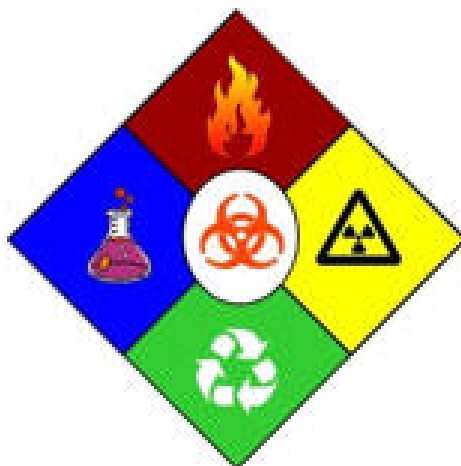




# *Chemical and Laboratory Safety Guide*



**Chemical Safety Guidelines for the Use of Chemicals**

**Environmental Health & Safety Division**

1405 Goss Lane, CI 1001  
Augusta, Georgia 30912

Revised: May 2017



## STATEMENT OF AUTHORITY

Upon publication of Augusta University Chemical Safety Guide the Institution Chemical Safety Committee (ICC) of Augusta University is hereby authorized to act as agent for Augusta University in matters of review, control, and mediation arising from the use or proposed use of chemicals at Augusta University.

Furthermore, it is hereby declared that the ICC derives its authority directly from the Office of the President of Augusta University in all matters involving chemical safety and/or violations of accepted practice described herein. The Chairman, or Acting Chairman, of the ICC is hereby granted the authority to immediately suspend a Principal Investigator's (PIs) or a Faculty member's authorization to use chemicals in Augusta University Laboratories, as well as temporarily suspend any project or protocol which is found to be a threat to health, safety, or property until such time that the issue may be resolved by appropriate management personnel.

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President, Augusta University

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Date

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# CHAPTER ONE

## AUGUSTA UNIVERSITY CHEMICAL AND LABORATORY SAFETY PROGRAM

### I. INTRODUCTION

The mission of Augusta University, Environmental Health and Safety Division's (EHS) Chemical Safety Office (CSO) is to provide environmental stewardship and chemical safety services to staff, students, patients, and visitors.

The purpose of the Augusta University Chemical Safety Guide (CSG) is to establish a written program that provides for and supports the procedures, equipment, and work practices for protecting personnel from the potential hazards of chemicals in their work areas, and for the protection of institutional property and the environment.

The CSG is designed to comply with the regulations of the U.S. Environmental Protection Agency (EPA), the U.S. Department of Transportation (DOT), the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA), Augusta/Richmond County Emergency Management Agency (EMA), James B. Messerly Waste Water Treatment Plant, Publicly Owned Treatment Works (POTW), and the rules and regulations of the state of Georgia. Additionally, the CSG is designed to serve as a technical reference, information resource, and training resource for all chemical users at Augusta University.

The Augusta University Institutional Chemical Safety Committee (ICC) authorizes faculty and Principal Investigators (PIs) to use chemicals through submission, review, and approval of the [Application for use of Chemicals in Laboratories](#) and the [Application for use of High Hazard Chemicals](#).

This manual summarizes the terms of the Chemical Safety Program and the regulations most applicable to campus employees and students who use or may be exposed to chemicals during the course of their employment. Special precautions, regulatory summaries, and other operating procedures are specified by the ICC, EHS and the CSO through Institutional Policies and Procedures and Standard Operating Procedures as provided.

**The CSG does not cover work with radioactive materials or biological agents. Procedures for work with these materials are addressed by the Radiation Safety Office and Biosafety Office respectively.**



## **II. RESPONSIBILITIES**

The Chemical and Laboratory Safety Guide provides technical guidance to personnel at all levels of responsibility on matters pertaining to the handling, use, storage, and disposal of hazardous chemicals.

Specifically, responsibilities are as follows:

### **A. THE INSTITUTIONAL CHEMICAL COMMITTEE**

The Institutional Chemical Committee (ICC) is responsible for recommending protocols in research and education conforming with the proper guidelines and regulations associated with the handling of toxic/hazardous chemicals, and to provide assurance that activities at Augusta University do not present unacceptable risks to health and safety of faculty, staff, students, patients, or visitors, unacceptable contamination of the environment, or unacceptable damage to institutional property and equipment. The ICC functions to: 1) review and approval all grant applications for animal and non-human use of hazardous chemicals; 2) to recommend and promote the adoption and implementation of programs related to chemicals hazards; 3) to recommend and promote the adoption of policies and procedures related to personnel safety, equipment, operations, and educational programs designated to promote safety awareness and safe practices at Augusta University. Committee recommendations are forwarded in writing to the Vice President for Research for necessary action.

### **B. ENVIRONMENTAL HEALTH AND SAFETY (EHS) DIVISION**

The Associate Vice President of the EHS Division oversees the operations and activities of the CSO and supervises the Chemical Safety Officer. Other departments within the EHS Division support the Chemical Safety Guide by providing technical guidance and resources, management oversight, services, and/or support at all levels of responsibility on matters pertaining to, use, storage, and disposal of hazardous materials, and for hazardous materials spill/release response.

### **C. CHEMICAL SAFETY OFFICE (CSO)**

The CSO encompasses the personnel and resource facilities necessary for the Chemical Safety Program. The CSO provides services that include, but are not limited to, access to Safety Data Sheets (SDS), hazardous waste disposal, chemical tracking systems, laboratory safety assistance visits (audits) and chemical safety reviews, hazard communication and right to know resources, consultation services, ICC representation, emergency spill response, and outside agency liaison services and support. The CSO compiles and distributes all reports and documentation as required under the Georgia Environmental Protection Division (EPD), the Federal Environmental Protection Agency (EPA), the Georgia Department of Transportation (DOT) Hazardous Materials Division, the Georgia Department of Labor (DOL), and the Board of Regents of the University of Georgia's Environmental Health & Safety Office.

#### **D. CHEMICAL SAFETY OFFICER**

The Chemical Safety Officer, who also serves as the Institutional Hazard Communication Right-to-Know Coordinator (RTK Coordinator) is responsible for chemical safety and protection, and hazardous communication, right-to-know activities and training on the Augusta University campus. Under the direct supervision of the Associate Vice President of the EHS Division, the Chemical Safety Officer is responsible for administering and overseeing institutional implementation of the safety protocols and procedures as described in this guide.

Specifically, the Chemical Safety Officer is responsible for:

1. Performing workplace hazard assessments upon request;
2. Assisting PIs and Supervisors in the selection of appropriate safety control requirements including standard operating procedures, engineering controls, personal protection equipment, and training;
3. Providing management oversight or assistance for compliance to chemical safety programs such as chemical inventory, chemical & laboratory safety, chemical exchange, and hazardous waste management;
4. Providing technical consultation and investigation, as appropriate, for workplace accidents or injuries as a result of chemical incidents or spills;
5. Reviewing plans for installation of engineering controls and new laboratory construction/renovation, as requested;
6. Assisting in determining medical surveillance requirement for laboratory personnel and other employees and students working with hazardous chemicals, and
7. Reviewing and evaluating the effectiveness of the Chemical Safety Guide at least annually and updating it as appropriate.

#### **E. PRINCIPAL INVESTIGATORS, DIRECTOR/CHAIRS, AND SUPERVISORS**

The Principal Investigator is a staff, faculty member or other individual who has supervision or authority over a laboratory where hazardous chemicals are used or stored. Most commonly, the PI will be a principal investigator for a research project involving the use of hazardous or highly hazardous chemicals which has been approved through the ICC. Other examples of a PI include staff or faculty members who serve as the Director/Chair or Supervisor in laboratories where chemicals are used for services, support, or educational purposes.

Directors/Chairs, Supervisors, or other individuals may also be faculty or staff members who have authority over employees and/or students and areas where hazardous chemicals are used or stored, such as facilities maintenance shops, grounds maintenance shops, and other areas that provide institutional services and support.

PIs, Directors/Chairs, Supervisors, and other such individuals having authority over employees and/or students and areas where hazardous chemicals are used or stored, also have responsibility for the health and safety of personnel in areas under their authority. These individuals may delegate safety duties to other members of their staff, such as Section Supervisors, but must make sure that any delegated safety duties are carried out in accordance with institutional policies and procedures.

The PI, Faculty member, Director/Chair, and Supervisor responsibilities include:

1. Identifying hazardous conditions or operations in the lab or work area;
2. Determining safe procedures and controls;
3. Implementing and enforcing standard safety procedures;
4. Consulting with the Institutional Chemical Committee (ICC) and the Chemical Safety Officer (CSO) prior to the use of any restricted or higher risk chemicals, such as chemicals that are highly reactive, potentially explosive, acutely or highly toxic, or a severe environmental hazard;
5. Consulting with the ICC and the CSO prior to conducting any higher risk experimental procedures so that special safety precautions may be taken;
6. Maintaining the on-line chemical inventory for their laboratories and work areas;
7. Providing laboratory or work area personnel with access to the CSG and any other Institutional Safety Plans;
8. Training laboratory personnel he/she supervises to work safely with hazardous chemicals and operations, including informing personnel of the location and availability of Hazard Information as described in this CSG;
9. Ensuring that all employee and/or students are provided with the appropriate personal protection equipment (e.g., lab coats, gloves, eye protection);
10. Promptly reporting work area accidents, near misses, and injuries to EHS, and
11. Informing facilities personnel, non-laboratory workers, any outside contractors, and other institutional employees who are not familiar with the areas of the potential hazards of their laboratory/workplace when they are required to work in the environment. Identified hazards should be minimized to provide a safe environment for repairs and renovations.

#### **F. DEPARTMENT or LABORATORY MANAGER**

Managers are individuals who coordinate for recruitment of faculty and staff, serve as liaison between Building Coordinators, Administrators, Finance and Grants, and Department Chairs and Directors to support business operations, chemical purchases, employee work assignments, and/or laboratory openings, closings, relocations, staffing, or any other activities for areas where hazardous chemicals are used or stored. Managers generally have direct knowledge of when activities affecting chemical and laboratory safety and regulatory compliance issues will occur.

As such, Managers shall be responsible for:

1. Advising their employees and/or students of any operations occurring in their work areas where hazardous materials are present;
2. Notifying the CSO when opening new laboratories and when new PIs are incoming;
3. Notifying the CSO of any laboratory moves, transfers, or closings at least thirty (30) days prior to when the event is scheduled to occur;
4. Notifying the CSO when laboratory workers are hired, retiring, relocating, or resigning, and
5. Establishing a system of controls of areas containing hazardous materials and personnel accessing those areas to include, but not limited to, vendors, maintenance, guests, and anyone else that may not be aware of the hazards contained therein.

## **G. AUGUSTA UNIVERSITY EMPLOYEES & STUDENTS**

All Augusta University employees and students who handle or may be exposed to hazardous chemicals during the course of their employment are required to comply with the standards and procedures as directed in this safety guide and all other institutional policies and procedures provided for chemical and laboratory safety. This includes laboratories and work areas that use off-the-shelf hazardous chemicals.

All personnel who work with hazardous chemicals in laboratories or other areas of campus are responsible for:

1. Following the CSG and any other Institutional Safety Plans;
2. Following oral and written safety rules, regulations, and standard operating procedures required for the tasks assigned;
3. Keeping their work areas safe and uncluttered;
4. Reviewing and understanding the hazardous materials and processes in their area prior to conducting work;
5. Using appropriate measures to control identified hazards, including consistent and proper use of engineering controls, administrative controls, and personal protective equipment;
6. Understanding the capabilities and limitations of personal protective equipment issued to them;
7. Maintaining their assigned personal protection equipment so that it provides its intended level of protection;
8. Gaining prior approval from the PI/ Supervisor for the use of restricted chemicals;
9. Consulting with PI/Laboratory Supervisors before using certain higher risk chemicals, such as particularly hazardous chemicals or highly reactive chemicals, or when conducting certain higher risk experimental procedures;
10. Promptly reporting accidents and unsafe conditions to the PI/Laboratory Supervisor;
11. Completing all required health, safety and environmental training;

12. Participating in the medical surveillance program, when required, and
13. Informing the PI/ Laboratory Supervisor of any work modifications ordered by a physician as a result of medical surveillance, an occupational injury or exposure.

## **H. CONTRACTORS AND SUBCONTRACTORS**

Contractors and subcontractors performing work at Augusta University could potentially expose employees, students, and visitors, to hazardous chemicals that are brought on campus.

Facilities Management shall ensure that the following information is either provided or made available to contractors and subcontractors:

1. Augusta University safety policies and procedures;
2. Identification of hazardous materials in which they may be exposed to while on the job, and
3. Safety Data Sheets (SDSs) for all chemicals in their work area.

It is the responsibility of Facilities Management staff that negotiates contract work to ensure the provisions identified above are included in such contracts. They must also provide contractors with information regarding the on-site hazards and SDSs, where applicable, to which their workers may be exposed prior to the contractors commencing work at Augusta University. SDSs may be obtained for all hazardous chemicals on site at Augusta University through the CSO website.

It is the responsibility of Facilities Management to identify and obtain SDSs for the chemicals that contractors may bring into Augusta University workplaces and to provide them to EHS prior to the contractor commencing work at Augusta University. EHS shall maintain copies of the SDSs for the duration of work where hazardous chemicals are used by contractors.

Renovation/construction contracts with Augusta University require the contractors to comply with various Augusta University procedures. These requirements are outlined in the Augusta University Guidelines for Contractors and Vendors.

The independent contractors and/or subcontractors shall ensure that their employees are provided with information and training on hazardous materials being used and stored by them at Augusta University.

Facilities Management shall be notified by the contractor at least 30 days prior to the commencement of scheduled work that will involve the use and storage of any hazardous chemicals at Augusta University. The 30 days advance notification may be waived in case of any emergency, but all other provisions stated above shall be in effect.

The independent contractors or subcontractors shall not commence work if they have not complied with the above requirements.

Contractors who introduce hazardous chemicals into the workplace shall include a

statement in all bids, agreements, contracts, or other instrument to the effect that such contractor shall be responsible for compliance to provide their employees the following information:

1. Identification of hazardous chemicals in which they may be exposed to while on the job site and procedures for obtaining an SDS;
2. Instructions on handling, emergency procedures, and disposal prior to introducing such hazardous chemicals into the workplace, and
3. Precautions employees may take to lessen the possibility of exposure by using appropriate protective measures, and an explanation of the labeling systems used.

Contractors shall ensure compliance with all applicable OSHA standards for the duration of the time that work is performed at Augusta University.

Contractors shall properly dispose of all hazardous waste generated by their operations.

EHS or Public Safety Division has the right to suspend the work of any contractor or subcontractor if a complaint is received from any Augusta University employee as a result of not complying with the provisions stated above. Any such delay shall be at the expense of the contractor or subcontractor.

## CHAPTER TWO

### AUTHORIZATION AND PROCUREMENT

#### I. AUTHORIZATION STANDARDS FOR LABORATORIES

To obtain authorization to procure and use hazardous chemicals or highly hazardous chemicals in laboratories, the PI is required to complete an ICC “[Application for use of Hazardous Chemicals in Laboratories](#)” and/or an “[Application for Use of High Hazard Chemicals in Laboratories](#),” and forward it to the Chemical Safety Officer for review and approval. Upon completion of the review and approval, the Chemical Safety Officer forwards the application(s) to the Institutional Chemical Committee for review and approval. PIs are notified in writing of their approval to use hazardous chemicals or highly hazardous chemicals and their assigned ICC approval number for use in purchasing supplies and equipment through Grants and Contracts funding.

#### II. AUTHORIZATION STANDARDS FOR NON-LABORATORY AREAS

While departments or divisions using hazardous or regulated chemicals, as a process of providing educational or support services, are not required to submit an application for authorization to the ICC for use of hazardous or highly hazardous chemicals on campus, they are bound by all applicable regulatory standards, and institutional policies and procedures supporting safety, protection of employees and/or students, and protection of institutional property and the environment as outlined in this guide. Prior to the purchase of any extremely hazardous or highly toxic chemical for use on campus, consultation with the CSO is required.

#### III. PROCUREMENT STANDARDS

It is expected that all departments and divisions purchasing hazardous chemicals, including those providing research, clinical, educational, and support services, shall seek the least hazardous materials for use and purchase only what is necessary to complete the task. This is done in an effort to minimize the risks to employees and students, and to comply with the regulatory requirements for pollution control and minimization of hazardous waste generated by the institution.

The purchase of all highly hazardous chemicals, chemotherapeutic drugs, and DEA regulated drugs shall be purchased through purchase orders. P-cards may not be used for purchasing hazardous chemicals. Non-hazardous chemicals and laboratory supplies may be purchased using a P-card.

## CHAPTER THREE

### FACILITIES & LABORATORIES EVALUATIONS, MONITORING & REVIEWS

#### I. FACILITIES & LABORATORIES ASSESSMENTS & EVALUATIONS

CSO staff members are available to perform on-site risk assessments, evaluate unique situations and resources, and provide recommendations to individual facilities and labs so they may achieve regulatory compliance and ensure worker safety.

#### II. COMPLIANCE STANDARDS

All faculty and students shall comply with the regulatory and institutional safety and health standards provided in this guide, and all other institutional programs, policies, and standard operating procedures that support chemical and laboratory safety, health, and the protection of the environment.

The Augusta University Institutional policy for Correction of Safety Hazards is available at: <https://augusta.policytech.com/dotNet/documents/?docid=572&mode=view>

#### III. SECURITY OF CAMPUS LABORATORIES, CHEMICALS, BIOLOGICALS AND RADIOLOGICAL MATERIALS

Laboratories must be locked when not in use to prevent inadvertent exposure of untrained personnel to laboratory hazards and to maintain security of chemicals and other hazardous materials. Principal Investigators and Faculty members must ensure that students and lab workers understand laboratory security requirements and are appropriately supervised when using laboratory facilities. Contact the Chemical Safety Office at (706) 721-2663 for advice and guidance regarding hazardous material security.

#### IV. MONITORING & REVIEWS

Laboratory safety assistance visits and regulatory reviews are conducted by CSO staff members as directed by the Chemical Safety Officer to assess laboratory practices and assist PIs and laboratory workers in correcting safety hazards and areas of regulatory non-compliance. Assistance visits are also performed when significant changes in hazards occur in a facility or laboratory space. Regulatory reviews, assistance visit checklists, and self-inspection guides are provided on-line at: <http://www.augusta.edu/services/ehs/chemsafe/clsprog.php>

#### V. VACATING/RELOCATING LABORATORIES

Department managers shall notify the CSO of any expected laboratory relocations, closings, and openings in sufficient time to manage the transfer, relocation, or disposal of hazardous chemicals.



A PI or a Faculty member is required to contact the CSO at least thirty (30) days in advance of a relocation, closing, or transfer of laboratory space and chemicals to arrange a site visit and to ensure the management of their chemicals and hazardous waste is done in accordance with regulatory requirements and institutional policies and procedures.

CSO staff members shall provide technical support and resources as directed by the Chemical Safety Officer for relocations, closings, openings, and transfer of laboratory space and hazardous chemicals.

## **VI. OFF CAMPUS TRANSFERS OF CHEMICALS AND EQUIPMENT**

When a laboratory closing or relocation involves the transport of chemicals to an off campus location, the PI Faculty member must arrange for the lab packing, labeling, and transport of all associated chemicals by a company authorized and permitted to provide these services.

It is the ultimate responsibility of the PI to ensure any equipment in the laboratory which could have been contaminated with hazardous materials is cleared and cleaned of all hazardous materials and contamination prior to transfer, surplus or disposal.

Hazardous chemicals being transferred off campus must be packaged by personnel registered with the Environmental Protection Agency (EPA) and transported by a transporter with a Department of Transportation (DOT) Commercial Driver's License (CDL) with a Hazardous Materials Endorsement as a Hazardous Materials Transporter. General household movers may not pack or transport hazardous chemicals.

Any equipment in the laboratory which will be transported off campus as a result of laboratory closings or relocation must be secured so as to prevent the possibility of spills, leaks, or discharge of hazardous chemicals in the process of the transport.

It is the ultimate responsibility of the PI or member of the Faculty to ensure that the equipment is properly secured for transport.

Chemical Safety will provide technical oversight and consultation for the surplus or off campus transport of laboratory equipment.

PIs are required to follow Laboratory Clearance Procedures for closing Augusta University laboratories or off campus relocation of laboratories. CSO shall provide oversight for all chemicals being transported off campus.

Laboratory Clearance Procedures and the Augusta University Laboratory Clearance form are provided on the following web page:

<http://www.augusta.edu/services/ehs/chemsafe/labchanges.php>



## CHAPTER FOUR

### HAZARD COMMUNICATION & RIGHT-TO-KNOW

#### I. WRITTEN HAZARD COMMUNICATION PLAN

In order to comply with the Georgia Public Employees Hazardous Chemical Protection and Right-to-Know (RTK) Act of 1988 as amended, and the Georgia Department of Labor, Chapter 300-3-19 Public Employee Hazardous Chemical Protection and Right-to-Know Rules, a written Hazardous Chemical Protection Communication Plan has been developed for Augusta University.

The written Hazard Communication Plan is available in APPENDIX B of this Guide and through the Institutional Right-to-Know Coordinator, who is located in Building CI at 1405 Goss Lane, Augusta, GA. Phone 706-721-2663, or on the web at: <https://augusta.policytech.com/dotNet/documents/?docid=576&mode=view>

#### II. INSTITUTIONAL HAZARD COMMUNICATION RIGHT-TO-KNOW COORDINATOR

The Chemical Safety Officer also serves as the Institutional Hazard Communication Right-to-Know Coordinator (RTK Coordinator). The RTK Coordinator shall:

- A. Act as liaison between the University System of Georgia's Right-To-Know Coordinator and Augusta University on hazardous chemical issues;
- B. Resolve questions regarding applicability of Hazard Communication Right-To-Know requirements for work places and work areas;
- C. Ensure that the Hazard Communication Right-To-Know poster is appropriately displayed in all work areas;
- D. Ensure that appropriate training is provided to all Augusta University employees and students;
- E. Ensure that a written Hazard Communication & Right-To-Know Program is developed for Augusta University. This program will include a list of hazardous chemicals used, stored, or manufactured in the particular work place, and will be available to all employees and/or students in the work place, and shall include a program for collection, maintenance, and distribution of SDSs;
- F. Ensure employees and/or students have access to current SDSs for those hazardous chemicals used in their work area, and
- G. Under direction of the Associate Vice President of EHS, provide management oversight and assistance for compliance to the Hazard Communication & Right-To-Know program.

The Augusta University RTK Coordinator shall supply to the University System RTK Coordinator a list of all hazardous chemicals or products present at Augusta University in January and July of each year. This list shall include, but may not be limited to, all

chemicals labeled as flammable, explosive, combustible, corrosive, reactive, oxidizing, toxic, poisonous, water reactive, pyrophoric, and/or organic peroxide.

The Augusta University Chemical Safety Officer/RTK Coordinator can be reached at 706-721-2663 or 706-721-2591.

### III. **SAFETY DATA SHEETS (SDS) MANAGEMENT PROGRAM**

A central file of Safety Data Sheets (SDSs) is maintained by the CSO (706-721-2663). Quick reference information and web search applications are provided electronically through the Chemical Inventory Database in EHS. Access to the Chemical Inventory Database is available via the Augusta University Intranet.

Additional access to SDS information is also available through Internet links on the EHS web page at: <http://www.augusta.edu/services/ehs/chemsafe/msdlinks.php>

Instruction on how to read a SDS is provided by the CSO and in the APPENDIX P of this Guide.

### IV. **HAZARDS COMMUNICATION & RIGHT-TO-KNOW TRAINING**

The Augusta University RTK Coordinator shall be responsible for providing and coordinating Basic and General Information Right-to-Know training to all employees and/or students. This shall be accomplished at orientation, with annual refreshers thereafter. Chemical Specific, On-the-Job, and Operational Training should be accomplished through the direct supervisor, PI, or Departmental Manager. However, if these individuals are unable to provide appropriate training, the responsibility shall reside with the RTK Coordinator as stipulated by state law.

All training must be documented to include:

- A. Course Title (Title of video, or title of printed material)
- B. Name of Instructor (or producer of video or printed material)
- C. Agenda with a brief outline of the context
- D. Date and time of training
- E. Location
- F. Name of Trainee, signature of the Trainee and date signed

Training programs must demonstrate comprehension and usability on the part of each employee receiving the training.

Board of Regents training in Basic Awareness Right to Know, Chemical Specific Right-To-Know, Hazardous Waste Awareness and Bloodborne Pathogens is provided on-line at: <http://www.augusta.edu/services/ehs/chemsafe/rtktraining.php>

**Georgia Department of Labor Right to Know Poster:** required to be posted in all laboratories, chemical areas, and where safety information is displayed. All Employees and or students should read this poster and become aware of their rights.

**AUGUSTA UNIVERSITY Emergency Response Flip Chart:** PI/Supervisors shall ensure that laboratory workers under their supervision are familiar with the Augusta University Emergency Response Flip Chart and that they are familiar with emergency procedures and know how to use emergency equipment.

For more information about Hazard Communication Right-to-Know training, go to APPENDIX B of this Guide, or contact the RTK Coordinator at 706-721-2663.

# CHAPTER FIVE

## INSTITUTIONAL HAZARD WARNING SYSTEMS

### I. SIGNS, LABELS, & PLACARDING SYSTEMS

The communication of chemical hazards at Augusta University is accomplished through signs, labeling, placarding systems, and other information and training resources such as Safety Data Sheets.

#### A. Hazard Placards

1. Augusta University Hazard Placards are approved by the Georgia State Fire Marshal's Office, and are placed outside of the entry into every laboratory and chemical storage area on the Augusta University campus.
2. Hazard Placards are posted for two purposes: 1) to alert the Augusta/Richmond County Fire Department and/or Emergency Responders of the hazards present in the room in the event of a fire or other emergency, and 2) to let employees, students, and visitors know which areas have restricted access requiring that they be accompanied by authorized personnel, as well as to inform them of the hazards associated with the materials in that area.
3. The design of the placard is based upon the National Fire Protection Association hazard systems including the NFPA 704 Diamond with health, fire, reactivity rating, and special hazard warnings. Additional symbols may also be included to convey specific notices or warnings about the hazards of the other materials used or stored in the room.
4. In addition to the warnings and notices, the Hazard Placard contains the names and phone numbers of those individuals to be contacted in the event of an emergency. The minimum PPE required for working in the room and the emergency response phone number for the CSO are also included on the Hazard Placard. For multipurpose lab rooms, PPE may vary considerably depending on the class present and the experiment being performed. In this situation, use the proper PPE accordingly.



5. Hazard Placards are produced and maintained by the CSO Staff Members using information provided in the EHS Chemical Inventory Database.
6. Hazard Placards are an institutional requirement for all laboratories and chemical storage areas. All referrals for areas in need of new or updated placards shall be directed to the CSO at 706-721-2663.

**B. Container Labeling**

1. Labels are required for all primary and secondary containers of hazardous materials and all hazardous chemical waste containers.
2. Primary containers are the original containers received from the manufacturer, distributor, or importer.
3. Secondary containers are cans, squeeze bottles and other vessels to which hazardous materials have been transferred by an employee.



OSHA Selection for Pictograms

4. Labels on primary and secondary containers must be in compliance with OSHA 29 CFR 1910.1200 Hazard Communication Standards and the Global Harmonization Standards (GHS) effective May 25, 2012, and the Georgia Public Employees Hazard Communication and Chemical Protection rules and regulations.
5. Specific requirements and details for labeling of primary and secondary chemical containers are provided under APPENDIX B of this guide.

Hazard Symbol	Name	Requirements
	Health Hazard	• Flammable Gases, Liquids and Solids • Flammable Aerosols • Oxidizing Gases, Liquids and Solids • Oxidizing Aerosols • Corrosive Liquids • Corrosive Solids • Acute Toxicity (Oral, Dermal, Inhalation) • Skin Sensitization • Serious Eye Irritation • Skin Irritation • Specific Target Organ Toxicity (Single and Multiple Exposure) • Aspiration Hazard • Hazardous to Aquatic Life (Acute) • Hazardous to Aquatic Life (Chronic)
	Flammable	• Flammable Gases, Liquids and Solids • Flammable Aerosols • Oxidizing Gases, Liquids and Solids • Oxidizing Aerosols • Corrosive Liquids • Corrosive Solids • Acute Toxicity (Oral, Dermal, Inhalation) • Skin Sensitization • Serious Eye Irritation • Skin Irritation • Specific Target Organ Toxicity (Single and Multiple Exposure) • Aspiration Hazard • Hazardous to Aquatic Life (Acute) • Hazardous to Aquatic Life (Chronic)
	Environment	• Flammable Gases, Liquids and Solids • Flammable Aerosols • Oxidizing Gases, Liquids and Solids • Oxidizing Aerosols • Corrosive Liquids • Corrosive Solids • Acute Toxicity (Oral, Dermal, Inhalation) • Skin Sensitization • Serious Eye Irritation • Skin Irritation • Specific Target Organ Toxicity (Single and Multiple Exposure) • Aspiration Hazard • Hazardous to Aquatic Life (Acute) • Hazardous to Aquatic Life (Chronic)
	Corrosive	• Flammable Gases, Liquids and Solids • Flammable Aerosols • Oxidizing Gases, Liquids and Solids • Oxidizing Aerosols • Corrosive Liquids • Corrosive Solids • Acute Toxicity (Oral, Dermal, Inhalation) • Skin Sensitization • Serious Eye Irritation • Skin Irritation • Specific Target Organ Toxicity (Single and Multiple Exposure) • Aspiration Hazard • Hazardous to Aquatic Life (Acute) • Hazardous to Aquatic Life (Chronic)
	Oxidizing	• Flammable Gases, Liquids and Solids • Flammable Aerosols • Oxidizing Gases, Liquids and Solids • Oxidizing Aerosols • Corrosive Liquids • Corrosive Solids • Acute Toxicity (Oral, Dermal, Inhalation) • Skin Sensitization • Serious Eye Irritation • Skin Irritation • Specific Target Organ Toxicity (Single and Multiple Exposure) • Aspiration Hazard • Hazardous to Aquatic Life (Acute) • Hazardous to Aquatic Life (Chronic)
	Explosive	• Flammable Gases, Liquids and Solids • Flammable Aerosols • Oxidizing Gases, Liquids and Solids • Oxidizing Aerosols • Corrosive Liquids • Corrosive Solids • Acute Toxicity (Oral, Dermal, Inhalation) • Skin Sensitization • Serious Eye Irritation • Skin Irritation • Specific Target Organ Toxicity (Single and Multiple Exposure) • Aspiration Hazard • Hazardous to Aquatic Life (Acute) • Hazardous to Aquatic Life (Chronic)

6. Hazardous waste containers must be in compliance with the EPA Resource Conservation and Recovery Act of 1970 (RCRA). Hazardous waste containers are containers into which hazardous chemical waste is collected from a chemical process or procedure that will be disposed of through the CSO when the container is full. It can also be a chemical in the original manufacturer's container or a secondary container of stock/working solution that is no longer needed by the laboratory that will be processed for disposal through the Hazardous Waste Management Program.

7. Specific requirements and details for labeling of hazardous chemical waste containers and the Augusta University Hazardous Waste Management Program can be found under APPENDIX D of this Guide.
8. Specific requirements and details for the labeling of exchange chemicals and the Chemical Exchange Program can be found under APPENDIX E.
9. Chemical containers and outside shipping packages must be in compliance with the DOT standards for packaging and labeling. Consult with the CSO for shipping hazardous chemicals.
10. A Hazard Label is required to be affixed to any surface (other than the bottom) of a package or containment device that contains a hazardous material. A Hazard Placard, which is required to be larger than the Label, must be affixed to every side of the bulk package, freight container, or transport vehicle that contains any quantity of a hazardous material.
11. When shipping containers of hazardous chemicals, the shipper is responsible for ensuring that:
  - a. The inner containers are marked with the same information provided by the manufacturer of the chemical, and
  - b. The outer packaging containers must be marked with the appropriate DOT information and labeling.



DOT Selection for Placards





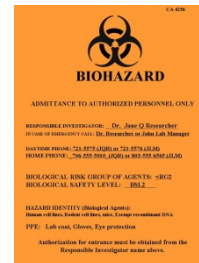
The CSO provides technical information and guidance on the packaging and labeling requirements of hazardous chemicals for shipment.

### C. Other Signs, Symbols, & Warnings

1. Caution signs must be used at the entrance to maintenance shops and service areas where hazardous materials are present or hazardous operations are conducted so that non-routine workers and visitors to the area may be aware of the potential hazards that are present. A caution sign may include the hazard types in the work area or may simply contain the work caution indicating the area is restricted and extra precautions are required, or an escort is required for entrance into the area.



2. A Biohazard Placard must also be posted at the entrances to laboratory areas to indicate there are specific biological hazards present in the room. Biohazard Placards indicate that access is restricted and contact names are provided for an escort to enter the room, or to be able to gather information from, in the event of an emergency.



3. Other signs are often used for identifying the location of safety showers, eyewash stations, other safety and first aid equipment, emergency exits, or other equipment where special or unusual hazards exist.
4. Laboratory managers, PIs and Faculty members are responsible for ensuring that work areas and entrances are appropriately posted.
5. CSO personnel and maintenance personnel may enter rooms on campus periodically during the course of their duties. Some investigators conduct experiments that must not be disturbed or use techniques that may be harmful to individuals who are not apprised of the danger. When such experiments are being conducted, appropriate warning signs such as DO NOT ENTER - EXPERIMENT IN PROGRESS or DO NOT ENTER - LASER IN USE, etc., should be clearly displayed on all entrances.
6. All employees and/or students should be aware of the signs, symbols, warnings and other posting in their work areas and should know the appropriate response to such warnings. When entering areas that are not a part of the employee's common work area, the presence of warning signs

indicates the area has restricted access and should not be entered without authorized personnel present. The appropriate response is to contact the individual listed on the Hazard Placard for an escort to enter, or to contact the supervisor for entrance instructions.

# CHAPTER SIX

## CHEMICAL SAFETY & PROTECTION PRINCIPLES

### I. TYPES OF CHEMICAL HAZARDS

#### A. Flammable and Combustible Liquids

Flammable liquids are typically the most common hazardous material found in a laboratory at Augusta University. The propensity to vaporize, ignite, burn or explode varies with the specific type or class of substance. Flammable and combustible liquids are separated into the following classes according to the National Fire Protection Association (NFPA):

<b>Class 1A (Highly Flammable)</b>	Flash Point <73°F (22.8°C) Boiling Point <100°F (37.8°C)	Ex: Ethyl ether, Dimethyl sulfide, Petroleum ether
<b>Class 1B Flammable</b>	Flash Point <73°F (22.8°C) Boiling Point ≥100°F (37.8°C)	Ex: Acetone, Toluene, Ethanol, Ethyl acetate, Hexane, Gasoline
<b>Class 1C Flammable</b>	Flash Point ≥73°F (22.8°C) Boiling Point <100°F (37.8°C)	Ex: Amyl acetate, Bromopentane, Butyric acid, Hexene, Xylene
<b>Class II Combustible</b>	Flash Point ≥100°F (37.8°C) & <140°F (60°C)	Ex: Acetic acid, Cumene, Formaldehyde
<b>Class IIIA Combustible</b>	Flash Point ≥140°F (60°C) & <200°F (93.4°C)	Ex: Benzaldehyde, Ethanolamine, Nitrobenzene

The NFPA has set limits for the storage of flammable liquids:

**TABLE 1**

#### **Flammable Liquids - Maximum Size of Containers**

Container Type	Class 1A <sup>1</sup> Liquids	Class 1B <sup>2</sup> Liquids	Class 1C <sup>3</sup> Liquids
Glass <sup>4</sup>	1 pt	1 qt	1 gal
Approved Metal or Plastic	1 gal	5 gal	5 gal
Safety Cans	2 gal	5 gal	5 gal
Metal Drums (ICC Spec)	60 gal	60 gal	60 gal

<sup>1</sup>Class 1A - Flash Point below 73°F. Boiling Point below 100°F.

<sup>2</sup>Class 1B - Flash Point below 73°F. Boiling Point at or below 100°F.

<sup>3</sup>Class 1C - Flash Point at or above 73°F. Boiling Point below 100°F.

<sup>4</sup>Exceptions may be made to this regulation, upon application to DEHS for storage of Class 1A and 1B liquids in glass containers not to exceed 1 gallon.

Institutional policies for the storage of flammable and combustible liquids can be found in the Augusta University Policy Library in the [Flammable and Combustible Liquids Policy](#).

Additional Information about flammable combustible liquids can be found in APPENDIX G of this Guide.

## **B. Poison/Toxic Substances**

A Toxic Substance is any poisonous material, other than a gas, that is known to cause death, injury, or harm to human health if swallowed, inhaled, ingested, or absorbed through the skin. Toxicity is the capability of a chemical to produce injury. Almost any substance can be toxic when taken in doses exceeding “tolerable” limits.

Before initiating work with a chemical substance, the researcher or laboratory worker should be familiar with the types of toxicity, the toxic dose, and the hazards of the chemical. It is also important to realize that two or more substances may act synergistically to produce a toxic effect greater than that of either substance alone. Furthermore, chemical reactions involving two or more substances may form products significantly more toxic than the starting materials. Therefore, the entire experimental procedure should be evaluated.

The CSO is available to help researchers plan experiments and protocols with toxic materials. The SDS should be reviewed to determine if any special neutralizing agents should be on hand to decontaminate areas, or if any emergency vaccines are necessary to treat exposure.

TABLE 4

COMBINED TABULATION OF TOXICITY CLASSES

Commonly Used Term	LD50 Single Oral Dose for Rats (g/kg)	4-hr Vapor Exposure Causing 2 to 4 Deaths in 6-rat Groups (ppm)	LD50 Skin for Rabbits (g/kg)	Probable Lethal Dose for Man
Extremely Toxic	0.001 or Less	Less than 10	0.005 or less	Taste
Highly Toxic	0.001 to 0.05	10 to 100	0.005 to 0.043	(1 grain) 1 tsp (4cc)
Moderately Toxic	0.95 to 0.5	100 to 1,000	0.044 to 0.340	1 oz (30 gm)
Slightly Toxic	0.5 to 5.0	1,000 to 10,000	0.35 to 2.81	1 pint (250 gm)
Practically Nontoxic	5.0 to 15.0	10,000 to 100,000	2.82 to 22.6	1 quart
Relatively harmless	>15.00	>100,000	>22.6	>1 quart

Below is a short list of elements that have no nutritional value, even in trace amounts. Some of these elements accumulate in the body, so there is no truly safe exposure limit for those elements (e.g., lead, mercury). Barium and aluminum are examples of elements which can be excreted, at least to a certain extent. Most of these elements are metals.

Aluminum	(Cr <sup>3+</sup> is necessary in trace amounts for proper nutrition)
Antimony	
Arsenic (metalloid)	Lead
Barium	Mercury
Beryllium	Osmium
Cadmium	Thallium
Hexavalent Chromium Cr <sup>6+</sup>	Vanadium

The [Office of Pollution Prevention and Toxics \(OPPT\)](#) manage programs under the [Toxic Substances Control Act](#) and the [Pollution Prevention Act](#). Under these laws, EPA evaluates new and existing chemicals and their risks, and finds ways to prevent or reduce pollution before it gets into the environment.

The **United States Toxic Substances Control Act (TSCA) of 1976** authorizes the EPA to secure information on all new and existing chemical substances, as well as to control any substances determined to cause unreasonable risk to public health or the environment. The EPA may issue a civil administrative complaint to any person or company who violates TSCA and may impose a civil penalty, including recovery of any economic benefit of non-compliance, in addition to requiring the correction of the violation. Penalties for violations of TSCA may exceed \$27,500 per violation (per day).

The guidelines for safe use and storage of Toxic Substances are provided in [APPENDIX L](#) of this Guide.



### C. Corrosive Substances

Corrosive materials cause destruction of tissue through chemical action at the point of contact. Corrosive chemicals can be liquids, solids, or gases, and most commonly affect the skin, eyes, and respiratory tract. Furthermore, the vascular network of the eyes may permit the rapid absorption of many chemicals.

Alkaline materials, phenols and strong acids are particularly corrosive and may cause permanent loss of vision.

The following is a list of some of the most common corrosive chemicals found in an academic or research laboratory:

<b>Inorganic Acids</b>	<b>Inorganic Bases</b>	<b>Oxidizing Agents</b>
Chromic acid	Ammonia, ammonium hydroxide	Bromine
Hydrochloric acid	Calcium hydroxide	Chlorine
Hydrofluoric acid	Calcium Oxide	Chromic acid
Nitric acid	Potassium hydroxide	Fluorine
Perchloric acid	Sodium hydroxide	Nitric acid
Phosphoric acid		Perchloric acid
Sulfuric acid		

<b>Organic Acids</b>	<b>Dehydrating Agents</b>	<b>Other Compounds</b>
Butyric acid	Calcium oxide	Tin chloride
Formic acid	Glacial acetic acid	Potassium chromate
Glacial acetic acid	Phosphorous pentoxide	Phosphorus Pentoxide
Oxalic acid	Sodium hydroxide	Phosphorous trichloride
Phenol	Sulfuric acid	
Salicylic acid		
Trichloroacetic acid		

**Acids and alkalis** should be stored separately in a cool ventilated area, away from metals, flammables, and oxidizing materials to prevent possible adverse chemical reactions. The storage area should be checked regularly for spills and leaks and there should be suitable spill cleanup materials available. Protective clothing should be worn whenever acids or alkalis are handled.

Guidelines for safe use and storage of acids and alkalis:

- Always pour acids into water, never the reverse.

- Cap bottles securely and store them securely.
- Do not store acids and alkalis together.
- Clean up spills promptly. Do not leave residues on a bottle or lab bench where another person may come in contact with them.
- Wear the proper personal protective equipment when handling acids or alkalis. This shall include rubber gloves, lab coat, and eye protection.

Four acids deserve special attention because of the hazards they present. These acids are **nitric acid, perchloric acid, picric acid, and hydrofluoric acid.**

**1. Nitric acid (CAS# 7697-37-2)**

Most commercially available nitric acid has a concentration of 68%. When a solution contains more than 86% it is referred to as fuming nitric acid. It is further characterized as white fuming nitric acid or red fuming nitric acid at concentrations above 95%.

Nitric acid is a highly corrosive inorganic strong mineral acid that is also a very strong and powerful oxidizing agent. The major hazard posed by it is chemical burns. Concentrated nitric acid attacks tissues readily and stains human skin yellow due to its reaction with keratin. These yellow stains turn orange when neutralized.

Precautions for using nitric acid under these conditions are similar to those for other mineral acids:

- Wear suitable gloves, eye protection, and other protective clothing to protect in the event of splashes or spills.
- Dilutions should be performed by adding acid to water, and not the other way around.
- Limit quantities in storage to what is needed for the next 6-12 months.
- Solutions not used at the end of the 12 month time limit should be disposed as hazardous waste through the CSO.

The standard first aid treatment for acid spills on the skin is, as for other corrosive agents, irrigation with large quantities of water. Washing is continued for at least ten to fifteen minutes to cool the tissue surrounding the acid burn and to prevent secondary damage. Contaminated clothing is removed immediately and the underlying skin washed thoroughly.

Being a strong oxidizing agent, reactions of nitric acid with compounds such as cyanides, carbides, or metallic powders can be explosive. Reactions with many organic compounds, such as turpentine, are violent and hypergolic (i.e. self-igniting). Therefore, nitric acid should be stored away from bases and organics.

Large acid spills (>200mL) should be referred to the CSO at x706-721-2663.



In the case of a small acid spill (<200 ml) contained in the fume hood, neutralize the spill by gradually adding alkaline material (sodium carbonate, lime) from the edges of the spill towards the center. Test the pH of the spilled material and continue neutralizing until the pH reaches the 6-9 range. Absorb with an inert material (vermiculite, dry sand). Do NOT use combustible materials, such as saw dust, or paper towels to absorb nitric acid spills! Place materials in a chemical waste container and dispose of appropriately. Appropriate chemical resistant gloves should be used when cleaning up a spill due to possible prolonged glove contact with nitric acid. After the spill has been completely absorbed, rinse the contaminated area thoroughly with soap and water solution.

## 2. **Perchloric acid (CAS# 7601-90-3)**

Perchloric acid is an inorganic compound with the formula  $\text{HClO}_4$ . Usually found as an aqueous solution, this colorless compound is a stronger acid than sulfuric and nitric acids. Although it is a powerful oxidizer, aqueous solutions at concentrations of 70% or less are generally safe; only showing strong acid features and no oxidizing properties. Perchloric acid is useful for preparing perchlorate salts, especially ammonium perchlorate. Overall, perchloric acid is dangerously corrosive and readily forms potentially explosive mixtures.

