ( n )-propylaluminum hydride</td>
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<td>diphosphine</td>
<td>( \text{P}_2 )</td>
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<tr>
<td>dipotassium ( aci )-nitroacetate</td>
<td>( \text{K}<em>2\text{C}</em>{2}\text{H}_4\text{O}_2 )</td>
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<td>( \text{C}<em>8\text{H}</em>{18}\text{B} )</td>
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<td>disilane</td>
<td>( \text{Si}_2 )</td>
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<td>disilyamino diborane</td>
<td>( \text{B}_2\text{NH}_2 )</td>
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<tr>
<td>disilyamino dichloroborine</td>
<td>( \text{B}_2\text{NH}_2\text{Cl}_2 )</td>
<td>Dichloraminodiborane compound</td>
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<td>( \text{S}_2\text{N}_2 )</td>
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<td>divanadium dodecacarbonyl</td>
<td>( \text{V}_2\text{O}_2\text{C}_2 )</td>
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<td>divinyl zinc</td>
<td>( \text{C}_2\text{H}_4\text{Zn} )</td>
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<td>( \text{C}_2\text{H}_3\text{Br} )</td>
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<td>ethanoyl chloride</td>
<td>( \text{C}_2\text{H}_3\text{Cl} )</td>
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<td>phenyl cyclotetramethylene borine</td>
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<td>phenyl silicide</td>
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<td>( \text{C}<em>6\text{H}</em>{13}\text{Si} )</td>
<td>Metal silicide compound</td>
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**Appendix I-21**
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<th>Phenyl Diazosulfide</th>
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<th>Tetramethyl Diborane</th>
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<td>Sodium Carbonyl</td>
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<td>Sodium Hydrazide</td>
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<td>Sodium Hydride</td>
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<td>Triethyl Bismuth</td>
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<td>Compound</td>
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<td>Description</td>
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<td>rubidium-arsenic alloy</td>
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<td>tetrabromosilane</td>
<td>triethyl diborane</td>
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<td>trimethyl gallium</td>
<td>trivinyl stibine</td>
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<td>tungsten</td>
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<td>trimethyl phosphine</td>
<td>unsymmetrical dimethyl hydrazine</td>
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<td>uranium</td>
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<td>uranium monocarbide</td>
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<td>zirconium dibromide</td>
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### Water Reactive Chemicals List

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<td>Acetic Anhydride</td>
<td>C₄H₆O₃</td>
<td>May boil explosively</td>
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<tr>
<td>Acetyl Chloride</td>
<td>CH₃COCl</td>
<td>Violently decomposes to HCl and acetic acid</td>
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<tr>
<td>Aluminum Bromide</td>
<td>AlBr₃</td>
<td>Violent hydrolysis</td>
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<tr>
<td>Aluminum Chloride</td>
<td>AlCl₃</td>
<td>Violent decomposition forming HCl gas</td>
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<tr>
<td>Boron Tribromide</td>
<td>BBr₃</td>
<td>Violent or explosive reaction when water added</td>
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<tr>
<td>Butyl Lithium</td>
<td>C₄H₉Li</td>
<td>Ignotes on contact with water</td>
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<tr>
<td>Calcium Carbide</td>
<td>Ca₃C₂</td>
<td>Gives off explosive acetylene gas</td>
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<td>CaO</td>
<td>Highly exothermic reaction</td>
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<td>CISO₃H</td>
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<td>(CH₃)₃SiCl</td>
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<tr>
<td>Cyanogen Bromide</td>
<td>CNBr</td>
<td>Releases cyanide gas on contact with water</td>
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<td>(CH₃)₂SiCl₂</td>
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<td>Lithium Aluminum Hydride</td>
<td>LiAlH</td>
<td>Releases and ignites hydrogen gas</td>
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<td>LiH</td>
<td>Violent decomposition</td>
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<td>P₂O₅</td>
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<tr>
<td>Phosphorus Tribromide</td>
<td>PBr₃</td>
<td>Reacts violently with limited amounts of warm water</td>
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<tr>
<td>Phosphorus Trichloride</td>
<td>PCl₃</td>
<td>Violent reaction releasing flammable. diphosphane</td>
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<td>KNH₂</td>
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<td>Forms KOH and hydrogen gas</td>
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<td>SiCl₄</td>
<td>Violent reaction producing silicic acid</td>
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<td>NaNH₂</td>
<td>Generates NaOH and NH₃ (flammable)</td>
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<td>Formula</td>
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<td>Heating and spontaneous ignition with 10% H₂O</td>
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<td>Na</td>
<td>Generates flammable hydrogen gas</td>
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<td>Reacts violently or explosively</td>
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<td>Sr</td>
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<tr>
<td>Trichloro Silane</td>
<td>SiHCl₃</td>
<td>Releases toxic and corrosive fumes</td>
</tr>
<tr>
<td>Triethyl Aluminum</td>
<td>Al(C₂H₅)₃</td>
<td>Explodes violently in water</td>
</tr>
<tr>
<td>Triisobutly Aluminum</td>
<td>Al(iC₄H₉)₃</td>
<td>Violent reaction with water</td>
</tr>
<tr>
<td>Zirconium Tetrachloride</td>
<td>ZrCl₄</td>
<td>Violent reaction with water</td>
</tr>
</tbody>
</table>
Appendix J

Recommended Laboratory Standard Operating Procedures and Other Resource Information

The Research Safety Committee, supported by the Office of Research Safety (ORS), is developing a repository of standard operating procedures (SOPs) for processes using hazardous chemical reagents and generating hazardous waste. Researchers, faculty, and instructors are encouraged to submit their SOPs (researchsafety@uga.edu or RSC@uga.edu) to build the reference database. Once reviewed and uploaded to the database, SOPs will be available to the UGA research community to facilitate creation of laboratory specific SOPS as part of the overall Chemical Hygiene Plan. The SOPs in concert with the lab specific CHP will foster workplace safety. The ORS will collaborate with other safety oversight units as necessary for the review of SOPs that may involve biohazards and/or animal or human research subjects.
Appendix K

Guidelines for Laboratory Openings and Closings
The purpose of this document is to define responsibilities when UGA labs are being opened, closed, or relocated. The goal is to achieve a safe and regulatory compliant transfer of laboratory supervision.