Anhydrous perchloric acid, which is usually formed when perchloric acid is mixed with concentrated sulfuric acid or phosphorus pentoxide, is unstable and restricted from use at Augusta University.

Given its strong oxidizing properties, perchloric acid is subject to extensive regulations. It is highly reactive with metals (e.g., aluminum) and organic matter (wood, plastics). Work involving the use of heated perchloric acid must be conducted in an appropriate perchloric acid fume hood, which has a wash-down capability in order to prevent accumulation of potentially explosive perchlorate crystals in the ductwork. For the specifications of a perchloric acid fume hood, as well as the requirements and procedures for installation, repair, removal, and relocation, contact the CSO at 706-721-2663.

Concentrated perchloric acid (>70%) is an oxidizer at temperatures  $> 150^\circ \text{C}$  and is potentially explosive when heated. Perchloric acid forms an azeotrope with water, consisting of about 72.5% perchloric acid. This form of the acid is stable and is commercially available. Such solutions are hygroscopic. Thus, if left open to the air, concentrated perchloric acid dilutes itself by absorbing water from the air.

Perchloric acid in concentrations up to 70% and used at room temperature acts similarly to other strong acids. Precautions for using perchloric acid under these conditions are similar to those for other mineral acids:

- Wear suitable gloves, eye protection, and other protective clothing to protect in the event of splashes or spills.

- Dilutions should be performed by adding perchloric acid to water, and not the other way around.
- Limit quantities in storage to what is needed for the next 6-12 months.
- Solutions not used at the end of the 12 month time limit should be disposed as hazardous waste through the CSO.

In the event of spills, neutralize with soda ash or other appropriate neutralizing agent. Soak up the spill with an inorganic based absorbent. Do NOT use rags, paper towels, or sawdust and then put them aside to dry out, as such materials may spontaneously ignite. Likewise, spills on wood may present a fire hazard after the liquid dries.

### 3. **Picric acid (CAS# 88-89-1)**

Picric acid is the chemical compound formally called 2, 4, 6-trinitrophenol (TNP). This yellow crystalline solid is one of the most acidic phenols.

Picric acid can form explosive compounds with many combustible materials. When picric acid becomes dehydrated below 30% it becomes unstable and may explode when shaken or handled. The picric acid container must be dated when received, and inspected monthly for adequate hydration of the picric acid solution as well as for the formation of yellow picrate salt crystals under and around the container lid. The inspection date must be recorded on the container or a log sheet.

Management of picric acid containers:

- Glass or plastic bottles are required, as picric acid can easily form metal picrate salts that are even more sensitive and hazardous than the acid itself.
- Date container when received and when opened.
- Wipe threads clean on the container and cap with a damp paper towel after each use to prevent the formation of picrate salt crystals.

Inspect container monthly to ensure that the picric acid:

- Is saturated greater than 70%;
- Has not solidified or partially solidified, and
- Picrate (yellow) crystals have not formed around lid of container.

Precautions for using picric acid are similar to those for other mineral acids:

- Wear suitable gloves, eye protection, and other protective clothing to protect in the event of splashes or spills.
- Dilutions should be performed by adding acid to water, and not the other way around.
- Limit quantities in storage to what is needed for the next 6-12 months.
- Solutions not used at the end of the 12 month time limit should be disposed as hazardous waste through the CSO.

### 4. **Hydrofluoric acid (HF) (CAS# 7664-39-3)**

HF is a solution of hydrogen fluoride in water. It is a valued source of fluorine and is a precursor to numerous pharmaceuticals such as fluoxetine (Prozac) and diverse materials such as PTFE (Teflon).

HF is a highly corrosive liquid and is a contact poison. It should be handled with extreme care, beyond that accorded to other mineral acids.

Additional information for HF is provided in APPENDIX M.

## **D. Highly Reactive Chemicals and Potentially Explosive Compounds**

### **1. General Reactions**

- a. When chemical reactions are considered safe, it is generally because the reaction rate is relatively slow or can be easily controlled. However, certain reactions proceed at such a fast rate and generate so much heat that they may result in an explosion. Care should be taken to ensure there is sufficient cooling and surface area for heat exchange.
- b. Many chemical reactions may involve hazards like those mentioned above, but can be handled safely if some preliminary planning is done. Planning an experiment should include knowledge of the reactivity, flammability, and toxicity of the chemicals used in and produced by the experiment. This information may be obtained from such sources as the Safety Data Sheet, Fire Protection Guide on Hazardous Materials (NFPA), or by calling the CSO at 706-721-2663.
- c. Lab workers should consult the laboratory Supervisor or PI when planning an experiment in which hazardous materials are used or hazardous conditions may occur. Such planning shall include selection of the proper safety procedures, clothing and equipment, as well as consideration of the possibility of a power failure, equipment breakdown, or fire, and the precautions that can be taken to minimize the consequences.

### **2. Specific Chemicals**

- a. **Peroxides-Organic peroxides** are a class of compounds that have unusual stability problems that make them among the most hazardous substances handled in laboratories. As a class, organic peroxides are considered to be powerful explosives. They are sensitive to heat, friction, impact, and light, as well as to strong oxidizing and reducing agents. All organic peroxides are flammable.

Specific chemicals that can form dangerous concentrations of peroxides are listed in Table 2.

TABLE 2

Examples of Peroxidizable Compounds  
Common Compounds That Form Peroxides During Storage

Ethyl ether	Isopropyl ether
Tetrahydrofuran	Divinyl acetylene
Dioxane	Vinylidene chloride
Acetal	Potassium metal
Methyl i-butyl ketone	Sodium amide
Ethylene glycol dimethyl ether (glyme)	Styrene
Vinyl ethers	Tetrafluoroethylene
Dicyclopentadiene	Chlorotrifluoroethylene
Diacetylene	Vinyl acetylene
Methyl acetylene	Vinyl acetate
Cumene	Vinyl chloride
Tetrahydronaphthalene	Vinyl pyridine
Cyclohexane	Chlorobutadine
Methylcyclopentane	Chloroprene

Organic peroxides are oxidizers and fuels combined in one, and are therefore unstable and potentially explosive. Under normal storage conditions, peroxide-forming compounds have the potential to generate and accumulate peroxide crystal formations which may violently detonate when subjected to thermal or mechanical shock. Peroxide-forming chemicals react with oxygen to form peroxy compounds, even at low concentrations.

The risk associated with peroxide formation increases if the peroxide crystallizes or becomes concentrated by evaporation or distillation. Factors that affect the rate of peroxide formation include exposure to air, light, heat, moisture and contamination from metals. It is extremely important to properly identify, handle, store, and dispose of peroxide forming chemicals.

- b. Ethers and other peroxide forming materials should be ordered only in small quantities and should be dated upon receipt and when opened.

They should not be used at or past one year after receipt if unopened, or past six months if opened.

Ethers should always be handled in a fume hood to assure proper ventilation. This will protect individuals from inhaling the vapors and prevent accumulation of explosive concentrations of the vapor. For methods of peroxide detection and removal, consult the CSO. **Do not use a fume hood to dispose of ether or any other solvent by means of evaporation. Arrange for CSO pick up for proper disposal.**

- c. All peroxide forming compounds must be stored in a cool place, away from light. Metal cans are preferable; do not store ethers in ground glass-stoppered bottles.

Do not store peroxide forming chemicals in non-explosion proof refrigerators.

Additional information for Highly Reactive Potentially Explosive Compounds is provided in APPENDIX N of this Guide.

### 3. Oxidizers

An *Oxidizer* is a chemical other than an explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases. Oxidizing chemicals can react violently with flammable and combustible materials. Oxidizers present fire and explosion hazards on contact with organic compounds and other oxidizing substances.

An oxidizing agent is not necessarily combustible itself, but may cause or contribute to the combustion of other materials by yielding oxygen.

## E. Metals

### 1. Alkali Metals

*Alkali metals* (e.g., sodium and potassium) react violently with water and decompose the water to give off hydrogen gas, which may be ignited by the heat of the reaction. Alkali metals can also ignite spontaneously in air.

Guidelines for safe use and storage:

- a. Store alkali metals under mineral oil or kerosene. Avoid using oils containing sulfur since a hazardous reaction may occur.
- b. Use only Class D dry powder fire extinguishers on alkali metal fires.
- c. Any waste of alkali metals must be placed in a labeled, leak-proof container and covered with mineral oil.

### 2. Non-Alkali Metal Powders

Finely powdered metals that come in contact with acids may ignite and burn. Metal powders can also create a dust explosion hazard when the powders become airborne in an area where a spark or flame is present. In addition, metal powders are subject to rapid oxidation, which may result in a fire or explosion.

Guidelines for safe use and storage:

- a. Store non alkali metals in closed containers away from acids, strong oxidizers, and ignition sources.
- b. Use only Class D dry powder fire extinguishers on alkali metal fires.

## F. Compressed Gases

Compressed gases have inherent pressure hazards and can also create health hazardous and/or flammable atmospheres. Common hazard characteristics of gases include flammability, toxicity, and corrosivity. A few gases (i.e., silane, diborane, phosphine) are considered pyrophoric (will ignite spontaneously in air).

One additional hazard property common to all compressed gases is the substantial volume expansion when released to air. A gas release in an inadequately ventilated room can create an oxygen-deficient environment.

Institutional policies for compressed gas cylinders can be found at: <https://augusta.policytech.com/dotNet/documents/?docid=570&mode=view>

The general guidelines for compressed gases are provided in APPENDIX H of this Guide.

## **G. Cryogenic Liquids**

Cryogenic liquids are materials with extremely low boiling points (i.e. 150 °F). Common examples of cryogenic liquids are liquid nitrogen, helium, and argon. Dry ice is the common term for frozen carbon dioxide. One special property of both cryogenic liquids and dry ice is that they undergo substantial volume expansion when converted to a gas phase, which can potentially lead to an oxygen deficient atmosphere where ventilation is limited. Some cryogenic liquids can also pose additional hazards including toxicity and flammability (i.e. liquid carbon monoxide).

The Standard Operating Procedures for cryogenic liquids and liquid nitrogen are provided in APPENDICES I & J.

## II. HAZARD PROTECTION CONTROLS

### A. Engineering Controls

Engineering hazard controls may be defined as an installation of equipment, or other physical facilities, including the selection and arrangement of experimental equipment. Engineering controls remove the hazards by initial design specification or by applying methods of substitution, minimization, isolation, or ventilation.

1. **Substitution** is the replacement of a hazardous material or process with one that is less hazardous.
2. **Minimization** is the expression used when a hazard is lessened by scaling down the hazard process (e.g. using micro-scale glassware so that chemical reactions can be carried out on a smaller scale)
3. **Isolation** is when a barrier is interposed between a material, piece of equipment, or process that presents a hazardous potential, and the property or persons who might be affected by the hazard (e.g. glove box, blast shield).
4. **Ventilation** is used to control toxic and/or flammable atmospheres by exhausting or supplying air to either remove hazardous atmospheres at their source or dilute them to a safe level. The two types of ventilation are typically termed local exhaust and general or dilution ventilation. *Local exhaust* attempts to enclose the material, equipment or process as much as possible and to withdraw air from the physical enclosure at a rate sufficient to assure that the direction of air movement at all openings is always into the enclosure (e.g. fume hood). *General or dilution ventilation* attempts to control hazardous atmospheres by diluting the atmosphere to a safe level by either exhausting or supplying air to the general area (e.g. evaporative cooler).

### B. Administrative Controls

All of the aforementioned engineering hazard control methods, in order to exist or be effective, require the application of administrative hazard controls as either supplemental hazard controls or to ensure that engineering controls are developed, maintained, and properly functioning.

Administrative hazard controls consist of managerial efforts to reduce hazards through planning, information and training (e.g. hazard communication), written policies and procedures (e.g., the Laboratory Chemical Safety Manual, Hazard Communication Program), safe work practices, and environmental and medical surveillance (e.g. work place inspections, equipment preventive maintenance, and exposure monitoring). Because they primarily address the human element of hazard controls, they are of vital importance and are always used to control chemical hazards.

### C. Personal Protection Equipment

Personal Protective Equipment (PPE) is considered a supplement to Engineering Control and Administrative Control. It is the least effective method of personal protection.

PPE includes a wide variety of items worn by an individual to isolate the person from chemical hazards. PPE includes articles to protect the eyes, skin, and the respiratory tract (e.g. safety glasses, goggles, face shields, lab coats, gloves, aprons, respirators). In some situations, PPE may be the only reasonable hazard control option, but for many reasons it is the least desirable means of controlling chemical hazards. PPE users must be aware of, and compensate for these undesirable qualities. PPE does not eliminate hazards but merely minimizes damage from hazards.

The effectiveness of PPE is highly dependent on the user. PPE is oftentimes cumbersome and uncomfortable to wear. Each type of PPE has specific applications, advantages, limitations, and potential problems associated with their misuse and those using PPE must be fully knowledgeable of these considerations. PPE must match the hazards and the conditions of use and be properly maintained in order to be effective. Their misuse may directly or indirectly contribute to the hazard or create a new one. The material of construction must be compatible with the chemical's hazards and must maximize protection, dexterity, and comfort.

At a minimum, all employees and/or students who work in laboratories are required to wear full length, long sleeved lab coats, safety glasses, and chemical resistant gloves that are appropriate for the chemicals they will be handling. Under some circumstances, depending upon the hazards associated with the chemical being handled, additional personal protection may be required.

Consultation is provided through the CSO for personal protection recommendations.

All employees and/or students who wear respirators must participate in the institutional Respiratory Protection Program. Contact the IHS at 706-721-2663 for more information.



# CHAPTER SEVEN

## EMERGENCY RESPONSE, SAFETY EQUIPMENT AND FIRST AID

### I. EMERGENCY RESPONSE & FIRST AID

All Augusta University employees and/or students are required to familiarize themselves with emergency response and fire safety procedures, as well as fire drills, planned evacuations, or other emergencies as directed on all postings and emergency notices.

- A. **Augusta University Emergency Response Flipcharts** are posted in all laboratories and work areas where chemicals are used or stored. These flipcharts instruct personnel on the actions to be taken in the event of an emergency including chemical, radiological, and biological spills, fires and flooding, an indoor air quality problem, or suspicious odor. Please contact the CSO at 706-721-2663 to obtain a flipchart for your area.

#### **Emergency procedures included on the Flipchart:**

1. Medical Emergencies: Immediate Procedures.
2. Fire: Code Red Procedures and How Fire Extinguishers Work
3. Radiation Spill: Major and Minor Spill Procedures
4. Chemical Spill: Major and Minor Spill Procedures
5. Biological Spills: Large/High Risk Spills and Small/Low Risk Spill Procedures
6. Personal Injury Procedures
7. Indoor Environmental Quality (IEQ) Problems or Complaints Procedures
8. Other procedures including Bomb Threat, Decontamination, Severe Weather and Active Shooter,

Employees and/or students should know the location of this flipchart in their area. All employees and/or students who work in chemical areas are required to become familiar with the procedures on this flipchart, and to follow them in the event of an emergency.

- B. **Code Red Posters** should be displayed in all areas providing the appropriate response to fires. Exit diagrams are also posted in areas to show exit pathways in the event of an emergency or fire. For Code Red posters and other issues related to fire safety, contact the Fire Safety Office at 706-721-2663.

The Code Red Poster is posted in all laboratories and other areas where hazardous chemicals are used or stored.

Employees and/or students should know the location of this poster in their area, and are required to become familiar with the procedures on this poster, and to follow them in the event of a fire.

**C. First Aid Procedures:**

1. Remain calm.
2. Initiate life saving measures, if required.
3. Activate Emergency Response by calling 706-721-2911.
4. If there is a fire, use proper extinguishers ONLY IF IT IS SAFE TO DO SO - cut off electrical circuits and/or gas lines and close all doors.
5. Do not move any injured personnel unless absolutely necessary.
6. Keep the injured personnel warm.
7. If clothing is on fire, help the individual to the floor and roll him/her around to smother the flames, or if a safety shower is immediately available, douse the person with water. Running to a safety shower or other source of water that is not immediately accessible will only serve to fan the flames and intensify the clothing fire. Fire blankets are intended, primarily as a first-aid measure for prevention of shock rather than against smoldering or burning clothes. By wrapping a person that is on fire, heat is retained and the clothing may continue to smolder, thus resulting in serious burns. In addition, if the person who is wrapped in the safety blanket is standing, a chimney effect may occur - smoke from the smoldering clothing would continue to rise past the person's face.
8. If chemicals have been spilled over a large area of the body, quickly remove all contaminated clothing while using the safety shower. Immediately flood the exposed areas with cold water for at least 15 minutes; resume if pain returns. If it is not going to be further detrimental to the individual, wash off chemicals by using a mild detergent or soap (preferred) and water; do not use neutralizing chemicals or salves. Seek medical attention.
9. If chemicals have been spilled on a confined area of the skin, immediately flush with cold water and, if it is not going to be further detrimental to the skin of the affected individual, wash by using a mild detergent or soap (preferred) and water. Remove any jewelry in the affected area. Seek medical attention.

10. If a chemical has been splashed into the eyes, immediately wash the eye and inner surface of the eyelid with copious amounts of water for 15 minutes. Check for and remove any contact lenses at once. An eyewash fountain should be used if available. Forcibly hold the eye open to wash thoroughly behind the eyelids. Seek medical attention.
11. In case of ingestion of a toxin, dilute the poison by having the victim drink large amounts of water (do not give liquids to an unconscious or convulsing victim). Attempt to learn what the ingested substances were. Save the label or container for transportation with the victim to the medical facility. Seek medical attention.

#### **D. Accident/ Injury Reports**

1. The Augusta University Accident Injury Reporting Policy is available at: <https://augusta.policytech.com/dotNet/documents/?docid=582&mode=view>
2. Employees (including student employees) - In the event of a laboratory accident, a Supervisor's Accident Investigation Report and an Employer's First Report of Injury shall be completed by the laboratory supervisor with the assistance of the injured employee. Once completed, these forms should be forwarded to Human Resources, and a copy sent to the EHS Division. If treatment or evaluation is necessary, all employees, students, and faculty are to report to Employee Health during regular business hours and must be reported to the Georgia Department of Administrative Services (DOAS) at 1-877-656-7475 within 24 hours of knowledge of injury. If after regular hours, or if the injury is serious and requires immediate care, report directly to the nearest emergency room. More information on Employee Health can be found at <https://paws.gru.edu/pub/hr/services/employee-health-wellness/Pages/default.aspx>
3. Students (not employed) - In the event of a laboratory accident, a Supervisor's Accident Investigation Report should be completed by the laboratory supervisor with the assistance of the injured student. Once completed, this form should be forwarded to Human Resources, and a copy sent to the EHS Division. If treatment or evaluation is necessary, all students are to report to Student Health Services during regular business hours. If after regular hours or if the injury is serious and requires immediate care, report directly to the nearest emergency room. More information on Student Health Services can be found at <http://www.augusta.edu/shs/>.
4. Visitors – In the event of an accident, it should be promptly reported to a Augusta University employee. When a non-Augusta University person reports an accident or injury, the Public Safety Division should be notified immediately and an Augusta University Public Safety Officer will respond to investigate the

reported accident/injury. The Public Safety report should be forwarded to the EHS Division.

## **II. SAFETY EQUIPMENT**

### **A. Fire Extinguishers**

1. All chemical laboratories shall have an appropriate type and size fire extinguisher. (If you have questions about fire extinguishers, call EHS Fire Safety at 706-721-2663.)

### **B. Safety Showers and Eyewashes**

1. Every laboratory is required to have a properly installed and functional eyewash and safety shower. The safety shower and eyewash station must be located within 25-feet of the work area. The maximum travel time to an eyewash station should be 10 seconds. Portable eye/face units and eyewash bottles are not permitted.
2. PIs and Faculty members will ensure that all laboratory employees and/or students under their supervision know the location of and how to use the safety shower and eyewash station in order to be able to locate it with eyes closed, if necessary.
3. The safety showers and eyewash stations should be kept clutter-free and accessible at all times.

### **C. First-Aid Kits**

A first-aid kit, meeting the standards outlined in ANSI Z308.1 Type I or II, must be located in a clearly visible place in all laboratories. This kit should include, at a minimum, the following:

#### **CONTENTS PER KIT**

1	Absorbent Compress, 4x8 minimum
16	Adhesive Bandages, 1x3 inch
5 yd.	Adhesive tape
10	Antiseptic applications, 0.5g each
6	Burn Treatment applications, 0.5g each
4	Sterile Pads, 3x3 inch minimum
2 pair	Medical Exam Gloves

1	Triangular bandage, 40x40x56 inch minimum
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The contents of the first aid kit must be checked annually for expired contents and restocked when items are removed.

Information on purchase of first-aid kits may be obtained from EHS.

**D. Required Minimum Personal Apparel For All Labs**

For entry into any lab, the minimum personal apparel shown here is required. Wear close-toed shoes and long pants or ankle length skirts at all times in the laboratory. A shirt or other top must cover the shoulders and not expose the midriff. Sandals or other shoes which expose the toes or ANY part of the top and/or heel of the foot are not appropriate. Lab workers should also confine long hair and loose clothing. **Students will not be allowed in any lab if they violate this safety dress code requirement.**



**E. Personal Protective Equipment (PPE)**

**PPE** refers to equipment used for protection of the eyes, face, head, and extremities against chemical, radiological and mechanical hazards while working with such hazards. This includes garments and devices such as protective clothing (coveralls, sleeves, hoods, and booties), chemically resistant gloves, respirators and protective shields and barriers.



#### MINIMUM STANDARDS

##### When Working

##### Full-length Lab Coat

##### Eye Protection or Safety Goggles

##### Chemical Resistant Gloves

### PPE Minimum Standards:

1. **Eye protection** that meets American National Standards Institute standard number Z-87.1 shall be worn while conducting procedures or working with chemicals in the laboratory. More information on ANSI Z-87.1 can be found at <http://www.nsta.org/publications/press/extras/files/riseandshine/Appendix5.3.pdf>. Ordinary prescription glasses without side shields will not provide adequate impact or splash protection for the eyes.
2. **Safety glasses with side shields, safety goggles or face shields**, depending on the hazards, shall be utilized where there is a possibility of splashing chemicals, violent reactions or flying particles. Specified goggles shall be worn for protection against laser hazards, and ultraviolet or other intense light sources.
3. **Contact lenses** should not be worn in the lab without proper eye protection (e.g. safety glasses, safety goggles, face shields, etc.). Contact lenses can trap chemicals under the lens and prevent flushing of the eyes.
4. **Chemical Protective Gloves** must be worn while working in the laboratory. Skin contact is a potential route of exposure to toxic materials. Dermatitis, erythema, burns, and absorption of toxic and/or carcinogenic chemicals are some of the consequences of exposing skin to hazardous liquids. Therefore, proper protective gloves must be worn at all times when working with hazardous chemicals or with materials of unknown toxicity. Gloves must not be reused once they have been taken off, and must be selected on the basis of the material being handled and their suitability for the particular laboratory operation. A Glove Selection Chart is available on the Chemical Safety Office website at: <http://www.augusta.edu/services/ehs/chemsafe/PDF%20files/gloveselechart.pdf>
5. **Full Length, Long Sleeved Laboratory Coats** shall be worn by employees and students while they are working with chemicals in the lab. Laboratory personnel shall not wear loose (e.g., saris, dangling neckties, and oversize or

ragged laboratory coats), skimpy (e.g., shorts and/or halter tops), or torn clothing. This type of clothing does not provide adequate protection for skin in the event of a chemical spill and may become entangled in laboratory equipment, and present a fire or tripping hazard. Clothes that have been contaminated with hazardous chemicals must not be worn outside the laboratory. In the event that contaminated or potentially contaminated clothing must be laundered, it must be offered to a cleaning service that is fully aware of, and capable of, decontaminating the hazardous components. Laboratory coats must never be taken home for washing. Laboratory coats that have been contaminated with a chemical or radiological contaminant that cannot be properly decontaminated must be collected as hazardous waste. Laboratory coats that have been contaminated with biological material should be washed with a 10% bleach solution for proper decontamination. Contact the Administrative Department Manager or the EHS for assistance in procuring proper laundering services for laboratory coats.

6. **Shoes** must be appropriate to provide foot protection. Closed-toed shoes will be worn at all times when working in laboratories. Open-toed shoes, sandals, or clogs offer little protection against chemical spills or broken glass and must not be worn in laboratories whether working or not.

# CHAPTER EIGHT

## HEALTH, HYGIENE AND HOUSEKEEPING IN LABORATORIES

### I. HEALTH, HYGIENE, AND PRUDENT PRACTICES

- A. Do not eat, drink, chew gum, use smokeless tobacco or apply cosmetics in work areas where chemicals are being used or stored.
- B. Storage of food or drinks to be consumed by humans is prohibited in laboratories and chemical areas, except in designated break areas away from potential contamination.
- C. Glassware or utensils that have been used for laboratory operations should never be used to prepare or consume food.
- D. Augusta University is a smoke free environment. Smoking in Augusta University buildings and on campus is prohibited.
- E. Hands should be washed often, even when gloves are being utilized. Avoid the use of solvents while washing hands because they remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, the solvents might even aid skin absorption of a toxic chemical. Hands should be washed before going to the bathroom.
- F. No solutions will be pipetted by mouth.

### II. HOUSEKEEPING

- A. Work areas shall be kept clean and clear from obstructions. Clean-ups should follow the completion of all processes and operations, or at a minimum, shall be done at the end of the day.
- B. Aisles, hallways, and stairways must be kept clutter free and not be used for storage areas.
- C. Chemicals stored in the laboratory should be inventoried periodically and unneeded items disposed of. Containers should also be examined for deteriorating labels. The quantity of chemicals stored in the laboratory shall be kept as low as possible.
- D. Old or outdated chemicals must be disposed of following proper disposal procedures. The laboratory Supervisor should arrange for the removal or property transfer of all hazardous materials which personnel have on hand when they are about to terminate, graduate or transfer.



- E. All spills and broken glassware shall be cleaned up immediately. Tongs and/or dustpans and brooms should be used to pick up or gather broken glass.
- F. Broken glassware, glass pipettes and needles/syringes must be placed in puncture-proof containers.
- G. Never store chemicals on shelves over laboratory benches unless there are restraining lips on the shelves. Storage of bottles on benches is undesirable because of their propensity to be knocked over.
- H. Storage of equipment and chemicals in hoods is inadvisable because this practice interferes with the airflow in the hood, clutters up the working space, and increases the amount of material that could become involved in a fire.
- I. It is best not to store chemicals on the floor. However, if it is a necessity to do so, all liquids should be in secondary containment and placed out of track areas where the potential for rupture or spillage is present.
- J. Wastes must be placed in appropriate receptacles and must be labeled and managed in accordance with the Hazardous Waste Management procedures provided in APPENDIX D of this guide.

### **III. WORKING ALONE AND UNATTENDED PROCEDURES**

- A. Persons working after hours or alone shall make arrangements with other persons in the building to check with each other periodically. Unattended operations, which may continue for several hours or overnight, requires prior approval.
- B. Experiments that include hazardous chemicals shall not be performed by a worker who is alone in a laboratory.
- C. All procedures and experiments are designed to be safe, but in case of an emergency, plans should be made to avoid any injuries in the event of a failure in power, water, gas or some other service. If an incident occurs, room lights should be left on and an appropriate warning sign must be placed on the door.
- D. When setting up unattended operations, regulate the water pressure automatically via the installation of a water pressure regulator. The regulator should be protected by an appropriate filter to prevent clogging. Monitor the water flow so that in the event of interruption, electricity and water supply can be turned off. The latter is necessary because a break in a connection can result in flooding. Position the monitor at some point after the water has passed through the apparatus and is on its way to the drain.

- E. Persons under the age of 18 are prohibited from entering laboratory areas or other areas where hazardous materials or conditions may be present except for the following:
1. Such entry is escorted or during a scheduled open house tour.
  2. Such entry is part of the normal duties of a student, student worker or intern who has been deemed competent to handle those risks by his or her supervisor including enrolled freshmen and joint-enrolled HS students for class labs and summer camps.
  3. Such entry has been pre-authorized in writing by the Department Chair on a per visit basis and approved by the Associate Vice President (AVP), EHS.

#### IV. REFRIGERATORS AND FREEZERS

Refrigerators must be labeled if used for storage of radioactive materials, biohazardous materials or chemicals. Flammable liquids stored in non-explosion proof refrigerators must be in closed containers.

Laboratory refrigerators must not be used for storage of food or beverages intended for human consumption and must have a label on the door stating this. Any refrigerators used to store food must be located outside of the laboratory/chemical storage area, in break areas only. Food and drinks to be consumed by humans are not permitted in the laboratory.

- A. Three types of refrigerators are available for use:
1. The **ordinary household refrigerator** is not equipped with explosion-safe controls or door switches and must not be used to cool flammable liquids. Sparks from controls or door switches may ignite the vapor-air mixture. This type of refrigerator must be modified to make it intrinsically safe before it can be used to store flammable liquids. If used to store flammable liquids, the flammable liquid container must be stored in an air-tight secondary container with desiccant material in order to trap any potential ignitable vapor.
  2. The **explosion-safe refrigerator** is constructed with its controls mounted outside the storage compartment. This type refrigerator is suitable for storing flammable liquids.
  3. The **explosion-proof refrigerator** also has its controls mounted on the outside, but in addition, the controls are of an explosion-proof design. This type is needed only where both the internal and external environment present a fire or explosion hazard.

## V. HEATING EQUIPMENT

- A. **Steam heated devices**, rather than electrically heated devices or Bunsen burners, shall be used whenever possible. (Steam heated devices do not present shock or spark hazards and can be left unattended with assurance that their temperature will not rise beyond 100 °C.)
- B. **Electrically heated devices** (specifically hot plates) that have their heating elements enclosed in a glass, ceramic, or insulated metal case should be used in laboratories. Laboratory workers should be aware of the possible spark hazard from the on-off switch of older hot plates.
- C. **Heating mantles** should be checked for breakage in the fiberglass cloth coating and to assure that no water or other chemicals are spilled into the mantle. Laboratory workers should be careful not to turn a variable transformer so high as to exceed the input voltage recommended for the mantle by the manufacturer.
- D. **Oil baths** should always be monitored via a thermometer or other devices to ensure that their temperature does not exceed the flash point of the oil being used. Smoking, caused by the decomposition of the oil or of organic materials in the oil, presents another hazard. A laboratory worker using an oil bath heated above 100 °C should be careful to guard against the possibility that water (or some other volatile substance) could fall into the hot bath. Such an accident can splatter hot oil over a wide area. The oil bath must never be supported on an iron ring because of the possibility of accidental tipping.
- E. **Burners or open flame devices** - When using burners, distribute the heat with a wire gauze pad. As with all heating equipment, burners should not be left on when not in use. Workers should understand the hazards of burners before proceeding with an experiment.

## VI. GLASSWARE

- A. Careful handling and storage procedures should be used to avoid damaging glassware. Damaged items should be discarded.
- B. Hand protection should be utilized when inserting glass tubing into stoppers or when placing rubber tubing on glass hose connections. To insert glass tubing:
  - 1. Fire polish the ends of the glass tubing;
  - 2. Wet the glass and stopper hole with glycerin or water;
  - 3. Wrap a cloth around the glass;
  - 4. Hold hands close together and rotate the glass back and forth, and
  - 5. Never attempt to push the glass into the stopper or tubing.

- C. On occasion it will be necessary to enlarge or bore a hole in a stopper. When utilizing a cork borer:
1. Select the appropriate size rubber or cork stopper;
  2. Select a borer of slightly smaller size than the hole to be bored;
  3. Sharpen the borer;
  4. Supporting the stopper with a cloth pad for palm protection, begin boring at the narrow end;
  5. Twist the borer while applying steady pressure;
  6. Check the alignment of the borer after each twist;
  7. Remove the borer when halfway through the stopper;
  8. Remove any plug in the borer, and
  9. Begin boring from the other end of the stopper, carefully checking the alignment.
- D. Removing glass tubing and/or thermometers from stoppers:
1. Lubricate the tubing with water or glycerin;
  2. Wrap the tubing with a towel;
  3. Gently twist the tubing, pulling lightly;
  4. If the tubing is stuck to the stopper, gently insert the end of a rat-tailed file between the tubing and stopper, and rotate gently, while lubricating with glycerin;
  5. If this method fails, cut the stopper away.
- E. When loosening stopcocks, stoppers or any other glass-to-glass connections which are frozen, it is important to remember that glass is fragile. Utilize one of the following:
1. Gentle tapping: with a wooden handle of a spatula, gently tap the frozen stopcock or stopper in the direction that it will come out. Work over a desktop covered with cushioning material.
  2. Heating: immerse the frozen connection in hot water. Then use technique #1. This method should be performed carefully and in combination with technique #2.

## **VII. LABORATORY CHEMICAL HOODS**

- A. OSHA has a requirement in 29 CFR1910.1450 titled, "Occupational Exposure to Hazardous Chemicals in Laboratories". The purpose of the standard is to provide an environment to protect lab workers from exposure to hazardous chemicals. Laboratory ventilation and fume hoods are important considerations in achieving this goal. If the lab uses hazardous substances, particularly hazardous substances or chemicals with a high degree of acute toxicity, then special provisions are required that may include a fume hood.

- B. The Board of Regents (BOR) concurs with this OSHA requirement with the following statement, "Fume hoods shall be located per the requirements of ANSI/AIHA Z9.5 (most recent version) and shall be located in a manner which prevents excessive air changes and/or cross-drafts in the laboratory in accordance with sound engineering principles".
- C. Section 2.1.1 of ANSI/AIHA Z9.5 states, "Adequate laboratory chemical hoods, special purpose hoods or other engineering controls shall be used when there is a possibility of employee overexposure to air contaminants generated by a laboratory activity".
- D. The intent of the OSHA requirement, as well as BOR concurrence, is that workers are not to be exposed above the allowable exposure limit for the individual chemical. At Augusta University, a chemical fume hood system shall be required in a laboratory wherever or whenever **one** of the following conditions exists:
  - 1. A flammable vapor, gas, fume, mist or dust is present either in reagents or may become present as a result of reactions at room temperature;
  - 2. A vapor, gas, fume, mist or dust hazard is suspected or is present in any concentration;
  - 3. A vapor, gas, fume, mist or dust is suspected or is present either in reagents or may become present as a result of reactions at room temperature, or
  - 4. A chemical with a permissible exposure limit (PEL) or a threshold limit value (TLV) that is < 50 PPM.
- E. Laboratory chemical hoods are intended to remove vapors, gases, and dusts of toxic, flammable, corrosive or otherwise dangerous materials. With the sash lowered, laboratory fume hoods can also afford workers protection from such hazards as chemical splashes or sprays and fires. However, they are not designed to withstand explosions.
- F. Laboratory chemical hoods must be inspected and certified annually. A hood certification sticker must be placed on all hoods. If the date of inspection is over a year and the hood is in use, contact the IHS Office at 706-721-2663.
- G. The following factors and guidelines should be observed in the daily operation of fume hoods:
  - 1. Before performing hazardous operations, make simple checks to determine that the hood is working (e.g., a small piece of paper held at the face of the hood will be sucked inward).

2. When work is being conducted in the hood, position the sash so that protection from splashes, flying debris, etc., is provided. Normally, this is a 10-14" work opening.
  3. Procedures should be conducted well inside the hood. Moving an apparatus 6" back from the front edge into the hood can reduce the vapor concentration at the face by 90%.
  4. Hoods are not intended for the storage of chemicals. Materials stored in them should be kept to a minimum and in a manner that will not interfere with airflow.
  5. Hoods should be considered as backup safety devices that can contain and exhaust toxic, offensive, or flammable materials. They should not be regarded as a means of disposing of chemicals.
- H. **Perchloric Acid Hoods:** The use of perchloric acid requires specially designed Perchloric Acid Fume Hoods. For the specifications of a Perchloric Acid Fume Hood, as well as the requirements and procedures for installation, repair, removal, and relocation, consult the CSO at 706-721-2663.

## VIII. TRANSPORTING CHEMICALS

- A. Transporting chemicals may be not only dangerous to the individual undertaking the transport, but also to innocent bystanders unaware of the potential hazard.
- B. When chemicals are carried, they must be placed in a safety container, such as an acid-carrying bucket, or other appropriate container to protect against breakage and spillage.
- C. When transported on a wheeled cart, the cart must have wheels large enough to negotiate uneven surfaces without tipping or stopping suddenly and the chemicals must be stored in an approved secondary containment to prevent spills or leaking.
- D. Hazardous chemicals should be transported on freight elevators, wherever possible, so as to avoid exposure to persons on passenger elevators. When a passenger elevator must be used:
  1. The chemicals must be labeled and carried in safety containers.
  2. Avoid transporting chemicals during busy times, such as change of classes.
- E. When transporting large volumes of chemicals as a result of a laboratory relocation, closure, or opening, the chemical move must be coordinated through the CSO to minimize the possibility of accidents, injuries, or exposures.

# CHAPTER NINE

## CHEMICAL SEGREGATION AND STORAGE

### I. SEGREGATION BY HAZARD & COMPATIBILITY

Segregation of hazardous chemicals most often relies upon the user's ability to recognize and understand the labeling systems used by manufacturers to identify chemical hazards and compatibility issues associated with the chemicals being segregated.

When certain hazardous chemicals are stored or mixed together, violent reactions may occur because the chemicals are unsuitable for mixing, or are incompatible. In general, classes of incompatible chemicals should be segregated from each other during storage.

Recommendations for segregation and storage of each chemical in the user's inventory are provided in the user's Chemical Inventory Database under Storage Requirements. Instructions for accessing this information in the database are provided under Module 2: Inventory of the on-line training course for the database at:

<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

For more information, refer to the EPA Chemical Segregation Chart found in APPENDIX Q.

### II. CHEMICAL STORAGE REQUIREMENTS

When organizing chemical storage areas, the safety features of the storage facility, chemical hazards, container integrity, compatibility of chemicals, and regulatory requirements for storage should be considered. It is recommended that all laboratories have a storage plan for workers to use as a reference.

In addition, the following information may be used as a guide in developing a storage plan.

#### A. **General Storage:**

1. Chemicals should be stored by hazard class (i.e. flammable with flammable, oxidizers with oxidizers, etc.)
2. Incompatible chemicals should be physically segregated from each other.
3. Chemicals should not be stored in direct sunlight or near heat and ignition sources.
4. Corrosive chemicals must be stored in trays large enough to contain spillage or leakage, or in appropriate corrosive cabinets where possible.
5. Chemicals must be properly labeled, including the date upon receipt, the date upon opening, and the PIs name.
6. All chemical containers must be labeled in accordance with the Augusta University Hazard Communication Plan, which is available under APPENDIX B of this guide.

7. Hazardous chemicals especially liquids, shall not be stored above shoulder height of the shortest person in the lab.
8. Shelves should be painted or covered with chemical resistant paint or other chemical resistant coating.
9. Shelves should be strong enough to hold chemicals being stored on them. Do not overload shelves.
10. All chemical shelving should have a ½ inch containment lip on the outer edge, a chemical resistant tray on the shelf, or doors covering the shelves.
11. Solids should be separated from liquids.
12. Secondary containment shall be used as required.
13. Chemicals shall not be stored under sinks or in fume hoods.
14. Ordinary, domestic refrigerators and walk-in coolers must not be used for the storage of flammable liquids, unless the container is stored in an air tight secondary container with desiccant, because they contain certain built-in ignition sources such as electrical contacts.
15. Explosives must be stored in approved explosion-proof refrigerators.
16. Personnel should be aware of the hazards associated with all hazardous chemicals.

**B. Storage of Acids:**

1. Large bottles of acids should be stored on lower shelves or in acid cabinets.
2. Oxidizing acids should be segregated from organic acids, flammables, and combustible materials.
3. Acids should be segregated from bases and active metals such as sodium, magnesium and potassium.
4. Acids should be segregated from chemicals that can generate toxic gases on contact, such as sodium cyanide and iron sulfide.
5. Acids must be stored in chemical resistant trays that are capable of containing any spillage or leakage from their container.
6. Make sure that all acids are stored by compatibility. Organic acids should not be stored with inorganic acids without proper segregation.

**C. Storage of Bases:**

1. Bases should be stored away from acids.
2. Large bottles of bases should be stored on lower shelves or in a corrosive cabinet.
3. Bases must be stored in chemical resistant trays that are capable of containing any spillage or leakage from their container.
4. Make sure that all bases are stored by compatibility.



**D. Storage of Flammables:**

1. According to NFPA (National Fire Protection Association) 30 & 45, for each area with flammable liquids, a maximum of 10gal/100sq. ft. may be stored in a non-sprinkler lab or 20gal/100sq ft. in a sprinkler lab.
2. The maximum allowable quantity for flammable liquid storage in any size lab must not exceed 120 gallons.
3. Regarding flammable liquid storage outside of approved flammable storage cabinets; there may be a maximum of 10 gallons of flammable liquids in original containers and an additional 25 gallons in approved safety cans not to exceed 2-gallon size. (NFPA 45)
4. NFPA specified safety cabinets must be used for storage of flammable liquids.
5. Only explosion-proof or intrinsically safe refrigerators and freezers should be used for storing flammable liquids.
6. Bonding and grounding wires should be used where flammable liquids >5 gallons are dispensed or where flammable liquids are being transferred from one metal container to another metal container.
7. Make sure that all flammables are stored by compatibility.
8. Our guidelines for flammable storage follow NFPA 30 & 45 standard.

**E. Storage of Water Reactive Chemicals:**

1. Water-Reactive chemicals should be stored in a cool and dry place. It is advisable that water-reactive chemicals be stored in air tight secondary containers so as to provide protection from accidental spillage or splashing of water.
2. In case of fire, a Class ABC (all-purpose) fire extinguisher, or Class D (fire extinguisher for the specific water-reactive chemical), should be used. Augusta University has a policy of using the ABC extinguishers for all fires. In the event you are unable to extinguish the fire without risk of personal injury, leave the room closing the door behind you and call 1-2911 from a safe location.
3. Make sure that all water reactive chemicals are stored by compatibility.

**F. Storage of Oxidizers:**

1. Oxidizers should be stored away from flammables, combustibles, and reducing agents (e.g. zinc, alkaline metals, etc.)
2. Make sure that all oxidizers are stored by compatibility.

**G. Storage of Toxic Compounds:**

1. Toxic compounds should be stored according to the nature of the chemical, with appropriate security employed when necessary.

2. A "Poison Control Network" telephone number must be posted in the laboratory (Poison Control Center 706-724-5050 and CDC 404-639-3235) alongside the Public Safety phone number.
3. Make sure that all toxins are stored by compatibility.

For more information or assistance with chemical storage and proper segregation, contact the CSO at 706-721-2663.

### III. Incompatible Chemicals

**Incompatibles** - Certain combinations of chemicals are particularly dangerous when physically mixed.

Unintentional or accidental mixing should be avoided, and proper precaution should be taken when storing chemicals that are incompatible with others. Table 3 below summarizes the incompatibility of various chemicals.

**TABLE 3**

**Examples of Incompatible Chemicals**

Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric acid and sulfuric acid
Alkali and Alkaline earth metals ( <i>such as aluminum or magnesium, calcium, lithium, sodium, potassium</i> )	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	any reducing agent
Azides	Acids
Bromine	See Chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite all oxidizing agents

Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadine, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Everything
Hydrocarbons - <i>Fluorine, Chlorine, Bromine, Iodine, Astatine</i>	Chromic acid, sodium, propane, benzene, peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, analine, nitromethane, combustible materials
Hydrogen sulfide	fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, or gases

Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium Chlorate	Sulfuric and other acids
Potassium Perchlorate	Sulfuric and other acids (see also chlorates)
Potassium Permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, and fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium Peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

# CHAPTER TEN

## CHEMICAL INVENTORY PROGRAM

### I. INTRODUCTION

There are three federal laws that establish the basis and the standards for collecting, storing, and maintaining chemical inventories, and producing regulatory reports from the data collected.

- A. The [Comprehensive Environmental Response, Compensation, and Liability Act](#) (CERCLA or Superfund) 42 U.S.C. s/s 9601 et seq. (1980). CERCLA was amended by SARA.
- B. The [Superfund Amendments and Reauthorization Act](#) (SARA), on October 17, 1986.
- C. The [Emergency Planning & Community Right-To-Know Act](#) (EPCRA); 42 U.S.C. 11011 et seq. (1986), which is Title III of SARA.

All facilities that use or store hazardous chemicals must complete and submit a Tier II report annually in February.

Also, under the Georgia Public Employees Hazardous Chemical Protection and Right-to-Know Rules Law, all USG institutions must submit chemical lists to the Local Emergency Planning Committees (LEPC) and the State Emergency Response Commission (SERC) in January and July annually, maintain a written hazard communication program, make safety data sheets (SDS) assessable, and ensure that all applicable chemical containers are labeled.

### II. CHEMICAL INVENTORY DATABASE

In an effort to meet this requirement, the CSO has developed a Chemical Inventory Program and provides a web-based database for managing chemical inventories. This database is used to collect, store, and maintain an avalanche of data, for 'Cradle-to-Grave' management and tracking of all hazardous chemicals brought on site, and to compile reports from the data collected for institutional decision makers and federal, state, and local regulators.

All chemical users are required to participate in the Chemical Inventory Program. PIs and other chemical users are required to maintain current inventories by completing semi-annual updates. Updates are to be completed at least 30 days prior to the report dates of January 1<sup>st</sup> and July 1<sup>st</sup> through the online Chemical Inventory Database. Access to the database is provided by the CSO.

The institutional information, chemical data, user access and security systems are maintained by a CSO staff member who serves as the database administrator. For more

information or access to the Chemical Inventory Database contact the CSO at 706-721-2663.

Information and on-line training for the Chemical Inventory Database are available at: <http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

Additional instructions for completing the chemical inventory spreadsheet can be found in APPENDIX A.

### **III. PROCUREMENT MONITORING**

- A. The Augusta University CSO will monitor chemical purchases as they are made available to the office and will update the Augusta University chemical database as new chemicals are purchased. The CSO will also verify that laboratories have required engineering control equipment in the facilities to work with ordered chemicals, and that personnel are properly trained and equipped.
- B. Personnel who are responsible for ordering chemicals for their laboratories should limit chemical purchases to the minimum amount needed to conduct required activity.
- C. It is up to you and your supervisor to ensure that the facilities in which the chemical will be handled are adequate and that anyone who handles the chemical has received training in order to handle them properly.
- D. Information on hazards of chemicals can be found in Safety Data Sheets (SDSs).
- E. **IF YOU ORDER A NEW CHEMICAL IT SHOULD BE ADDED TO YOUR CHEMICAL INVENTORY AS SOON AS POSSIBLE!**

# CHAPTER ELEVEN

## HAZARDOUS WASTE MANAGEMENT PROGRAM

### I. INTRODUCTION

To protect human health and the environment, EPA works with its federal, state, and tribal regulatory partners to assure compliance with statutes and regulations in the management of hazardous wastes and underground storage tanks. The major federal law governing proper management of these wastes and units is the [Resource Conservation and Recovery Act \(RCRA\)](#). Most of the compliance monitoring responsibility under RCRA is delegated to the states and local authorities. EPA provides oversight of compliance monitoring activities in the RCRA program to ensure facilities are properly inspected.

The Resource Conservation and Recovery Act (RCRA) gives EPA the authority to control hazardous waste from "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances.

The Federal Hazardous and Solid Waste Amendments (HSWA) are the 1984 amendments to RCRA that focused on waste minimization and phasing out land disposal of hazardous waste as well as corrective action for releases. Some of the other mandates of this law include increased enforcement authority for EPA, more stringent hazardous waste management standards, and a comprehensive underground storage tank program.

EPA and its regulatory partners inspect facilities that generate, transport, treat, store or dispose of hazardous waste to verify compliance with applicable regulations.

**The Hazardous Waste Management Program** was designed to ensure that the collection, storage, and disposal of all hazardous chemical waste generated at Augusta University is accomplished in compliance with all federal, state, and local rules and regulations, and to provide the details of in-process hazardous waste treatment procedures as approved by the Chemical Safety Officer.

### II. HAZARDOUS WASTE DETERMINATIONS

It is the responsibility of the person who generated the waste to manage all wastes in accordance with all federal, state, and local rules and regulations. This includes collection, segregation, storage and disposal of all hazardous wastes.

Hazardous waste can be liquids, solids, gases, or sludge. They can be discarded commercial products, like cleaning fluids or pesticides, by-products of manufacturing processes, or the by-products of laboratory procedures. Hazardous waste determinations

must be made by individuals that are trained and are familiar with RCRA regulations.

Hazardous waste determinations are provided by CSO staff members who are trained in all EPA and DOT regulations governing hazardous chemical wastes. This information is entered in the Chemical Inventory Database for all chemicals in the user's inventory. Hazardous waste information is then made available through the Chemical Inventory Database in the form of a Chemical Fact Sheet. Instructions for how to access this fact sheet are provided under Module 2: Inventory, of the Chemical Inventory Database on-line training course which is located at: <http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

Additional information about hazardous waste determinations is provided through EPA's hazardous waste determination tool which is accessible on the web at: <http://www.epa.gov/epawaste/hazard/dsw/tool.htm#s5>

Chemical users may also contact the CSO to request a site visit for hazardous waste determinations, collection, and disposal information.

### **III. WASTE MINIMIZATION AND THE CSO CHEMICAL EXCHANGE PROGRAM**

The Chemical Exchange Program is part of the CSO Hazardous Waste Reduction Plan as submitted to the Georgia Department of Natural Resources, Environmental Protection Division. The program is managed and monitored by EHS, CSO.

The Chemical Exchange Program was established to help minimize the amount of hazardous chemical waste generated by Augusta University by collecting and redistributing usable unwanted chemicals.

Under the Chemical Exchange Program, PIs or chemical users may contribute usable chemicals in the original reagent containers for redistribution to other laboratories on campus through the CSO. Chemicals may be submitted for exchange using the following procedures:

- A. The original manufacturers label on chemicals being offered for exchange shall not be removed, defaced, or otherwise destroyed.
- B. All exchange chemicals shall be processed through the Chemical Inventory Database, for pickup and re-distribution.
- C. An Exchange Chemical label, which is produced using the Chemical Inventory Database, shall be attached to the container in a manner that does not destroy, cover, or otherwise deface the original container label.

The details of this program are provided in APPENDIX E.

For more information about this program, contact the CSO at extension 706-721-2663.



## IV. WASTE ACCUMULATION

### A. Satellite Accumulation Area

**A Satellite Accumulation Area (SAA)** is a designated area used to store hazardous waste temporarily. Satellite accumulation provisions allow generators to accumulate a limited amount of hazardous waste at or near the point of generation as long as the area is under the supervision of the individual performing the procedure or process that generates the waste. (*Resource Conservation and Recovery Act of 1976 (RCRA), as amended, 42 U.S.C. § 6922*)

Federal regulations specify that not more than 55 gallons of non-acutely hazardous waste or one quart of acutely hazardous waste may be stored in a satellite area. [Acutely hazardous wastes are wastes listed in 40 CFR 261.31 with the Hazard Code “H” and P-listed hazardous wastes identified in 40 CFR 261.33(e).] These wastes may be stored in satellite accumulation areas until the Satellite Accumulation Container is filled, or the accumulation start date has been met, (whichever comes first) without a RCRA permit or interim status, if the following provisions on container use, management, and labeling are met.

1. The wastes must be placed in containers that are in good condition as provided in 40 CFR 265.171. If a container holding hazardous waste begins to leak, the waste must either be transferred to a container that is in good condition or be managed in some other manner in accordance with RCRA requirements [40 CFR 262.34(c)(1)(i)].
2. The wastes must be compatible with their containers as required by 40 CFR 265.172, which states that containers storing hazardous waste must be made of, or lined with, materials that will not react with and are otherwise compatible with the hazardous waste being stored, so that the ability of the containers to contain the wastes is not impaired [40 CFR 262.34(c)(1)(i)].
3. The containers holding the waste must be managed in accordance with 40 CFR 265.173(a). These regulations state that a container holding hazardous waste must always be closed during storage, except when it is necessary to add or remove waste [40 CFR 262.34(c)(1)(i)].
4. Containers in satellite accumulation areas must be marked with the words “Hazardous Waste” or with other words that identify the contents of the containers [40 CFR 262.34(c)(1)(ii)], including the chemical name for each constituent with percent concentration for each chemical in the container. In addition to this, the ICC requires that each hazardous waste container also have the name of the PI in charge of the laboratory or the generator, and the building and room number for where the waste is generated.

5. The Satellite Accumulation Area must be at or near the point of generation where wastes initially accumulate and under the control of the generator of the waste [40 CFR 262.34(c)(1)].

Information about Satellite Accumulation Areas and Satellite Accumulation Container Labels is provided on-line at:

<http://www.augusta.edu/services/ehs/chemsafe/hazwaste.php>

## B. **Central Accumulation Area**

The two **Central Accumulation Areas (CAA)**, one located at the CS building in the Augusta University-Health Sciences campus and the other located at Augusta University-Summerville campus, are temporary storage locations for hazardous/non-hazardous chemical waste that has been collected from various campus locations and is awaiting shipment for final treatment or disposal.

Augusta University-Health Sciences and Augusta University-Summerville campuses are Small Quantity Generators (SQG).

A Small Quantity Generator:

- 1 Generates greater than 100 kilograms (220 lbs.) but less than 1000 kilograms (2200 lbs.) of hazardous waste in a calendar month.
- 2 May accumulate hazardous waste in a Central Accumulation Area for 180 days or less without a permit or without having interim status provided that the quantity of waste on-site never exceeds 6000 kilograms (13,200 lbs.) of hazardous waste or 1 kilogram (2.2 lbs.) of acutely hazardous "P" listed waste.

## V. **HAZARDOUS WASTE DISPOSAL**

All hazardous waste must be processed through the Chemical Inventory Database for pickup and disposal by the CSO.

Instructions for how to use the Chemical Inventory Database to submit a request for pickup of hazardous waste and to produce AUGUSTA UNIVERSITY Hazardous Waste Labels for each waste container are available on-line under Module 4: Waste Pickup at: <http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

# CHAPTER TWELVE

## OTHER SAFETY SUPPORT SERVICES

The EHS Division provides technical support through various programs, resources, and services to assist all Augusta University research faculty and support staff in achieving full regulatory compliance and providing a safe and healthy work environment for all employees, students, patients, and visitors. Information about EHS is provided on-line at: <http://www.augusta.edu/services/ehs/>

### **I. CHEMICAL SAFETY OFFICE (CSO)**

Chemical Safety Programs directed at specific areas of regulatory compliance are managed and monitored under the CSO. Details about the various programs are provided on-line at: <http://www.augusta.edu/services/ehs/chemsafe/>

### **II. INDUSTRIAL HYGIENE AND SAFETY OFFICE (IHS)**

The Chemical Fume Hood Inspection Certification Program is managed under the IHS Office.

In addition to chemical fume hoods, IHS also provides oversight for Laminar Flow Hoods, environmental monitoring and indoor air quality assessments, inspection/certification of eyewash stations and safety showers, and oversight of the employee respiratory protection program. IHS is also responsible for the management of Universal Wastes generated by the institution. For more information or questions about any of these programs, contact the IHS Officer at 706-721-2663, or go to: <http://www.augusta.edu/services/ehs/ihs/>

### **III. FIRE SAFETY OFFICE (FSO)**

Fire safety issues are managed under the Fire Safety Office. Issues associated with fire safety include, but may not be limited to, fire extinguishers, electrical safety, fire reporting (Code-RED), Christmas and Holiday decorations, fire safety inspections and fire alarms, hot work operations, fire safety education and training, and accident/injury reporting. For more information or questions contact the Fire Safety Officer at x706-721-2663 or go to: <http://www.augusta.edu/services/ehs/firesafe/>

### **IV. BIOLOGICAL SAFETY OFFICE (BSO)**

Biological safety issues are managed under the Biological Safety Office. Issues related to biological safety include, but may not be limited to, biosafety protocol review and approval, biosafety audits and training, and compliance with federal laws regarding biosafety and bioterrorism. For more information and questions about biological safety, contact the Biological Safety Officer at 706-721-2663, or go to: <http://www.augusta.edu/services/ehs/biosafe/>

# CHAPTER THIRTEEN

## SAFETY PROCEDURES FOR TEACHING LABORATORIES

### I. INTRODUCTION

This chapter of the Augusta University Chemical and Laboratory Safety Guide is designed as a stand-alone guidance document for students and faculty in teaching and research laboratories at the Summerville Campus and is redundant in some respects with guidance in other chapters.

The mission of the Augusta University, Environmental Health and Safety Division (EHS) is to provide environmental safety services to staff, patients, students and visitors.

To fulfil this mission for the teaching laboratory staff and students, EHS will strive to protect, educate and provide sound leadership for a safe conduct of operations in Augusta University research and teaching laboratories. EHS will assist faculty members in ensuring compliance with all federal, state and local laws.

Individual labs and their assigned instructors are encouraged to augment this guide with specific information and procedures as needed.

### II. RESPONSIBILITIES

#### A. Responsibilities of Environmental Health and Safety (EHS)

1. Provide Hazard Communication/Right-to-Know training.
2. Provide general lab safety training.
3. Document and maintain general lab safety training records.
4. Upon request, assist departments in developing protocol/project-specific training.
5. Schedule training courses.
6. Conduct exposure assessment and collect all relevant information regarding any over exposure incident.
7. Conduct laboratory safety assistance visits of teaching labs and chemical storage rooms
8. Provide consultations and if necessary, respond to accidents, spills or other lab emergencies.

#### B. Responsibilities of Department Managers and Faculty










1. Set a good example by wearing required PPE in the lab.
2. Ensure that students wear the appropriate personal protective equipment (PPE) (i.e., lab coats, safety glasses, chemical splash goggles, and appropriate gloves).
3. Teach students to never dispose of chemicals or hazardous waste in sink drains or general trash.
4. Identify laboratory workers or student workers who require training.
5. Ensure that workers attend scheduled training sessions, including refresher training.

6. Provide protocol/project-specific training for Lab Workers to include all undergraduate students and any post graduate students or other workers in the lab identified by the faculty member as requiring project specific training.
7. Provide training to lab workers for the safe handling of high hazard chemicals (organometallics and pyrophorics).
8. Conduct a risk-benefit analysis of using high hazard chemicals compared to no hazard or less hazardous chemicals in teaching or research labs.
9. Know the location and proper use of safety equipment and convey this information to students and lab workers.
10. Ensure that the Augusta University Critical Event and Emergency Response Guide flipchart is posted and that Lab Workers know where it is posted for safety procedures to follow in the event of an emergency/accident.
11. Notify EHS of all incidents resulting in injury and/or exposure to chemicals after obtaining necessary medical attention.
12. Review the **Safety Data Sheet** for risks and safe handling procedures for hazardous chemicals prior to each experiment.
13. **Enforce all safety rules and procedures at all times.**

### **C. Responsibilities of Students and Lab Workers**





1. Follow all **SAFETY PROCEDURES FOR LABORATORIES**
2. Follow the Faculty Members instructions and guidance
3. Wear required PPE
4. Know the location and proper use of lab safety equipment (eye wash and shower stations, fire extinguishers, first aid kit etc.)
5. Follow lab practices that minimize personal exposure and environmental damage from hazardous material.
6. Be alert to possible chemical exposure. In the event of exposure, inform the responsible faculty member and take appropriate action following the “Critical Event and Emergency Response Guide” located on the wall in your lab.
7. Know the nine Hazard Communication Standard (HCS) Pictograms  
*Look for these hazard symbols on your chemical containers (see below)*

### OSHA Hazard Communication Standard Pictograms


<p><b>Health Hazard</b></p> 	<p><b>Flame</b></p> 	<p><b>Exclamation Mark</b></p> 
<ul style="list-style-type: none"> <li>• Carcinogen</li> <li>• Mutagenicity</li> <li>• Reproductive Toxicity</li> <li>• Respiratory Sensitizer</li> <li>• Target Organ Toxicity</li> <li>• Aspiration Toxicity</li> </ul>	<ul style="list-style-type: none"> <li>• Flammables</li> <li>• Pyrophorics</li> <li>• Self-Heating</li> <li>• Emits Flammable Gas</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>	<ul style="list-style-type: none"> <li>• Irritant (skin and eye)</li> <li>• Skin Sensitizer</li> <li>• Acute Toxicity (harmful)</li> <li>• Narcotic Effects</li> <li>• Respiratory Tract Irritant</li> <li>• Hazardous to Ozone Layer (Non Mandatory)</li> </ul>
<p><b>Gas Cylinder</b></p> 	<p><b>Corrosion</b></p> 	<p><b>Exploding Bomb</b></p> 
<ul style="list-style-type: none"> <li>• Gases under Pressure</li> </ul>	<ul style="list-style-type: none"> <li>• Skin Corrosion/ burns</li> <li>• Eye Damage</li> <li>• Corrosive to Metals</li> </ul>	<ul style="list-style-type: none"> <li>• Explosives</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>
<p><b>Flame over Circle</b></p> 	<p><b>Environment (Non Mandatory)</b></p> 	<p><b>Skull and Crossbones</b></p> 
<ul style="list-style-type: none"> <li>• Oxidizers</li> </ul>	<ul style="list-style-type: none"> <li>• Aquatic Toxicity</li> </ul>	<ul style="list-style-type: none"> <li>• Acute Toxicity (fatal or toxic)</li> </ul>




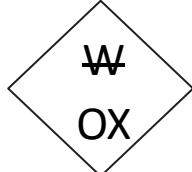
### III. KNOW YOUR EMERGENCY EQUIPMENT AND WARNING SYMBOLS

- Know the location of all the exits in the laboratory and the nearest exits from the building.
- Know how to reach emergency personnel by phone following guidance in the “Critical Event and Emergency Response Guide” located on the wall in your lab.
- Know the location and proper use of the following safety equipment:

<p>Fire extinguishers Alarm systems with pull stations Eye washes First-aid kits Deluge safety showers</p>	 
	

- Understand the hazards in your lab by knowing what the numbers on the NFPA Diamond represent (*study the levels below and compare them to the diamond on the wall at your lab entranceways*)

<p style="text-align: center;"><b>Understanding the National Fire Protection Association Hazard Labels</b></p> <p>The National Fire Protection Association (NFPA) has developed a visual guide (see below) for many chemicals. This NFPA 704 Hazard Identification system, the NFPA diamond, is a quick visual review of the health hazard, flammability, reactivity, and special hazards a chemical may present in short-term, acute exposures that are most likely to occur as a result of fire, spill, or similar emergency. The diamond is broken into four sections (blue, red, yellow, and white). The symbols and numbers in the four sections indicate the degree of hazard associated with a particular chemical or material.</p> <p><b>Remember Higher #'s = <i>Greater Danger</i></b></p>	 <p>The diagram shows a diamond divided into four quadrants: top (red) with '3', left (blue) with '2', right (yellow) with '1', and bottom (white) with 'W' over 'OX'.</p>
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<p><b>Health Hazard Numbering (Blue, to the left)</b></p> <p>4 Danger - May be fatal on short exposure. Specialized protective equipment required  3 Warning - Corrosive or toxic. Avoid skin contact or inhalation  2 Warning - May be harmful if inhaled or absorbed  1 Caution - May be irritating  0 No unusual hazard</p>	
<p><b>Flammability Numbering (Red, at the top)</b></p> <p>4 Danger - Flammable gas or extremely flammable liquid  3 Warning - Flammable liquid flash point below 100 °F  2 Caution - Combustible liquid flash point of 100 to 200 °F  1 Combustible if heated  0 No unusual hazard</p>	
<p><b>Reactivity Numbering (Yellow, to the right)</b></p> <p>4 Danger - Explosive material at room temperature  3 Danger - May be explosive if shocked, heated under confinement, or mixed with water  2 Warning - Unstable or may react violently if mixed with water  1 Caution - May react if heated or mixed with water but not violently  0 Stable - Not reactive when mixed with water</p>	
<p><b>Special Notice Key (White, at the bottom)</b></p> <p>W - Water Reactive  OX - Oxidizing Agent</p>	

#### IV. REPORT ACCIDENTS TO YOUR RESPONSIBLE FACULTY MEMBER AND DO THE FOLLOWING

- Eye Contact with chemicals: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention. Hold eyelids open.
- Ingestion: Consult the MSDS/SDS, a chemical first aid manual or call Public Safety at 706-721-2911 on campus, and then call the Poison Control Information Center at 1-800-282-3171. Seek medical attention as soon as possible.
- Skin Contact: Promptly flush the affected area with water from the faucet or drench shower (minimum of 15 minutes) and remove any contaminated clothing. If symptoms persist after washing, seek medical attention. *(If spill is on clothing, first remove clothing from the skin and soak the area with water as soon as possible)*

**Lab personnel should call for emergency medical treatment if needed!!!**

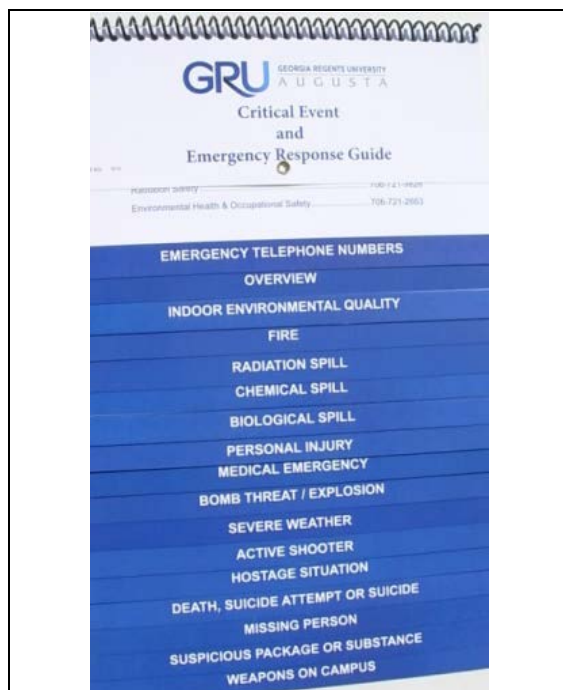
**If injured complete the “Augusta University Student Health Service Injury Report” found at: <http://www.augusta.edu/shs/documents/studentinjuryformsixteen.pdf>**

#### **Students:**

- If you have an accident, injury or exposure while on AUGUSTA UNIVERSITY property, take the necessary precautionary actions to reduce further injury and immediately contact Student Health Services at (706)721-3448 or report to the Student Health Services facility located at Pavilion II (AF-Building) on Laney Walker Blvd. on the Augusta University downtown campus. Report incidents to EHS after obtaining necessary medical attention.

**Refer to** the “Critical Event and Emergency Response Guide” located on the wall in your lab for medical emergency guidance.

#### **Critical Event and Emergency Response Guide**





**V. CHEMICAL SPILL PROCEDURES AS DESCRIBED IN THE “CRITICAL EVENT AND EMERGENCY RESPONSE GUIDE” (follow these steps):**

- Alert people in immediate area of spill
- Wear protective clothing including safety glasses, gloves, and lab coat
- Avoid breathing vapors from the spill
- Use appropriate kit to neutralize and absorb inorganic acids and bases. Collect residue, place in container and dispose as chemical waste.
- For other chemicals use appropriate kit or absorb spill with vermiculite, gel absorbent, or clay absorbent (cat litter). Collect residue, seal container and dispose as chemical waste.
- Clean spill area with water



**Mercury Spill procedures**

- Evacuate the affected area and notify the Chemical Safety Office at (706)721-2663
- Close off interior doors and windows in the room.

**VI. REQUIRED MINIMUM PERSONAL APPAREL FOR ALL LABS**

For entry into any lab, the minimum personal apparel shown here is required. Wear close-toed shoes and long pants or ankle length skirts at all times in the laboratory. A shirt or other top must cover the shoulders and not expose the midriff. Sandals or other shoes which expose the toes or ANY part of the top and/or heel of the foot are not appropriate. Lab workers should also confine long hair and loose clothing. **Students are not permitted in any lab if they violate this safety dress code requirement.**



**VII. PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR TEACHING LABS**

A graded approach will be taken by the faculty in determining what level of PPE is required. When determining what experiments to conduct, the responsible faculty member will analyze the risk of the chemicals to be used and assure that the available PPE is sufficient for the hazards posed.

Unless otherwise instructed by a faculty member or his/her designated representative, use **the following PPE** for the following lab activities:

- A. Safety glasses are required to enter a lab where chemicals are in use.
  1. Safety glasses must meet the ANSI Z87.1 standard for impact resistance and have side shields for splash protection.
  2. Safety glasses or goggles must be worn over prescription glasses. Safety glasses worn over prescription glasses must be of a type intended for this purpose (Often referred to as Over the Glass Safety Glasses). Regular prescription glasses will not provide adequate protection in this case.
  3. Prescription safety glasses are acceptable as long as they have side shields for splash protection. Side shields must also meet the ANSI Z87.1 standard for impact resistance and be non-vented.
  
- B. Certain laboratory courses require lab coat, apron, and gloves when high hazard chemicals are in use in an experiment or when high hazard chemicals are being moved to or from a storage area. Full length long sleeve lab coats (or laboratory apron) and appropriate gloves are required in those cases. High hazard chemicals or experiments include:
  1. Experiments involving highly corrosive materials including concentrated mineral acids (e.g. stock concentrated solutions of hydrochloric acid, sulfuric acid, nitric acid) or caustic base solutions with a concentration greater than 50% (e.g. sodium hydroxide, potassium hydroxide) in a quantity great enough to affect a majority of the body surface in a spill i.e. greater than about 10 ml).
  2. Highly toxic materials including substances with a NFPA rating of 3 or 4
  3. Any chemical listed by the institution as a highly hazardous chemical.
  
- C. Some types of chemicals have special hazards that deserve consideration for using additional PPE. Examples include:
  1. Potentially Explosive Chemicals
    - Peroxide forming chemicals
    - Picric Acid
  2. Pyrophoric Chemicals
    - Butyllithium
    - Metal powders
  3. Highly Toxic Chemicals
    - Epinephrine
    - Ammonium Nitrate
  4. Inhalation Hazards
    - Acetyl Chloride
    - Nitrogen Oxides

### 5.Highly Corrosive Chemicals

- Nitric Acid
- Caustic Base Solutions of Greater than 50% Concentration

A more complete list of high hazard chemicals can be found on the CSO website at: <http://www.augusta.edu/services/ehs/chemsafe/HiHazList%200213.pdf>

A laboratory coat must be worn when handling any of these chemicals. At the discretion of the instructor/faculty member, a one-time exemption may be made to allow a student wear an apron to complete an experiment as long as the student is wearing a long sleeve shirt under the apron. For toxic or corrosive chemicals, disposable gloves shall be used. In addition to this PPE, proper engineering controls such as a vented chemical enclosure or chemical fume hood will assist in providing protection against the hazards of these chemicals. If these engineering control measures are not available, the instructor shall specify additional PPE appropriate for the hazards posed by these chemicals.

A “Glove Selection Guide” can be found on the CSO web site at: (<http://www.AugustaUniversity.edu/services/ehs/chemsafe/PDF%20files/gloveselechart.pdf>)

## **VIII. PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR RESEARCH LABS**

### **A. PERSONAL PROTECTIVE EQUIPMENT IN A RESEARCH LAB**

In addition to the required personal apparel described in section F. above, the following PPE is required when working in a research laboratory.

1. Eye protection is safety glasses with side shields or safety goggles.
  - Safety glasses must meet the ANSI Z87.1 standard for impact resistance and have side shields for splash protection.
  - Safety glasses or goggles must be worn over prescription glasses. Safety glasses worn over prescription glasses must be of a type intended for this purpose (Often referred to as Over the Glass Safety Glasses). Regular prescription glasses will not provide adequate protection in this case.
  - Prescription safety glasses are acceptable as long as they have side shields for splash protection. Side shields must also meet the ANSI Z87.1 standard for impact resistance and be non-vented.
  - If the experiment requires other forms of eye protection such as goggles or face shields, they will be provided by the faculty member.
2. When working with toxic or corrosive materials in amounts or concentrations where there is a risk for dermal burns, wear appropriate disposable gloves, provided by the Principal Investigator (PI).
  - Select gloves which are appropriate for the chemical(s) being used and also the process
  - Before use, check gloves (even new ones) for physical damage such as tears or pin holes and for previous chemical damage: this is especially important when dealing with corrosive materials.

- Most chemically resistant gloves, especially lightweight disposables, are combustible: keep hands well away from unprotected flames or other high temperature heat sources.
  - Removing gloves in a way that avoids the contaminated exterior contacting the skin.
  - Do not re-use disposable gloves
3. Long sleeve cloth lab coats
- Lab Coats shall be full length as shown in the illustration below. Labs where open flames are used the lab coat shall be made of 100% cotton or flame resistant material.
  - Labs where pyrophoric materials are handled- lab coat must be of flame resistant materials.

### **PPE for working with Organometallic and Pyrophoric Chemicals**

Special PPE required for working with these type hazards include 100% natural fiber clothing and flame retardant lab coats, appropriate gloves and safety glasses or goggles.

### **Minimum PPE for Lab Workers**

*(working with chemicals in a research lab)*



**Full Length  
Lab Coat**



**Safety Glasses**



**Chemical Resistant  
Gloves**

## **IX. LAB HYGIENE AND CONDUCT OF OPERATIONS**

When conducting an experiment in a research lab or a teaching lab, the student or lab worker should routinely follow common sense habits, i.e., implementing Administrative Control (see below) to minimize accidents and spills.

### **A. ADMINISTRATIVE CONTROL MEASURES**

1. Preplan your experiment, keeping your work area clean, using extreme care when handling glass, always point test tubes away from others when heating, keep flammable materials away from open flames, no eating or drinking in the lab and always wash your hands before you leave the lab.

2. Never work alone in the laboratory without supervision. Always perform the experiments or work precisely as directed. (Note: the ultimate responsibility for safe lab operations resides with the faculty member). Depending on the expertise of the student or lab worker, and the nature of the experiment being conducted, a faculty member may allow work without direct supervision. An emergency cell phone number should be provided to the individual if an exception is granted by the faculty member.
3. Before each activity in the laboratory, review pertinent information from the **Safety Data Sheet** on the risk and safe handling procedure of hazardous chemicals prior to each experiment. Make sure you understand all the potential hazards of the materials, the process, and the equipment involved in the activity.
4. Know where to find emergency procedures - **Refer to** the “Critical Event and Emergency Response Guide” located on the wall in your lab.
5. Immediately report any spills, accidents, or injuries to a faculty member
6. Long term experiments that cannot be continuously attended must have notification posted on the laboratory door describing the materials in use, the location in the laboratory, and the researcher’s contact information.
7. Never attempt to catch a falling object.
8. Be careful when handling hot glassware and apparatus in the laboratory. Hot glassware looks just like cold glassware.
9. Make sure no flammable solvents are in the area when lighting a flame.
10. Turn off all heating apparatus, gas valves, and water faucets when not in use.
11. Clean up the work area on completion of an operation or at the end of each day

#### **X. EATING AND DRINKING AND PREVENTING CONTAMINATION**

Food and beverages are NOT permitted in laboratory rooms. DO NOT eat, drink, chew gum, or apply cosmetics in a laboratory or areas where chemicals are present. Do not store food or beverages in refrigerators in the lab or where chemicals are stored. Keep your hands away from your face, eyes, mouth, and body while using chemicals. Wash hands after removing gloves, and before leaving the laboratory. Never use the keyboard on your computer, your cell phone or a calculator with potentially contaminated gloves.

#### **XI. PLACARDS POSTED OUTSIDE LAB**

The placard posted outside a lab provides of important information.

	<ul style="list-style-type: none"> <li>• “CAUTION” reminds you there are hazards in the lab</li> <li>• “NO FOOD OR DRINK ALLOWED”</li> <li>• What Level of PPE is required when working</li> <li>• The NFPA diamond discussed in detail in prior sections gives us a rating of the various hazards in the lab</li> <li>• Emergency contact Phone Numbers</li> </ul>
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## XII. USE OF CHEMICAL FUME HOOD

Use a chemical fume hood for operations that may result in release of toxic chemical vapors or dust. As a rule of thumb, use a hood or other local ventilation device when working with volatile substance or aerosolizable materials that you wish to remove from your breathing zone. Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made; keep materials stored in hoods to a minimum and do not allow them to block vents or air flow. Always have a contingency plan, to include personnel evacuation, in the event of hood failure.

## XIII. TRAINING REQUIREMENTS

### A. Faculty/Researcher/ Lab Worker

The following computer based training is required:

1. Board of Regents Basic Awareness and Right to Know Training with Global Harmonized System
2. Board of Regents Chemical Specific Training
3. Board of Regents Hazardous Waste Awareness Training
4. In addition research lab workers shall also receive project specific training prior to starting work.

### B. Students

Before beginning a lab experiment, students must be familiar with the hazards and emergency response actions for chemical spills or accidents.

## References

1. 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories.
2. 29 CFR Subpart Z, Toxic and Hazardous Substances.
3. Safety in Academic Chemistry Laboratories, the American Chemical Society, 1990.
4. Prudent Practices in the Laboratory handling and disposal of chemicals, the National Research Council, 1995.
5. Georgia Tech Lab Safety Manual
6. The Harvard University, Longwood Area, Chemical Hygiene Plan.
7. The University of Southern California Laboratory Safety Program.
8. The University of West Florida Chemical Hygiene Plan.
9. The FSU Safety Manual, Handling and Storage of Hazardous Materials.

**Websites**

National Science Teachers Association (NSTA) [www.nsta.org](http://www.nsta.org)

National Safety Council (NSC) [www.nsc.org](http://www.nsc.org)

National Fire Protection Association (NFPA) [www.nfpa.org](http://www.nfpa.org)

MSDS Online [www.msdonline.com](http://www.msdonline.com)

Laboratory Safety Institute (LSI) [www.labsafety.org](http://www.labsafety.org)

## **APPENDICES**

- Appendix A: HAZARDOUS CHEMICAL INVENTORY PROGRAM
- Appendix B: HAZARDOUS CHEMICAL PROTECTION & HAZCOM PLAN
- Appendix C: SHIPPING /TRANSPORT OF HAZARDOUS MATERIAL POLICY
- Appendix D: HAZARDOUS WASTE MANAGEMENT PROGRAM
- Appendix E: CHEMICAL EXCHANGE PROGRAM
- Appendix F: PROGRAM FOR MANAGEMENT OF DEA REGULATED MATERIALS
- Appendix G: FLAMMABLE & COMBUSTIBLE MATERIALS SOP
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- Appendix I: CRYOGENIC LIQUIDS STANDARD OPERATING PROCEDURE
- Appendix J: LIQUID NITROGEN SAFETY
- Appendix K: CORROSIVE MATERIALS STANDARD OPERATING PROCEDURE
- Appendix L: POISON/TOXIC SUBSTANCES STANDARD OPERATING PROCEDURE
- Appendix M: HYDROFLUORIC ACID STANDARD OPERATING PROCEDURE
- Appendix N: HIGHLY REACTIVE AND POTENTIALLY EXPLOSIVE COMPOUNDS SOP
- Appendix O: CHEMICAL STORAGE FLOW CHART
- Appendix P: HOW TO READ A SAFETY DATA SHEET
- Appendix Q: GLOBAL HARMONIZATION STANDARDS
- Appendix R: GUIDELINES FOR SAFE HANDLING OF CHEMOTHERAPEUTIC AGENTS
- Appendix S: AUGUSTA UNIVERSITY HIGH HAZARD CHEMICALS
- Appendix T: OSMIUM TETROXIDE STANDARD OPERATING PROCEDURE
- Appendix U: HAZARDOUS CHEMICAL PLACARDS
- Appendix V: GUIDELINES FOR IDENTIFYING AND HANDLING SUSPICIOUS  
MAIL/PACKAGES



**APPENDIX A**  
**HAZARDOUS CHEMICAL INVENTORY PROGRAM**

**I. PURPOSE**

Chemicals play an important role in research and teaching at Augusta University. Unlike industrial production facilities, laboratories at academic institutions generally have small quantities, but a large variety of chemicals with multiple hazards or risk factors, and multiple points of hazardous waste generation. Mismanagement of hazardous chemicals can result in regulatory citations, costly fines, and jail time if the citation is deemed a “willful” violation.

This policy was designed to establish procedures for the safe use, handling, transport, storage, and disposal of hazardous chemicals in order to comply with all federal, state, and local rules and regulations, and to promote environmental stewardship, safety, and health in the management of hazardous chemicals at Augusta University.

**II. POLICY**

Augusta University shall take every precaution to protect all persons and property against hazards presented by the use, handling, storage, transport and disposal of hazardous chemicals.

All employees and/or students and facilities that use, handle, store or transport hazardous chemicals shall participate in the Chemical Inventory Management Program provided by EHS, and comply with all institutional policies and standard operating procedures that support the objectives of this policy.

**III. RESPONSIBILITIES**

**A. Environmental Health and Safety Division (EHS)**

Environmental Health and Safety Division (EHS) provides a software package that incorporates all elements needed to achieve regulatory compliance in the management of hazardous chemicals from the moment they arrive on campus until they are totally consumed, or disposed as hazardous wastes.

**B. Principal Investigators, Supervisors, and Other Responsible Parties**

Principal Investigators who wish to use hazardous chemicals in laboratories must seek and receive prior approval through the ICC and the CSO. Applications for the use of hazardous chemicals in laboratories are available at:

<http://www.augusta.edu/services/ehs/chemsafe/> , See ICC Application for Use of Hazardous Chemicals in Laboratories.

While other campus facilities, such as service, support, and teaching or clinical laboratories are not required to submit the ICC application for use of hazardous chemicals, they are required to follow all standard operating procedures for use, handling, transport, storage and disposal of hazardous chemicals, including the use of

the Chemical Inventory Database for capturing and maintaining inventories and disposal of hazardous chemical wastes.

#### **IV. HIGH HAZARD CHEMICALS**

Extremely hazardous chemicals that pose a high risk to personnel and property, such as highly reactive potentially explosive chemicals, chemicals that are highly toxic, potentially lethal, or chemicals that are highly regulated, such as the Department of Homeland Security Appendix A listed chemicals, and dioxins or dioxin forming compounds, shall not be purchased or brought on campus without prior approval from the CSO and ICC. Principal Investigators or other individuals who wish to use high hazard chemicals must seek and receive ICC and CSO approval for the use of High Hazard Chemicals prior to bringing such materials on campus. An application for the use of High Hazard Chemicals is provided at: <http://www.augusta.edu/services/ehs/chemsafe/>

Written laboratory or process procedures, including associated hazards or risks, appropriate precautions, symptoms of exposure, proper personal protection equipment, and waste disposal procedures must be provided and approved through the CSO for employees who will be expected to handle or work with these types of materials. Principal Investigators, Supervisors, or other responsible persons are to train employees and/or students in these procedures prior to releasing them for work.

While campus facilities such as services and support facilities, or teaching and clinical laboratories are not required to submit the ICC application for use of high hazard chemicals, they are required to seek and receive written approval from the CSO prior to bringing such materials on campus. All departments are required to comply with standard operating procedures provided for such materials. Talk to your CSO representative or contact the CSO at 706-721-2663 for more information on the use of high hazard chemicals.

#### **V. Chemical Inventory Database**

The EHS Assistant Chemical Inventory Database is a web based database program used to collect store, and maintain an avalanche of data, and to compile reports from that data, on institutional decision makers and federal, state, and local regulators. Instructions for how to use the various menu items of the database are provided by the CSO through an on-line training resource located at: <http://www.augusta.edu/services/ehs/chemsafe/invprog.php>

The institutional information, chemical data, user access and security systems are maintained by a CSO member who serves as the database administrator.

The Chemical Inventory Database allows controlled access to each PI's laboratory information. The PI will not have the ability to access any laboratory information other than his own. The program is secured behind a firewall to prevent access from outside sources. It is password protected, and cannot be accessed by any unauthorized person inside or outside

of the Augusta University Network. Laboratory Worker access to the database will not be provided without approval from each individual PI.

All clinical and research laboratories and other facilities that use, handle, store, transport, or dispose hazardous chemicals are required to comply with the requirements provided under the Chemical Management Program, and to use the EHS Assistant Chemical Inventory Database for inventory and management of their hazardous chemicals and hazardous chemical wastes.

Principal Investigators, Supervisors and other responsible persons where hazardous chemicals are used and/or stored are required to:

- Maintain current inventories, with at minimum, semi-annual updates. Updates are to be completed by January 1<sup>st</sup> and July 1<sup>st</sup> of every calendar year using the CSA Web chemical inventory database. The Semi-Annual Review Statement provided in the database is to certify that the physical review has been accomplished and the inventories are updated as required. Detailed instructions on how to complete the updates are provided in the on-line training provided above and in a Web User's Manual, which is available on the Web at:  
<http://www.augusta.edu/services/ehs/chemsafe/PDF%20files/WebMANUALRev9-10-09.pdf>
- When performing the Chemical Inventory Updates, conduct a physical review of all chemical in stock be and updated the database accordingly. While performing the physical review, the container labeling, integrity, and seals should be checked and fixed for compliance. Time sensitive chemicals should be checked for expiration dates and disposed as required.
- Process all hazardous chemical waste for pickup and disposal through the CSA Web chemical inventory database using the Waste Pickup applications provided in the CSA Web chemical inventory database. Instructions for accomplishing this are provided in the on-line training provided at:  
<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

## **VI. PROCEDURES**

Institutional processes and Standard Operating Procedures for the management of Hazardous Chemicals are provide in the Augusta University Chemical & Laboratory Safety Guide, which is available on-line at:

<http://www.augusta.edu/services/ehs/chemsafe/chemsafeguide2016.pdf>

For more information about the Chemical Inventory Program Contact the CSO at 706-721-2663, or talk to your CSO representative.



**APPENDIX B**

**Hazardous Chemical Protection and HazCom Plan**

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## **Purpose**

Augusta University has established this plan in order to comply with the Georgia Public Employees Hazardous Chemical Protection and Right-to-Know Act (RTK) of 1988 as amended, and Georgia Department of Labor Chapter 300-3-19 Public Employee Hazardous Chemical Protection and Right-To-Know Rules.

### **1. Policy Statement**

It is the policy of the Augusta University to provide guidelines, assign responsibilities and outline procedures for an effective Chemical Safety Training Program. Training shall be provided to all employees who handle chemicals, or who are potentially exposed to chemicals during their normal course of employment, and any time a new chemical hazard is introduced into the workplace. All employees of the Augusta University shall comply with the Augusta University RTK Plan. This plan is available by contacting the Augusta University RTK Coordinator in the Division of Environmental Health and Safety (EHS). No employee of Augusta University shall be discharged, disciplined, or discriminated against for exercising their rights under this plan.

### **2. Delegation of Authority**

The Augusta University RTK Coordinator shall be responsible for providing and coordinating Basic and General Information Training to all employees. This shall be accomplished at orientation, with annual refreshers thereafter. Chemical Specific, On-the-Job, and Operational Training should be accomplished through the direct supervisor, Principal Investigator (PI), or Departmental Manager. However, if these individuals are unable to provide appropriate training, the responsibility shall reside with the RTK Coordinator as stipulated by state law.

All training must be documented to include:

- A. Course Title (Title of video, or title of printed material)
- B. Name of Instructor (or producer of video or printed material)
- C. Agenda with a brief outline of the context
- D. Date & time of training
- E. Location
- F. Name of Trainee, Signature of the Trainee and date signed

Training programs must demonstrate comprehension and usability on the part of each employee receiving the training.

### **3. Procedure**

#### **3.1 Procurement of Hazardous Chemicals**

- 3.1.1 Augusta University employees will purchase hazardous chemicals according to Augusta University procurement policies and will ensure that copies of material safety data sheets for these chemicals are sent to the Augusta University RTK Coordinator.

### 3.2 Material Safety Data Sheet (SDS) Program

- 3.2.1 The EHS Material Safety Data Sheet (SDS) Program is established for the collection, review, and storage of SDS for all chemicals on the Augusta University campus, and to ensure that all employees have access to current chemical hazard information for those chemicals to which they are exposed or potentially exposed as part of their employment at Augusta University.
- 3.2.2 Under the SDS Program, the RTK Coordinator receives a SDS for all chemicals delivered. The RTK Coordinator ensures that each SDS received is reviewed for any health and safety information. Information provided on the SDS is entered in the Chemical inventory Database under the Chemical Catalog. This information is then made available to the Principal Investigators (PIs) or Supervisors of work areas where hazardous chemicals are used or stored through the Chemical Inventory database in the form of a report called a “Chemical Fact Sheet.” Through this system, the PI can generate and print a Chemical Fact Sheet for all chemicals provided in their inventory, and distribute the information to their staff members.
- 3.2.3 When a new hazardous substance may be brought into the workplace, the PI, Supervisor, or Manager of employees who may be exposed to the new substance, are required to ensure that the SDS for the new substance has been reviewed for toxicity information before a final decision is made to acquire the substance. A determination must be made as to whether a less toxic substance can be used, and if there is no less toxic substance available, the PI/Supervisor must ensure that the CSO has reviewed the SDS and determined whether additional engineering controls or personal protective equipment will be needed to protect employees who may be handling or exposed to the substance.
- 3.2.4 A central file of SDSs will be maintained by the Augusta University RTK Coordinator. Access to SDSs will be provided to Augusta University employees during normal business hours. Emergency or after business hour access to SDSs can be obtained by contacting the Public Safety Division. Public Safety will contact the EHS on-call staff member for emergency access. SDSs are also available from the Augusta University CSO web site at;  
<http://www.augusta.edu/services/ehs/chemsafe/msdlinks.php>

### 3.3 Chemical Inventory Program

- 3.3.1 The EHS Chemical Inventory Program is established to collect and maintain a list of all hazardous chemicals used or stored in Augusta University and to make the list available to all Augusta University employees. All laboratories or work areas where chemicals are used or stored are required to participate in the Chemical Inventory Program.
- 3.3.2 A Chemical Inventory Database with web access has been provided

through the EHS CSO. CSO staff members perform an initial input of chemical inventories. Access to the database is then provided to the Principal Investigator (PI) or the Supervisor of the work area. PIs or work area Supervisors are required to perform a physical review of their inventory and update their database inventory information, at minimum, during the month of January and July of every calendar year.