There are minimum safety and regulatory requirements that must be met by laboratory personnel before any lab is allowed to become operational. Similarly, when laboratories are vacated, they must be left in a condition that is safe and suitable for a new occupant or other employees involved in renovation projects.

I. Responsibilities

A. **Department heads** ensure that all principal investigators (PI) using chemical, biological, or radioactive agents are aware of the requirements necessary to obtain clearance from the Office of Research Safety (ORS) and the Office of Biosafety in order to open, close, or relocate a lab. If any hazardous materials or equipment is left behind by an absent or unidentified PI, the department head (or unit head) assumes responsibility for the proper closing of the laboratory.

B. **Principal Investigators** are responsible for the safe operations of labs under their supervision, as well as completing the tasks required to open, close, or relocate a laboratory at UGA. The PI is responsible for the relocation or removal of all hazardous agents as well as the decontamination of all equipment and surfaces occupied in the laboratory area. The PI may delegate tasks to another party such as lab personnel possessing appropriate training and knowledge, but this does not absolve the PI of the responsibility of ensuring these tasks are completed according to the applicable guidelines.

C. **Office of Research Safety** is responsible for providing proper guidance for any chemical and/or radioactive laboratory opening, closing, or relocation and for alerting the UGA Office of Biosafety when applicable. ORS will issue final clearance on lab openings, closings, and relocations.

D. **Contact Numbers**

1. Chemical and Laboratory Safety: 706-542-5288
2. Radiation Safety: 706-542-0107
3. Biological Safety: 706-542-7265
5. Chematix Assistance: 706-542-5801

II. Opening a New Laboratory

This information is intended to guide principal investigators, department heads, unit heads, and lab contacts through the process of opening and beginning work in a new laboratory. It should be used by PIs new to UGA and current PIs that are relocating their
operations from one area on campus to another. Please read and follow all instructions within this document. An [Open New Lab Request Form](#) must be completed online. Once it has been submitted a member of Chemical and Laboratory Safety will contact you to assist in getting your laboratory open in a safe and regulatory compliant manner.

For new PIs or current PIs opening a new lab within UGA:

A. Any chemicals being transferred into the new lab must be in usable condition.

B. Do not transfer chemical waste from one room to another. If chemical waste is found in the new lab, please have it picked up through the hazardous materials program (706-369-5706).

C. All new chemicals are purchased through [UGA Central Research Stores (CRS)](#).

D. You and your staff should complete all appropriate training.

E. To transfer chemicals into the new lab, utilize the chemical inventory system within [Chematix](#).

F. Print and read UGA’s [Chemical and Laboratory Safety Manual](#).

G. Acquire and correctly fill in a laboratory entrance caution sign. You can obtain this and any other sign you might need through ORS 706-542-5288. See Appendix D for details on filling out a lab caution sign.

H. Chemical and Laboratory Safety (CLS) is the lead department in assisting personnel in lab openings, if you have any questions, please contact CLS at 706-542-5288

III. Laboratory Close-out or Relocation

This information is intended to guide principal investigators, department heads, unit heads, and lab contacts when operations within a lab are scheduled to be discontinued or relocated. Please read and follow all instructions below. Once the [Close-out or Relocation Lab Request Form](#) has been completed, please click “Submit.” A member of Chemical and Laboratory Safety will contact you to schedule a close-out survey.

A. Submit this form 60 days prior to the desired date of lab closure.

B. Refrigerators, freezers, and cold rooms should be emptied and decontaminated.

C. Remove gas cylinder connections, replace valve stem covers, and make arrangements to return gas cylinders to the supplier. Call Chemical and Lab Safety (706-542-5288) for guidance if the supplier will not accept them.

Appendix K-3
D. Do not transfer chemical waste from one room to another. Have all chemical waste picked up through the hazardous materials program (706-369-5706) prior to vacating a lab.

E. Never dispose of hazardous materials by sink or trash receptacles.

F. If there are chemicals that are still usable and another lab is willing to accept them, use Chematix to transfer them to the lab(s) that have agreed to accept them. Otherwise, use Chematix to create waste cards for all chemicals and submit a waste pickup request. For large quantities of chemical containers (75+), call the Hazardous Materials Group at (706) 369-5706 for assistance before creating waste cards in Chematix. For Chematix assistance, call 706-542-5801.

G. Place all needles, scalpels, etc. into sharps boxes for disposal.

H. All shared lab areas must be cleared by the departing PI and staff or another PI must assume responsibility for the entire space and contents. This includes labs, freezers, cold rooms, dark rooms, autoclave rooms, storage areas, etc.

I. Chemical and Laboratory Safety (CLS) is the lead department in assisting personnel in lab close-outs and relocations, if you have any questions, please contact CLS at (706) 542-5288.