- 3.3.3 Inventories collected in the database are used to generate the list of all hazardous chemicals. This list is available for review to all Augusta University employees through the Augusta University RTK Coordinator and the CSO. The inventory database is also used to generate EPCRA Tier I, Tier II and SDS reports as required under SARA Title III section 311 and 312. These reports are produced and distributed by the EHS Chemical Safety Officer.

### 3.4 Container Labeling

#### 3.4.1 Original Containers

3.4.1.1 Any Augusta University employee ordering a chemical or product containing a hazardous chemical should verify that all containers received for use:

- are clearly labeled as to the contents;
- display the appropriate hazard warnings;
- show the name and address of the manufacturer;
- show the name of the PI;
- show the date the chemical was received.

#### 3.4.2 Secondary Containers

3.4.2.1 Supervisors will ensure that all secondary containers, i.e., containers that chemicals are placed into from “original containers,” are labeled with either an extra copy of the original manufacturer's label or with a label containing the:

identity of content;

name of PI;

- date chemical was transferred to the secondary container;
- a rack of vials or test tubes may be labeled as a rack as long as every vial or test tube in the rack contains the same chemical and presents the same hazard.

#### 3.4.3 Unlabeled Containers

3.4.3.1 If an employee finds a container in the workplace, and it is unlabeled or carries a defaced label and is thought to contain a hazardous chemical, the employee should immediately notify his or her supervisor or the CSO during normal duty hours. After



hours employees should contact the Public Safety Division who will notify the EHS on-call staff member or keep the container in a safe place until the next working day and notify the supervisor.

### 3.5 Employee Training

#### 3.5.1 Basic Awareness RTK Training.

3.5.1.1 Prior to beginning work, all Augusta University employees will receive Basic Awareness RTK Training. The training can be accessed through the web site at <http://www.usg.edu/facilities/rtk-ghs> and covers:

- An overview of the hazardous chemical protection laws, regulations, and policies in place for Augusta University.
- A summary of employee rights in hazardous chemical protection.

#### 3.5.2 Chemical-Specific RTK Training.

3.5.2.1 Augusta University employees who work with chemicals or who work in an area where chemicals are stored or used will receive Chemical-specific RTK Training in addition to Basic Awareness RTK Training before beginning work. The training can be accessed through the web site at <http://www.usg.edu/facilities/rtk-ghs> and covers:

- How to identify hazardous chemicals in the workplace.
- Physical and health effects of the chemicals.
- Methods and observation techniques used to determine the presence or release of the chemicals in the work area.
- How to lessen or prevent exposure to these chemicals by proper work practices and use of personal protective equipment.
- Emergency procedures to be followed in the event of exposure.
- Procedures for safe disposal of waste chemicals.

#### 3.5.3 Hazardous Waste Awareness RTK Training.

3.5.3.1 Augusta University employees who work with hazardous chemicals and therefore generate hazardous waste will receive Hazardous Waste Awareness Training before beginning work. The training can be accessed through the web site at <http://www.usg.edu/facilities/training/hazwaste/> and covers:

- Identifying the regulatory drivers for hazardous wastes at University System of Georgia (USG) institutions.

- Types and identification of hazardous wastes.
- Characteristics of hazardous wastes.
- Determination of hazardous waste status and generator identification number.
- Common areas on campus where hazardous wastes are generated.
- Hazardous waste accumulation and disposal.
- Hazardous waste and emergency response

#### 3.5.4 Bloodborne Pathogens RTK Training

3.5.4.1 Augusta University employees who work with or are exposed to fresh human or non-human primate material (blood, fluid, tissue) will receive Bloodborne Pathogens RTK Training before beginning work. The training can be accessed through the web site at <http://www.usg.edu/facilities/training/pathogens/> and covers:

- Definition of bloodborne pathogens.
- Explanation of Universal Precautions.
- Recognizing the sign or label indicating bloodborne pathogen hazard.
- Examples of ways bloodborne pathogens are transmitted from person to person in the workplace.
- Differentiation between engineering control and workplace control.
- Emergency response involving blood or body fluids and waste disposal.

#### 3.5.5 Annual Refresher RTK Training.

3.5.5.1 Augusta University employees who are required to take Chemical Specific RTK Training, Hazardous Waste Awareness RTK Training, and/or Bloodborne Pathogens RTK Training will take annual refresher training for each calendar year during Augusta University's Annual Training and Compliance Awareness Month in November.

### 3.6 Training Records

3.6.1 RTK Training will be recorded and records will be maintained for a minimum of three years by the CSO.

### 3.7 Informing Contractors

3.7.1 Contractors who introduce hazardous materials into the workplace shall include a statement in all bids, agreements, contracts, or other instrument to the effect that such contractor shall be responsible for compliance to

provide their employees the following information:

3.7.1.1 Hazardous chemicals to which they may be exposed while on the job site, and procedures for obtaining SDSs.

3.7.1.2 Instruction in handling, emergency procedures, and disposal prior to introducing such hazardous chemicals into the workplace.

3.7.1.3 Precautions employees may take to lessen the possibility of exposure by using appropriate protective measures, and an explanation of the labeling systems used.

3.7.1.4 Contractors shall ensure compliance with all applicable OSHA standards for the duration of the time work is performed at Augusta University.

3.7.2 It is the responsibility of Facilities Management staff who negotiate contract work to ensure the provisions identified above are included in such contracts, and to provide contractors with information regarding the on-site hazards, and SDSs where applicable, to which their workers may be exposed prior to the contractors commencing work at Augusta University. SDS may be obtained for all hazardous chemicals on site at Augusta University through the CSO website.

3.7.3 It is the responsibility of Facilities Management to identify and obtain SDS for the chemicals contractors may bring into Augusta University workplaces and to provide them to EHS prior to the contractor commencing work at Augusta University. EHS shall maintain copies of the SDS for the duration of work where hazardous chemicals are used by contractors.

3.7.4 Renovation/construction contracts with Augusta University require the contractors to comply with various Augusta University procedures. These requirements are outlined in the Augusta University Guidelines for Contractors and Vendors.

### 3.8 Hazardous Chemical Lists

3.8.1 The Augusta University RTK coordinator will provide the Board of Regents of the University System of Georgia RTK Coordinator and the Local Emergency Planning Committee (LEPC) with a list of all hazardous chemicals present at Augusta University in January and July of each year. Each PI will maintain his/her chemical inventory in the database and will be reminded at least twice a year to update their inventory before each submission to the BOR and the LEPC.

## 4. Responsibilities

4.1 Augusta University RTK Coordinator shall:

4.1.1 Act as liaison between Augusta University and the University System of Georgia on hazardous chemicals issues.

4.1.2 Resolve questions regarding applicability of the Chapter 300-3-19 rules to

individual workplaces and work areas at Augusta University.

4.1.3 Make arrangements for and provide training to all Augusta University Employees as required in the University System of Georgia RTK Plan;

4.1.4 Ensure that Augusta University employees have access to current chemical hazard information for those chemicals to which they are exposed or potentially exposed to as part of their employment at Augusta University.

4.2 Supervisors shall:

4.2.1 Ensure that employees are informed of any operations in their workplaces where hazardous materials are present.

4.2.2 Ensure that Augusta University employees under their supervision receive initial and annual RTK Training as required in this plan.

4.2.3 Provide employees under their supervision with information and training on specific hazardous chemicals in the work area at the time of their initial assignment and whenever a new hazard is introduced into their work area.

## **5. Anti-discrimination Policy**

5.1 The poster provided by the Georgia Department of Labor titled, "You Have the Right to Know about the Hazardous Chemicals in Your Workplace" shall be prominently displayed in all areas where hazardous chemicals are used or stored. Augusta University is prohibited from discharging, or discriminating against, an employee who exercises his/her rights to obtain information regarding hazardous chemicals used in the workplace. Grievances for the violation of employee rights as described in this plan should be filed through the established procedures at Augusta University. If unresolved, then a grievance may be filed with the Commissioner of Labor, c/o the Safety Engineering Section, of the Georgia Department of Labor.

## APPENDIX C

### Shipping and/or Transport of Hazardous Material Policy

*Volume: Environmental Health and Safety*

*Responsible Office: Environmental Health and Safety*

*Originally Issued: October 2008*

*Revised: Not Applicable*

#### **Policy Statement**

Any Augusta University employee who handles, offers for shipment or transport, ships or transports hazardous materials or causes hazardous materials to be shipped or transported must comply with all State, Federal and International Regulations for shipping and transport. They must also adhere to the requirements of all pertinent trade associations, couriers, carriers, airlines, rail or other vehicles and/or transport services.

The Augusta University Shipping and/or Transport of Hazardous Material policy affects all employees, units, departments, divisions and subsidiaries of Augusta University who ship and/or transport hazardous materials. This includes all those individuals who arrange for transport and/or may engage in any of the following activities on behalf of this institution:

- Filling packages,
- Marking and labeling packages,
- Preparing shipping papers,
- Handling, loading, securing, segregating packages within a transport vehicle, freight container or cargo hold, and
- Transporting hazardous materials

Pre-authorization from the Environmental Health and Safety (EHS) Division is required for any Augusta University shipment and/or transport activities involving hazardous materials.

#### **Reason For Policy**

Augusta University employees may need to ship and/or transport hazardous materials in the commission of their responsibilities for Augusta University. The shipment/transport of hazardous materials is regulated by several State, Federal and International standards, and these regulations, as well as their enforcement have become more stringent particularly after 9/11/2001. Additionally, the shipment and/or transport of hazardous materials have the potential to pose environmental, public health, national security, and commercial risks.

The Augusta University Shipping and/or Transport of Hazardous Materials policy is designed to

provide a reference for regulatory compliance and standards to minimize the risks associated with the shipping and/or transport of hazardous materials. This policy applies to faculty, staff and students who (a) handle, offer for shipment or transport, ship or transport hazardous materials or cause hazardous materials to be shipped or transported, or (b) supervise those who do.

Hazardous materials or dangerous goods shipped or transported, to or from any area within the United States, using commercial transportation, couriers, carriers, airlines, rail or other vehicles and/or transport services must comply with [Hazardous Materials Regulations, 49 CFR Parts 171-179](#), and the standards provided by the International Air Transport Association, the International Maritime Organization and the U.S. Department of Transportation.

**Entities Affected By This Policy**

This policy affects all units, divisions and subsidiaries of Augusta University who ship and/or transport hazardous materials.

**Who Should Read This Policy**

All faculty, staff and students who (a) handle, offer for shipment or transport, ship or transport hazardous materials or cause hazardous materials to be shipped or transported, or (b) supervise those who do.

**Contacts**

<b>Contact</b>	<b>Phone</b>	<b>e-mail/URL</b>
Biological Safety Office	706-721-2663	<a href="http://www.augusta.edu/services/ehs/biosafe/">http://www.augusta.edu/services/ehs/biosafe/</a>
Chemical Safety Office	706-721-2663	<a href="http://www.augusta.edu/services/ehs/chemsafe/">http://www.augusta.edu/services/ehs/chemsafe/</a>
Radiation Safety Office	706-721-9826	<a href="http://www.augusta.edu/services/ehs/radsafe/">http://www.augusta.edu/services/ehs/radsafe/</a>
Associate Vice President, Environmental Health and Safety	706-721-9826	<a href="http://www.augusta.edu/services/ehs/">http://www.augusta.edu/services/ehs/</a>

Legal Affairs Office	706-721-4018	<a href="http://www.augusta.edu/services/legal/">http://www.augusta.edu/services/legal/</a>
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### **Printable Version of This Policy**

<https://augusta.policytech.com/dotNet/documents/?docid=576&mode=view>

### **Related Documents**

#### **Augusta University Offices**

Biological Safety Office Webpage: <http://www.augusta.edu/services/ehs/biosafe/>

Chemical Safety Guide: <http://www.augusta.edu/services/ehs/chemsafe/>

Radiation Safety Guide:

[http://www.augusta.edu/services/ehs/radsafe/documents/au\\_rsm6\\_1\\_16.pdf](http://www.augusta.edu/services/ehs/radsafe/documents/au_rsm6_1_16.pdf)

### **External Agencies**

#### **Department of Transportation (DOT)**

Title 49 Code of Federal Regulations for Export of Hazardous Materials

[http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title49/49cfrv2\\_02.tpl](http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title49/49cfrv2_02.tpl)

#### **International Air Transport Association (IATA)**

Dangerous Goods Webpage

<http://www.iata.org/whatwedo/cargo/dgr/Documents/DGR57-Addendum1-EN-20160119.pdf>

#### **Center for Disease Control (CDC)**

Procedures to Import Etiological Agents

[http://www.unm.edu/~sheaweb/sheamanual/biosfty/biosaf\\_i.htm](http://www.unm.edu/~sheaweb/sheamanual/biosfty/biosaf_i.htm)

Etiologic Agent Import Permit Program

<http://www.cdc.gov/od/eaipp/>

Select Agent and Toxin (SAT) Program

<http://www.cdc.gov/od/sap/>

#### **USDA Animal and Plant Health Inspection Service (APHIS)**

National Center for Import and Export (NCIE) Homepage

<https://www.aphis.usda.gov/aphis/ourfocus/importexport>

Materials Requiring Import Permits

<http://www.aphis.usda.gov/vs/ncie/biofacts.html>

Materials Exempt from Import Permits

[http://www.aphis.usda.gov/vs/ncie/fac\\_imp.html](http://www.aphis.usda.gov/vs/ncie/fac_imp.html)

Regulated Articles: Genetically Modified Organisms Requiring Permits for Transport

<http://www.niehs.nih.gov/odhsb/biosafe/7cfr340.htm#340.2>

## **U.S. Department of Commerce Bureau of Industry and Security (BIS)**

Introduction to Export Controls

<http://www.bis.doc.gov/licensing/exportingbasics.htm>

## **U.S. Department of the Treasury Office of Foreign Assets Control (OFAC)**

Foreign assets control regulations for exporters and importers brochure

<http://www.ustreas.gov/offices/enforcement/ofac/regulations/facei.pdf>

## **Definitions**

These definitions apply to these terms as they are used in this policy:

1. **Classification:** Determining whether a package contains a hazard and if so, determining the type of hazard being shipped/transported. Hazard categories, numbered 1-9 indicate the type of hazard, not the degree of hazard. The hazard categories are: 1) Explosives, 2) Gasses, 3) Flammable Liquids, 4) Flammable Solids, 5) Oxidizing Substances, 6) Toxic/Infectious Agents, which can be further classified as Class A or Class B. 7) Radioactive, 8) Corrosive, 9) Miscellaneous.
2. **Commerce:** *Any trade, traffic, or transportation in the United States which: (1) Is between a place under the jurisdiction of a State or Indian tribe and any place outside of such jurisdiction; or(2) Is solely within a place under the jurisdiction of a State or Indian tribe but which affects trade, traffic, or transportation.*
3. **Courier:** A person or company employed to deliver messages, packages and mail.
4. **Documenting:** The act of completing the shipper's declaration and signing any amendments or alterations, as well as packaging certifications. Shippers/transporters must also maintain records of training to properly package and ship/transport hazardous materials as well as records of shipments/transport.
5. **Identification:** Determining the Proper Shipping Name, Technical Name, UN number, quantity limits and any special provisions needed to mark a package containing hazardous materials.
6. **Dangerous Goods:** The European term for hazardous materials.
7. **Etiological Agent:** Any infectious agent known (or sometimes suspected) to cause disease. This includes, but is not limited to, bacteria, viruses, rickettsia, parasites, yeasts, and molds, or materials which may carry these items. Furthermore, chemical/radioactive hazards may also be considered etiological agents.
8. **Genetically Modified Organisms (GMOs):** Living organisms with artificially altered DNA.



9. **Hazardous Materials:** A substance or material capable of posing an unreasonable risk to health, safety, and property when transported. This definition includes explosives, gasses, radioactive material, flammable or combustible liquid or solids, poisons, toxic or infectious substances, patient or animal specimens and other biological material or wastes, oxidizing or corrosive material, chemicals with any hazard rating of  $\geq 2$ , compressed gas (including dry ice and liquid nitrogen) and genetically modified organisms (GMOs).
10. **HMA:** *Hazardous Materials Regulations, 49 CFR Subchapter C, Parts 171 through 180.*
11. **Label:** *An appropriate group of written, printed or graphic information elements concerning a hazardous product, selected as relevant to the target sector(s), which is affixed to, printed on, or attached to the immediate container of a hazardous product, or to the outside packaging of a hazardous product.*
12. **Labeling:** The process of applying the appropriate labels to the exterior of a package for example, dry ice, hazardous material, infectious substance, etc.
13. **Marking:** The process of applying the following to the exterior of a package: Shipping Name, UN number, quantity of sample in grams or milliliters, name and address of the shipper/transporter and recipient, name and telephone number of a person responsible for the shipment/transport and net weight (kilograms) of dry ice, if used.
14. **Mixture:** *Solution composed of two or more substances in which they do not react.*
15. **MSDS:** *"Material Safety Data Sheet" and in this document is used interchangeably with Safety Data Sheet (SDS).*
16. **Motor carrier:** *A for-hire motor carrier or a private motor carrier of property. The term includes a motor carrier's agents, officers and representatives as well as employees responsible for hiring, supervising, training, assigning, or dispatching of drivers.*
17. **Motor vehicle:** *Any vehicle, machine, tractor, trailer, or semitrailer propelled or drawn by mechanical power and used upon the highways in the transportation of passengers or property, or any combination thereof.*
18. **Package:** The complete product of the packing operation consisting of the packaging and contents prepared for shipping/transport.
19. **Packaging:** Receptacles and any other components or materials necessary for the receptacle to perform its containment function and to ensure compliance with minimum packing requirements. Furthermore, packaging may have to meet specific testing and certification requirements.
20. **Packing:** The art and operation by which articles or substances are enveloped in wrappings and/or enclosed in packaging or otherwise secured.
21. **Placard:** *A sign or plaque attached to or hung from a vehicle or building to indicate information about the vehicle, building, or contents. Placards can vary in purpose, size and content. Their universal purpose is to convey a message.*

22. **Select Agents:** Pathogens or biological toxins which have been declared by the U.S. Department of Health and Human Services or by the U.S. Department of Agriculture to have the “potential to pose a severe threat to public health and safety” (42 CFR 73).
23. **Shipper:** Someone who prepares a package for transit via courier. The shipper is responsible for general compliance with state, federal and international regulations concerning proper classification, identification, packing, marking, labeling and documenting of shipments. Shippers are required to obtain the necessary permits and ensure that the recipient of the package has also obtained the necessary permits to facilitate acceptance of the hazardous materials.
24. **Toxin:** A poisonous substance produced by living cells or organisms.
25. **Transporter:** Someone who prepares a package for transit via a method other than shipment; including carrying by hand, or transporting by automobile, rail, ship or aircraft. The transporter is responsible for general compliance with state, federal and international regulations concerning proper classification, identification, packing, marking, labeling and documenting of transports. Transporters are required to obtain the necessary permits and ensure that the recipient of the package has also obtained the necessary permits to facilitate acceptance of the hazardous materials.
26. **Secretary:** The Secretary of Transportation. State. A State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, the Virgin Islands, American Samoa or Guam.

## Overview

In the wake of the terrorist attacks of September 11, 2001, and subsequent threats related to biological and other hazardous materials, the Department of Transportation undertook a broad review of government and industry programs overseeing the transportation, safety and security of hazardous materials. This policy has been drafted as a response to the ensuing regulations, their more stringent enforcement and the high criminal and civil liabilities associated with improper shipment/transport and export/import of hazardous materials.

Under the new government regulations which became Effective May 5, 2003, special packaging, labeling, marking, permits or licensing may be required in order to ship or transport hazardous materials and waste. In addition, transportation trade associations (e.g. IATA), couriers, carriers, and transport services (airlines, rail lines), and automobile insurance companies often impose additional limitation or requirements on shipment or transport of hazardous materials. This policy is intended to provide a road map for compliant shipping/transport of hazardous materials.

This policy applies to all faculty, staff and students who (a) handle, offer for shipment or transport, ship or transport hazardous materials or cause hazardous materials to be shipped or

transported, or (b) supervise those who do. This would include any person involved in any of the following stages of the shipping or transport process:

1. Determining if a material is a hazardous material.
2. Design, production and/or sale of packaging for hazardous materials.
3. Determining proper packaging for a hazardous material.
4. Marking and labeling packaging.
5. Filling out shipping/transport papers.
6. Loading or unloading the hazardous material.
7. Moving the packaging in a warehouse during the course of transport.
8. Operation of a vehicle transporting the material.

To ensure hazardous materials are handled and/or stored in an appropriately safe manner, and in accordance with State and Federal regulations and guidelines, any Augusta University employee or unit wishing to receive hazardous materials must be properly sublicensed or authorized by the appropriate institutional safety committee prior to receipt.

### **Process/Procedures**

1. Hazardous materials must be packaged according to IATA and Department of Transportation standards for shipment/transport or as documented on any Augusta University safety protocol.
2. Shipments or transport may only be done by those who have received current and appropriate training for shipment/transport of hazardous materials. In the case of shipping and/or transporting biological materials and/or dry ice, this training will be provided by the Biosafety Office. Certification of completion of an EHS-approved training program must be provided to the pertinent EHS section office prior to receiving shipment/transport authorization.
3. Any licenses, permits and/or authorization required for possession of the hazardous materials by the recipient must be confirmed by the shipper/transporter and EHS before shipment/transport from Augusta University or must be in place prior to receipt of hazardous materials by Augusta University facilities and personnel (e.g. Institutional Radioactive Materials License/sublicense, or Select Agent entity/individual registrations with CDC or USDA).
4. The EHS Division and its staff are available upon request to assist with planning and regulatory compliance.
5. Any required permits, licenses or authorization documents must be received by the shipper or transporter prior to shipping/transport. These may include:
  - 5.1. Copies of the recipient's radioactive materials license showing the recipient is an authorized to possess such materials.

- 5.2. Permits for transport of some hazardous materials such as etiological agents.
- 5.3. Import permits from the country of destination must be obtained for international shipment/transport of some hazardous materials.
- 5.4. Permits authorizing transfer of Select Agents issued from the Centers of Disease Control or U.S. Department of Agriculture.
- 5.5. Export permits for domestic or international transfer of commerce-controlled materials, and/or some hazardous materials.
- 6. Classification, Packing, Labeling and Marking
  - 6.1. All aspects of the shipment/transport (container, packing, labeling, surveys, shipping papers, Shipper's Declarations, etc.) must be in accordance with the U.S. Department of Transportation regulations (49 CFR), the International Air Transport Association Dangerous Goods Regulations (IATA DGR) , International Civil Aviation Organization (ICAO) Regulations for Shipping of Dangerous Goods, and any pertinent courier or airline requirements.
  - 6.2. Shipment of hazardous materials via the U.S. Postal Service (USPS) is generally permissible, but must be in accordance with the U.S. Department of Transportation regulations (49 CFR).
  - 6.3. Shippers/transporters are responsible for providing the appropriate containers and/or packaging materials for shipments/transport. The shipper/transporter must be able to show documentation certifying that packaging used complies with the standards required for shipment/transport of hazardous materials as stated by the IATA DGR.
- 7. Persons contemplating transporting hazardous materials by methods other than utilizing a courier, including carrying by hand and/or transporting via automobile, ship or aircraft should contact the appropriate EHS section for assistance. Furthermore, a current copy of the regulations involved in transporting hazardous materials is maintained for references at EHS.
- 8. The shipper/transporter (i.e. the person who classifies, identifies, packs, labels, marks and documents the shipment or transported package) will be the statutory shipper/transporter and must sign the shipping/transport papers. These responsibilities are assigned to the shipper/transporter, as only the shipper/transporter has direct knowledge of the contents of the package. For radioactive material, this person must be the Principal Authorized User (PAU) or their designee; for other hazardous materials, this must be the Principal Investigator (PI) or their designee.
- 9. Shippers/transporters are required to maintain shipping/transport records, including copies of the waybill, shipper's declarations, permits/licenses, confirmation of receipt records and package compliance documentation. These records, along with documentation of required training must be kept on-hand and provided for inspection upon request by EHS or Federal, State, or International authorities.
- 10. Hazardous material must not be carried by hand in the passenger compartment of an airline or other means of mass transit. Hazardous material must not be transported as carry-on luggage. Most hazardous materials cannot be transported as checked baggage. Some

hazardous materials can be transported as checked baggage, but this practice is generally not recommended. However, any hazardous materials which can be exported according to federal and international regulations and meet the airline's restrictions, must always be transported as checked baggage and fully declared.

11. Security plans, if required by law for the particular hazardous material being shipped or transported, must be approved by the pertinent EHS section responsible for such material.
12. Empty packaging used for previous shipment/transport must be decontaminated and the labels and/or markings should be removed or obliterated as required by International, Federal and/or State regulations.
13. Authorization by the appropriate EHS Safety Officer is required before shipment or transfer of hazardous materials.

### Responsibilities

The responsibilities each party has in connection with Environmental Health and Safety's Policy 4.0.03, Shipping and/or Transport of Hazardous Material, are:

<p>Shippers/Transporters</p>	<p>The shippers/transporters are responsible for:</p> <ol style="list-style-type: none"> <li>1. General compliance with state, federal and international regulations concerning proper classification, identification, packing, marking, labeling and documenting of shipments/transport.</li> <li>2. Obtaining the proper training for shipping/transporting hazardous materials and producing documentation of successful completion of the training.</li> <li>3. Obtaining certified packaging, if required.</li> <li>4. Maintaining proper documentation including:             <ol style="list-style-type: none"> <li>a) Completing the shipper's declaration and signing any amendments or alterations, as well as packaging certifications.</li> <li>b) Maintaining records of training to properly package and ship/transport hazardous materials as well as records of shipments/transport.                 <ol style="list-style-type: none"> <li>1. Obtaining the necessary permits for shipments /transport including, but not limited to:                     <ol style="list-style-type: none"> <li>a) International import/export permits.</li> </ol> </li> </ol> </li> </ol> </li> </ol>
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	<p>b) CDC/USDA permits for etiological agents and/or select agents.</p> <ol style="list-style-type: none"> <li>1. Confirming that the consignee/receiver has obtained the necessary permits to facilitate acceptance of the hazardous materials.</li> </ol>
<p>Principal Investigators (PI) Principal Authorized Users (PAU) Supervisors of Shippers/Transporters</p>	<p>Responsibilities include:</p> <ol style="list-style-type: none"> <li>1. Being aware of the policies concerning the shipping/transport of hazardous materials.</li> <li>2. Advising the shipper/transporter/recipient under their supervision to obtain appropriate training prior to shipping/transport of hazardous materials and ensuring compliance with all regulations.</li> <li>3. Advising the shipper/transporter/recipient to comply with the PI/PAU/supervisor's safety protocols.</li> </ol>
<p>Recipients</p>	<ol style="list-style-type: none"> <li>1. Obtaining the necessary permits/authorizations to facilitate acceptance of the hazardous materials.</li> <li>2. Obtaining approval from the respective safety committee to possess and use the hazardous materials.</li> </ol>
<p>Environmental Health and Safety Office</p>	<ol style="list-style-type: none"> <li>1. Consulting and assisting those who intend to ship/transport/receive hazardous materials and authorizing the shipment/transport/receipt of hazardous materials. Training may be provided by the Biosafety Office to those wishing to ship some biological materials and/or dry ice.</li> <li>2. Authorize shipment of hazardous materials.</li> </ol>
<p>Legal Affairs Office</p>	<p>Provide guidance for compliance with: Department of Commerce Export Control Regulations, Department of the Treasury Foreign Assets Control (OFAC) regulations.</p>

## **FORMS & INFORMATION RESOURCES**

### **Augusta University Agencies**

#### **Biological Safety Protocol Application Forms:**

<http://www.augusta.edu/research/ibc/apps.php>

#### **Chemical Safety Protocol Application Forms:**

Use of high hazard chemicals in laboratories

<http://www.augusta.edu/services/ehs/chemsafe/documents/hihazapp-05-2015.pdf>

List of high hazard chemicals

<http://www.augusta.edu/services/ehs/chemsafe/PDF%20files/HiHazList%200411%20Rev.pdf>

#### **Radiation Safety Protocol Application Forms:**

Non-human use of radioactive materials

<http://www.augusta.edu/services/ehs/radsafe/documents/nonhumanresearch-2.pdf>

Human use research involving ionizing radiation

<http://www.augusta.edu/services/ehs/radsafe/documents/ancillaryapprovalapplication-1.pdf>

### **External Agencies**

#### **Center for Disease Control (CDC)**

Permit to Import or Transport Etiologic Agents, Hosts or Vectors of Human Disease

<http://www.cdc.gov/od/eaipp/importApplicationForms.htm>

Applications for Registration, Use and Transfer of Select Agents and Toxins

<http://www.selectagents.gov/formsOverview.htm>

#### **U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS)**

Application for Veterinary Services Permits for the import and interstate movement of bacteria, viruses, and prions that are disease agents of animals and poultry.

[http://www.aphis.usda.gov/animal\\_health/permits/](http://www.aphis.usda.gov/animal_health/permits/)

Application for Biotechnology Permits for the import, interstate movement, or release of genetically engineered organisms considered regulated articles.

<http://www.aphis.usda.gov/biotechnology/submissions.shtml>

**U.S. Department of Commerce Bureau of Industry and Security (BIS)**

Application for an Export License for Commerce Controlled Materials

<http://www.bis.doc.gov/licensing/applying4lic.htm>

**U.S. Department of the Treasury Office of Foreign Assets Control (OFAC)**

Brochure on foreign assets control regulations for exporters and importers

<http://www.ustreas.gov/offices/enforcement/ofac/regulations/facei.pdf>

OFAC forms

<http://www.ustreas.gov/offices/enforcement/ofac/forms/index.shtml>

**Appendices**

**United Nations Economic Commission for Europe (UNECE)**

Dangerous Goods

<http://www.unece.org/trans/welcome.html>

**International Civil Aviation Organization (ICAO)**

Dangerous Goods Webpage

<http://www.icao.int/anb/FLS/DangerousGoods/FLSDG.cfm>

**U.S. Customs and Border Protection**

Import Requirements

[http://www.cbp.gov/xp/cgov/import/infrequent\\_importer\\_info/](http://www.cbp.gov/xp/cgov/import/infrequent_importer_info/)

**Transport Canada**

Transport of Dangerous Goods/Hazardous Materials in Canada

<http://www.tc.gc.ca/tdg/menu.htm>

**U.S. Postal Service (USPS)**

Regulations Concerning Shipment of Hazardous Materials (Publication 52)

<http://pe.usps.gov/cpim/ftp/pubs/pub52/pub52c3.pdf>

**FEDEX**

Shipping of Hazardous Materials Via FEDEX

<http://www.fedex.com/us/services/customcritical/surfaceexpedite/hazardous.html?link=4>

**UPS**

Shipping of Hazardous Materials Via UPS

[http://www.ups.com/using/services/accs/hazmat/hzm\\_home.html](http://www.ups.com/using/services/accs/hazmat/hzm_home.html)



**DHL**

Shipping of Hazardous Materials Via DHL

[http://www.dhl.com/publish/g0/en/information/shipping/danger\\_goods.high.html](http://www.dhl.com/publish/g0/en/information/shipping/danger_goods.high.html)

**Saf T Pak**

Infectious Substance & Diagnostic Specimen Packaging

<http://www.saftpak.com/home.htm>

**Delta Airlines**

Considerations for Shipping Hazardous Materials

[http://www.delta.com/traveling\\_checkin/baggage/special\\_baggage/dangerous\\_goods/index.jsp](http://www.delta.com/traveling_checkin/baggage/special_baggage/dangerous_goods/index.jsp)

**United Airlines**

Considerations for Shipping Hazardous Materials

<http://www.united.com/page/article/0,6722,1035,00.html>

**Northwest Airlines (NWA)**

Considerations for Shipping Hazardous Materials

<http://www.nwa.com/travel/luggage/restricted.html>

**American Airlines**

Considerations for Shipping Hazardous Materials

<http://www.aa.com/aa/i18nForward.do?p=/travelInformation/baggage/restrictedArticles.jsp>

**Continental Airlines**

Considerations for Shipping Hazardous Materials

<http://www.continental.com/web/en-US/content/travel/baggage/dangerous.aspx?SID=6C5B8B032DD0419CB27E00330F0BDEBE>

This entry was posted in *Administrative, Environmental Health and Safety (EHS)* and tagged *environmental health and safety, shipping hazardous material, transporting hazardous material*. Bookmark the *permalink*. Both comments and trackbacks are currently closed.

## APPENDIX D

### HAZARDOUS WASTE MANAGEMENT PROGRAM

#### 1.0 INTRODUCTION

- 1.1 Federal, state, and local governments have imposed strict regulations concerning the handling, storage, and disposal of hazardous chemicals. Compliance with these regulations, good safety practices, and the necessity to avoid liabilities, dictate that the institution follow a conservative approach in the management of hazardous waste generated from these materials. The purpose of the Hazardous Waste Management Program is to assure that the management of all hazardous chemical waste generated at Augusta University is accomplished in accordance with all federal, state, and local rules and regulations, and to ensure the safety and protection of personnel, property, and the environment.
- 1.2 Environmental Health and Safety Division (EHS) is charged with management of all hazardous and regulated waste generated at Augusta University. All hazardous chemicals are classified according to its hazards for hazardous waste determinations and profiled for disposal or recycling according to regulatory requirements by special sections under EHS. This is accomplished through hazardous waste assessment site visits and through the Chemical Inventory Database, under Inventory: Satellite Accumulations, Hazardous Waste Streams.
- 1.3 The term “hazardous waste” as used under the Hazardous Waste Management Program, means any chemical or chemical mixture that is no longer of use to the possessor, and whose chemical or physical properties may endanger or harm personnel, property, or the environment if handled inappropriately. Hazardous waste includes, but is not limited to, those items specifically identified as “hazardous waste” under federal, state, and local rules and regulations. If any question exists on how waste should be handled, or if a waste assessment site visit is desired, contact the EHS CSO at 706-721-2663 before attempting disposal by any method.
- 1.4 Chemicals shall not be poured down the drain or dumped in the general trash, unless the CSO (CSO) has given written permission for that specific chemical to be disposed in such a manner.
- 1.5 Unwanted chemicals or chemical mixtures that are still usable may be offer to other Augusta University chemical users through the Chemical Exchange Program. For more information about the Chemical Exchange Program contact Chemical Safety at 706-721-2663.

## 2.0 **POLICY**

- 2.1 Federal, state, and local governments have imposed strict regulations concerning the management, storage, and disposal of hazardous chemicals. Compliance with these laws, good safety practices, and the necessity to avoid liabilities, dictate that the institution follows a conservative approach in handling this hazardous waste material.
- 2.2 EHS is charged with ensuring that all hazardous waste generated at Augusta University is handled properly.
- 2.3 The term “hazardous waste” as used in this manual means any substance no longer of use to the possessor whose chemical properties may endanger personnel, material, or the environment if handled improperly. Hazardous waste includes, but is not limited to, those items specifically identified as “hazardous waste” under federal and state statutes. If any question exists on how waste should be handled contact EHS at 706-721-2663 before attempting disposal by any method.
- 2.4 Chemicals shall not be poured down the drain or dumped in the general trash, unless the CSO has given written permission for that specific chemical to be disposed in such a manner.

### 2.5 **Waste Minimization**

- 2.5.1 Government regulations and internal cost control require that as little hazardous waste as possible be generated. The following guidelines are intended as a checklist to accomplish this waste minimization – they are not intended to restrict required activities:
  - a. Before beginning a project, determine the hazards associated with the material.
  - b. Where possible, substitute less hazardous substances.
  - c. Use small batch or micro-level reactions where possible.
  - d. Order and maintain the minimum amount of any specific chemical.
- 2.5.2 Certain chemicals are difficult and/or costly to dispose of and should be given special consideration. Examples are:
  - a. Any heavy metal (mercury, barium, cadmium, chromium, beryllium, silver, selenium, tellurium, etc.) either elemental or as compounds.
  - b. Chlorophenols, dioxins, cyanides and polychlorinated biphenyls.
  - c. Compressed gases (to include lecture bottles) or containers with liquid under pressure (especially if the substance is poisonous). Where possible, arrange with the supplier to accept return of used containers.

- d. Manufacturers' samples. Either arrange for the manufacturer to accept return of unused material or ensure they provide an ample description of the product and its characteristics.

## **2.6 Accumulation of Hazardous Waste**

- 2.6.1 Excess amounts of waste should not be allowed to accumulate. When chemical waste containers are full, they should be turned in the CSO as chemical waste. Do not wait to accumulate several containers, but turn in each container as soon as it is full.
- 2.6.2 Each laboratory/activity will conduct as least an annual survey and dispose of unneeded/expired chemicals.
- 2.6.3 At the end of any project or prior to the departure of a PI all chemicals be clearly identified and unneeded/expired chemicals will be turned in as chemical waste.

## **2.7 Segregation of Wastes**

To the extent feasible, waste should be segregated and not combined. Mixing of different types of wastes poses dangers and imposes cost penalties. Special attention must be paid to segregation of chemical waste from radioactive waste, biomedical waste, and general trash.

## **3.0 RESPONSIBILITIES**

### **3.1. Principal Investigator/Hazardous Waste Generators**

- 3.1.1 Principal Investigators/Hazardous Waste Generators shall participate in the Chemical Inventory and Waste Management Programs provided by Environmental Health and Safety Division (EHS) to ensure the 'Cradle-to-Grave' tracking of all hazardous chemical wastes generated at Augusta University.
- 3.1.2 Principal Investigators//Hazardous Waste Generators are required to provide sufficient information about their chemicals to enable the CSO to identify and classify these materials in accordance with EPA and DOT standards for proper handling, storage, transport and disposal as a hazardous waste or mixture of hazardous wastes.
- 3.1.3 Principal Investigators shall process all hazardous chemical waste through the Chemical Inventory Database, Waste Pickup Module.

- 3.1.4 All hazardous chemicals that may occur as waste or part of a waste mixture shall be captured in the Chemical Inventory Database, Inventory Module.
- 3.1.5 To avoid the generation of unknown hazardous wastes, all chemicals and hazardous chemical waste containers shall be labeled as described in the Institutional Chemical Committee (ICC), *Chemical Safety Guide, Chapter III, Section A2(a) and Chapter V, Section E2*.

## **3.2 Management of Hazardous Waste Containers**

Hazardous Chemical Waste Containers must be:

- 3.2.1 Compatible with the wastes that are being collected,
- 3.2.2 Sealed, and remain closed except when waste is being added or removed from the container
- 3.2.3 Removed from the satellite accumulation area and placed in centralized storage within 72 hours of becoming full.
- 3.2.4 Processed through the Chemical Inventory Database provided by EHS for pickup and disposal by the CSO
- 3.2.5 Labeled with the “Hazardous Waste” label produced in the Chemical Inventory Database, Waste Pickup Module, prior to pickup by the CSO.

## **3.3. Management of Time Sensitive Chemicals**

Time sensitive chemicals are chemicals that have the potential for becoming highly reactive and potentially explosive.

- 3.3.1 Therefore, all time sensitive chemicals, shall also be labeled with the date received and date opened, in addition to the labeling requirements described in the Institutional Chemical Committee (ICC), *Chemical Safety Guide, Chapter III, Section A2(a)*.
- 3.3.2 All time sensitive chemicals, including peroxide forming compound and reactives, shall be wasted on or before the date of expiration, through the Chemical Inventory Database, and shall have a “Hazardous Waste” label produced in the database attached.
- 3.3.3 Principal Investigators shall ensure that all volatile chemicals, such as peroxide forming compounds, are tested, stabilized, and have a Hazardous Waste Label attached, prior to pick up by the CSO.

3.3.4 Because time sensitive chemicals, such as peroxide forming compounds, have the potential to become highly reactive and potentially explosive when expired, this could pose an unacceptable risk to CSO staff. Under such circumstances outside intervention for treatment, and removal of the chemical from the laboratory would be required. Should an expired chemical require outside intervention for treatment and removal, EHS shall arrange for an outside contractor to complete the task, and the Principal Investigator shall assume the costs.

3.3.5 To ensure monitoring of time sensitive materials, Principal Investigators are required to enter in the Chemical Inventory Database, the date received and date opened for all time sensitive chemical, in their Chemical Inventory

3.3.6 This includes peroxide forming compounds such as:

**1) ORGANIC**

- ethers, acetals
- olefins with allylic hydrogens, chloro- and fluoroolefins, terpenes
- dienes, vinyl acetylenes
- aldehydes
- ureas, amides, lactams
- vinyl monomers including vinyl halides, acrylates, methacrylates, vinyl esters

**2) INORGANIC**

- alkali metals, particularly potassium
- alkali metal alkoxides and amides
- organometallics

**3.4 Satellite Accumulation Area Containers:**

**Satellite Accumulation Area Containers** are containers where hazardous waste is collected, which are at or near the point of generation, the container is under the control of the individual performing the process that generates the waste, and the container will be removed from the Satellite Accumulation Area within 72 hours of becoming full.

**3.4.1 Satellite Accumulation Area Container Labels:**

- **Database Labels for Satellite Accumulation Area Containers** can be produced in the Inventory Module of the Chemical Inventory Database. For detailed instruction on how to use the Satellite Accumulation applications go to the On-line training for the Chemical Inventory Database at:  
<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

- Module 2: Inventory provides detailed instructions for how to use the Satellite Accumulation application to identify hazardous waste streams and how to print satellite accumulation container labels from your list of waste streams.
- **Generic Satellite Accumulation Area Container labels** are also available on the following Web page: <http://www.augusta.edu/services/ehs/chemsafe/hazwaste.php> If you choose to use this label, you must fill out all of the information, include the names and % concentration for all chemical in the Satellite Accumulation Container (no formulas or abbreviation) and mark the hazard categories that apply for the waste.

**3.4.2** All wastes generated in Satellite Accumulation containers shall be processed through the Chemical Inventory Database, Waste Pickup module, and shall have a “Hazardous Waste” label produced in the Chemical Inventory Waste Pickup Module attached prior to pickup by the CSO.

### **3.5 Other Hazardous Chemical Waste Containers:**

**3.5.1** All chemicals being offered for hazardous waste pickup and disposal shall be processed through the Chemical Inventory Database, Waste Pickup Module.

**3.5.2** All chemicals being offered for hazardous waste disposal shall be labeled with a “Hazardous Waste” label produced in the Chemical Inventory Waste Pickup Module. Detailed instruction on how to use the Chemical Inventory Database, Waste Pickup to process chemicals and chemical waste for disposal, and how to produce the Hazardous Waste label, go to the following Web Page: <http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

See Module 4: Waste Pickup

### **3.6 Notification for Collection or Hazardous Waste Pickup Requests:**

**3.6.1** Notification for Collection or requests for pickup of hazardous chemical wastes and chemicals for exchange is provided through the Chemical Inventory Database, Waste Pickup Module.

**3.6.2** Once the request for pickup request has been processed through the Chemical Inventory Database, there is no need to call or contact the CSO. Schedules identifying the location, and containers to be picked up are produced using the Chemical Inventory Database. CSO staff members produce these schedules prior to going out on campus to complete the pickup requests.

**3.6.3** On-line training and written instructions on how to use the Chemical Inventory Database, is provided on the following Web page:  
<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

**3.6.4** Access to the database is provided by the CSO. For access or more information, contact the CSO or call 706-721-2663.

**3.7 Chemical Safety Office Responsibilities:**

**3.7.1** RCRA Trained CSO Staff members shall perform pickups on Wednesday of every week.

**3.7.2** CSO staff members shall use the “Buddy System” for collection of all hazardous wastes and exchange chemicals from laboratories on campus.

**3.7.3** Hazardous Waste generated at Augusta University is profiled for handling, storage, transport, and disposal by CSO staff members through the Chemical Inventory Database, Chemical Catalog systems.

**3.7.4** This information is made available to the chemical users through the Chemical Inventory Database web application, in the form of a “Chemical Fact Sheet” report.

**3.7.5** The CSO provides an On-line Training Resource for the Chemical Inventory Database: On-line Training for how to use the Inventory Systems and the Waste Pickup Module in the Chemical inventory Database is provided at the following Web Site:  
<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>



## APPENDIX E

### CHEMICAL EXCHANGE PROGRAM

The [Pollution Prevention Act \[42 U.S.C. §13101 et seq. \(1990\)\]](#) focused attention on reducing the amount of pollution through cost-effective changes in production, operations, and use of raw materials.

The [National Waste Minimization Program](#) supports efforts that reduce the amounts of waste generated, and lower the toxicity and persistence of wastes that are generated.



Pollution prevention and waste minimization requires cradle-to-grave analysis. The production of hazardous waste begins when you select the products you are going to use. We reduce the production of hazardous waste by promoting the use of non-toxic or less-toxic substances, purchasing only the amounts needed for the study, and by implementing conservation techniques, such as micro-scale processes. We can also reduce the amount of hazardous wastes entering the waste stream by looking for ways to recycle, reuse, and re-distribute usable unwanted materials, rather than putting them into the waste streams.



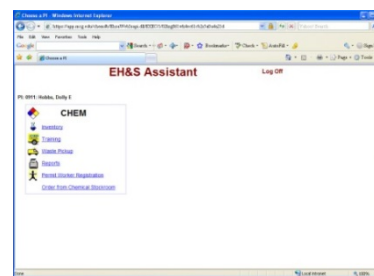
[Environmental Health & Occupational Safety \[IH&S\]](#) has several established recycling programs including products such as Spent Fluorescent lamps, Heavy Metal Batteries, Liquid Mercury, Paint, and Used Oil. For more information about recycling programs, contact IH&S at 706-721-2663.

The Augusta University Chemical Exchange Program was first established in 1987 as part of our Waste Minimization Plan, and was last updated in 2008 as part of our Biennial Report to the EPA/EPD.

The Chemical Exchange Program is managed and monitored by EHS, CSO.

Under the Chemical Exchange Program, Principal Investigators or chemical users may contribute useable chemicals in the original reagent containers for redistribution to other laboratories on campus through the CSO. Chemicals may be submitted for exchange using the following procedures:

- D. The Original manufacturers label on chemicals being offered for exchange shall not be removed, defaced, or otherwise destroyed.
- E. All exchange chemicals shall be processed through the [Chemical Inventory Database](#), for pickup and re-distribution.
- F. An Exchange Chemical label, which is produced using the Chemical Inventory Database, shall be attached to the container in a manner that does not destroy, cover, or otherwise deface the original container label.
- G. On-line training for how to use process and label exchange chemicals in the Chemical Inventory Database is available at the following Web Site:



<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

[Module 4: Waste Pickup](#) – explains how to process and label an exchange chemical for pickup using the Waste Pickup module.

[Module 7: Order From Chemical Stockroom](#) – explains how to view the exchange inventory and ordering from the exchange list.

For more information about the Chemical Exchange Program, talk to your CSO Representative or call the CSO at 706-721-2663.

## APPENDIX F

### PROGRAM FOR MANAGEMENT OF DEA REGULATED MATERIALS

#### **1.0.PURPOSE**

To ensure that all substances regulated by the Drug Enforcement Agency (DEA) are handled, stored, and disposed in accordance with regulatory requirements

The Controlled Substances Act, Title II of the Comprehensive Drug Abuse Prevention and Control Act of 1970, provides for the regulation of the manufacture and distribution of narcotics, stimulants, depressants, hallucinogens, anabolic steroids, and chemicals used in the production of controlled substances. Controlled substances are defined in the Controlled Substances Act, the Code of Federal Regulations (CFR), and in the Georgia Controlled Substances Act. In the event of any conflict between this policy and applicable laws, the laws shall take precedent.

Drugs with addictive potential are divided into categories (known as ‘schedule’ and ‘class’) based on the DEA’s perception of their potential for abuse, history and current pattern of abuse, risk to public health, etc. There are a total of 5 schedules (I-V), as well as separate groupings for pre-cursor chemicals. Specific lists of controlled substances are provided by schedule.

Classification at the state level may differ from federal classes. Regulations for schedule I (C-I) controlled substances are more restrictive than for schedule II (C-II), which are more restrictive than those for schedule III through schedule V (C-III through C-V). Additionally, Georgia classifies specific listed substances as well as those substances available only by prescription as “dangerous drugs.”

Links to these Scheduled substances and Listed chemicals are available on the Environmental Health and Safety Division’s (EHS) CSO website, <http://www.augusta.edu/services/ehs/chemsafe/>

To ensure controlled substances are handled and/or stored in an appropriately safe manner, and in accordance with State and Federal regulations and guidelines, any Augusta University researcher or practitioner wishing to receive and use these materials for research must be properly licensed and authorized by the appropriate regulating body prior to receipt and use.

Each researcher who is authorized to use controlled substances is responsible for compliance with Federal and State laws, which form the basis for Augusta University policies and procedures; this policy is designed to assist Augusta University researchers in achieving such compliance.

The following groups, including physicians, have licenses that permit legally prescribing drugs to their patients. This policy does not apply to:

- Augusta University Healthcare practitioners providing patient services,

- Augusta University veterinarians practicing animal care, and
- Approved or licensed administration of controlled substances to human subjects.

## **2.0.DELEGATION OF AUTHORITY**

### **VICE PRESIDENT FOR ADMINISTRATION**

The Vice President for Administration is responsible for providing administrative, logistical and operational services to facilitate the teaching, research and health care missions of Augusta University.

### **ASSOCIATE VICE PRESIDENT FOR ENVIRONMENTAL HEALTH AND SAFETY DIVISION**

The Associate Vice President for Environmental Health and Safety Division (EHS) is responsible for providing environmental health and safety services to the Augusta University community. The CSO, under supervision of the Associate Vice President of EHS, shall assist Principal Investigators by:

- 1 identifying adequate training for handling and use,
- 2 negotiating reverse distribution activities as needed
- 3 providing for documented disposal as needed
- 4 perform periodic lab inspection to verify compliance

The Chemical Safety Lab Review Checklist and the Chemical Storage and DEA Review Checklist are available at:

<http://www.augusta.edu/services/ehs/chemsafe/>

### **LEGAL AFFAIRS OFFICE**

The Augusta University Legal Affairs Office shall provide guidance for compliance with;

- 1 Agents of the Drug Enforcement Administration (DEA)
- 2 Agents of the Georgia Drugs and Narcotics Agency (GDNA)

### **RESEARCHERS/PRINCIPAL INVESTIGATORS/and/or PRACTITIONERS**

Researchers/Principal Investigators (PIs) and/or Practitioners are responsible for:

- 1 Obtaining required registration and licenses
- 2 General compliance with state, and DEA regulations in the receipt, storage, use, and disposal of controlled substances.
- 3 Obtaining the proper training for employees under their direct supervision for receipt, storage, use, and disposal of controlled substances.
- 4 Maintaining proper documentation including:
  - a. Ensuring that all controlled substances under their responsibility are stored in a locked, secure location with limited access,
  - b. Completing and maintaining proper records of used of controlled substances,

- c. Disposing of their controlled substances in accordance with regulatory and institutional requirements,
- d. Retaining and maintaining disposal records if and when any material is disposed.

### 3.0 **DEFINITIONS**

These definitions and acronyms apply to these terms as they are used in this policy:

- 1 **Clinical Use** - Use of Controlled Substances by researchers/investigators at MCG for research purposes not including healthcare practitioners providing patient services or veterinarians practicing animal care.
- 2 **Controlled Substance** - A drug or other substance, or immediate precursor, included in schedule I, II, III, IV or V of the DEA Title 21, Chapter 13, Subchapter I.
- 3 **DEA** - U.S. Drug Enforcement Administration
- 4 **GDNA** - Georgia Drugs & Narcotics Agency acting as a law enforcement and regulatory division for the Georgia State Board of Pharmacy, ensuring that registrants follow the laws pertaining to dangerous drug and controlled substances.
- 5 **IACUC** - Institutional Animal Care and Use Committee acts as oversight to ensure that all research in MCG using invertebrate and vertebrate animals comply with all federal laws that govern humane care and treatment of laboratory animals.
- 6 **List Chemical** - A chemical specified by regulation as a chemical that is used in manufacturing a controlled substance.
- 7 **Practitioner** - A physician, dentist, veterinarian, scientific investigator, pharmacist, hospital employee or other person licensed, registered, or otherwise permitted, by the United States or the jurisdiction in which he practices or does research, to distribute, dispense, conduct research with respect to, administer, or use in teaching or chemical analysis, a controlled substance in the course of professional practice or research.
- 8 **Researcher/Principal Investigator** - An Augusta University employee conducting research in a Augusta University facility.
- 9 **Reverse Distributor** - A distributor registered with DEA to take control of the controlled substance for the purpose of returning them to the manufacturer or, if necessary, dispose of them.

### 4.0 **ACTIONS**

- 1 Prior to obtaining or using controlled substances or regulated drugs, researchers at Augusta University must register with the DEA and with the Georgia Licensing Board. The registration process provides a framework for DEA and state agency oversight to monitor and regulate activities pertaining to usage, materials and access of controlled substances. Agents/employees of the registrant may be authorized to work with the controlled substances, under specified circumstances. Additionally, the researcher must provide the CSO with a copy of the DEA and State licenses to show license numbers, authorized Schedules and date of approval.
- 2 Each registrant must:

- a. Follow applicable DEA and State regulations;
  - b. Maintain registration with Federal and State Agencies;
  - c. Engage only in those activities and use of controlled substances as specifically permitted in their license;
  - d. Maintain all required records;
  - e. Control and safeguard Controlled Substances; and
  - f. Maintain documentation of collaborative use of controlled substances with other researchers.
- 3 Training specific to controlled substances handling is not required for registration, however, training is strongly recommended because:
- a. Registrants and their lab workers must comply with the laws and regulations relating to the registration and with university policies and procedures; and
  - b. Augusta University policies and procedures are designed to aid compliance. Training seminars, or meetings to discuss procedures, may be arranged through the registrant's department, or directly with Augusta University Institutional Chemical Safety Committee (ICC) through the Chemical Safety Officer.
- 4 Security must be maintained as specified by Federal and State agencies to prevent theft, loss or misappropriation. Controlled substances are kept locked and secured from unauthorized access or removal. Loss or suspected theft is immediately reported to the licensee organization and to the CSO.
- 5 Each researcher will use DEA registered reverse distributors for disposal (contact EHS at 706-721-2663 for assistance in locating a reverse distributor). Each researcher will ensure that disposal of all controlled substances is completed prior to the termination date of the DEA registration when registration is not renewed, and/or when the researcher leaves Augusta University.
- 6 Required records, including reports, registration, shipping receipts, and inventory records must be maintained by the registrant for three years, at the address listed on the registration. All required records must be available for inspection at the registered site. Required records include:
- a. Receipt date and quantity;
  - b. Log of use and disposition; and
  - c. Inventory.
- Researchers whose registration is not renewed for any reason should retain their records for three years from registration expiration date. All records for researchers who leave Augusta University will be transferred to their department Chair.
- 7 Inspections may be conducted of registrants' records, security, inventory or other issues required for compliance with regulations or with Augusta University policies and procedures. Inspections or notification of pending inspections by federal or state regulatory personnel (or other non-Augusta University agents) should be reported immediately to the department head and to EHS at 706-721-2663. A representative from

EHS will escort and stay with the inspector throughout the inspection. Inspections may be conducted by:

- a. Agents of the Drug Enforcement Administration (DEA);
- b. Agents of the Georgia Drugs and Narcotics Agency (GDNA); or
- c. Other authorized police and law enforcement agencies.

A copy of the inspection report or a summary of results of the inspection should be sent to EHS. Assistance visits may also be conducted by authorized MCG employees, including but not limited to members of the EHS Division (using the checklist entitled Research Use of Controlled Substances Safety Review Checklist), Institutional Animal Care and Use Committee (IACUC), and the Augusta University Public Safety Division. This checklist may be revised without amending the entire policy.

- 8 Compliance with this policy is required as a condition of employment. Failure to follow this policy may result in disciplinary actions, which may include termination from employment.

## **RELATED DOCUMENTS**

### **AUGUSTA UNIVERSITY DEPARTMENTS**

Augusta University Chemical Safety Guide

<http://www.augusta.edu/services/ehs/chemsafe/documents/ChemSafGuide062011.pdf>

Research Use of Controlled Substances Policy

<http://policy.augusta.edu/2010/09/08/research-use-of-controlled-substances-policy-2/>

### **EXTERNAL AGENCIES**

21 CFR 1300 to 1316: Drug Enforcement Administration, Department of Justice.

<http://www.gpo.gov/fdsys/pkg/FR-2012-01-27/html/2012-1150.htm>

Official Code of Georgia Title 16, Crimes and Offenses, Article 1, Chapter 13, Sections 1,2,3, & 4, Controlled Substances; Article 2 Regulation of Controlled Substances, Parts 1 & 2, and; Article 5, encompass "Drug Researchers". O.C.G.A. § 16-13-1,2:

<http://www.legis.state.ga.us/cgi-bin/glcodesdetail.pl?code=1-1-1>

Official Code of Georgia, Title 26, Food, Drugs, and Cosmetics, O.C.G.A. § 26-4-1-5:

<http://www.legis.state.ga.us/cgi-bin/glcodesdetail.pl?code=1-1-1>

Rules of the Georgia State Board of Pharmacy. § 480-20, 480-26, et. seq. permit, license and registration requirements: link from URL

[http://rules.sos.state.ga.us/cgi-bin/page.cgi?g=GEORGIA\\_STATE\\_BOARD\\_OF\\_PHARMACY%2Findex.html&d=1](http://rules.sos.state.ga.us/cgi-bin/page.cgi?g=GEORGIA_STATE_BOARD_OF_PHARMACY%2Findex.html&d=1)

O.C.G.A. § 43-50 Georgia Veterinary Practice Act; links to these laws and to the Veterinary Boards Rules can be found at URL: [http://www1.legis.ga.gov/legis/1999\\_00/fulltext/hb372.htm](http://www1.legis.ga.gov/legis/1999_00/fulltext/hb372.htm)

Controlled Substances Security Manual, A Security Outline of the Controlled Substances Security Act of 1970: US Dept of Justice Drug Enforcement Administration, can be found at URL [http://www.deadiversion.usdoj.gov/pubs/manuals/sec/sec\\_req.htm](http://www.deadiversion.usdoj.gov/pubs/manuals/sec/sec_req.htm)



## APPENDIX G

### FLAMMABLE AND COMBUSTIBLE MATERIALS STANDARD OPERATING PROCEDURES

#### 1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with flammable materials. This general use SOP only addresses safety issues specific to flammability hazards of chemicals. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., both general use SOPs for flammable liquids and particularly hazardous substances would apply to benzene). Any questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor, or Chemical Safety (706-721-2663).

#### 2.0 CLASS DESCRIPTION

Flammable substances are one of the most common hazardous materials found in the laboratory. The propensity to vaporize, ignite, burn or explode varies with the specific type or class of substance. An indicator of the flammability of a solvent is its flash point, the lowest temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air. This information is usually available on the label affixed to the container. For the purposes of laboratory safety, both flammable and combustible liquids are considered fire hazards. Flammable liquids have a flash point of less than or equal to 100°F(38°C) and combustible liquids have a flash point of greater than or equal to 100°F(38°C) and less than or equal to 200°F(93°C).

Flammable and combustible liquids are separated into the following classes according to the National Fire Protection Association (NFPA)

<b>Class 1A (Highly Flammable)</b>	Flash Point <73°F (22.8°C) Boiling Point <100°F (37.8°C)	Ex: Ethyl ether, Dimethyl sulfide, Petroleum ether
<b>Class 1B Flammable</b>	Flash Point <73° F (22.8° C) Boiling Point ≥100° F (37.8° )	Ex: Acetone, Toluene, Ethanol, Ethyl acetate, Hexane, Gasoline
<b>Class 1C Flammable</b>	Flash Point ≥73° F (22.8° C) Boiling Point <100° F (37.8° C)	Ex: Amyl acetate, Bromopentane, Butyric acid, Hexene, Xylene
<b>Class II Combustible</b>	Flash Point ≥100°F (37.8°C) & <140° (60°C)	Ex: Acetic acid, Cumene, Formaldehyde
<b>Class IIIA Combustible</b>	Flash Point ≥140°F (60°C) & <200°F (93.4°C)	Ex: Benzaldehyde, Ethanolamine, Nitrobenzene

### 3.0 CONTROL OF HAZARDS – GENERAL

The NFPA has set limits for the storage of flammable liquids.

Table 9.4.3 Maximum Allowable Size — Containers, Intermediate Bulk Containers (IBCs), and Portable Tanks

Container Type	Flammable Liquids			Combustible Liquids	
	Class IA	Class IB	Class IC	Class II	Class IIIA
Glass	1 pt (0.5 L)	1 qt (1 L)	1.3 gal (5 L)	1.3 gal (5 L)	5.3 gal (20 L)
Metal (other than drums) or approved plastic	1.3 gal (5 L)	5.3 gal (20 L)	5.3 gal (20 L)	5.3 gal (20 L)	5.3 gal (20 L)
Safety cans	2.6 gal (10 L)	5.3 gal (20 L)	5.3 gal (20 L)	5.3 gal (20 L)	5.3 gal (20 L)
Metal drum (e.g., UN 1A1/1A2)	119 gal (450 L)	119 gal (450 L)	119 gal (450 L)	119 gal (450 L)	119 gal (450 L)
Approved metal portable tanks and IBCs	793 gal (3000 L)	793 gal (3000 L)	793 gal (3000 L)	793 gal (3000 L)	793 gal (3000 L)
Rigid plastic IBCs (UN 31H1 or 31H2) and composite IBCs with rigid inner receptacle (UN31HZ1)	NP	NP	NP	793 gal (3000 L)	793 gal (3000 L)
Composite IBCs with flexible inner receptacle (UN31HZ2) and DOT/UN-approved flexible IBCs	NP	NP	NP	NP	NP
Non-bulk Bag-in-Box	NP	NP	NP	NP	NP
Polyethylene UN1H1 and UN1H2, or as authorized by DOT exemption	1.3 gal (5 L)	5.3 gal (20 L)*	5.3 gal (20 L)*	119 gal (450 L)	119 gal (450 L)
Fiber drum NMFC or UFC Type 2A; Types 3A, 3B-H, or 3B-L; or Type 4A	NP	NP	NP	119 gal (450 L)	119 gal (450 L)

NP: Not permitted for the container categories so classified unless a fire protection system is provided that is developed in accordance with 16.3.6 and is approved for the specific container and protection against static electricity is provided.

\*See 9.4.3.1.

For the purposes of determining laboratory fire hazard classification, liquidized flammable gases shall be treated as if they are Class I flammable liquids; this is 4 L (1.1 gal) of liquefied flammable gas, (e.g. hydrogen) is to be considered equivalent to 4 L (1.1 gal) of Class I flammable liquid.

### 4.0 USE OF FLAMMABLE/COMBUSTIBLE LIQUIDS

The use of flammable and combustible chemicals is restricted to locations that are properly designed for such use. Laboratories or groups of laboratories using these liquids are required to be a fire area. A fire area is defined as a structurally protected room or section of a building having at least a 1-hour fire rated construction in accordance with the codes adopted by the State of Georgia.

## 5.0 **FLAMMABLE/COMBUSTIBLE LIQUID STORAGE**

In general, the following guidelines should be observed when storing flammable materials:

1. Substitute nonflammable liquids whenever possible.
2. Keep only small quantities of flammable materials available for immediate use.
3. An approved safety can with a self-closing cover, vent, and flame arrester is the proper container for storing flammable liquids or waste solvents in small quantities. An ordinary five-gallon container does not provide adequate protection in cases of fire.
4. Refrigerators and cooling equipment used for storing flammable liquids should be explosion-safe (see Section -). These are externally wired, thereby removing possible internal sources of ignition. If an explosion proof refrigerator is not available, small containers (up to 500 ml) of flammable liquids may be stored in a non-explosion proof refrigerator provided that the container is sealed within a desiccated secondary container that is also sealed.(Note: Parafilm® does not constitute sealed)
5. Flammable and combustible chemicals will only be stored in flammable chemical storage cabinets that comply with National Fire Protection Standards (NFPA 30) for flammable and combustible storage.
6. Biodegradable Scintillation fluid should be used whenever possible.

Storage of flammable and combustible liquids in fire areas shall not exceed the following amounts.

1. Not more than 10 gallons [37 Liters] in proper containers but not in safety cans.
2. Not more than 25 gallons [94 Liters] in UL (Underwriters Laboratory) approved safety cans with automatic closures and flame arrestors.
3. Not more than three (3) flammable cabinets per fire area, not to exceed the maximum allowable storage inside and outside flammable safety cans and cabinets for the fire area.
4. Flammable Cabinets cannot be larger than 120 gallon [454 Liter] capacity and must be UL approved.
5. Not more than Three Hundred and Sixty (360) gallons in safety cabinets (UL approved) in a fire area.
6. Maximum Allowable Quantities (MAQ) per fire area, including quantities inside and outside flammable safety cans and cabinets is determined by the building and fire area classification, total square feet, and the MAQ permitted by the National Fire Protection Association codes and standards (NFPA 30) as adopted and amended by the State of Georgia. Contact Chemical Safety at x706-721-2663 for MAQs per fire area.

It is the Responsibility of All Personnel to ensure that each laboratory, fire area, and storage area housing flammable and combustible liquids is in compliance with these guidelines.

In general, the following safety practices shall be observed.

1. Do not heat flammable chemicals with an open flame.
2. For highly flammable chemicals, avoid static electricity or hot surfaces as they can serve as ignition sources.
3. No electrical devices with cracked or frayed electrical wiring, or damaged housing shall be used.
4. Transfer flammable liquids with caution. The friction of flowing liquids may be sufficient to generate static electricity which in turn may cause a spark and ignition. Therefore, grounding or bonding all such containers is required before pouring from them. (contact Fire Safety Office at 706-721-2663 for the details of this procedure.).
5. Substitute nonflammable liquids whenever possible.
6. Flammable and combustible chemicals should be used in laboratory fume hoods (or other well ventilated areas) whenever possible, especially when used in larger quantities (> 500mL) or when using above room temperature and/or pressure. If the process does not permit the handling of large quantities of flammable liquids in the fume hood, contact Chemical Safety at 706-721-2663 to review the adequacy of all ventilation measures.
7. Maximum Allowable Quantities for storage of flammables outside ~~an~~ of inside liquid storage fire cabinet are based upon fire walls, total square feet, fire suppression systems, and building codes. Contact the CSO for Maximum Allowable Quantities per laboratory in a fire area. Each laboratory presents an unique condition.
8. Fire extinguishers appropriate for the fire hazards present must be available in all laboratories and storage areas. Class D fire extinguishers must be available in the immediate work area when working with flammable metals such as magnesium, sodium, and potassium.
9. Ensure secondary containment and segregation of incompatible chemicals per guidance within the CSO Chemical Storage Plan for Laboratories. Also, follow any substance-specific storage guidance provided in Safety Data Sheet.

NOTE: Certain flammables that are also considered particularly hazardous substances (i.e., benzene) may require use of a fume hood (due to toxicity potential).

#### **4.0 PERSONAL PROTECTION EQUIPMENT**

1. At minimum, ANSI approved safety glasses, full length lab coat, and closed toed shoes are to be worn when entering laboratories having hazardous chemicals.
2. Because of the nature of these chemicals, additional protection may be required, including but not limited to the following:
  - a. When handling hazardous chemicals or contacting potentially contaminated surfaces, protective gloves are to be worn. For proper selection of glove material, review the Safety Data Sheet for the chemical you will be handling the CSO Glove Selection Chart.

- b. Goggles (vs. safety glasses) are appropriate in processes where splash or spray is possible.
- c. For hazardous chemicals that are toxic via skin contact/absorption, additional protective clothing (i.e., faceshield, apron, oversleeves) may be appropriate where chemical contact with body/skin is possible.

## **5.0 WASTE DISPOSAL**

1. Many flammable liquids intended for disposal may likely be considered hazardous wastes. For general guidance regarding waste disposal,

Solutions that are greater than or equal to 24 % concentration of alcohol are considered a hazardous waste and must be collected for hazardous waste disposal through the CSO. Flammable liquids cannot be poured down the drain.

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## **APPENDIX H**

### **Compressed Gas Cylinders: Safety for Use, Storage and Handling Policy**

*Responsible Office: Environmental Health & Safety, Environmental Health and Occupational Safety*

*Originally Issued: October 1987*

*Revised: January 2013*

#### **1.0 Purpose**

To establish procedures for the safe use, handling, and storage of compressed gas cylinders.

#### **2.0 Policy**

Augusta University shall take every precaution to protect all persons and property against hazards presented by the use, handling, and storing of compressed gas cylinders.

All cylinders purchased or supplied by vendors shall meet the requirements stated in the U.S. Department of Transportation Specifications and Regulations, American National Standards, and the National Fire Protection Association Standard 45, 51, 55, and 99 as adopted by the State of Georgia. Handling, use, and storage of compressed gas cylinders shall be in accordance with these regulations and standards.

#### **3.0 Responsibility of Materials Management**

3.1 Ensure that compressed gases purchased or supplied by vendors meet the proper standards.

3.2 Ensure that cylinders are stored, handled, transported, and secured safely as stated in the DOT regulations and NFPA 45, 51, 55 and 99 as adopted by the State of Georgia.

3.2.1 Cylinders shall not be delivered to an area where proper safe securing is not available.

3.2.2 Cylinders shall be transported, stored, and used in an upright position, not horizontal.

3.2.3 Cylinders shall be moved using a proper cylinder cart having a restraint.

#### **4.0 Responsibility of All Personnel**

Users of compressed gas cylinders shall comply as follows:

4.1 Compressed Gas Cylinders shall be stored in a safe, dry, well-ventilated placed prepared and reserved for the purpose.

4.2 Compressed Gas Cylinders should not be stored near elevators, gangways, stairwells, or other places where they can be knocked down or damaged.

4.3 Oxygen cylinders shall not be stored within 20' (6m) of gas cylinders or highly combustible materials. If closer, cylinders shall be separated by a fire-resistive partition at least 5' (1.6 m) having a fire resistive rating of at least 0.5 hour.

4.4 Acetylene and liquefied fuel gas cylinders shall be stored with the valve end up. If storage areas are within 100' (30.5 m) distance of each other and not protected by automatic sprinklers, the total capacity of acetylene cylinders stored and used inside the building shall be limited to 2000 ft<sup>3</sup> (57 m<sup>3</sup>) of gas, exclusive of cylinders in use or connected for use. Quantities exceeding this total shall be stored in a special room built in accordance with the specifications of NFPA 51, "Oxygen-Fuel Gas Systems for Welding and Cutting," either in a separate building or outdoors.

4.5 Acetylene storage rooms and buildings shall be well ventilated. Open flames shall be prohibited. Storage rooms shall have no other occupancy

4.6 Cylinders are not designed for temperatures in excess of 125°F (54°C). Accordingly, they shall not be stored near sources of heat such as radiators or furnaces, or near highly flammable substances like gasoline, oil or volatile liquids.

4.7 Cylinder storage shall be planned so that cylinders will be used in the order in which they are received from the supplier.

4.8 Storage rooms for cylinders containing flammable gases shall be well ventilated to prevent the accumulation of explosive concentrations of gas; no source of ignition shall be permitted; smoking shall be prohibited; wiring shall be in conduit; electric lights shall be in fixed position, enclosed in glass or other transparent material to prevent gas from contacting lighted sockets or lamps, and they shall be equipped with guards to prevent breakage; electric switches shall be located outside the room.

4.9 A flame or electric arc shall never be permitted to contact any part of a compressed gas cylinder.

4.10 All Cylinders, full or empty, shall be restrained/secured by approved methods or devices during storage, use, and transport, including cylinders stored in manifold closets, cylinder rooms, or at bench-top operations. No more than four cylinders, including the cylinders in use and reserve cylinders, may be secured together in any location that is not specifically designed to be a cylinder storage facility.

4.11 Laboratories may have no more than one (1) reserve cylinder for a cylinder in use, with the exception of cylinders attached to a manifold system. Reserve cylinders are not allowed in the same fire area, when the Cylinders “in use” are attached to a manifold system. Therefore you may not have any reserve cylinders for cylinders attached to a manifold system, unless the reserve cylinders are stored in a separate fire area. Contact Chemical Safety at 706-721-2663 for more detailed information.

4.12 A Laboratory gas cylinder is considered “in use” if it is:

- Connected through a regulator to a laboratory operation,
- A single cylinder alongside the laboratory operation as a reserve, or
- Connected to a manifold being used to deliver gas to a laboratory operation

4.13 For Laboratory gas cylinders “not in use” or cylinders in Non-Laboratory areas, NFPA 55 shall apply.

- All cylinders must be segregated by hazard class [e.g., flammable, pyrophoric, oxidizer, corrosive, and unstable reactive classes 2,3,and 4 (not simple asphyxiants), and
- there must be a twenty (20) foot distance separating each hazard class - unless each hazard class is separated by a five (5) foot wall of non-combustible material with a 0.5 hour fire resistance rating.

4.14 Compressed gas cylinders containing, flammable, pyrophoric, oxidizer, corrosive, unstable reactive, or asphyxiate, gases shall not be used in a confined spaces without a “Confined Space Permit’ or a “Hot Work Permit” whichever may apply. See the Confined Space Entry Policy at: <https://augusta.policytech.com/dotNet/documents/?docid=571&mode=view> .

4.15 Where removable caps are provided for valve protection, such caps shall be kept on cylinders at all times except when cylinders are in use.



4.16 Cylinders shall not be stored near heat sources or combustible materials, lubricant, electrical wiring and ignition sources, or other non-compatible compressed gases. Storage areas must be well ventilated.

4.17 Flammable gas cylinders shall not be stored with or secured together with Oxidizing gas cylinders.

4.18 Cylinders shall be marked "EMPTY" when empty and not be refilled by anyone other than the owner. Empty means to 25 PSI.

4.19 Cylinders shall not be subject to temperatures above 125 degrees F or artificially created low temperatures.

4.20 Cylinders shall never be brought into unventilated rooms or other closed quarters such as cold rooms or walk-in coolers.

4.21 The correct pressure-reducing regulator must be used for each type of cylinder gas as specified in NFPA 99-4, and each must work properly and be used correctly according to the manufacturer's specifications.

4.22 Before a regulator is removed from a cylinder valve, the cylinder valve shall be closed and the gas released from the regulator.

4.23 Cylinders of compressed gas shall not be used without a pressure-reducing regulator attached to the cylinder valve except where cylinders are attached to a manifold—in which case the regulator shall be attached to the manifold header.

4.24 Regulators and pressure gauges shall be used only with gases for which they are designed and intended. Make no attempt to repair or alter cylinders, valves, or attachments. This shall be done by the manufacturer.

4.25 The threads on a regulator or union shall correspond to those on the cylinder valve outlet. Connections that do not fit shall not be forced.

4.26 Cylinder valves shall be opened slowly. Cylinders without hand-wheel valves shall be opened with a spindle key, special wrench, or other tool provided or approved by the gas supplier.

4.27 To prevent rusting, cylinders stored in the open shall be protected from contact with the ground and against weather extremes such as ice and snow accumulations in winter and continuous direct rays of the sun in the summer.

4.28 Safety devices in valves or on cylinders shall not be tampered with.

4.29 When in doubt about the proper handling of a compressed gas cylinder or its contents, the supplier of the gas shall be consulted.

4.30 When empty cylinders are to be returned to vendor, they shall be marked EMPTY or MT. Close the valves and replace the valve protection caps if the cylinders are designed to accept caps.

4.31 Numbers or marks stamped on cylinders shall not be removed or changed.

4.32 Cylinders shall be properly labeled as to their contents.

This entry was posted in *Administrative, Environmental Health and Occupational Safety* and tagged *compressed gas cylinders, environmental health and safety, National Fire Protection Association (NFPA), safe handling, safe use*. Bookmark the *permalink*. Both comments and trackbacks are currently closed.

## APPENDIX I

### CRYOGENIC LIQUIDS STANDARD OPERATING PROCEDURES

#### 1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with cryogenic liquids and dry ice. This general use SOP only addresses safety issues specific to cryogenic hazards of chemicals. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., for liquid hydrogen, both this general use SOP and the general use SOP for flammable liquids would apply). If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or Environmental Health and Safety (706-721-2663).

#### 2.0 CLASS DESCRIPTION

Cryogenic liquids are materials with extremely low boiling points (i.e. less than – 150 °F). Common examples of cryogenic liquids are liquid nitrogen, helium, oxygen, and argon. Dry ice is the common term for frozen carbon dioxide. One special property of both cryogenic liquids and dry ice is that they undergo substantial volume expansion when converted to a gas phase, which can potentially lead to an oxygen deficient atmosphere where ventilation is limited. Oxygen enriched atmospheres become explosion hazards. Few cryogenic liquids can also pose additional hazards including toxicity and flammability (i.e. liquid carbon monoxide). Under normal conditions, cryogenic tanks vent about 3-4% of their contents per day. This does not pose a risk unless stored in a confined space.

**Volume Expansion ratios of liquid cryogenics to gas**

<b>Liquid Nitrogen</b>	<b>1:696</b>
<b>Liquid helium</b>	<b>1:575</b>
<b>Liquid Argon</b>	<b>1:847</b>
<b>Liquid Hydrogen</b>	<b>1:851</b>
<b>Liquid Oxygen</b>	<b>1:860</b>

#### 3.0 CONTROL OF HAZARDS – GENERAL

1. Only work with cryogenic liquids in well-ventilated areas to avoid localized oxygen depletion or build up of flammable or toxic gas.
2. If the process does not permit the handling of cryogenic liquids in well-ventilated areas (i.e., lab ventilation having a minimum of 6 air changes per hour), contact Environmental Health and Safety at 706-721-2663 to determine necessity of an oxygen-deficiency monitor.
3. Handle objects that are in contact with cryogenic liquids with tongs and/or proper gloves.

4. Transfers or pouring of cryogenic liquids should be done carefully to avoid splashing.
5. Containers and systems containing cryogenic liquids should have pressure relief mechanisms.
6. Cryogenic liquid cylinders and other containers (such as Dewar flasks) should be filled no more than 80% of capacity to protect against thermal expansion.
7. Cryogenic liquid/dry ice baths should be open to the atmosphere to avoid pressure build up.
8. Keep liquid oxygen away from organic materials and ignition sources.
9. Transfer of liquid hydrogen in an air atmosphere can condense oxygen in the liquid hydrogen, creating an explosion risk.
10. Cryotube thawing - In addition to wearing proper safety equipment, when thawing cryotubes, place the cryotube in a heavy-walled container (e.g., a desiccator) or behind a safety shield to protect yourself in the event that the tube shatters. Shield or wrap fiber tape around glass dewars to minimize flying glass and fragments should an explosion occur. Note: Plastic mesh will not stop small glass fragments.
11. Cryogenic liquid dewars are to be stored in well-ventilated areas. Storage in unventilated closets, environmental rooms, and stairwells is prohibited.
12. Large dewars must be tethered/ anchored to a wall.
13. Store flammable cryogenic liquids and liquid oxygen away from combustible materials and sources of ignition.
14. Additionally, follow all substance-specific storage guidance provided in the Safety Data Sheet documentation.

#### **4.0 PERSONAL PROTECTION EQUIPMENT**

1. Full length long sleeved lab coat, closed toed non-permeable material shoes, and long pants with pants legs outside of shoes/boots, heavy gloves (e.g., cryogenic gloves), safety goggles, face shield, and lab apron are to be worn when using or handling cryogenics.

#### **5.0 WASTE DISPOSAL**

Coordinate with the vendor/supplier for return of dewar(s) or tank.

#### **6.0 MINIMUM TRAINING REQUIREMENTS**

1. Board of Regents of the University Systems of Georgia Required On-line Training:
  - Basic Awareness Right-to-Know Training (Required upon initial employment only for all Employees)
  - Chemical Specific Right-to-Know Training (Required upon employment and annually for Personnel handling chemicals)
  - Hazardous Waste Awareness Training (Required upon employment and annually for Personnel handling chemicals)
2. Initial Chemical & Biological Safety Training (Required upon employment for all faculty & staff who will be working in laboratories)

3. EPA Training for Augusta University Laboratory Staff (Required upon employment and annually for all faculty & staff who will be working in laboratories)

## 7.0 **ICC APPROVALS REQUIRED**

1. All Principal Investigators (PI) are required to seek Institutional Chemical Committee approval for use of hazardous chemicals in laboratories.
2. Lab workers shall consult with PI regarding need for prior approval of high hazard chemicals.
3. Laboratory personnel shall seek and the PI must receive, from the ICC, prior approval involving the use of hazardous and highly hazardous, and restricted chemicals.
4. In general, a highly hazardous or 'restricted chemical' would be any chemical that poses an unreasonable risk to employees, such as chemicals that are potentially explosive or potentially lethal through inhalation, ingestion, or absorption.
5. For more information about restricted chemicals, contact the CSO at 706-721-2663.

## 8.0 **SPILL & ACCIDENT**

1. Prompt response to chemical spills is critical to protect worker health & safety and to mitigate adverse effects to the environment. For further guidance, refer to "[Augusta University Emergency Response Flip Chart](#)". In event of a spill of a cryogenic material, notify others in the area and evacuate to an area with adequate ventilation.
2. All spills, accidents, ~~or~~ exposures, and/or near misses are to be reported to the CSO.
3. Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:
  - A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure).
  - Symptoms or signs of exposure to a hazardous chemical develop.

### **Decontamination Procedures:**

1. **Personnel:** If immediate medical attention is required, call x1-2911.
  - a. Remove any contaminated clothing, and IMMEDIATELY flush contaminated skin with warm, not hot water for at least 15 minutes following any skin contact.
  - b. For eye exposures, IMMEDIATELY / flush eyes w/ water for at least 15 minutes.
  - c. Consult SDS for guidance on appropriate first aid.
  - d. Where medical attention is required, the CSO shall provide SDS(s) for the chemical(s) involved to aid medical staff in proper diagnosis and treatment.
2. **Area:** Decontamination procedures vary depending on the material being handled. The toxicity of some materials can be neutralized with other reagents.

## APPENDIX J

### LIQUID NITROGEN SAFETY

#### Standard Operating Procedures

*(Post in all Laboratories and areas that use Liquid Nitrogen)*

#### A. REFILLING DEWARS IN LABORATORIES

1. Never refill Dewars or transfer Liquid Nitrogen alone!
2. Make sure that there is good ventilation. Open a door if you are in a small room.
3. Use Dewars rated for liquid nitrogen
  - a. Never use a Dewar that does not have a pressure venting lid/stopper.
  - b. Never use Dewars with makeshift or homemade lids/stoppers.
  - c. Use pressure venting lids/stoppers supplied by the Dewar manufacturer
  - d. Thermos® type containers, with tight fitting tops are not permissible substitutes for cryogenic containers
4. Dewars larger than 20 Liters will be lifted and poured by two people
5. Do not use a Funnel
6. Wear Required Personal Protective Equipment:
7. Cryogenic Gloves or similar loose fitting gloves
8. Lab Coat
9. Liquid proof Shoe Covers/Spats
10. Chemical Splash Goggles or Laboratory Face Shield
11. Long pants without cuffs worn outside of shoes/boots
12. Closed toed shoes of impermeable material

#### B. DISPENSING LIQUID NITROGEN FROM STORAGE TANKS

1. Dispense only into Dewars that are rated for liquid nitrogen. (See A.3 above)
2. Dispense only into Dewars that are:
3. Equipped with carrying handles or wheels
4. Stable/not in danger of tipping over easily
5. Persons filling Dewar(s) will be in constant attendance during filling
6. Prevent Splashing. Place filling hose at or below the mouth of the receiving Dewar
7. Wear Required Personal Protective Equipment (see A.6-10 above)

#### C. TRANSPORTING LIQUID NITROGEN BETWEEN BUILDINGS

1. Use Dewars rated for liquid nitrogen. (See A.3 above)
2. Never Transport Liquid Nitrogen in a Open Container

3. Wear or Carry Required Personal Protective Equipment (see A. 6-10 above)
4. Do not use unstable wheeled carts or Dewars
5. Avoid grates, large cracks in sidewalks/pavement, or other hazards that could cause tipping

#### D. TRANSPORTING LIQUID NITROGEN WITHIN LABORATORIES AND BETWEEN LABORATORIES IN THE SAME BUILDING

1. Use Dewars rated for liquid nitrogen (see A. 3 above).
2. Do not transport Liquid Nitrogen in Open Containers
3. Wear Required Personal Protective Equipment (see A. 6-10 above)
4. If you are carrying a Dewar containing Liquid Nitrogen:
5. Make sure Dewar is your ONLY load (no books, coffee, other items)
6. Carry transport Dewar as far away from your face and body as possible
7. Watch for other people who may run into or bump you
8. Small containers (i.e. < 1 liter) of liquid nitrogen may be carried in a secondary carrying device when using stairwells.

#### E. TRANSPORTING CYROGENICS ON ELEVATORS

1. Use service elevators only.
2. **Under no circumstances shall personnel ride on an elevator with a container of cryogenic material**
  - a. Elevator will be placed in manual with the intermediate floors locked out, the tank placed on the elevator by one person and taken off on the selected floor by a second person; or
  - b. Elevator left in automatic and personnel stationed at each intermediate floors disallowing any passengers to enter the elevator, and one person on the destination floor to remove the tank
3. All persons engaged in cryogenic tank transfer shall wear appropriate PPE (see A 7-12).

**APPENDIX K  
CORROSIVE MATERIALS  
STANDARD OPERATING PROCEDURES**

**1.0 INTRODUCTION**

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with corrosive materials. This general use SOP only addresses safety issues specific to corrosive hazards of chemicals. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., for perchloric acid, both the general use SOPs for corrosives and unstable reactives would apply). If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or Chemical Safety (x706-721-2663).

**2.0 CLASS DESCRIPTION**

**Corrosives** consist of four major classes: strong acids, strong bases, dehydrating agents and oxidizing agents.

Inhalation of the vapors of these substances can cause severe bronchial irritation. These chemicals erode the skin and the respiratory epithelium and are particularly damaging to the eyes.

**Alkaline materials, phenols and strong acids** are particularly corrosive and may cause permanent loss of vision.

The following is a list of some of the most common corrosive chemicals found in an academic or research laboratory.

<b>Inorganic Acids</b>	<b>Inorganic Bases</b>	<b>Oxidizing Agents</b>
Chromic acid	Ammonia, ammonium hydroxide	Bromine
Hydrochloric acid	Calcium hydroxide	Chlorine
Hydrofluoric acid	Calcium Oxide	Chromic acid
Nitric acid	Potassium hydroxide	Fluorine
Perchloric acid	Sodium hydroxide	Nitric acid
Phosphoric acid		Perchloric acid
Sulfuric acid		

<b>Organic Acids</b>	<b>Dehydrating Agents</b>	<b>Other Compounds</b>
Butyric acid	Calcium oxide	Tin chloride
Formic acid	Glacial acetic acid	Potassium chromate



Glacial acetic acid	Phosphorous pentoxide	Phosphorus Pentoxide
Oxalic acid	Sodium Hydroxide	Phosphorous trichloride
Phenol	Sulfuric acid	
Salicylic acid		
Trichloroacetic acid		

**Four acids deserve special attention** because of the hazards they pose. These are: **nitric acid, perchloric acid, picric acid, and hydrofluoric acid.**

**Nitric acid (CAS# 7697-37-2)**

Most commercially available nitric acid has a concentration of 68%. When a solution contains more than 86% it is referred to as Fuming Nitric Acid. It is further characterized as white fuming nitric acid or red fuming nitric acid at concentrations above 95%.

Nitric acid is a highly corrosive inorganic strong mineral acid that is also a very strong and powerful oxidizing agent. The major hazard posed by it is chemical burns its oxides are highly toxic. Concentrated nitric acid attacks tissues readily and stains human skin yellow due to its reaction with keratin. These yellow stains turn orange when neutralized.

Because nitric acid is also an oxidizing agent, it may form flammable and explosive compounds with many materials (e.g., ethers, acetone and combustible materials). Paper used to wipe up nitric acid may ignite spontaneously when dry. Nitric acid should be used only in a hood and should be stored away from combustible materials.

Precautions for using nitric acid under these conditions are similar to those for other mineral acid:

- Wear suitable gloves, eye protection, and other protective clothing to protect in the event of splashes or spills.
- Dilutions should be performed by adding acid to water, and not the other way around.
- Limit quantities in storage to what is needed for the next 6-12 months.
- Solutions not used at the end of the 12 month time limit should be disposed as hazardous waste through Chemical Safety.

The standard first aid treatment for acid spills on the skin is, as for other corrosive agents, irrigation with large quantities of water. Washing is continued for at least ten to fifteen minutes to cool the tissue surrounding the acid burn and to prevent secondary damage. Contaminated clothing is removed immediately and the underlying skin washed thoroughly.

Being a strong oxidizing agent, reactions of nitric acid with compounds such as [cyanides](#), [carbides](#), metallic powders can be [explosive](#) and those with many [organic compounds](#), such as [turpentine](#), are violent and [hypergolic](#) (i.e. self-igniting). Hence, it should be stored away from bases and organics.

Large acid spills should be referred to the CSO at 706-721-2663.

In the case of a small acid spill (<200 ml) contained in the fume hood, neutralize the spill by gradually adding alkaline material (sodium carbonate, lime) from the edges of the spill towards the center. Test the pH of the spilled material and continue neutralizing until the pH reaches the 6-9 range. Absorb with an inert material (vermiculite, dry sand). Do NOT use combustible materials, such as saw dust, or paper towels to absorb nitric acid spills! Place materials in a chemical waste container and dispose of appropriately. Appropriate chemical resistant gloves should be used when cleaning up a spill due to possible prolonged glove contact with nitric acid. After spill has been completely absorbed, wipe contaminated area down with a soap and water solution.

### **Perchloric acid (CAS# 7601-90-3)**

Perchloric acid is an inorganic, strong mineral acid  $\text{HClO}_4$ . Usually found as an aqueous solution, this colorless compound is a stronger acid than [sulfuric](#) and [nitric acids](#). It is a powerful oxidizer, but its aqueous solutions up to appr. 70% are generally safe, only showing strong acid features and no oxidizing properties. Perchloric acid is useful for preparing [perchlorate](#) salts, especially [ammonium perchlorate](#), an important [rocket fuel](#). Overall, Perchloric acid is dangerously corrosive and readily forms potentially explosive mixtures.

Under some circumstances it may act as an oxidizer and/or present an explosion hazards. It forms highly explosive and unstable compounds with many organic compounds and even with metals. Unstable perchlorate compounds may collect in the ductwork of fume hoods and cause fire or violent explosions. Therefore, perchloric acid should be used with extreme caution and only in a fume hood designed for its use, a perchloric acid hood has corrosion resistant ductwork and a wash down system.

Minimum quantities of perchloric acid should be kept on hand and the container stored in a perchloric acid hood on a glass tray that is deep enough to hold the contents of the bottle. Perchloric acid should not be kept for more than one year since explosive crystals may form.

Anhydrous perchloric acid is unstable, is restricted, and should not be used at Augusta University.

Given its strong [oxidizing](#) properties, perchloric acid is subject to extensive regulations. It is highly reactive with metals (e.g., [aluminum](#)) and organic matter (wood, plastics). Work conducted with perchloric acid must be conducted in

fume hoods with a wash-down capability to prevent accumulation of oxidizers in the ductwork.

Concentrated perchloric acid (70%) is an oxidizer at temperatures above 150° C and is potentially explosive when heated. Perchloric acid forms an azeotrope with water, consisting of about 72.5% perchloric acid. This form of the acid is stable and is commercially available. Such solutions are hygroscopic. Thus, if left open to the air, concentrated perchloric acid dilutes itself by absorbing water from the air.

Perchloric acid in concentrations up to 70% and used at room temperature acts similarly to other strong acids. Precautions for using perchloric acid under these conditions are similar to those for other mineral acid:

- Wear suitable gloves, eye protection, and other protective clothing to protect in the event of splashes or spills.
- Dilutions should be performed by adding perchloric acid to water, and not the other way around.
- Limit quantities in storage to what is needed for the next 6-12 months.
- Solutions not used at the end of the 12 month time limit should be disposed as hazardous waste through Chemical Safety.

Management of Perchloric acid containers:

1. Date container when opened.
2. Inspect at the end of six months for the formation of perchlorate (white) crystals around container lid.
3. Date container with inspection date.
4. When container is twelve months old, turn it in as hazardous waste to CSO at 706-721-2663.

Spills and other emergencies

1. In the event of spills, neutralize with soda ash or other appropriate neutralizing agent.
2. Soak up the spill with an inorganic based absorbent.
3. Do NOT use rags, paper towels, or sawdust and then put them aside to dry out, as such materials may spontaneously ignite.
4. Likewise, spills on wood may present a fire hazard after the liquid dries.
5. See the Emergency Response Flip Chart for management of large spills.

### **Picric acid (CAS# 88-89-1)**

Picric acid is the chemical compound formally called 2,4,6-trinitrophenol (TNP). This yellow crystalline solid is one of the most acidic phenols. Like other highly nitrated compounds such as TNT, picric acid is an explosive.

Picric acid can form explosive compounds with many combustible materials. When the picric acid becomes dehydrated below 30% it becomes unstable and may explode when shaken or handled. The picric acid container shall be dated

when received and inspected monthly for adequate hydration of the picric acid solution and for the formation of yellow picrate salt crystals under and around the container lid. The inspection date will be recorded on the container or a log sheet.

Management of picric acid containers:

2. Glass or plastic bottles are required, as picric acid can easily form metal [picrate](#) salts that are even more sensitive and hazardous than the acid itself.
3. Date container when received and when opened
4. Inspect container monthly to ensure that the picric acid :
  1. Is saturated greater than 70%,
  2. Has not solidified or partially solidified
  3. Picrate (yellow) crystals have not formed around lid of container.
5. When container is twelve months old, turn it in as hazardous waste to CSO at 706-721-2663.

Precautions for using Picric acid are similar to those for other mineral acids:

1. Wear suitable gloves, eye protection, and other protective clothing to protect in the event of splashes or spills.
2. Dilutions should be performed by adding acid to water, and not the other way around.
3. Limit quantities in storage to what is needed for the next 6-12 months.
4. Solutions not used at the end of the 12 month time limit should be disposed as hazardous waste through Chemical Safety.

### **Hydrofluoric acid (CAS# 7664-39-3)**

Hydrofluoric acid (HF) is a [solution](#) of [hydrogen fluoride](#) in [water](#). It is a valued source of [fluorine](#) and is a precursor to numerous pharmaceuticals such as [fluoxetine](#) ([Prozac](#)) and diverse materials such as [PTFE](#) ([Teflon](#)).

Hydrofluoric acid is a highly [corrosive](#) liquid and is a contact [poison](#). It should be handled with extreme care, beyond that accorded to other mineral acids.

For this reason, an SOP Guidelines for Hydrofluoric acid is provided in **Appendix G** of this guide under **Hydrofluoric acid Standard Operating Procedures**. All employees who will be handling Hydrofluoric acid are required to read this SOP.

## **3.0 CONTROL OF HAZARDS – GENERAL**

1. In general, handling processes should be designed to minimize the potential for splash, splatter, or other likely scenarios for accidental contact.
2. Do not pour water into acid. Slowly add the acid to the water and stir.
3. Never empty carboys or drums of chemicals by means of air pressure. Use a tilting rack, a safety siphon, or a liquid pump.
4. Never mouth pipette. Use a mechanical aid or a pipette bulb for pipetting.

5. Open bottles or carboys slowly and carefully and wear protective equipment to guard hands, face, and body from splashes, vapors, gases and fumes.
6. Wipe drips from containers and bench tops. Be especially careful to wipe up visible residues of sodium hydroxide and potassium hydroxide from all surfaces. Skin contact with dry residue will result in burns.
7. **Acids and alkalis (bases)** should be stored separately in a cool ventilated area, away from metals, flammables, and oxidizing materials to prevent possible adverse chemical reactions. The storage area should be checked regularly for spills and leaks and there should be suitable spill cleanup materials available. Protective clothing should be worn whenever acids or alkalis are handled.
8. Cap bottles securely and store them securely, but do not store acids and alkalis together.

### **PERSONAL PROTECTION EQUIPMENT**

3. At minimum, safety glasses, full length lab coat, and closed toed shoes are to be worn when entering laboratories having hazardous chemicals.
4. Because of the nature of these chemicals, additional protection may be required, including but not limited to the following:
  - a. When handling hazardous chemicals or contacting potentially contaminated surfaces, protective gloves are to be worn. For proper selection of glove material, review the **Safety Data Sheet** for the chemical you will be handling the **CSO Glove Selection Chart**.
  - b. Goggles (vs. safety glasses) are appropriate in processes where splash or spray is possible.
  - c. For hazardous chemicals that are toxic via skin contact/absorption, additional protective clothing (i.e., faceshield, apron, oversleeves) may be appropriate where chemical contact with body/skin is possible.

### 5.0 **WASTE DISPOSAL**

2. Many flammable liquids intended for disposal may likely be considered hazardous wastes. For general guidance regarding waste disposal,
3. Solutions that are greater than or equal to 25% concentration of flammable liquid(s) are considered a hazardous waste and must be collected for hazardous waste disposal through the CSO. Flammable liquids cannot be poured down the drain.

### 6.0 **MINIMUM TRAINING REQUIREMENTS**

4. Board of Regents of the University Systems of Georgia Required On-line Training:
  - Basic Awareness Right-to-Know Training (Required upon initial employment only for all Employees)
  - Chemical Specific Right-to-Know Training (Required annually for Personnel handling chemicals)

- Hazardous Waste Awareness Training (Required annually for Personnel handling chemicals)
5. Chemical & Biological Safety Orientation Training (Required upon employment for all faculty & staff who will be working in laboratories)
  6. Laboratory Safety Training (Required upon employment for all Laboratory Workers)
  7. Fire Safety Training/Test – recommended
  8. Environmental Awareness Training – recommended

## 7.0 **ICC APPROVALS REQUIRED**

6. All Principal Investigators (PI) are required to seek Institutional Chemical Committee approval for use of hazardous chemicals in laboratories.
7. Lab workers shall consult with PI regarding need for prior approval of high hazard chemicals.
8. Laboratory personnel shall seek and the PI must receive, from the ICC, prior approval involving the use of hazardous and highly hazardous, and restricted chemicals.
9. In general, a highly hazardous or ‘restricted chemical’ would be any chemical that poses an unreasonable risk to employees, such as chemicals that are potentially explosive or potentially lethal through inhalation, ingestion, or absorption.
10. For more information about restricted chemicals, contact the CSO at 706-721-2663.

## 8.0 **SPILL & ACCIDENT**

4. Prompt response to chemical spills is critical to protect worker health & safety and to mitigate adverse effects to the environment. For further guidance, refer to "**Augusta University Emergency Response Flip Chart**".
5. All spills, accidents, or exposures are to be reported to the CSO.
6. Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:
  - A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure).
  - Symptoms or signs of exposure to a hazardous chemical develop.

### **Decontamination Procedures:**

3. **Personnel:** If immediate medical attention is required, call x1-2911.
  - a. Remove any contaminated clothing, and IMMEDIATELY flush contaminated skin with water for at least 15 minutes following any skin contact.
  - b. For eye exposures, IMMEDIATELY / flush eyes w/ water for at least 15 minutes.
  - c. Consult SDS for guidance on appropriate first aid.
  - d. Where medical attention is required, the CSO shall provide SDS(s) for the chemical(s) involved to aid medical staff in proper diagnosis and treatment.

4. **Area:** Decontamination procedures vary depending on the material being handled. The toxicity of some materials can be neutralized with other reagents. All surfaces should be wiped with the appropriate cleaning agent following dispensing or handling. Waste materials generated should be treated as a hazardous waste.

## APPENDIX L

### POISON/TOXIC SUBSTANCES STANDARD OPERATING PROCEDURES

#### 1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with toxic materials. This general use SOP only addresses safety issues specific to toxic hazards of chemicals. In some instances, several general use SOPs may be applicable for a specific chemical. If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or Chemical Safety (706-721-2663).

#### 2.0 CLASS DESCRIPTION

**2.1 Toxicity Class** includes poisonous, toxic, irritating materials, and infectious substances,

- *lethal dose (LD<sub>50</sub>) for acute oral toxicity* of not more than 500 mg/kg or a solid with an LD<sub>50</sub> for acute oral toxicity of not more than 200 mg/kg that, when administered by mouth, is likely to cause death within 14 days in half the test animals,
- *lethal dose (LD<sub>50</sub>) for acute dermal toxicity* of not more than 1,000 mg/kg that, when administered by continuous contact with bare skin, is likely to cause death within 14 days in half of the test animals.
- *lethal concentration (LC<sub>50</sub>) for acute inhalation toxicity* of not more than 10 mg/L, or a saturated vapor concentration in air at 68° F (20° C) of more than one-fifth of the LC<sub>50</sub> for acute toxicity on inhalation of vapors and with an LC<sub>50</sub> for acute inhalation toxicity of vapors of not more than 5,000 ml/m<sup>3</sup> that, when administered by continuous inhalation for 1 hour, is likely to cause

death  
within  
days  
half of  
the

TABLE 4

14  
in

COMBINED TABULATION OF TOXICITY CLASSES

Commonly Used Term	LD50 Single Oral Dose for Rats (g/kg)	4-hr Vapor Exposure Causing 2 to 4 Deaths in 6-rat Groups (ppm)	LD50 Skin for Rabbits (g/kg)	Probable Lethal Dose for Man
Extremely Toxic	0.001 or Less	Less than 10	0.005 or less	Taste
Highly Toxic	0.001 to 0.05	10 to 100	0.005 to 0.043	(1grain) 1tsp (4cc)
Moderately Toxic	0.95 to 0.5	100 to 1,000	0.044 to 0.340	1 oz (30 gm)
Slightly Toxic	0.5 to 5.0	1,000 to 10,000	0.35 to 2.81	1 pint (250 gm)
Practically Nontoxic	5.0 to 15.0	10,000 to 100,000	2.82 to 22.6	1 quart
Relatively harmless	>15.00	>100,000	>22.6	>1 quart



test animals.

The **effects of toxicity** may be qualified as:

1. Local toxicity – substance effects appear in tissues at the point of contact upon exceeding the tolerable dose limit.
2. Acute toxicity - substance effects after only one or a few short, contacts at or above the tolerable dose limits.
3. Chronic toxicity - substance effects after many small exposures over a long period of time, at or above the tolerable dose limits.

Below is a short list of elements that have no nutritional value, even in trace amounts. Some of these elements accumulate in the body, so there is no truly safe exposure limit for those elements (e.g., lead, mercury). Barium and aluminum are examples of elements which can be excreted, at least to a certain extent. Most of these elements are metals.

Aluminum	Antimony	<u>Arsenic</u> (metalloid)	Barium	
Beryllium	Cadmium	Lead	Mercury	Osmium
Thallium	Vanadium			

Hexavalent Chromium Cr<sup>6+</sup> (Cr<sup>3+</sup> is necessary in trace amounts for proper nutrition)

- 2.2** *Irritating Material* is any liquid or solid substance (such as tear gas) that gives off intense fumes and causes extreme but reversible localized irritant effects on the eyes, nose, and throat, temporarily impairing a person's ability to function.
- 2.3** *Infectious substance* means a material known or reasonably expected to contain a pathogen. A pathogen is a microorganism that can cause disease in humans or animals. Examples of pathogens include bacteria, viruses, fungi, and other infectious agents. An infectious substance must be assigned to one of the following two packaging categories:

**Category A:** An infectious substance transported in a form capable of causing permanent disability or life-threatening or fatal disease in otherwise healthy humans or animals when exposure occurs. Category A infectious substances are nonmailable. A Category A infectious substance is assigned the identification number UN2814 or UN2900, based on the known medical history or symptoms of the source patient or animal, endemic local conditions, or professional judgment concerning the individual circumstances of the source human or animal.

**Category B:** An infectious substance that does not meet the criteria for inclusion in Category A. A mailpiece known or suspected to contain a Category B infectious substance must bear the proper shipping name "Biological Substance, Category B" on the address side of the mailpiece and must be assigned to and marked with identification number UN3373 (as shown in [Exhibit 346.12a2 7or](#), for regulated medical waste and sharps medical waste, identification number UN3291).

### 3.0 **CONTROL OF HAZARDS – GENERAL**

Before initiating work with a chemical substance, the researcher or laboratory worker should be familiar with the types of toxicity, the toxic dose, and the hazards of the chemical. It is also important to realize that two or more substances may act synergistically to produce a toxic effect greater than that of either substance alone. Furthermore, chemical reactions involving two or more substances may form products significantly more toxic than the starting materials. Therefore, the entire experimental procedure should be evaluated.

The CSO is available to help researchers plan experiments and protocols with toxic materials.

Use a properly functioning lab **fume hood** when handling toxic chemicals, or other chemicals that can form mists/ vapors upon contact with air (often referred to as "fuming" is recommended.

When handling poisonous/toxic materials, minimally wear the following PPE:

- Safety glasses (Safety goggles + face shield when splash potential exists)
- Full length, long sleeve laboratory coat
- Protective gloves to match the potential chemical hazards (refer to **CSO Chemical Glove Selection Chart**).
- close toed shoes
- 

An individual may be exposed to a chemical substance via a number of different routes: Inhalation, Ingestion, Absorption, Injection/puncture. Following basic laboratory safety rules can prevent exposure to toxic chemicals.

1. *Do not Pipette by mouth – ever*
2. *Read the Safety Data Sheet before handling the chemical*
3. *Identify and use the appropriate safety equipment needed for using the chemical*
4. *Identify and use the appropriate personal protection equipment to use for handling the equipment*
5. *Do not Taste or Sniff Chemicals*
6. *Do not Casually dispose of chemicals down the drain or in the general trash*
7. *Do not eat, drink, or chew gum in the laboratory*
8. *Do not apply makeup, cosmetics, or lotions in the laboratory*

The CSO is available to help researchers plan experiments and protocols with toxic materials, and for consultation in segregation of incompatible materials for storage.

Prompt response to chemical spills is critical to protect worker health & safety and to mitigate adverse effects to the environment. For further guidance, refer to the “Augusta University Emergency Response Flip Chart”.

Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:

- A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure).
- Symptoms or signs of exposure to a hazardous chemical develop.

Many poison toxic materials intended for disposal are likely be considered hazardous wastes.

For general guidance regarding waste disposal, contact Chemical Safety at 706-721-2663.

## APPENDIX M

### HYDROFLUORIC ACID (CAS# 7764-39-4) STANDARD OPERATING PROCEDURES

#### 1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with Hydrofluoric acid (HF). This general use SOP only addresses safety issues specific to the hazards of Hydrofluoric acid (HF). In some instances, several general use SOPs may be applicable for a specific chemical. If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or Chemical Safety (x706-721-2663).

#### 2.0 CLASS DESCRIPTION

Hydrofluoric acid (HF) is a solution of hydrogen fluoride in water. It is a valued source of fluorine and is a precursor to numerous pharmaceuticals such as fluoxetine (Prozac) and diverse materials such as PTFE (Teflon).

Hydrofluoric acid (HF) has a number of physical, chemical, and toxicological properties that make it especially hazardous to handle. Both anhydrous hydrofluoric acid and aqueous solutions are clear, colorless, and highly corrosive liquids. When exposed to air, anhydrous HF and concentrated solutions produce pungent fumes, which are also dangerous. HF shares the corrosive properties common to mineral acids, but possesses the unique ability to cause deep tissue damage and systemic toxicity. Chemically, HF is regarded as a weak acid due to its slow dissociation of the hydrogen ion; however, this also makes neutralization difficult. HF is one of the most destructive acids to tissue known.

All forms—dilute or concentrated solutions or the vapor—can cause serious burns. Inhalation of HF mists or vapors can cause serious respiratory tract irritation that may be fatal. Burns from hydrofluoric acid heal slowly and with great difficulty. Therefore, hydrofluoric acid should be used in a suitable fume hood while gloves, safety glasses and lab coat are being worn.

Hydrofluoric acid is a highly corrosive acid, capable of dissolving many materials, especially oxides. Its ability to dissolve glass has been known since the 17th century. Because of its high reactivity toward glass and moderate reactivity toward many metals, hydrofluoric acid is usually stored in plastic containers (although PTFE is slightly permeable to it).<sup>[3]</sup>

Care should be taken to avoid contacting hydrofluoric acid with metals or ammonia since toxic fumes may result. Hydrofluoric acid etches glass, due to the strong bond formed between fluoride anions and the silicon molecules in glass. It will also react with glazes,

enamels, pottery, concrete, rubber, leather, many metals (especially cast iron) and many organic compounds. Upon reaction with metals, hydrogen gas is generated that may pose an explosion hazard. HF should not be stored in steel cylinders for more than 2 years due to potential over-pressurization from hydrogen gas formation.

Hydrogen fluoride gas is an acute poison that may immediately and permanently damage lungs and the corneas of the eyes. Hydrofluoric acid penetrates tissue more rapidly than typical mineral acids, and because of this ability, poisoning can occur readily through exposure of skin or eyes, or when inhaled or swallowed.

### **3.0 EXPOSURE CONTROL, PPE AND WORK PRACTICES:**

The ACGIH ceiling limit and OSHA TWA for Hydrofluoric acid is 3 ppm. Local ventilation should always be used when working with Hydrofluoric acid, work in a fume hood. The use of concentrated or anhydrous Hydrofluoric acid is restricted; contact Chemical Safety prior to ordering or receiving is required. Procedures or procedures requiring the heating of Hydrofluoric acid also must be approved through Chemical Safety.

#### **Working Safely with Hydrofluoric Acid:**

##### **Preparation**

1. Before any employee uses Hydrofluoric acid (HF), they should do the following:
  - a. Read an SDS for Hydrofluoric acid (HF).
  - b. Read this SOP.
  - c. Review or create a written procedure for the process in which Hydrofluoric acid (HF) is used, incorporating information contained in this document.
  - d. Know the first aid procedures in case of exposure
  - e. Know what to do in case of a spill.
  - f. Always use the appropriate Personal Protection Equipment, as identified below, when handling Hydrofluoric acid.

##### **Designated Area**

1. Hydrofluoric acid (HF) should always be handled inside of a fume hood which is identified with a sign stating "Danger, Hydrofluoric Acid Used in this Area."
2. The SOP should be posted or readily available near the designated area.

##### **First Aid supplies required:**

1. a tube of 2.5% calcium gluconate gel (consider several tubes if large volumes of HF are present) or benzalkonium chloride (2 g/L) solution must be present.
2. the gel should be replaced annually (instructions for producing Calcium gluconate gel are provided in the following text.
3. Ensure you have ready access to a good supply of running water and know the location of the safety shower and eyewash.

##### **Safe Laboratory Practices**

1. Never work alone or after hours with HF.

2. HF reacts with glass, which should never be used to store or transfer it.
3. Use chemically compatible containers, such as those made from polyethylene or other plastics, but not Teflon.
4. Ensure all containers of HF are clearly labeled.
5. Always work with a chemically compatible secondary containment tray.
6. Ensure HF containing vials and flasks are securely supported and not likely to tip over.
7. Keep containers closed to minimize exposure and prevent etching of fume hood glass from HF vapors.

#### **Safe Clinical Practices**

1. HF gels of low concentration (6 - 10%) are approved for dental clinical use provided that all manufactures procedures are followed explicitly.
2. All personnel shall wear appropriate PPE
3. Appropriate antidote will be kept in First Aid Kit and kept fresh.
4. All personnel who shall use, store, or dispose of HF shall be trained by a competent person.

#### **Transporting Hydrofluoric acid (HF)**

1. If an HF containing solution must be transported from one lab area to another:
2. Place the object in a clean, chemically compatible container and close the lid.
3. Remove your gloves before transporting the container to avoid the possibility of chemical contamination on your gloves spreading to door handles and other objects.
4. Or consider putting on a single clean glove with which to carry the container, leaving an ungloved hand to open doors and handle other objects. Or have a lab mate open doors and handle objects for you.

### **4.0 PERSONAL PROTECTION EQUIPMENT**

5. At minimum, safety glasses, full length lab coat, chemical resistant gloves and closed toed shoes are to be worn when entering laboratories having hazardous chemicals.
6. Because of the nature of these chemicals, additional protection may be required, including but not limited to the following:
  - a. Not all chemical gloves provide adequate protection against Hydrofluoric Acid. High quality gloves made from butyl, nitrile, or chloroprene are recommended. Two pairs of gloves are recommended when working with concentrations exceeding 20% or when heave exposure to gloves is expected. Always check the gloves for leaks prior to use.
  - b. Chemical safety goggles are required when working with any Hydrofluoric Acid solution. Additionally, a face shield should be worn when working with solutions greater than 2% (1molar).
  - c. A full length, long sleeved lab coat is required. Additionally, a rubber apron should be worn when working with solutions greater than 2% (1 molar).

7. The purpose for personal protection equipment (PPE) is to shield the individual in the event of a release of vapor, a spill, or other incident. PPE is not a substitute for safe work practices. Although incidents involving Hydrofluoric acid may not be totally eliminated, pre-planning will minimize the effects of such incidents. All laboratories using Hydrofluoric acid should develop written procedures that outline the safe use of Hydrofluoric acid, as well as how to respond to personnel contamination and spills. The following section will provide general guidelines to use when developing a laboratory specific procedure.

## **5.0 HYDROFLUORIC ACID EXPOSURES**

HF differs from other protic acids because the fluoride ion readily penetrates the skin, causing the destruction of deep tissue layers. This process may continue for days if left untreated. Strong acid concentrations (over 50%), “cause immediate, severe, burning pain and a whitish discoloration of the skin which usually proceeds to blister formation.” In contrast, the effects of more dilute solutions may be delayed. The latency period for symptoms (redness, swelling, and blistering) to appear after exposure to aqueous HF solutions in the 20-50% range may be up to eight hours. Solutions less than 20% may not produce symptoms for up to twenty four hours.

Although HF exposures can result in injury, quick response will minimize the damage. All exposures should be treated immediately even though burns may not be felt for hours. Commercially available HF first aid and spill response kits shall be standard equipment in laboratories that use or store HF. Affected personnel must receive medical attention for all eye and inhalation exposures, and all skin burns. Maintain a copy of these procedures and the Safety Data Sheet to take to the emergency room or Occupational Health.

### **Calcium Gluconate Gel**

Calcium Gluconate gel is required in all areas that use or store HF. The Calcium Gluconate combines with hydrofluoric acid to neutralize the powerful ion. The immediate application of antidote gel to burn site reduces burn damage to bone and deep tissue. Calcium Gluconate Gel is for external use only. Manufactured calcium gluconate has a shelf life of approximately 2 years.

### **Skin Contact**

1. Immediately proceed to the nearest wash station/safety shower and wash the contaminated area with copious amounts of running water for 5 minutes. Speed and thoroughness in washing off the acid is essential.
2. Remove all contaminated clothing while rinsing.
3. While washing the affected area, have someone call x1-2911 for emergency medical assistance.
4. With gloved fingers, apply Calcium Gluconate Gel liberally to the affected areas and continuously massage into skin until pain has subsided and for at least 15 minutes afterwards. The gel will turn white (CaF<sub>2</sub> precipitate) upon reaction with the acid.

5. If symptoms and/or pain recur, further application of the calcium gluconate gel should be made in the same way, and continued until the pain subsides. If the acid has penetrated below the nails, the calcium gluconate gel should be liberally applied over and around the nail area, and the area continually massaged for 15 minutes.
6. After initial first aid-treatment, all employees exposed to Hydrofluoric acid (HF) acid should be Proceed to Occupational Health or the Emergency Room for appropriate follow-up and/or treatment. Take calcium gluconate gel with you.

### **Eye Contact**

HF contact with the eye can cause eye burns and destruction of the cornea. Blindness results from severe or untreated exposures.

1. Immediately flush the eyes with water, preferably at eyewash for at least 15 minutes.
2. Gently hold the eyelids away from the eye to fully irrigate the eye.
3. Do not apply 2.5% calcium gluconate gel to the eye.
4. While washing the eye, have someone call x1-2911 for emergency medical assistance.
5. Flushing can be limited to five minutes if medical personnel are immediately available to administer sterile calcium gluconate (1%) solution (via continuous drip into eyes).
6. Proceed to a physician for appropriate follow-up and/or treatment.

### **Inhalation**

Inhalation of HF vapors may cause “laryngospasm, laryngeal edema, bronchospasm and/or acute pulmonary edema.” The symptoms of exposure are coughing, choking, chest tightness, chills, fever, and blue skin.

1. Immediately move affected person to fresh air and call 1-2911 for medical assistance.
2. Keep victim warm, comfortable and quiet.
3. If breathing has stopped, start artificial respiration at once.
4. Oxygen should be administered as soon as possible by medical personnel.
5. Proceed to a physician for appropriate follow-up and/or treatment.
6. The Permissible Exposure Limit (PEL) set by the U.S. Occupational Safety and Health
7. Administration (OSHA) is a time weighted average exposure for 8 hours of 3 ppm. The National Institute for Occupational Safety and Health (NIOSH) has set the Immediately Dangerous to Life and Health (IDLH) level at 30 ppm (30 min).

### **Ingestion**

Severe burns to the mouth, esophagus, and stomach may occur upon ingestion of HF. The ingestion of a small amount of HF has resulted in death.

1. Have the victim drink large amounts of room temperature water as quickly as possible to dilute the acid. Do not induce vomiting. Do not give anything by mouth to an unconscious person.
2. Call x1-2911 for medical assistance.



3. Give several glasses of milk or several ounces of milk of magnesia, Mylanta, Maalox, or calcium or magnesium based antacid tablets with water. The calcium or magnesium in these substances may act as an antidote. Avoid administering bicarbonates at all costs; the carbon dioxide byproduct could severely injure the victim.
4. Proceed to a physician for appropriate follow-up and/or treatment.

### **CALCIUM GLUCONATE SOLUTIONS**

Calcium Gluconate 2.5% Gel (HF GEL).

1. Mix one 10cc's of a 10% calcium gluconate solution with 30cc's of a water soluble biologically inert lubricant, such as KY gel, to obtain 40cc's of calcium gluconate 2.5% gel by weight.

Calcium Gluconate 1% Eye Irrigation Solution

1. To obtain 100cc's of a 1% calcium gluconate solution, mix 90cc's of normal saline solution with 10cc's of a 10% calcium gluconate solution.
2. To obtain 1000cc's of a 1% calcium gluconate solution mix 900cc's of a normal saline solution with 100cc's of a 10% calcium gluconate solution.

Calcium Gluconate 2.5% Solution for Nebulization or for injection - To be administered in by Medical Professionals/ Emergency Room only.

1. To obtain 100cc's of a 2.5% calcium gluconate solution, mix 75cc's of a normal saline solution with 25cc's of a 10% solution of calcium gluconate.
2. To obtain 1000cc's of a 2.5% calcium gluconate solution, mix 750cc's of a normal saline solution with 250cc's of a 10% solution of calcium gluconate.

### 6.0 **WASTE DISPOSAL**

1. Waste HF should be placed in a chemically compatible container that is clearly labeled with a Hazardous Waste tag and that is compliant with Augusta University policies (e.g. secondary containment, closed cap, etc.).
2. Dispose of HF containing hazardous waste containers following the usual hazardous waste disposal procedures.

### 6.0 **MINIMUM TRAINING REQUIREMENTS**

1. Laboratory Safety Training provided by the CSO
2. Hazard Communication & Right to Know Training as described on the following web page: <http://www.augusta.edu/services/ehs/chemsafe/rtktraining.php>
3. EPA Training for Augusta University Laboratory Staff at: <http://www.augusta.edu/services/ehs/chemsafe/rtktraining.php>

4. Where hydrofluoric acid is used, training is to include the Hydrofluoric acid SOP which includes **emergency first aid procedures**.

## 7.0 **ICC APPROVALS REQUIRED**

11. All Principal Investigators (PI) are required to seek Institutional Chemical Committee approval for use of hazardous chemicals in laboratories.
12. Lab workers shall consult with PI regarding need for prior approval of high hazard chemicals.
13. Laboratory personnel shall seek and the PI must receive, from the ICC, prior approval involving the use of hazardous and highly hazardous, and restricted chemicals.
14. In general, a highly hazardous or 'restricted chemical' would be any chemical that poses an unreasonable risk to employees, such as chemicals that are potentially explosive or potentially lethal through inhalation, ingestion, or absorption.
15. For more information about restricted chemicals, contact the CSO at 706-721-2663.

## 8.0 **SPILL & ACCIDENT**

7. Prompt response to chemical spills is critical to protect worker health & safety and to mitigate adverse effects to the environment. For further guidance, refer to "**Augusta University Emergency Response Flip Chart**".
8. All spills, accidents, or exposures HF are to be reported to the CSO.
9. Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive immediate medical attention/consultation in the event of exposure resulting from a spill or accident.

### **Hydrofluoric Acid Spill Kit required:**

1. Many spill kits say they can be used on small spills (less than 100 ml) HF but their neutralizers contain sodium carbonate. Though a very effective neutralizer for all common acids, its use on HF will produce the extremely toxic salt, Sodium Fluoride as a by-product. Large spills (greater than 100 ml of > 20% HF) require trained Emergency Response with Self Contained Breathing Apparatus (SCBA).
2. An appropriate neutralizer contains calcium hydroxide which will neutralize the HF spill to the insoluble and non-toxic Calcium Fluoride thus simplifying the subsequent residue disposal.

## APPENDIX N

### HIGHLY REACTIVE & POTENTIALLY EXPLOSIVE COMPOUNDS STANDARD OPERATING PROCEDURES

#### 1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with highly reactive & potentially explosive materials. This SOP is generic in nature and only addresses safety issues pertaining to oxidizer hazards of chemicals. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., for Hydrogen Peroxide, both general use SOPs for highly reactive/ unstable materials and oxidizers would apply). If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or the CSO (706-721-2663).1.4

#### 2.0 CLASS DESCRIPTION

Highly reactive chemicals include those which are inherently unstable and susceptible to rapid decomposition as well as chemicals which, under specific conditions, can react alone, or with other substances in a violent uncontrolled manner liberating heat, toxic gases, or leading to an explosion.

Reaction rates almost always increase dramatically as the temperature increases (the general rule of thumb is the reaction rate doubles with each 10° C increase). Therefore, if heat evolved from a reaction is not dissipated, the reaction can accelerate out of control and possibly result in injuries or costly accidents. Air, light, heat, mechanical shock (when struck, vibrated or otherwise agitated), water, and certain catalysts can cause decomposition of some highly reactive chemicals, and initiate an explosive reaction. One must use specialized procedures and control equipment whenever working with reactive materials. These are described in the special handling and use requirements of the reference section.

Chemicals that fall under the description of Highly Reactive Potentially explosive compounds could Explosives, Self-Reactive Substances, Pyrophoric liquids and Solids, Self-Heating liquids or solids, Peroxides and Organic Peroxides.

#### 2.1 EXPLOSIVES

An explosive substance (or mixture) is a solid or liquid which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases. A pyrotechnic substance (or mixture) is designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining, exothermic chemical reactions. Table 2.1 includes OSHA hazard division and characteristics.

**Table 2.1 Explosives**

<b>Division</b>	<b>Characteristics</b>
1.1	Mass explosion hazard
1.2	Projection hazard
1.3	Fire hazard or minor projection hazard
1.4	No significant hazard
1.5	Very insensitive substances with mass explosion hazard
1.6	Extremely insensitive articles with no mass explosion hazard

**All explosive chemicals are restricted from transport and must be approved through the CSO prior to purchase or receiving. See:**  
<http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>

## **2.2 SELF-REACTIVE**

Self-reactive substances are thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen (air). This definition excludes materials classified under the GHS as explosive, organic peroxides or as oxidizing. These materials may have similar properties, but such hazards are addressed in their specific endpoints. There are exceptions to the self-reactive classification for material:

- Its heat of decomposition is less than 300 J/g; or
- Its self-accelerating decomposition temperature (SADT) is greater than 75°C (167°F) for a 50 kg (110 lb) package.

Substances and mixtures of this hazard class are assigned to one of the seven 'Types', A to G, on the basis of the outcome of the UN Test Series A to H (*UN Manual of Tests and Criteria*). Currently, only the transport sector uses seven categories for self-reactive substances (Table 2.2).

**Table 2.2 Self-Reactive Substances**

<b>Type</b>	<b>Criteria</b>
A	Can detonate or deflagrate rapidly, as packaged.
B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates, but is liable to undergo a thermal explosion in that package.

C	Possess explosive properties when the substance or mixture as package cannot detonate or deflagrate rapidly or undergo a thermal explosion.
D	<ul style="list-style-type: none"> <li>▪ Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or</li> <li>▪ Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or</li> <li>▪ Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.</li> </ul>
E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
F	Neither detonates in the cavitated bubble state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.
G	Neither detonates in the cavitated state nor deflagrates at all and shows non effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.

**All Self-Reactive/Potentially Explosive chemicals are restricted from transport and must be approved through Chemical Safety prior to purchase or receiving. See: <http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>**

### 2.3 **PYROPHORIC/SPONTANEOUSLY COMBUSTIBLE**

Pyrophorics must be handled under inert atmospheres and in such a way that rigorously excludes air/moisture since they ignite on contact with air and/or water. They all tend to be toxic and many come dissolved in a flammable solvent. Other common hazards include corrosivity, teratogenicity, water reactivity, peroxide formation, along with damage to the liver, kidneys, and central nervous system. Be especially vigilant when working tertiary butyl lithium which is **extremely pyrophoric**. Researchers working with pyrophoric materials must be proficient and must not work alone!

#### **Pyrophoric Liquids**

A pyrophoric liquid is a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis of the outcome of the UN Test N.3 (UN Manual of Tests and Criteria).

### **Pyrophoric Solids**

A pyrophoric solid is a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air. Substances and mixtures of this hazard class are assigned to a single hazard category on the basis of the outcome of the UN Test N.2 (*UN Manual of Tests and Criteria*).

### **Examples of Pyrophoric Materials**

Grignard Reagents: RMgX (R=alkyl, X=halogen)

Metal alkyls and aryls: Alkyl lithium compounds; tert-butyl lithium

Metal carbonyls: Lithium carbonyl, nickel tetracarbonyl

Metal powders (finely divided): Cobalt, iron, zinc, zirconium

Metal hydrides: Sodium hydride

Nonmetal hydrides: Diethylarsine, diethylphosphine

Non-metal alkyls: R<sub>3</sub>B, R<sub>3</sub>P, R<sub>3</sub>As; tetramethyl silane, tributyl phosphine

Phosphorus

Potassium

Sodium

Gases: Silane, dichlorosilane, diborane, phosphine, arsine

An extensive list of pyrophoric compounds can be found in Bretherick's *Handbook of Reactive Chemical Hazards*.

**All Pyrophoric/Spontaneously Combustible chemicals are restricted from transport and must be approved through Chemical Safety prior to purchase or receiving. See: <http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>**

## **2.4 SELF-HEATING**

A self-heating substance is a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat. This endpoint differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days). Substances and mixtures of this hazard class are assigned to one of two hazard categories on the basis of the outcome of the UN Test N.4 (*UN Manual of Tests and Criteria*).

### **Self-Heating and Spontaneous Ignition (spontaneous combustion)**

Materials that may catch fire by spontaneous ignition are:

- Rags and waste with oil and paint residues.
- Towels and linen, during laundering and drying.
- Paint overspray or material from a paint spray booth.
- Coal dust.

- Haystacks.
- A number of chemical substances, such as cellulose nitrate.

Spontaneous ignition occurs when a combustible material is heated to its ignition temperature by a chemical reaction involving the oxygen in the air. The oxidation of the combustible material creates heat. If this heat cannot be dissipated, it will build up in the combustible material until ignition occurs. Generally, the buildup of heat to ignition point occurs when the material is in a pile so that the heat being generated cannot adequately escape.

Fires in spray painting facilities have been attributed to the self-ignition of paint overspray or the residues in paint spray booths. This may have been due to the self-heating of drying oils, but some paint pigments are also capable of self-heating and may be able to ignite other combustible materials.

Self-heating material may be:

- Extremely flammable, will ignite itself if exposed to air
- Burs rapidly, releasing dense, white, irritating fumes
- May re-ignite after fire is extinguished
- When it is a corrosive, contact with metals may produce flammable hydrogen gas
- Containers may explode when heated
- In a fire will produce irritating, corrosive, and/or toxic gases
- Contact with substance may cause burns to skin and eyes

**All Self-Heating chemicals are restricted from transport and must be approved through Chemical Safety prior to purchase or receiving. See: <http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>**

## 2.5 WATER REACTIVE

### **Substances which on Contact with Water Emit Flammable Gases**

Substances that, in contact with water, emit flammable gases are solids or liquids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results (UN Test N.5 *UN Manual of Tests and Criteria*) which measure gas evolution and speed of evolution.

**Table 3.6 Substances which on Contact with Water Emit Flammable Gases**

Category	Criteria
1	≥10 L/kg/1 minute

2	$\geq 20$ L/kg/ 1 hour + $< 10$ L/kg/1 min
3	$\geq 1$ L/kg/1 hour + $< 20$ L/kg/1 hour
Not classified	$< 1$ L/kg/1 hour

**Some Water Reactive chemicals are restricted from transport and may require approved through Chemical Safety prior to purchase or receiving.**

See: <http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>

## 2.6 **OXIDIZERS**

### **Oxidizing Liquids**

An oxidizing liquid is a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results (UN Test O.2 *UN Manual of Tests and Criteria*) which measure ignition or pressure rise time compared to defined mixtures.

### **Oxidizing Solids**

An oxidizing solid is a solid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material. Substances and mixtures of this hazard class are assigned to one of three hazard categories on the basis of test results (UN Test O.1 *UN Manual of Tests and Criteria*) which measure mean burning time and re compared to defined mixtures. Currently, several workplace hazard communication systems cover oxidizers (solids, liquids, gases) as a class of chemicals.

**Some Oxidizing chemicals may be restricted from transport and may require approved through Chemical Safety prior to purchase or receiving. See:**

<http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>

## 2.7 **PEROXIDES, ORGANIC PEROXIDES, & PEROXIDE FORMING COMPOUNDS**

An organic peroxide is an organic liquid or solid which contains the bivalent -O-O- structure and may be considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term also includes organic peroxide formulations (mixtures). Such substances and mixtures may:

- be liable to explosive decomposition;
- burn rapidly;
- be sensitive to impact or friction;
- react dangerously with other substances.



Substances and mixtures of this hazard class are assigned to one of seven 'Types', A to G, on the basis of the outcome of the UN Test Series A to H (*UN Manual of Tests and Criteria*). Currently, only the transport sector uses seven categories for organic peroxides.

**Table 3.7 Organic Peroxides**

Type	Criteria
A	Can detonate or deflagrate rapidly, as packaged.
B	Possess explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package.
C	Possess explosive properties when the substance or mixture as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion.
D	<ul style="list-style-type: none"> <li>▪ Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement; or</li> <li>▪ Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or</li> <li>▪ Does not detonate or deflagrate at all and shows a medium effect when heated under confinement.</li> </ul>
E	Neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
F	Neither detonates in the cavitated state nor deflagrates and shows only a low or no effect when heated under confinements as well as low or non-explosive power.
G	Neither detonates in the cavitated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization.

The following Peroxidizable Compounds also have restricted storage requirements.

<i>Peroxide Hazard on Storage: Waste through Chemical Safety After Three Months</i>	
Divinyl acetylene Divinyl ether Isopropyl ether	Potassium metal Sodium amide Vinylidene chloride
<i>Peroxide Hazard on Concentration: Waste through Chemical Safety After One Year</i>	

Acetal Cumene Cyclohexene Cycloxyene Cyclopentene Diacetylene Dicyclopentadiene Diethyl ether Diethylene glycol dimethyl ether (diglyme)	Dioxane Ethylene glycol dimethyl ether (glyme) Furan Methyl acetylene Methylcyclopentane Methyl isobutyl ketone Tetrahydronaphthalene (Tetralin) Tetrahydrofuran Vinyl ethers
<b>Hazardous Due to Peroxide Initiation of Polymerization*: <i>Waste through Chemical Safety After One Year</i></b>	
Acrylic acid Acrylonitrile Butadiene Chloroprene Chlorotrifluoroethylene Methyl methacrylate	Styrene Tetrafluoroethylene Vinyl acetylene Vinyl acetate Vinyl chloride Vinyl pyridine

\* Under storage conditions in the liquid state the peroxide-forming potential increases and certain of these monomers (especially butadiene, chloroprene, and tetrafluoroethylene) should be discarded after three months.

All of the above Peroxidizable compounds are required to be tested in storage. If there is any suspicion that peroxide is present, do not open the container or otherwise disturb the contents. Call EHS for disposal. The container and its contents must be handled with extreme care. If solids, especially crystals, for example, are observed either in the liquid or around the cap, peroxides are most likely present.

If no peroxide is suspected but the chemical is a peroxide former, the chemical can be tested by the lab to ensure no peroxide has formed.

Peroxide test strips, which change color to indicate the presence of peroxides, may be purchased through most laboratory reagent distributors. For proper testing, reference the manufacturer's instruction. Do not perform a peroxide test on outdated materials that potentially have dangerous levels of peroxide formation.

The following recommendations should be followed to control the hazards of peroxides.

1. Know the properties and hazards of all chemicals you are using through adequate research and study, including reading the label and SDS.
2. Inventory all chemical storage at least twice a year to detect forgotten items, leaking containers, and those that need to be discarded.
3. Identify chemicals that form peroxides or otherwise deteriorate or become more hazardous with age or exposure to air. Label containers with the date

received, the date first opened and the date for disposal as recommended by the supplier.

4. Minimize peroxide formation in ethers by storing in tightly sealed containers placed in a cool place in the absence of light. Do not store ethers at or below the temperature at which the peroxide freezes or the solution precipitates.
5. Choose the size container that will ensure use of the entire contents within a short period of time.
6. Visually or chemically check for peroxides of any opened containers before use.
7. Clean up spills immediately. The safest method is to absorb the material onto vermiculite or a similar loose absorbent.
8. When working with peroxidizable compounds wear impact-resistant safety eyewear and face shields. Visitor specs are intended only for slight and brief exposure, and should not be used when working with peroxidizable compounds.
9. Do not use solutions of peroxides in volatile solvents under conditions in which the solvent might be vaporized. This could increase the concentration of peroxide in the solution.
10. Do not use metal spatulas or magnetic stirring bars (which may leach out iron) with peroxide forming compounds, since contamination with metals can lead to explosive decomposition. Ceramic, Teflon or wooden spatulas and stirring blades are usually safe to use.
11. Do not use glass containers with screw-top lids or glass stoppers. Polyethylene bottles with screw-top lids may be used.

**Some Peroxides, Organic Peroxides, and Peroxide Forming compounds may be restricted from transport and may require approved through Chemical Safety prior to purchase or receiving. See:**

<http://www.augusta.edu/services/ehs/chemsafe/hihazlist0814.pdf>

### **3.0 EXPOSURE CONTROL, PPE AND WORK PRACTICES**

#### **Purchasing Standards:**

Obviously, chemicals that have the potential to be or become explosive of chemicals, are self-reactive, pyrophoric, self-heating, and/or form peroxides pose an extraordinary high safety risk, and would therefore warrant more regulatory controls and extended safety requirements than most chemicals.

All Explosives are restricted for transport and are not allowed on campus. Uninhibited highly reactive chemicals such as potential explosives, pyrophoric/spontaneously combustible, self-reactive, self-heating, water reactive, oxidizer, peroxide, organic peroxide, and peroxide forming compounds are may be restricted for transport and restricted for purchase.

For more information and guidance contact Chemical Safety at 706-721-2663 prior to purchasing or receiving such chemicals.

### **The Chemical Reactivity Worksheet**

The Chemical Reactivity Worksheet (CRW) is a free software program you can use to find out about the chemical reactivity of thousands of common hazardous chemicals. (Reactivity is the tendency of substances to undergo chemical change, which can result in hazards—such as heat generation or toxic gas byproducts.)

The chemical datasheets in the CRW database contain information about the intrinsic hazards of each chemical and about whether a chemical reacts with air, water, or other materials. It also includes case histories on specific chemical incidents, with references.

You can also create your own custom chemical datasheets (for instance, if your facility produces a proprietary chemical that is not in the standard database).

Additionally, this chemical reactivity tool includes a reactivity prediction worksheet that allows you to virtually "mix" chemicals—like the ones in the photo of the derailed tank cars—to find out what dangers could arise from accidental mixing. (For instance, if the reaction is predicted to generate gases, the CRW will list the potential gaseous products, along with literature citations related to the prediction.)

More Information about the Chemical Reactivity Worksheet go to the following web site: <http://response.restoration.noaa.gov/chemaids/react.html>

### **Application for Use of High Hazard Chemicals**

Principal Investigators are required to submit an [Application for the Use of High Hazard Chemicals in Laboratories](#), prior to purchase or bringing on campus any of these chemicals.

While areas other than laboratories are not required to fill out the Application for use of high hazard chemicals, they are required to consult with the CSO prior to purchasing or bringing any such products on campus.

## **6.0 MINIMUM TRAINING REQUIREMENTS**

1. Board of Regents of the University Systems of Georgia Required On-line Training:
  - a. Basic Awareness Right-to-Know Training (Required upon initial employment only for all Employees)
  - b. Chemical Specific Right-to-Know Training (Required annually for Personnel handling chemicals)
  - c. Hazardous Waste Awareness Training (Required annually for Personnel handling chemicals)
2. Chemical & Biological Safety Orientation Training (Required upon employment for all faculty & staff who will be working in laboratories)

3. Laboratory Safety Training (Required upon employment for all Laboratory Workers)
4. Chemicals of this nature require Chemical Specific Training – contact the CSO for more information
5. Fire Safety Training/Test – recommended
6. Environmental Awareness Training – recommended

## 7.0 **ICC APPROVALS REQUIRED**

16. All Principal Investigators (PI) are required to seek Institutional Chemical Committee approval for use of hazardous chemicals in laboratories.
17. Lab workers shall consult with PI regarding need for prior approval of high hazard chemicals.
18. Laboratory personnel shall seek and the PI must receive, from the ICC, prior approval involving the use of hazardous and highly hazardous, and restricted chemicals.
19. In general, a highly hazardous or ‘restricted chemical’ would be any chemical that poses an unreasonable risk to employees, such as chemicals that are potentially explosive or potentially lethal through inhalation, ingestion, or absorption.
20. For more information about restricted chemicals, contact the CSO at 706-721-2663.

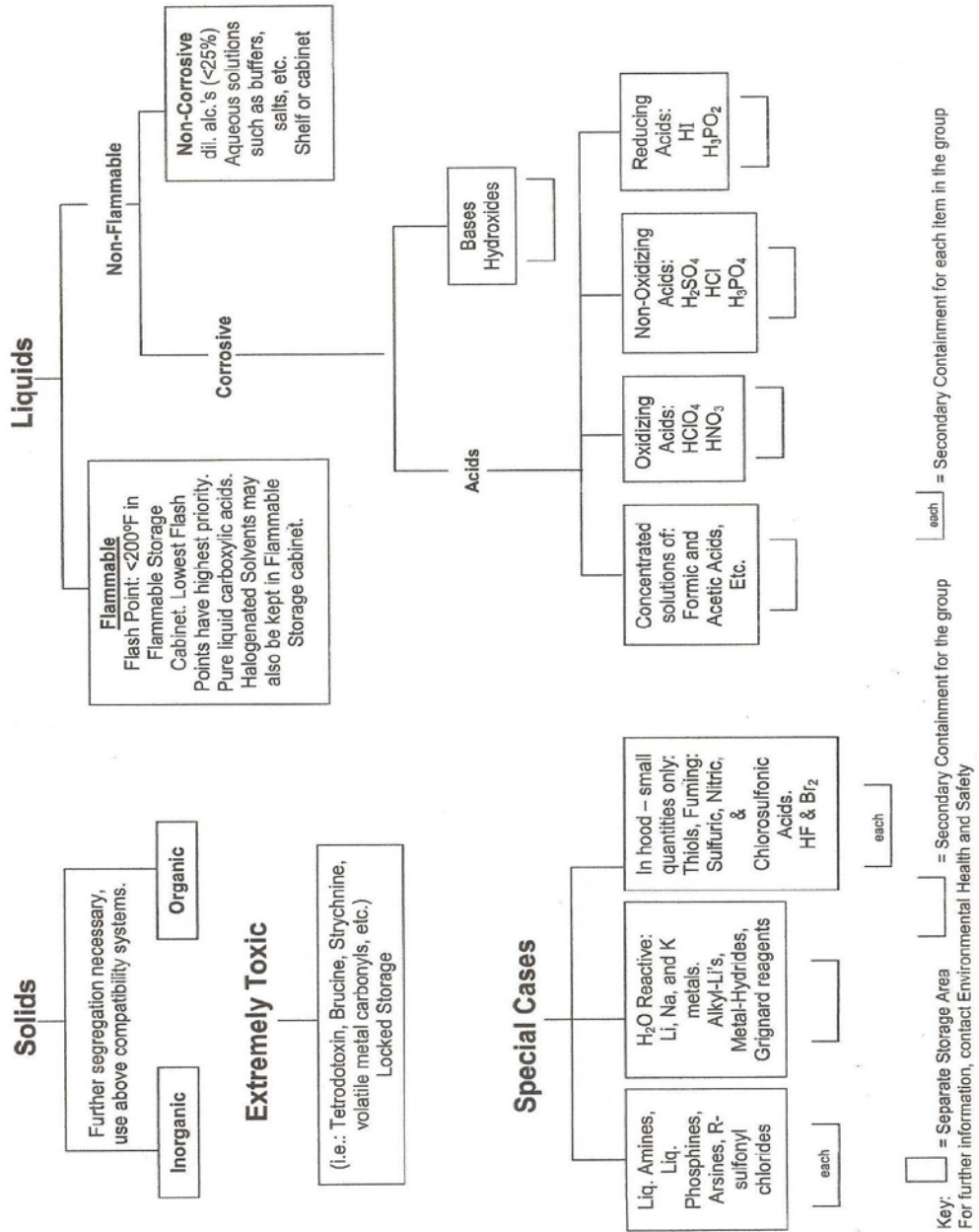
## 8.0 **SPILL & ACCIDENT**

10. Prompt response to chemical spills is critical to protect worker health & safety and to mitigate adverse effects to the environment. For further guidance, refer to "**Augusta University Emergency Response Flip Chart**".
11. All spills, accidents, or exposures are to be reported to the CSO.
12. Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:
  - A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure).
  - Symptoms or signs of exposure to a hazardous chemical develop.

# APPENDIX O CHEMICAL STORAGE FLOW CHART

## CHEMICAL STORAGE FLOW CHART

To be used in conjunction with the Hazardous Materials Compatibility Chart, Fisher Color Code or Flinn Safety Systems.



## APPENDIX P

### FROM MSDS TO SDS: HOW TO READ A SAFETY DATA SHEET

#### A. INTRODUCTION

1. *Safety Data Sheets [SDS] are replacing the current Material Safety Data Sheets [MSDS].* By June 1<sup>st</sup>, 2015 all Material Safety Data Sheets (MSDS) will be replaced by the new Safety Data Sheets (SDS).
2. *What is a Safety Data Sheet (SDS)?* A Safety Data Sheet is defined by OSHA as “Written or printed material concerning a hazardous chemical which is prepared in accordance with the standard.”
3. *Differences between the Material Safety Data Sheets (MSDS) and the Safety Data Sheets (SDS) –*
  - The **SDS Contains 16 Sections**, with specific information required in each section and a specifically defined order of presentation. Unlike the MSDS which could contain 9 sections in any specific order and no specifically required information.
  - **SDS clearly defines the term Chemical Name and Common Name – the Chemical name, as defined, must appear on the SDS-** On an MSDS, you may see one or the other, but both are not required.
  - **SDS requires you to use their hazard statements, and pictograms to demonstrate hazards associated with the product.** MSDS may use statements or symbols from other regulations to identify or classify the hazards associated with a product
  - **SDS follow a strict format with 16 section information layout.** MSDS can range from nine to sixteen sections

- Safety Data Sheets
- GHS Format: 16 sections required, in specified order
- Reclassification based on GHS Criteria
  - Health & Environmental
  - Physical
  - Building Block Approach



4. **The Role of the SDS:** The SDS should provide comprehensive information about a chemical substance or mixture.
- a. **Primary Use:** *in Transport, in the Work place , and for Emergency Response.*
  - b. **Primary Users:** *Emergency Responders, Transporters, Employers and Workers use the SDS as a source of information about hazards and to obtain advice on safety precautions.*
  - c. **Access for employees:**
    - *Must be Readily accessible, During work shift*
    - *There can be not No barriers to immediate employee access*
    - *When employees travel - May be kept at primary workplace*

**B. SAFETY DATA SHEET STANDARDIZED FORMAT**

**The New Safety Data Sheet (SDS) Standardized Format – 16 Sections of the SDS and what they contain.** The table below shows the 16 required sections of the new SDS and the information required under each section.

**Minimum information for an SDS**

<b>Section 1.</b>	<b>Identification of the substance or mixture and of the supplier</b>	<ul style="list-style-type: none"> <li>▪ GHS product identifier.</li> <li>▪ Other means of identification.</li> <li>▪ Recommended use of the chemical and restrictions on use.</li> <li>▪ Supplier's details (including name, address, phone number, etc.).</li> <li>▪ Emergency phone number.</li> </ul>
<b>Section 2.</b>	<b>Hazards identification</b>	<ul style="list-style-type: none"> <li>▪ GHS classification of the substance/mixture and any national or regional information.</li> <li>▪ GHS label elements, including precautionary statements. (Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol, e.g., flame, skull and crossbones.)</li> </ul>



		<ul style="list-style-type: none"> <li>Other hazards which do not result in classification (e.g., dust explosion hazard) or are not covered by the GHS.</li> </ul>
<b>Section 3.</b>	<b>Composition/ information on ingredients</b>	<p><b>Substance</b></p> <ul style="list-style-type: none"> <li>Chemical identity.</li> <li>Common name, synonyms, etc.</li> <li>CAS number, EC number, etc.</li> <li>Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance.</li> </ul> <p><b>Mixture</b></p> <ul style="list-style-type: none"> <li>The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cutoff levels.</li> </ul> <p><i>NOTE: For information on ingredients, the competent authority rules for CBI take priority over the rules for product identification.</i></p>
<b>Section 4.</b>	<b>First aid measures</b>	<ul style="list-style-type: none"> <li>Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion.</li> <li>Most important symptoms/effects, acute and delayed.</li> <li>Indication of immediate medical attention and special treatment needed, if necessary.</li> </ul>
<b>Section 5.</b>	<b>Firefighting measures</b>	<ul style="list-style-type: none"> <li>Suitable (and unsuitable) extinguishing media.</li> <li>Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products).</li> <li>Special protective equipment and precautions for firefighters.</li> </ul>
<b>Section 6.</b>	<b>Accidental release measures</b>	<ul style="list-style-type: none"> <li>Personal precautions, protective equipment and emergency procedures.</li> </ul>

		<ul style="list-style-type: none"> <li>▪ Environmental precautions.</li> <li>▪ Methods and materials for containment and cleaning up.</li> </ul>
<b>Section 7.</b>	<b>Handling and storage</b>	<ul style="list-style-type: none"> <li>▪ Precautions for safe handling.</li> <li>▪ Conditions for safe storage, including any incompatibilities.</li> </ul>
<b>Section 8.</b>	<b>Exposure controls/ personal protection.</b>	<ul style="list-style-type: none"> <li>▪ Control parameters, e.g., occupational exposure limit values or biological limit values.</li> <li>▪ Appropriate engineering controls.</li> <li>▪ Individual protection measures, such as personal protective equipment.</li> </ul>
<b>Section 9.</b>	<b>Physical and chemical properties</b>	<ul style="list-style-type: none"> <li>▪ Appearance (physical state, color, etc.).</li> <li>▪ Odor.</li> <li>▪ Odor threshold.</li> <li>▪ pH.</li> <li>▪ melting point/freezing point.</li> <li>▪ initial boiling point and boiling range.</li> <li>▪ flash point.</li> <li>▪ evaporation rate.</li> <li>▪ flammability (solid, gas).</li> <li>▪ upper/lower flammability or explosive limits.</li> <li>▪ vapor pressure.</li> <li>▪ vapor density.</li> <li>▪ relative density.</li> <li>▪ solubility(ies).</li> <li>▪ partition coefficient: n-octanol/water.</li> <li>▪ autoignition temperature.</li> <li>▪ decomposition temperature.</li> </ul>
<b>Section 10.</b>	<b>Stability and reactivity</b>	<ul style="list-style-type: none"> <li>▪ Chemical stability.</li> <li>▪ Possibility of hazardous reactions.</li> <li>▪ Conditions to avoid (e.g., static discharge, shock or vibration).</li> <li>▪ Incompatible materials.</li> <li>▪ Hazardous decomposition products.</li> </ul>

<b>Section 11.</b>	<b>Toxicological information</b>	<p>Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including:</p> <ul style="list-style-type: none"> <li>▪ information on the likely routes of exposure (inhalation, ingestion, skin and eye contact);</li> <li>▪ Symptoms related to the physical, chemical and toxicological characteristics;</li> <li>▪ Delayed and immediate effects and also chronic effects from short- and long-term exposure;</li> <li>▪ Numerical measures of toxicity (such as acute toxicity estimates).</li> </ul>
<b>Section 12.</b>	<b>Ecological information</b>	<ul style="list-style-type: none"> <li>▪ Ecotoxicity (aquatic and terrestrial, where available).</li> <li>▪ Persistence and degradability.</li> <li>▪ Bioaccumulative potential.</li> <li>▪ Mobility in soil.</li> <li>▪ Other adverse effects.</li> </ul>
<b>Section 13.</b>	<b>Disposal considerations</b>	<ul style="list-style-type: none"> <li>▪ Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging.</li> </ul>
<b>Section 14.</b>	<b>Transport information</b>	<ul style="list-style-type: none"> <li>▪ UN Number.</li> <li>▪ UN Proper shipping name.</li> <li>▪ Transport Hazard class(es).</li> <li>▪ Packing group, if applicable.</li> </ul>

		<ul style="list-style-type: none"> <li>▪ Marine pollutant (Yes/No).</li> <li>▪ Special precautions which a user needsto be aware of or needs to comply with in connection with transport or conveyance either within or outside their premises.</li> </ul>
<b>Section 15.</b>	<b>Regulatory information</b>	<ul style="list-style-type: none"> <li>▪ Safety, health and environmental regulations specific for the product in question.</li> </ul>
<b>Section 16.</b>	<b>Other information including information on preparation and revision of the SDS</b>	

**C. MAINTAINING, RETRIEVAL, AND DISTRIBUTION OF THE SDS**

Employers may keep and make SDSs available on computer as long as:

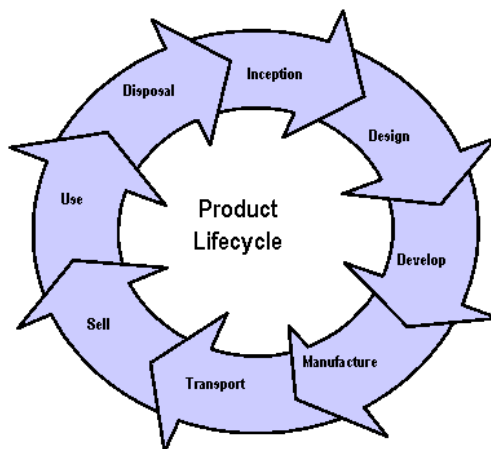
1. Employees/Users agree to this type of information access,
2. All employees have immediate access to the SDSs for chemicals in their work areas, without leaving their work area, or purchasing new technology for access,
3. Some positive verifiable form of notification is provided, such as memo or email with all information necessary to access the SDS is provided, including signature of receipt,
4. Some positive verifiable form of notification of updated SDS is provided, such as memo or email, including signature of receipt,
5. Some positive verifiable form that the SDS was received as requested, such as a signature of receipt,
6. Employee must be able to print out a hard copy of the SDS,
7. An alternative backup system must be available for rapid access to the SDS in the case of a power outage or other emergency – Keep the hard copies of SDS for backup access.

## D. CONTRACTORS

1. It is the responsibility of independent contractors working on State property to ensure its contract employees are provided information and trained on hazardous chemicals.
2. Workplace Managers shall be notified prior to any hazardous chemical work at a State site by an independent contractor.
3. Independent contractors shall provide a copy of Safety Data Sheets to the state facility for all hazardous materials they bring on site.
4. The state facility shall provide Safety Data Sheets to independent contractors for any hazardous materials they may come in contact with while on the work site.

## E. CHEMICALS THAT ARE COVERED

1. The GHS covers all hazardous chemicals.
2. There are no complete exemptions from the scope of the GHS for any particular type of chemical or product.
3. The term chemical is used broadly to include substances, products, mixtures, preparations, and any other terms that may be used by existing systems.
4. The goal is to identify the intrinsic hazards of chemical substances and mixtures and to convey information about the hazards identified.



5. Will all hazardous chemicals require a GHS Label and Safety Data Sheet?
  - *The need for GHS labels and/or Safety Data Sheets is expected to vary by product category or stage in the chemical's lifecycle from research/production to end use.*
  - *For example, pharmaceuticals, food additives, cosmetics and pesticide residues in food will not be covered by the GHS at the point of consumption, but will be covered where workers may be exposed (workplaces), and in transport.*
  - *The exact requirements for labels and Safety Data Sheets will continue to be defined in national regulations. However, national requirements are expected to be consistent with the detailed discussion of scope provided in Chapter 1.1 of the GHS document.*

## F. COMPLIANCE REQUIREMENTS

Train employees on the new label standards for shipping hazardous chemicals and for workplace labeling, and safety data sheets (SDS) including the order of information on the SDS by **December 1<sup>st</sup>, 2013.**

Change their Written Hazard Communication Program to reflect the new requirements, Safety Data Sheets, Labeling for shipment, Workplace labeling, Information distribution, and Training by **June 1, 2015.**

**December 1<sup>st</sup>, 2015** – the Distributor shall not ship containers labeled by the chemical manufacturer or importer unless it has a GHS Label [Employers are distributors when shipping hazardous chemicals]

Fully implement the Updates to workplace labeling, hazard communication programs, and training programs, including but not limited to, provide additional employee training for newly identified physical hazards, health hazards, and environmental hazards by **June 1, 2016.**

During the transition period, [*between now and June 1<sup>st</sup>, 2016*] Employers may comply with either 29 CFR 1910.1200 (the final standard) or the current standard or both.

## G. GHS: U.S. AGENCY STATUS

- The **Environmental Protection Agency (EPA)** Office of Pesticide Programs has incorporated most of the GHS elements
- **Department of Labor’s Occupational Safety & Health Administration [OSHA]** – modified it’s regulations to incorporate most of the GHS elements
- **Department of Transportation [DOT]** – modified it’s regulations and placarding systems to incorporate most of the GHS elements by the time NAFTA went into effect in 1994 – will incorporate the new Environmental Hazard Class and Categories.
- **Consumer Product Safety Commission (CPSC)** – is completing a comparison of agency regulations and guidelines under the Federal Hazardous Substances Act to GHS. This review will determine which sections of the GHS might be considered for



implementation along with statutory and regulatory changes that would be necessary for implementation.

**H. MORE INFORMATION ABOUT GHS**

<http://www.epa.gov/oppfead1/international/globalharmon.htm>

<http://www.osha.gov/dsg/hazcom/index.html>

<http://www.osha.gov/dsg/hazcom/global.html>

<http://www.phmsa.dot.gov/hazmat/regs/international> - Under International Menu, select Global Harmonization of Hazard Classification and Labeling Systems

<http://www.cpsc.gov/phth/GHSpolicy.html>

<http://safety.blr.com/workplace-safety-news/hazardous-substances-and-materials/hazard-communication/EPA-Drifts-Toward-Global-Harmonization/>

## APPENDIX Q

### GLOBAL HARMONIZATION STANDARDS

#### I. WHAT IS GLOBAL HARMONIZATION

1. Global Harmonization is a common and coherent approach to defining and classifying hazards, and communicating information on labels and safety data sheets.
2. Target Audiences include workers, consumers, transport workers, and emergency responders.
3. GHS provides the underlying infrastructure for establishment of national, comprehensive chemical safety programs.

#### J. USA AGENCIES AFFECTED

5. *The Environmental Protection Agency (EPA) Office of Pesticide Programs has incorporated most of the GHS elements*
6. *Department of Labor's Occupational Safety & Health Administration [OSHA] –modified it's regulations to incorporate most of the GHS elements*
7. *Department of Transportation [DOT] – modified it's regulations and placarding systems to incorporate most of the GHS elements by the time NAFTA went into effect in 1994 – will incorporate the new Environmental Hazard Class and Categories.*
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#### K. ELEMENTS OF THE NEW STANDARD

1. **A new Hazards Classification System** that is standardized and comprehensive.
2. A new Standardized, comprehensive system for **Labeling**, using **Placards**, and **other warnings**, to communicate hazards including:
  - a. **pictograms**,
  - b. **signal words**
  - c. **hazard statements, and**
  - d. **precautionary statements**
3. A new Standardized format for the production of **Safety Data Sheets [SDS]** to include 16 specified sections, presented in a specific format and order, with more



uniform, logical, and comprehensive information than what was previously provided on a Material Safety Data Sheet (MSDS), and a standardized system of distribution.

## L. GHS HAZARD HAZARD CLASSIFICATION SYSTEM

1. Specific criteria is provided for classification of Health, Physical, and Environmental hazards associated with a chemical or mixture
2. Under the Global Harmonization System, there are three groups of hazard classes:
  - a. **Physical Hazards Group** – with 16 Physical Hazard Classes and 49 Categories
  - b. **Health Hazards Group** – with 11 Health Hazard Classes, 26 Categories, and 6 Sub-Categories
  - c. **Environmental Hazard Group** –with 1 (one) Environmental Hazard Class called *Acute & Chronic Aquatic Environmental Toxin*, that has 3 Acute Categories and 4 Chronic Categories

Each hazard class may have more than one category.

### 3. **PHYSICAL HAZARD GROUP**

- a. **Explosives** – *with 6 Categories*
- b. **Flammable Gases** – *with 2 Categories*
- c. **Flammable Aerosols** – *with 2 Categories*
- d. **Oxidizing Gases** – *One Category*
- e. **Gases Under Pressure** – *with 4 types*
- f. **Flammable Liquids** – *with 4 Categories*
- g. **Flammable Solids** – *with 2 Categories*
- h. **Self-Reactive Substances** – *with 7 types*
- i. **Pyrophoric Liquids** – *One Category*
- j. **Pyrophoric Solids** – *One Category*
- k. **Self-Heating Substances** – *with 2 Categories*
- l. **Substances which on Contact with Water Emit Flammable Gas** – *with 4 Categories*
- m. **Oxidizing Liquids** – *with 3 Categories*
- n. **Oxidizing Solids** – *with 3 Categories*
- o. **Organic Peroxides** – *with 7 Categories*
- p. **Corrosive to Metals** – *One Category*

#### 4. HEALTH HAZARD GROUP

- a. **Acute Toxin** – 5 Categories
- b. **Skin Corrosion/Irritation** – 5 Categories
- c. **Serious Eye Damage/Eye Irritation** - 4 Categories
- d. **Respiratory Sensitization** – 3 Categories
- e. **Skin/Dermal Sensitization** – 2 Categories
- f. **Germ Cell Mutagen** – 3 Categories
- g. **Mutagen** – 1 Category
- h. **Carcinogen** – 3 Categories
- i. **Reproductive Toxin** – 3 Categories
- j. **Lactation Toxin** – 1 Category
- k. **Target Organ Systemic Toxin [TOST] – Single Dose** – 3 Categories
- l. **Target Organ Systemic Toxin [TOST] - Repeated Dose** – 2 Categories
- m. **Aspiration Toxin** – 2 Categories
- n. **Biotoxins** – 1 Category

#### 5. ENVIRONMENTAL HAZARD GROUP

**GHS covers only one environmental hazard:**

- a. *Hazardous to the Aquatic Environment*

**There are three acute and four chronic categories for aquatic toxicity.**

- 1) *Acute aquatic toxicity* - with 3 Categories
- 2) *Chronic aquatic toxicity* - with 4 Categories
  - a. *Bioaccumulation potential*
  - b. *Rapid degradability*

#### M. ELEMENTS OF THE NEW GLOBAL HARMONIZATION LABELING, PLACARDS & OTHER WARNINGS

May 2012, OSHA updated the requirements for labeling of hazardous chemicals under its Hazard Communication Standard (HCS). As of June 1, 2015, all labels will be required to have pictograms, a signal word, hazard and precautionary statements, the product identifier, and supplier identification. A sample revised HCS label, identifying the required label elements, is shown on the right. Supplemental information can also be provided on the label as needed.

- 1. Global Harmonization Key elements for **Labeling Chemical Containers**, using **Placards**, and **other Warning signs and Symbols** to communicate hazards includes:
  - a. **Product Identifier /Name**
  - b. **Signal Word**

- c. **Symbols or Pictograms (s)**
- d. **Hazard Statement(s)**
- e. **Precautionary Statements, and**
- f. **Name, address, and telephone number of the manufacturer, importer, or other responsible party**

2. **Product Identifier/Chemical Name:**

The name of the chemical as it appears on the chemical container label or in the Safety Data Sheet, which provides a unique means by which the user can identify the chemical and permits cross-reference to be made among the list of hazardous chemicals required in the written hazard communication program, the label, and the Safety Data Sheet.

The Product Identifier can be the Chemical Name, Common Name, or a Synonym.

Chemical Name is defined as the scientific designation of a chemical in accordance with the nomenclature system developed by

- the International Union of Pure and Applied Chemistry (IUPAC) or
- Chemical Abstracts Service (CAS) rules of nomenclature.

Common Name or Synonym is a trade name, brand name, or generic name used to identify a chemical other than its chemical name.

The Product Identifier /Name on the Container must match the name on the Safety Data Sheet (SDS).

Include the chemical identity of substance or ingredients of a mixture that contribute to the classification as hazardous.

Transport hazmat must include proper shipping name.

3. **Signal Words:**

The signal word indicates the relative degree of severity a hazard. Two signal words were Chosen: "Danger and Warning" The signal words used in the GHS are:

- "**Danger**" for the more severe hazards, and
- "**Warning**" for the less severe hazards.

4. **Symbols/Pictograms:**

There are **Symbols/Pictograms** under the GHS to convey the health, physical and environmental hazards assigned to the GHS hazard class and category.

A **Pictogram** is a symbol plus other graphic elements, such as a border, background pattern, or color that is intended to convey specific information about the hazards of a chemical.



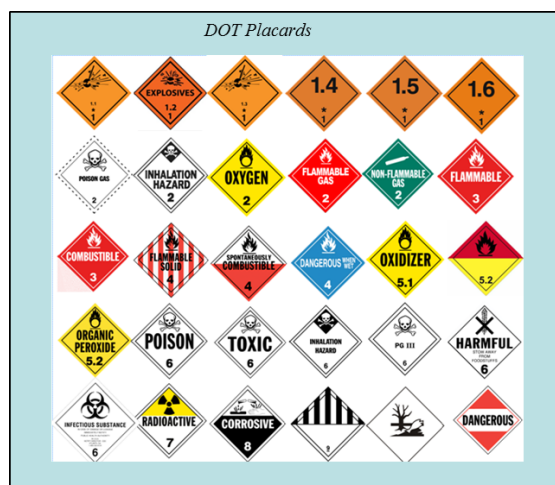
DOT - For transport, pictograms will have the background and symbol colors currently used.

For other sectors, pictograms will have a black symbol on a white background with a red diamond frame. A black frame may be used for shipments within one country. Each pictogram consists of a different symbol on a white background within a red square frame set on a point (i.e. a red diamond).



Where a transport pictogram appears, the GHS pictogram for the same hazard should not appear.

GHS Pictograms		
<b>Health Hazard</b>  <ul style="list-style-type: none"> <li>• Carcinogen</li> <li>• Mutagenicity</li> <li>• Reproductive Toxicity</li> <li>• Respiratory Sensitizer</li> <li>• Target Organ Toxicity</li> <li>• Aspiration Toxicity</li> </ul>	<b>Flame</b>  <ul style="list-style-type: none"> <li>• Flammables</li> <li>• Pyrophorics</li> <li>• Self-Heating</li> <li>• Emits Flammable Gas</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>	<b>Exclamation Mark</b>  <ul style="list-style-type: none"> <li>• Irritant (skin and eye)</li> <li>• Skin Sensitizer</li> <li>• Acute Toxicity (harmful)</li> <li>• Narcotic Effects</li> <li>• Respiratory Tract Irritant</li> <li>• Hazardous to Ozone Layer (Non Mandatory)</li> </ul>
<b>Gas Cylinder</b>  <ul style="list-style-type: none"> <li>• Gases under Pressure</li> </ul>	<b>Corrosion</b>  <ul style="list-style-type: none"> <li>• Skin Corrosion/ burns</li> <li>• Eye Damage</li> <li>• Corrosive to Metals</li> </ul>	<b>Exploding Bomb</b>  <ul style="list-style-type: none"> <li>• Explosives</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>
<b>Flame over Circle</b>  <ul style="list-style-type: none"> <li>• Oxidizers</li> </ul>	<b>Environment (Non Mandatory)</b>  <ul style="list-style-type: none"> <li>• Aquatic Toxicity</li> </ul>	<b>Skull and Crossbones</b>  <ul style="list-style-type: none"> <li>• Acute Toxicity (fatal or toxic)</li> </ul>



## 5. Hazard Statements

A **single harmonized hazard statement** is used for each **Category of hazard within each hazard class**. **Hazard Statements** are standardized and assigned phrases that describe the hazard(s) as determined by hazard classification. An appropriate statement for each GHS hazard should be included on the label for products possessing more than one hazard

Examples: Flammable Liquids

	Category 1	Category 2	Category 3	Category 4
Symbol	Flame	Flame	Flame	No symbol
Signal word	Danger	Danger	Warning	Warning
Hazard statement	Extremely flammable liquid and vapour	Highly flammable liquid and vapour	Flammable liquid and vapour	Combustible liquid

## 6. **Precautionary Statements or Supplemental Information**

Precautionary Statements supplement the hazard information by briefly providing measures to be taken to minimize or prevent adverse effects from physical, health or environmental hazards. *GHS label should include appropriate precautionary information.*

The precautionary statement can be”

- General : Read label before use,
- Prevention: Use personal protection equipment as required,
- Response: Call Poison Center or doctor/physician,
- Storage: Store in cool, dry place
- Disposal : Avoid release to the environment
- First aid would be included in precautionary information.

While, they are not yet harmonized, the intent is to harmonize precautionary statements in the future.

## 7. **Manufacturers, Distributors and Importers Identification and Contact Information Identification:**

The name, address and emergency telephone number of the Manufacturer, Distributor, or Importer of the product must be provided on the label.

## 8. **How are multiple hazards handled on labels?**

- a. Where a substance or mixture presents more than one GHS hazard, there is a GHS precedence scheme for pictograms and signal words.

- b. For substances and mixtures covered by the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, the precedence of symbols for physical hazards should follow the rules of the UN Model Regulations.
  - c. For health hazards the following principles of precedence apply for symbols:
    - if the skull and crossbones applies, the exclamation mark should not appear;
    - if the corrosive symbol applies, the exclamation mark should not appear where it is used for skin or eye irritation;
    - if the health hazard symbol appears for respiratory sensitization, the exclamation mark should not appear where it is used for skin sensitization or for skin or eye irritation.
  - d. If the signal word 'Danger' applies, the signal word 'Warning' should not appear. All assigned hazard statements should appear on the label. The Competent Authority may choose to specify the order in which they appear.
  - e. The GHS hazard pictograms, signal word and hazard statements should be located together on the label. The actual label format or layout is not specified in the GHS. National authorities may choose to specify where information should appear on the label or allow supplier discretion.
9. There has been discussion about the size of GHS pictograms and that a GHS pictogram might be confused with a transport pictogram or "diamond". Transport pictograms (Table 4.10) are different in appearance than the GHS pictograms (Table 4.9). Annex 7 of the Purple Book explains how the GHS pictograms are expected to be proportional to the size of the label text. So that generally the GHS pictograms would be smaller than the transport pictograms.

## N. **SPECIFIC LABELING REQUIREMENTS**

### 1. **Manufacturer/Distributor/Importer Labeling Requirements:**

*Manufacturer/Distributor/Importer labels must have the following information:*


- a. **Chemical Identity** or Product Name – Must match the Product Name on the Safety Data Sheet – names must be consistent with IUPAC, Or CAS Technical Name

- b. **Hazard Warning** with the following:
- Symbols/Pictograms – based upon the GHS Classification
  - Signal Word – based upon the degree of severity
    - Danger – for more severe hazards
    - Warning – for less severe warnings
- c. **Physical, Health, or Environmental Hazard Statements:** Standard phrases assigned to a hazard class and category that describes the hazards – only one signal word, assigned to the most severe hazard should be used on a label.
- d. **Supplemental Information** including:
1. Precautionary Measures
  2. First Aid Statements
- e. **Name, Address, and phone number of the Manufacturer/Supplier.**

- f. **In addition** – it is an institutional requirement for all laboratories to write the PI's first initial and last name, date received, and date opened on all chemical containers.

**The Manufacturer shall:**

- Be in compliance with the GHS labeling standards by June 1 2015.
- Shall update their MSDSs to the new SDS format and supply the updated SDS to Employers by June 1, 2013.
- Shall include a Safety Data Sheet for each shipment.

SAMPLE LABEL	
<p style="text-align: center;"><b>PRODUCT IDENTIFIER</b></p> <p>CODE _____            Product Name _____</p> <p style="text-align: center;"><b>SUPPLIER IDENTIFICATION</b></p> <p>Company Name _____            Street Address _____            City _____ State _____            Postal Code _____ Country _____            Emergency Phone Number _____</p> <p style="text-align: center;"><b>PRECAUTIONARY STATEMENTS</b></p> <p>Keep container tightly closed. Store in cool, well ventilated place that is locked.            Keep away from heat/sparks/open flame. No smoking.            Only use non-sparking tools.            Use explosion-proof electrical equipment.            Take precautionary measure against static discharge.            Ground and bond container and receiving equipment.            Do not breathe vapors.            Wear Protective gloves.            Do not eat, drink or smoke when using this product.            Wash hands thoroughly after handling.            Dispose of in accordance with local, regional, national, international regulations as specified.</p> <p><b>In Case of Fire:</b> use dry chemical (BC) or Carbon dioxide (CO<sub>2</sub>) fire extinguisher to extinguish.</p> <p><b>First Aid</b>            If exposed call Poison Center.            If on skin (on hair): Take off immediately any contaminated clothing. Rinse skin with water.</p>	<p style="text-align: center;"><b>HAZARD PICTOGRAMS</b></p>  <p style="text-align: center;"><b>SIGNAL WORD</b> <b>Danger</b></p> <p style="text-align: center;"><b>HAZARD STATEMENT</b> <b>Highly flammable liquid and vapor.</b> <b>May cause liver and kidney damage.</b></p> <p style="text-align: center;"><b>SUPPLEMENTAL INFORMATION</b></p> <p><b>Directions for use</b></p> <p>_____</p> <p>_____</p> <p>Fill weight: _____ Lot Number _____</p> <p>Gross weight: _____ Fill Date: _____</p> <p>Expiration Date: _____</p>

- d. Distributors shall not ship containers labeled by the Manufacturer or importer unless it is a GHS Label [December 1, 2015]

2. **Employer/Employee Workplace Labeling**

- a. Employees shall not remove or deface the label on any incoming chemical containers
- b. Employees shall ensure that all incoming chemical containers have the GHS label
- c. When the contents of a vendor's container is transferred into a new, unlabeled container, it must be labeled with the same information as required on the manufacturer/distributor label.
- d. In addition, it is an institutional requirement to place the last name of the PI on the container and the date the chemical(s) was placed in the container.

- e. **Secondary Containers, Stock solutions, and working solutions** must be labeled with the following:

- **Product Identification or Name** – as it appears on the Manufacturer's Container or Safety Data Sheet – no abbreviation or chemical formulas (Identify Hazardous Ingredients for mixtures with percent concentration, where appropriate).
- **Hazard Warnings** – using the GHS pictograms or words such as flammable, corrosive, toxic, reproductive hazard, nephrotoxic, etc.
- **All Workplace labels** or other forms of warning must be legible, in English, and prominently displayed on the container.
- **In addition** – the PI's last name and date the chemical(s) were placed in the container are also required on the label..

<p><b>Ethanol 75%</b> <b>Flammable</b> <b>10/11/12</b> <b>D Bridges</b></p>
---

f. **Portable Container Labeling**

**Portable Containers** are defined as containers into which chemicals are transferred, that are intended for the immediate use of the employee who



performs the transfer, that will remain under the control of the person who performed the transfer, and that will be emptied by the end of the work shift by the person who performed the transfer.

Employers are not required to label **portable containers** into which hazardous chemicals are transferred from a labeled container.

The container must be labeled with the same information as a secondary container if a *chemical, Stock solution, or working solution* :

- Will be used by anyone other than the individual performing the transfer or making the solution; or
- Will not be under the control of the individual performing the transfer during the entire period of use; or
- Will not be consumed by the end of the work shift –

g. **Stationary Container Labeling**

A **stationary container** is any stationary tank or process container and its associated equipment, pipework, and fittings, such as: above and below ground tanks, boilers, vats or other such containers.

Employers may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing a label to individual stationary process containers, as long as the alternative method identifies the container to which it is applicable, and conveys the information that is required on a label, and as long as the written materials, such as process sheets, batch tickets and operating procedures, are readily accessible to the employees in their work area throughout their work shift.












- h. Older containers that the PI has in storage – All older containers of chemicals that the PI has in storage, that do not have the GHS compliant label, must be relabeled with the new GHS Compliant label.

O. **HAZARD COMMUNICATION STANDARD PICTOGRAMS**

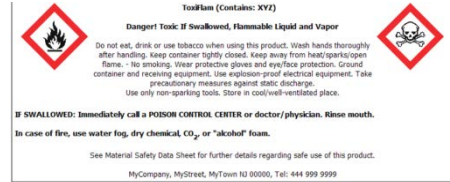
As of **June 1, 2015**, the Hazard Communication Standard (HCS) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

There are nine pictograms under the GHS. However, only eight pictograms are required under the Hazard Communication Systems (HCS). The following table shows the Pictogram for each group of hazard classes. Under EPA, all pictograms would be used.

<p><b>Health Hazard</b></p>  <ul style="list-style-type: none"> <li>• Carcinogen</li> <li>• Mutagenicity</li> <li>• Reproductive Toxicity</li> <li>• Respiratory Sensitizer</li> <li>• Target Organ Toxicity</li> <li>• Aspiration Toxicity</li> </ul>	<p><b>Flame</b></p>  <ul style="list-style-type: none"> <li>• Flammables</li> <li>• Pyrophorics</li> <li>• Self-Heating</li> <li>• Emits Flammable Gas</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>	<p><b>Exclamation Mark</b></p>  <ul style="list-style-type: none"> <li>• Irritant (skin and eye)</li> <li>• Skin Sensitizer</li> <li>• Acute Toxicity (harmful)</li> <li>• Narcotic Effects</li> <li>• Respiratory Tract Irritant</li> <li>• Hazardous to Ozone Layer (Non Mandatory)</li> </ul>
<p><b>Gas Cylinder</b></p>  <ul style="list-style-type: none"> <li>• Gases under Pressure</li> </ul>	<p><b>Corrosion</b></p>  <ul style="list-style-type: none"> <li>• Skin Corrosion/ burns</li> <li>• Eye Damage</li> <li>• Corrosive to Metals</li> </ul>	<p><b>Exploding Bomb</b></p>  <ul style="list-style-type: none"> <li>• Explosives</li> <li>• Self-Reactives</li> <li>• Organic Peroxides</li> </ul>
<p><b>Flame over Circle</b></p>  <ul style="list-style-type: none"> <li>• Oxidizers</li> </ul>	<p><b>Environment (Non Mandatory)</b></p>  <ul style="list-style-type: none"> <li>• Aquatic Toxicity</li> </ul>	<p><b>Skull and Crossbones</b></p>  <ul style="list-style-type: none"> <li>• Acute Toxicity (fatal or toxic)</li> </ul>

## P. SHIPPING CHEMICAL CONTAINERS

- When shipping Chemical Containers, Employer/Employees are required to comply with the Manufacturer/Distributor/Importer requirements for labeling chemical containers for OSHA and DOT.
  - Chemical Identity** or Product Name
  - Hazard Warning** with the following:
    - Symbols/Pictograms
    - Signal Word – Danger or Warning Depending upon the degree of hazards
  - Physical, Health, or Environmental Hazard Statements:**
  - Supplemental Information**
  - Name, Address, and phone number of the Manufacturer/Supplier.**
- Examples of ‘Inner Package’ Labeling:



3. Employer/Employee(s) are required to package and label all containers being shipped, in accordance with DOT requirements. Examples of ‘Outer Packaging’ are as follows:

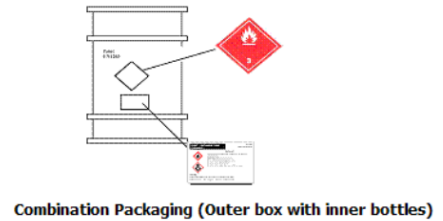
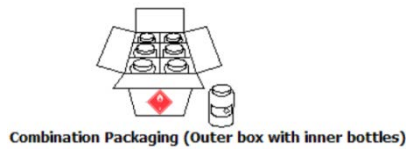
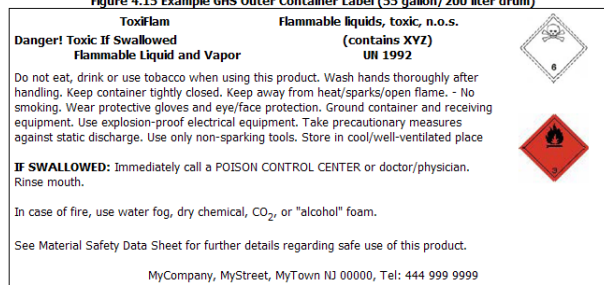


Figure 4.15 Example GHS Outer Container Label (55 gallon/200 liter drum)



4. Employer/Employee(s) are also required to include a copy of the Manufacturer’s Safety Data Sheet with the shipment.

## Q. COMPLIANCE DEADLINES

1. Employers must train workers on the new label elements and SDS format by **December 1, 2013**. Chemical manufacturers, importers, distributors, and employers must comply with all modified provisions of the final rule by **June 1, 2015**.
2. Distributors may not ship products labeled by manufacturers under the old system after **December 1, 2015**. By **June 1, 2016**, all manufacturer labels must be in compliance with the new GHS labeling systems.
3. By **June 1, 2016**, Employers must update alternative workplace labeling and hazard communication programs as necessary, and provide additional worker training for new

identified physical and health hazards. During this transition period, all chemical manufacturers, importers, distributors, and employers may comply with either 29 CFR 1910.1200 (this final standard), or the current standard, or both.

## APPENDIX R

### Guidelines for Safe-Handling of Chemotherapy Agents and Other Highly Toxic Chemicals Used in Augusta University Laboratories and Facilities

- I. Introduction**
- II. Roles and Responsibilities**
  - A. Principal Investigators (PI), Laboratory Supervisors, and/or Instructors
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  - A. Occupational Health Issues and Risks
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  - G. Waste Management- Collection, Segregation, Labeling and Storage
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  - H. Spill Procedures Involving Chemotherapeutic Agents and Waste
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- V. References**
- VI. Attachments**

## Guidelines for Safe-Handling of Chemotherapy Agents and Other Highly Toxic Chemicals

### I. Introduction:

Chemotherapy agents (also referred to as antineoplastic agents) are toxic compounds used to control or kill cancer cells. These agents present additional hazards to human health not found with most other chemicals used in research settings (e.g., increases spontaneous changes in DNA, can cause birth defects, cancer, and the inability to produce offspring). Additionally, direct contact with these agents can have a variety of acute health effects ranging from irritation to the skin, eyes, mucous membranes, and/or cause ulcers and necrosis (death) of tissue at very low doses<sup>1</sup>. The use of other highly toxic chemicals in research operations poses similar health risks. Toxicity varies with each specific agent/chemical and depends on the concentration, frequency and duration of exposure<sup>1</sup>. In 2004, the CDC published a National Institute for Occupational Safety and Health (NIOSH) Alert, pertaining to preventing occupational exposures to antineoplastic and other hazardous drugs in health care settings<sup>1</sup> with an updated list of these drugs released in 2012<sup>2</sup>.

Here are some examples of chemotherapeutic agents/other highly toxic chemicals listed in the 2004 publication and a few others that are commonly used on campus:

Asparaginase  
Bleomycin  
Bromodeoxyuridine (BrdU)  
Carboplatin  
Cisplatin  
Cyclophosphamide  
Cyclosporin  
Diethylnitrosoamine (DEN)  
Docetaxel  
Doxorubicin  
Etoposide  
Fluorouracil (5FU)  
Gemcitabine  
Paclitaxel  
Methotrexate  
Mitomycin  
MPTP  
Streptozotocin (STZ)  
Tamoxifen  
Temozolomide  
Teniposide  
Topotecan  
Viblastine  
Vincristin

For a more complete list, see [the NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings 2012.](#)

Similarly, administration of these agents/chemicals to research animals presents additional exposure opportunities for workers not encountered when dealing with human patients, where closed delivery systems may be used and the handling of excreta is reduced. Many hazardous agents/chemicals and their metabolites can be excreted in the urine and feces for up to 72 hours or more post-delivery<sup>3</sup>. In 2010, the CDC published a workplace solutions document on the safe handling of hazardous drugs for veterinary healthcare workers stressing the need to establish a program to provide protective measures for veterinary healthcare workers exposed to hazardous drugs<sup>4</sup>. Accordingly, laboratory staff, Environmental Services (EVS) “housekeeping” staff and Laboratory Animal Services (LAS) staff may be exposed to chemotherapy drugs or other highly toxic chemicals via:

- Inhalation – by generating aerosols (i.e., reconstituting powder/lyophilized agents, pipetting, expelling air from syringes, cleaning up spills, packaging biowaste, changing animal cages)
- Absorption – by direct contact with skin/mucous membranes (i.e., needle stick injury, spills, touching contaminated surfaces, equipment, animal carcasses or animal bedding containing urine/feces)
- Ingestion – by contact with contaminated items (i.e., food/drink, eating utensils, cigarettes, chewing gum)

Therefore, special procedures for the use of these agents/chemicals and disposal of waste are necessary. The Georgia State Environmental Protection Division (EPD) categorizes “Chemotherapy waste” as biomedical waste and defines it as any disposable material which has come in contact with cytotoxic (toxic to cells) or antineoplastic agents during the preparation, handling, and administration of such agents. Such waste includes, but is not limited to, masks, gloves, gowns, empty IV tubing bags and vials, and other contaminated materials (e.g., animal caging, bedding and carcasses)<sup>5</sup>. The GA State EPD further requires that all Chemotherapy waste, in any trace amount, be incinerated and not autoclaved or placed in the regular trash. This prevents entry of these toxic compounds into the environment, as autoclave operation results in air emissions and wastewater discharge; and the regular trash is landfilled. As a result, chemotherapy waste must be segregated in compliance with the GA State EPD regulations to ensure that it is properly disposed. Likewise, it is prudent practice to dispose of other highly toxic chemicals similarly. If you are unsure whether handling of a certain chemical requires special procedures, contact the CSO (CSO) at 706-721-2663.

The purpose of this document is to ensure that workers are informed of the hazards associated with working with these drugs/chemicals and are provided with guidelines on safe handling procedures to minimize potential exposure and the special waste handling procedures as required by state law.

## II. Exemption from Guideline:

The PI may submit information to the CSO to be submitted through the Board of Regents of the University System of Georgia to the Georgia Environmental Protection Division (GA EPD) for consideration for exemption from this requirement to segregate, collect and dispose waste by incineration if the PI believes that the agent is completely metabolized in the animal and is not excreted. While response from the GA EPD to such request is awaited, the PI will comply with the guideline as stipulated in this document.

Also, the default timeline for the hazardous period (defined in Section F 2a) this guideline is 5 days; however, reduction of this time period will be considered on a case-by-case basis based on information provided by the PI to the CSO. This document will be revised to reflect a new hazardous period as more data is collected.

## III. Roles and Responsibilities:

### A. **Principal Investigators (PIs), Laboratory Supervisors and/or Instructors will:**

1. Consider use of less hazardous chemicals in lieu of working with a chemotherapeutic agent/ other highly toxic chemical.
2. Develop a Standard Operating Procedure (SOP) based on these guidelines for safe handling of chemotherapy agents or other highly toxic chemicals prior to initiating experiments using these agents. If you have a Biosafety Protocol you must amend your existing SOP. This SOP should be submitted to the Chemical and Biological Safety Offices for review and posted in the laboratory.
3. An MSDS for each agent should be readily available for laboratory staff.
4. Ensure that agents/chemicals are handled in a Chemical Fume Hood or a ducted Class II, B2 Biosafety Cabinet that has been certified to work properly.
5. Provide specialized equipment, such as N-95 respirators (if applicable), chemo-rated nitrile gloves, safety glasses, or disposable plastic-backed absorbent pads or sheets to laboratory staff.
6. Post signage in the laboratory and animal facility (provided by the CSO) to alert others of the potential hazards.
7. Ensure that all personnel working with these agents have been trained (see Section III.B.) and are familiar with the SOP.
8. Ensure that these agents are added to the chemical inventory, separated from other chemicals and are stored in a secondary container that is sealed to prevent spills/leaking.
9. Use the chemotherapy stickers and yellow sharps containers provided by Chemical Safety and the yellow bags or clear bags (with chemotherapy stickers attached) provided by LAS to properly disposed of chemotherapy waste. Other highly toxic chemicals should also be disposed of using this method.
10. Ensure that personnel receive medical-follow up after any exposure to these agents/chemicals through Occupational Health Services and/or the Emergency Room.
11. Report any spills, exposures or accidents to the CSO (and LAS, in the case of animal facilities).



**B. Laboratory Staff will:**

1. Read the SOP developed by the PI using this guidance document and comply with all required safety regulations.
2. Be aware of Occupational Exposure risks (see Section III.A.) and seek Occupational Health counseling if a personal health issue exists or if a spill, exposure or accident occurs.
3. Complete the training requirements listed in Section III.B., and SOP specific training from PIs, Supervisors or Instructors.
4. Wear appropriate PPE such as chemo-rated nitrile gloves, safety glasses, a lab coat, long pants and closed toed shoes.
5. Use a Chemical Fume Hood or ducted Class II, B2 Biosafety for agent/chemical preparation, handling, animal injection and cage changing.
6. Transport the agent/chemical according to Section III.E.2., using a secondary container and proper labeling.
7. Properly label all containers of agents/chemicals, cages housing animals injected with these agents/chemical materials contaminated with these agents/chemicals, and wastes.
8. Label cages with a “Do Not Disturb” card and perform all husbandry, cage changing, feeding and watering during the “hazardous period” (see definition of hazardous period in Section III.F.2.a.). After the “hazardous period” LAS will resume care for the animals.
9. Use the chemotherapy stickers and yellow sharps containers provided by Chemical Safety and the yellow bags or clear bags (with chemotherapy stickers attached) provided by LAS to properly dispose of chemotherapy waste. Other highly toxic chemicals should also be disposed of using this method.
10. Report any spills, exposures, accidents or unsafe conditions to the laboratory supervisors immediately.

**IV. Standards and Guidance:**

**A. Occupational Health Issues and Risks**

Personnel who have/developed health conditions which may increase their risks for working with these agents/chemicals (e.g., immunocompromised, pregnancy) should contact Occupational Health Services (Ext. 1-3418) prior to beginning work with these agents, to schedule an occupational risk assessment and be provided medical surveillance<sup>6</sup>.

**B. Training Requirements:**

- Initial Chemical and Biological Laboratory Safety Training (didactic format – required once)
- Environmental Protection Agency EPA Training for Augusta University Laboratory Staff (required annually)
- GA Board of Regents Chemical Specific Right-to-Know module (required annually)
- GA Board of Regents Hazardous Waste Awareness Right-to-Know module (required annually)

- Laboratory and protocol-specific training (required as needed). This includes review of the Material Safety and Data Sheets (MSDS) for each highly toxic agent/chemical and a walk-through of animal facilities with a LAS representative and a CSO representative to ensure the SOPs are understood and can be implemented.

### **C. Personal Protective Equipment (PPE):**

It is the responsibility of the PI/Laboratory Supervisor/Instructor to provide to laboratory staff the appropriate PPE for handling chemotherapy and other highly toxic chemicals. The minimum PPE required includes:

- Eye protection (i.e., safety glasses, goggles, face shield)
- A laboratory coat
- Chemo-rated nitrile gloves
- N-95 respirator (if required, fit testing must be performed by the Occupational Health Office)

### **D. Facilities:**

1. *Isolating Work Area (designated area, restricted access)*
  - a. A designated area for working with chemotherapy agents/other highly toxic chemicals shall be established. The area can be an entire laboratory, an approved animal room, a specific laboratory workbench, a ducted Class II, B2 biosafety cabinet or a laboratory chemical fume hood.
  - b. Areas where these agents/chemicals are used shall have limited access.
2. *Signage requirements*
  - a. It is the responsibility of the PI to ensure that the work area is posted with a warning sign that has been provided by the CSO.

### **E. Storage and Transport:**

1. *Storage and Segregation*
  - a. All chemotherapy agents/other highly toxic chemicals should be stored separately from other chemicals in the laboratory using secondary containment. The agents/chemicals should be stored in closed bins and on shelves with anti-roll tips to prevent accidental falling.
2. *Transport*
  - a. Chemotherapy agents/other highly toxic chemicals must be transported in secondary containers. The containers shall be non-breakable, sealable, and labeled with the words, "Chemotherapy Agent" or "Highly Toxic Chemical" and PI contact information.

### **F. Handling of Chemotherapy Agents/Other Highly Toxic Chemicals:**

1. *General Guidelines*
  - a. In a posted room, using a ventilated cabinet (see Section III.D.), the user will work on a plastic-backed absorbent sheet to protect work surfaces.
  - b. Yellow bags, sharps and liquid waste collection containers will be available next to the work area for disposal of waste.
  - c. Sharps should never be re-sheathed prior to disposal unless the sharp comes equipped with a safety device designed to be engaged after usage.

- d. **Cleaning Work Surfaces:**
  - i. All areas (i.e., bench tops, fume hood, biosafety cabinet interiors and equipment) where chemotherapy agents/other highly toxic chemicals are handled must be cleaned with soap and water after completion of experiments.
  - ii. All sponges and wet towels used to clean contaminated surfaces **MUST** be disposed in a yellow bag.
  - iii. If these agents/chemicals are used in conjunction with bio-hazardous agents, the area should be cleaned with soap and water first and then decontaminated for the biological materials.
2. *Specific Practices for Agent/Chemical Use in Animals*
  - a. Definition of “Hazardous Period” – The “hazardous period” refers strictly to the use of chemotherapy/other highly toxic chemicals in small animals. It is the period from the last injection of an agent/chemical that the agent/chemical ceases to be excreted in the urine/feces. During this period small animal husbandry/care and the collection of small animal bedding will be the responsibility of the PI/research staff. The collection of small animal bedding is to ensure that chemotherapy wastes are not autoclaved or disposed of in the regular trash, but incinerated according to the Georgia EPD law. The PI/staff should place a “Do Not Disturb” card on the animal cage. After the “hazardous period” when the agent/chemical is no longer being excreted, the bedding will no longer need to be collected and LAS can resume care of the animals.
  - b. All procedures (i.e., cage changes, necropsy) will be performed wearing the required PPE, see Section III.C.
  - c. Injection of agents/chemicals into animals **MUST** be performed in a Class II, B2 Biosafety Cabinet or Chemical Fume Hood. Animals should be appropriately restrained and/or sedated prior to administration of toxic agents.

#### **G. Waste Management- Collection, Segregation, Labeling and Storage:**

Yellow color-coding is used to distinguish chemotherapy agent/highly toxic chemical wastes from general bio-hazardous wastes. Proper segregation of all contaminated wastes is the responsibility of the PI. All waste handling must be performed wearing the required PPE (see Section III.C.).

##### *1. Concentrated Chemotherapy Agents/Other Highly Toxic Chemicals*

- a. Vials with more than a small residual amount that need to be disposed of are considered hazardous waste. A waste pick up request must be generated through the PI’s chemical inventory account in the database. The waste label from the chemical database must be taped to the container for pick up by the CSO for disposal.

##### *2. Liquid Wastes*

- a. Any liquid culture waste must be collected in properly labeled containers and decontaminated for biological agents and/or biological toxins by treating with 10% bleach solution or alcohol as appropriate for the biological agent. The PI should confirm with the CSO that these disinfection/deactivation methods will

not react with the chemotherapeutic agents in the solution to produce dangerous vapors or additional toxic chemicals.

- b. Upon biological decontamination, the liquid waste must be collected in durable non-breakable and labeled containers and disposed through the CSO.
- c. A waste pick up request must be generated through the PI's chemical inventory in the database. A waste label from the chemical database must be taped to the container for pick up by the CSO for disposal.
- d. Water bottles spiked with these agents/chemicals, if not completely used, the liquid should be collect and disposed of as described in (a.) above.

### 3. *Solid Wastes*

- a. All solid chemotherapy agents/other highly toxic chemical contaminated waste items must be disposed of in a yellow bag. When the yellow bag become full, it is the responsibility of the research staff to close the bag, twist the bag tightly to seal it, secure closed (rubber band, tape, twist ties) and place it in biowaste box.
- b. All contaminated sharps (syringes, needles blades, broken glass/plastic items) **MUST** be disposed of in a yellow sharps container. When a yellow sharps container becomes 2/3 full, the container will be closed and sealed and placed **upright** in biowaste box by the research staff.

### 4. *Small Animal Waste*

- a. All caging and bedding materials generated during the hazardous period (see Section III.F.2.a.) are treated as solid waste and are collected in yellow bags.
- b. If a Class II, B2 Biosafety Cabinet or Chemical Fume Hood is not available for cage changing, use of disposable cages will be required to minimize aerosol production.
- c. If non-disposable cages are used, the PI/staff while donning N-95 respirators will moisten dirty bedding with water to prevent dust generation prior to dumping. Note that donning an N-95 respirator requires medical evaluation and fit testing by the Occupational Health Office.
- d. The outside of the new cage shall be wiped down with soap and water to ensure no residual agents/chemical on the research staff's gloves are transferred to the outside of the caging.
- e. Animal carcasses should be disposed of in yellow plastic bags or clear plastic bags (provided by LAS) with yellow stickers (provided by the CSO) and placed in the carcass freezer.

### 5. *Large Animal Waste*

- a. Pig/dog waste will not require collection. Pig/dog runs will be hosed down by LAS staff into the sewer, avoiding direct jet stream at excreta and wearing PPE inclusive of a tyvek suit, N-95 respirator, gloves and face shield.

## **H. Spill Procedures involving Chemotherapeutic Agents and Waste:**

### 1. *Small Spill*

A small spill is one where the individual responsible feels (s)he is capable of handling the spill safely without the use of respiratory protection or the assistance of trained emergency response personnel. Keep in mind that small amounts of chemotherapeutic agents can be much more harmful than many other types of

chemicals. When in doubt, contact the CSO at 706-721-2663. The procedure for cleaning a small spill is:

- a. Control the area of the spill by restricting access to any other personnel. Alert others to evacuate and avoid the area until spill is cleaned.
- b. Remove any potentially contaminated PPE and replace with appropriate chemotherapy PPE as described above. Care must be taken when broken glass is a component of the spill to avoid personal injury and accidental exposure through the skin. Also contaminated glass requires special handling for disposal and should not be placed in regular trash. Contact the CSO at 706-721-2663 if in doubt about how to proceed.
- c. Liquids should be absorbed with absorbent gauze or absorbent pads.
- d. Clean up spill and contaminated surfaces of equipment or instruments using soap and water only.
- e. Solids should be wiped up with wet absorbent gauze or absorbent pads.
- f. The spill area should then be cleaned from outer edge to center of spill to avoid spreading.
- g. Clean the area three times using a soap solution followed by clean water.
- h. If any surfaces, equipment or instruments are contaminated with chemotherapeutic agents/other highly toxic chemical and biohazardous materials, subsequent decontamination to ensure inactivation of biohazardous materials must be performed as per the Biosafety SOPs.
- i. All contaminated items used to clean up the spill MUST be disposed of in a yellow bag.

## 2. *Large Spill*

A large spill is any spill that requires emergency response personnel and/or requires a respirator to avoid inhalation of the chemotherapy agent. The procedure for cleaning a large spill is:

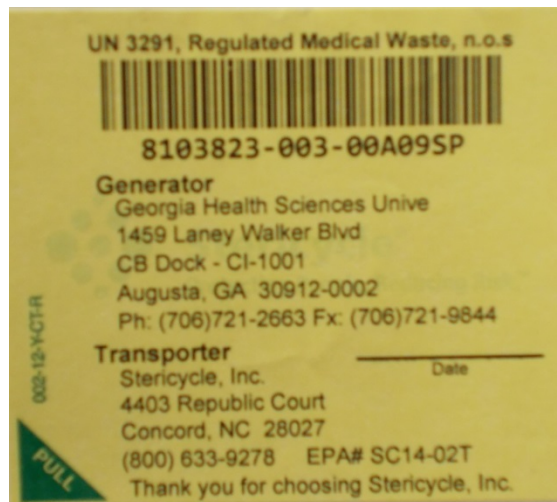
- a. Stop work immediately.
- b. Step away from the spill area into an isolated area outside of exposure risk and remove any potentially contaminated PPE.
- c. Evacuate all personnel from the laboratory/facility and close the door(s).
- d. Restrict access to lab. Place signage at door to ensure no entry takes place.
- e. Call the CSO at 706-721-2663 or Campus Public Safety at 1-2911 after hours.
- f. Remain on site to speak to first responders.

## V. References

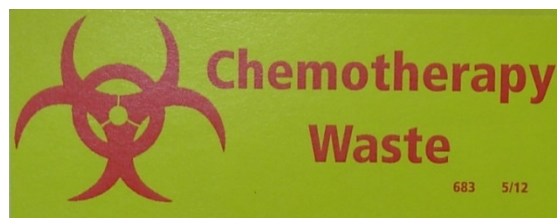
1. NIOSH ALERT Preventing Occupational Exposures to Antineoplastic and Other Hazardous Drugs in Health Care Settings, 2004; <http://www.cdc.gov/niosh/docs/2004-165/>
2. NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings, 2012; <http://www.cdc.gov/niosh/docs/2012-150/pdfs/2012-150.pdf>
3. Cass Y, Musgrave CF (1992). Guidelines for safe handling of excreta contaminated by cytotoxic agents. *Am J Hosp Pharm* 49:1957-1958.

4. NIOSH Workplace Solutions, Safe Handling of Hazardous Drugs for Veterinary Healthcare Workers, 2010;  
<http://www.cdc.gov/niosh/docs/wp-solutions/2010-150/pdfs/2010-150.pdf>
5. Georgia Department of Natural Resources, Environmental Protection Division, Solid Waste Management, Biomedical Waste (Chapter 391-3-4-.15)  
<http://rules.sos.state.ga.us/docs/391/3/4/15.pdf>
6. OSHA Technical Manual: Controlling Occupational Exposure to Hazardous Drugs, Section VI Chapter 2 (OSHA 1999)  
[http://www.osha.gov/dts/osta/otm/otm\\_vi/otm\\_vi\\_2.html](http://www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html).

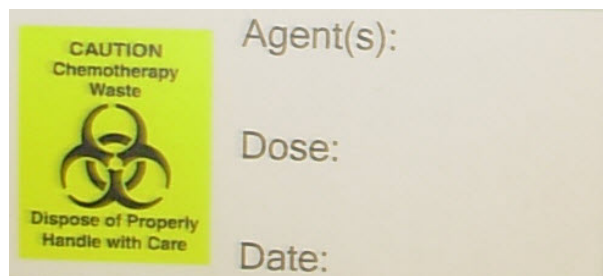
## **VI.Attachment**



Stericycle Stickers



Chemotherapy Waste Stickers



Chemical Hazard Cage Labels

**Chemotherapy Work Area Hazard Sign**

<b>WARNING!</b>	
	
<b>TOXIC CHEMICAL HAZARD</b>	
<input type="checkbox"/> Carcinogen <input type="checkbox"/> Other (Specify): _____	<input type="checkbox"/> Reproductive Hazard
Contact PI or the Chemical Safety Office for MSDS	

Principal Investigator: \_\_\_\_\_

Agent(s)/Concentration: \_\_\_\_\_ Dose: \_\_\_\_\_

Date/Time Administered: \_\_\_\_\_

Building: \_\_\_\_\_ Room: \_\_\_\_\_

**For 5 days after administration/exposure AND until bedding is changed:**

- Don gloves, lab coat (or gown or coveralls), and (if required for your location) shoe covers for handling animals and closed cages.
- Open cages (including for cage-change) in ventilated cage-changing station, biological safety cabinet or chemical fume hood. If not available, employees will wear N-95 (or better) respirators when working with open cages.
- Don gloves, (closed-front) gown, shoe covers, and N-95 respirator (plus face shield, safety glasses, or goggles) before dumping bedding. (Note: if bedding is dumped inside fume hood or biological safety cabinet, the respiratory and face protection is not required.)
- Dump bedding in ventilated dumping station, chemical fume hood, or biological safety cabinet, or equivalent.

Emergency Contact	Name	Work Phone	After- hours Number
<b>Primary</b>			
<b>Secondary</b>			
<b>EHS</b>	Chemical Safety Office	706-721-2663	706-664-8607

## APPENDIX S

### AUGUSTA UNIVERSITY High Hazard Chemicals

The [OSHA Laboratory Standard](#) requires that provisions for additional employee protection be included for work involving particularly hazardous chemicals. These chemicals include “select carcinogens”, reproductive toxins, and other chemicals which have a high degree of acute toxicity. Each chemical, compound, drug, functional group or category listed in this document is considered High Hazard Chemicals by Augusta University (Augusta University).

The OSHA Laboratory Standard states for work involving particularly hazardous chemicals, specific consideration are given to the following provisions where appropriate:

- Establishment of a designated area
- Use of containment devices such as fume hoods or glove boxes
- Procedures for safe removal of contaminated waste
- Decontamination procedures

EHS can assist researchers by providing information on working with these hazardous chemicals. General guidelines and recommendations for the safe handling, use, and control of hazardous chemicals and particularly hazardous chemicals can be found in MSDSs and other references such as AUGUSTA UNIVERSITY’s Chemical Safety Guide and **Prudent Practices in the Laboratory**.

#### Establishment of a Designated Area

For projects involving use of any chemical included in AUGUSTA UNIVERSITY High Hazard Chemicals, laboratories should establish a designated area where these chemicals will be used. In some cases, a designated area could be a room out of a suite of rooms, or could mean a fume hood within a laboratory. The idea is to designate one area that everyone in the laboratory is aware of where the high hazard chemicals can be used.

In certain cases of establishing designated areas, Principal Investigators (PIs) and laboratory supervisors may want to restrict use of high hazard chemical to a fume hood, glove box or other containment device. This information should be included as part of the laboratory’s SOPs and covered during the lab and project-specific training.

Establishing a designated area not only provides better employee protection, but can help minimize the area where potential contamination of high hazard chemicals could occur. If a designated area is established, a sign should be posted (on a fume hood for example) indicating the area is designated for use with high hazard chemicals. Most designated areas will have special PPE requirements and/or special waste and spill cleanup procedures as well. These and other special precautions should be included within the lab’s SOPs.

#### Safe Removal of Contaminated Materials and Waste



Some high hazard chemicals may require special procedures for safe disposal of both waste and/or contaminated materials including collecting in special colored bags. When in doubt, contact EHS at 706-721-2663 to determine proper disposal procedures. Once these disposal procedures have been identified, they should be included as part of the laboratory's SOPs and everyone working in the lab should be trained on those procedures.

### **Decontamination Procedures**

Some high hazard chemicals may require special decontamination or deactivation procedures (such as Diaminobenzidine waste or Ethidium bromide) for safe handling. Review MSDSs and the AUGUSTA UNIVERSITY CSO website when working with high hazard chemicals to determine if special decontamination procedures are required. If they are required, then this information should be included in the laboratory's SOPs and appropriate training provided to laboratory personnel who work with these chemicals.

### **OSHA Particularly Hazardous Substances**

Select carcinogens, reproductive toxins, and chemicals with high acute toxicity (also known as "highly toxic") are considered to be high-risk materials and are treated by OSHA as "Particularly Hazardous Substances". Additional provisions for working with Particularly Hazardous Substances are described in the Chemical Safety Guide.

#### **Carcinogens**

Carcinogens are chemicals or physical agents that cause cancer or tumor development, typically after repeated or chronic exposure. Their effects may only become evident after a long latency period and may cause no immediate harmful effects. NOTE: "Select carcinogens", as previously mentioned, also include those chemicals that are considered suspect carcinogens.

#### **Chemotherapeutic/Antineoplastic Agents**

Exposure to chemotherapeutic agents pose a health hazard to lab and animal workers and any waste contaminated with any of these agents must be incinerated in compliance with Georgia EPD regulations. The List of Chemotherapeutic Agents include:

- Arsenic (III) Oxide
- Azaserine
- Chlorambucil
- Cyclophosphamide
- Daunomycin
- Hydrochloride
- Melphalan
- Mitomycin
- Streptozotocin
- Uracil Mustard

The complete NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings 2012 is at, <http://www.cdc.gov/niosh/docs/2012-150/pdfs/2012-150.pdf>

**Reproductive Toxins**

Reproductive toxins include substances that cause chromosomal damage (mutations) or lethal or malformation effects on fetuses (teratogenesis). Many reproductive toxins cause damage after repeated low-level exposures. Effects become evident after long latency periods.

## APPENDIX T

### OSMIUM TETROXIDE STANDARD OPERATING PROCEDURES

Osmium Tetroxide ( $\text{OsO}_4$ ) is highly poisonous, even at low exposure levels, (It is also a severe oxidizer), and must be handled with appropriate precautions. In particular, inhalation at concentrations well below those at which a smell can be perceived, can lead to pulmonary edema, and subsequent death; and exposure to the eye fixes tissue and causes blindness. Osmium tetroxide is regarded as a substance with poor warning properties, and noticeable symptoms can take hours to appear after exposure.  $\text{OsO}_4$  also stains the human cornea, which can lead to blindness if proper safety precautions are not observed.

Prior to using  $\text{OsO}_4$ , the PI must ensure that all students and laboratory workers receive specific instruction regarding the hazards of osmium tetroxide as described in Section VII (1.1.4.) of the Chemical Hygiene Plan (Laboratory Safety Handbook).

#### Control Measures

1. Osmium tetroxide solutions must be prepared and handled in a certified fume hood.
2. Choose a hood with minimal equipment or obstructions, to ensure good capture and exhaust of vapors.
3. Working surfaces should be protected with plastic backed absorbent pads to insure containment of any spills.
4. Post a warning sign on the hood to alert others to that osmium tetroxide is present. The sign should include the hazards of osmium. The Emergency Information Card posted in the hall at the entrance to the lab should also reflect the use of this material.
5. Ensure that the safety shower and eyewash unit are operational, and access is unblocked.

#### Personal Protective Equipment (PPE)

The following minimum PPE must be worn when working with pure osmium tetroxide and concentrated solutions:

1. Splash proof chemical safety goggles (safety glasses alone are not adequate protection because of osmium tetroxide's severe effects on the eyes).
2. Disposable nitrile gloves (NOT latex). Double-gloving is recommended when working with pure osmium tetroxide or concentrated solutions. Double glove and Change gloves frequently and when contaminated, punctured or torn. Wash hands immediately after removing gloves.
3. Standard or disposable laboratory coat or disposable coveralls, buttoned and with the sleeves rolled down. A standard laboratory coat may be reused before laundering if it has not been contaminated with osmium tetroxide. If a garment is contaminated, remove, place in chemical hood, and decontaminate with corn oil or aqueous solutions of sodium sulfide or sodium sulfite before disposing of as hazardous waste or laundering.

## Safe Use Procedures

1. Because of its high acute toxicity and powerful oxidizing ability, Osmium tetroxide must be handled using prudent practices. In particular, all work with osmium tetroxide must be conducted in a fume hood to prevent exposure by inhalation, and personal protective equipment (see above) must be worn at all times to prevent eye and skin contact.
2. Osmium tetroxide should be purchased as a liquid to avoid particulate exposure from the powdered form. The solutions should be stored in labeled tightly sealed containers, and these should be placed in secondary containment.
3. Secondary containment should be used anytime the material is transported to another lab location.
4. When osmium tetroxide is freshly prepared and active, it is colorless to pale yellow in color. When the material reacts and causes oxidation, it turns black. This is helpful to know, especially in the event of a splash or spill or inadvertent dermal exposure (black dots will appear on the skin).
5. When moving pure osmium tetroxide to a chemical hood, do not remove it from the secondary containment until it is in the hood.  
Prepare the smallest amount of solution necessary for the procedure, typically 50 ml or less. Prepare the solution volumetrically rather than gravimetrically. If a balance must be used, weighing must take place in the chemical hood.  
Pure osmium tetroxide or its concentrated solutions must be opened only in a chemical hood that has been certified within the last 12 months. During use, the sash must be lowered to operating height.
6. All labware that has contacted osmium tetroxide must be decontaminated by rinsing or dipping in corn oil or aqueous solutions of ~~sodium sulfide~~ or sodium sulfite before removing from the hood.
7. Immediately after working with osmium tetroxide, decontaminate any spills with kitty litter soaked with corn oil. Dispose of contaminated kitty litter as hazardous waste.
8. Wipe down the area with aqueous solutions of ~~sodium sulfide~~ or sodium sulfite.

## Spills

In the event of a spill, take appropriate actions to prevent exposure of osmium to everyone in the room, and to avoid the spread of contamination. If the spill is small and manageable (less than 2 ml), lab personnel will:

1. Alert personnel in the immediate area.
2. Isolate the area to prevent the spread of contamination.
3. Don appropriate PPE (At a minimum, double gloves, buttoned lab coat and safety goggles).
4. Cover the spill with inert clay absorbent (e.g.: Oil-Dri, or kitty litter) that has been infused with vegetable oil (corn oil is preferred).
5. Scoop the contaminated material up and place it in a glass or plastic container (jar or pail) with a tight fitting lid. The Director of EHS can assist in obtaining an appropriate waste container.
6. Wash the area with an aqueous solution of sodium sulfite.
7. Clean the area again with detergent solution.
8. Remove contaminated PPE carefully and place it in the waste container.
9. Label the container with a properly completed hazardous waste label, and transport to the 180-Day Hazardous Waste Storage Area.
10. Notify the Director of EHS (Chemical Hygiene Officer).(really?)
11. When the quantity spilled is greater than 2 ml, lab personnel will:
12. Evacuate the area, and close all doors leading to lab upon exiting.

13. Place a sign stating “OSMIUM TETROXIDE SPILL; DO NOT ENTER” on the door to warn others of the spill.
14. Call Campus Safety, who will request assistance from the NLFD Hazardous Materials Response Team.
15. Notify the Director of EHS (Chemical Hygiene Officer)
16. **Personnel Exposure**
17. Immediately seek medical attention for any exposure.
18. Skin exposure: Flush exposed skin with water for at least 15 minutes while removing any contaminated clothing.
19. Eye exposure: Flush eyes with water for at least 15 minutes. Affected individuals may need help holding their eyes open under water.
20. Inhalation exposures: If osmium tetroxide vapor has been inhaled from a spill, move the victim to fresh air immediately.

### **Handling and Storage Procedures**

Pure osmium tetroxide and concentrated solutions should be stored in a location that is secure to unauthorized access, such as a locked cabinet, or a refrigerator within a laboratory that is locked when authorized personnel are not present. A refrigerator containing osmium tetroxide must be labeled with a caution sign noting the presence of osmium tetroxide and its hazards.

Store pure osmium tetroxide and its concentrated solutions in appropriate, sealed glass containers within unbreakable secondary containment (i.e., a bottle or vial within a sealed compatible plastic jar or metal can with lid). Label all containers, including secondary containment, with the chemical name and hazard warning.

### **Neutralizing Osmium Tetroxide**

To reduce hazards involved in discarding osmium tetroxide, the following neutralization procedure should be used:

- A 2% solution of osmium tetroxide can be fully neutralized by twice its volume of vegetable oil (corn oil is preferred because of its high percentage of unsaturated bonds). For every 10 mL of 2% osmium tetroxide solution, 20 ml of corn oil is required. Pour the corn oil into the osmium tetroxide solution, and wait for the oil to completely turn black.
- To test if osmium tetroxide is fully neutralized, hold a piece of filter paper soaked in corn oil over the solution. Blackening indicates that osmium tetroxide is still present and more corn oil should be added.
- Aqueous solutions contaminated with osmium tetroxide can be fully neutralized by adding sodium sulfide or sodium sulfite to reduce osmium tetroxide to less hazardous forms.
- Dispose of neutralized solutions as hazardous waste.

## APPENDIX U

### HAZARDOUS CHEMICAL PLACARDS

#### I. PURPOSE

The purpose of this policy is to establish recommended standards for posting hazardous material identification signs or placards at laboratories, rooms, buildings, facilities, and other interior or exterior locations where hazardous materials are stored or used.

Placards or signs are targeted specifically at individuals outside of their normal work area and for outside emergency response personnel who are not familiar with the areas they are entering. They alert emergency responders of potential hazards so they can protect themselves from injury while responding to a fire or other emergency. They are also used to identify rooms and areas where access is restricted or specified personal protection is required. Placards or Signs are standardized to comply with the guidelines for Emergency Responders' Right to Know, and for the uniform posting of hazardous material sites as described in Section 704 of the National Fire Protection Association (NFPA) code, 29 CFR 1910, 40 CFR Part 355, and Sara Title III for hazard communication.

Chemical Placards or hazard warning signs are produced, posted and updated by Environmental Health & Safety Division's CSO staff.

#### II. POLICY

Augusta University shall take every precaution to protect all persons and property against hazards presented by the use, handling, storage, transport and disposal of hazardous chemicals. This includes the production and posting of Standardized Chemical Placards or Hazard Warning Signs at the entrances to all rooms and areas where hazardous chemicals are used or stored. The Standardized Placards or Signs shall comply with Section 704 of the National Fire Protection Association (NFPA) code, 29 CFR 1910, 40 CFR Part 355, and Sara Title III.

Environmental Health and Safety Division provides a Chemical Inventory Database that contains all of the elements necessary to identify areas where hazardous chemicals are used or stored, and to produce Standardized Placards or Signs for posting at entrances to all rooms and areas where hazardous chemicals are used or stored.

All chemical users, including Principal Investigators, Supervisors, and other individuals, who are responsible for areas where hazardous chemicals are used or stored, are required to use the EHS Chemical Inventory Database for capturing and maintaining reasonably accurate chemical inventories.

#### III. RESPONSIBILITIES

##### **Departmental Managers**

Departmental Managers shall be provided access to the EHS Chemical Inventory Database to monitor institutional and departmental information for the rooms under their control, and to notify the CSO of any changes or corrections that need to be made to ensure that information is as

accurate as possible. Departmental Managers are to notify the CSO in advance of any pending changes, such as laboratory openings, transfers/relocations, reassignments, and closings, or other areas where hazardous chemicals will be transferred/relocated, removed/disposed, or for which responsibilities will be reassigned.

Departmental Managers shall also serve as a point of contact for emergencies associated with the buildings or rooms under their management and responsibility, during normal working hours, after hours, weekends, and holidays. Emergency contact information shall be provided to the CSO for posting as required on the Chemical Placard signs for use by Emergency Responders.

**Principal Investigators, Supervisors, & Other Responsible Parties:**

Chemical users are defined as Principal Investigators, Supervisors, and other individuals, who are specifically responsible for areas where hazardous chemicals are used, handled, stored, transported or disposed.

Chemical users shall provide the CSO with the all of the necessary data for creating a chemical inventory account in the EHS Chemical Inventory Database including.

At minimum, all chemical inventories shall be updated twice a year, by January 1<sup>st</sup>, and July 1st of every calendar year using the Chemical inventory Database systems. In addition, chemical users are to complete the Inventory Semi-Annual Review Statement to certify that they have updated their chemical inventories as required.

Principal Investigators or other Chemical Users shall also serve as a Primary Contact for emergencies associated with rooms to which they are assigned, during normal working hours, after hours, weekends, and holidays. Principal Investigators or Chemical Users shall provide an Alternate Contact, who is familiar with the chemicals and processes in their assigned rooms, who can be contacted in the event they cannot be reached for an emergency. Contact information for the Primary and Alternate Contacts shall be provided to the CSO for posting as required on the Chemical Placard signs. Primary and Alternate Contact information is posted specifically for use by Emergency Responders.

**Environmental Health and Safety Division (EHS)**

Environmental Health and Safety Division (EHS) provides, a software package that incorporates all elements needed to achieve regulatory compliance in identifying areas where hazardous chemicals are used, handled, stored, transported, or disposed, and for producing the appropriate Chemical Placards or Hazard Warning Signs for these areas. Institutional and departmental information in the EHS Chemical inventory Database is entered and updated by the CSO using information provided by the Departmental Managers and Principal Investigators.

CSO shall update and post the Standardized Placards/Signs as needed based upon the information provided in the Chemical Inventory Database by Principal Investigators, Chemical Users, and Departmental Directors or Managers.

#### IV. PROCEDURES

Institutional processes and Standard Operating Procedures for the Laboratory Placarding and of Hazardous Chemical Inventories are provide in the Augusta University Chemical & Laboratory Safety Guide.

##### **Chemical Inventory Database:**

The EHS Chemical Inventory Database has a CSA Web access application that allows controlled access to each PI's laboratory or Chemical Users inventory information. The PI or Chemical User will not have the ability to access any information other than his own. The program is secured behind a firewall, is password protected, and cannot be accessed by any unauthorized person inside or outside of the Augusta University Network. Laboratory Worker access to the database will not be provided without approval from each individual PI.

All clinical and research laboratories and other facilities that use, handle, store, transport, or dispose hazardous chemicals are required to comply with the requirements provided under the Chemical Management Program, and to use the EHS Assistant Chemical Inventory Database for inventory and management of their hazardous chemicals and hazardous chemical wastes.

Principal Investigators (PI), Supervisors and other responsible persons where hazardous chemicals are used and/or stored are required to maintain current inventories, with at minimum, semi-annual updates.

Chemical Inventory Updates are to be completed by January 1<sup>st</sup> and July 1<sup>st</sup> of every calendar year using the CSA Web chemical inventory database. Detailed instructions on how to complete the inventory updates are provided in an On-line Training resource and in a Web User's Manual, which is available on the Web at:

<http://www.augusta.edu/services/ehs/chemsafe/databasetrainingresources.php>

When performing the Chemical Inventory Updates, it is expected that a physical review of all chemical in stock be accomplished, and the database updated accordingly. The Semi-Annual Review Statement provided in the database it to certify that the physical review has been accomplished and the inventories are updated as required.

For more information about the Chemical Inventory Program Contact the CSO at 706-721-2663, or talk to your CSO representative.



## APPENDIX V

### **Guidelines for Identifying and Handling Suspicious Mail Packages on Campus**

Augusta University is committed to ensuring the safety of our students, faculty, staff, patients and visitors. In light of recent acts of bio-terrorism around the country, many of us are concerned about the safety of items sent through the mail. To reduce the probability that anyone handling mail at the University could be exposed to false or real safety and health threats (biological, chemical, radiological, bombs) via the mail, all members of the campus community are encouraged to become familiar with the following procedures. **Please disseminate this document to all individuals who handle or open mail.**

(Procedures are based on information provided by the FBI, Postal Service, Centers of Disease Control and Prevention, and the Department of State.)

#### **How to Recognize a Suspicious Mail Item:**

1. Excessive postage.
2. Handwritten or poorly typed address.
3. Misspelling of name.
4. Incorrect titles or misspelled titles.
5. Title, but no name.
6. No return address.
7. Shows a city or state in the postmark that does not match the return address.
8. Misspellings of common words.
9. Excessive weight.
10. Lopsided, rigid or uneven packaging.
11. Oily stains, discolorations or strange odor.
12. Protruding wires or tin foil.
13. Ticking sound.
14. Excessive securing - tape or string.
15. Restrictive markings - Confidential or Personal.

#### **Handling a Suspicious Unopened Mail Item:**

1. Do not open any mail item that appears suspicious.
2. Isolate the suspicious mail item and place it in a plastic bag or container and seal it.
3. If you do not have a bag or container, then cover the mail item with anything (e.g. clothing, paper, trash can, etc.) and do not remove this cover.
4. If possible, place the item in the Glove box until EHS arrives.
5. Ensure that all persons who have touched the mail item wash their hands with soap and water.
6. **Contact David Heath (Mailroom/Receiving Supervisor) immediately at 706-721-3996, Campus Public Safety at 706-721-2911 and EHS at 706-721-2663 and request for them to respond.**

#### **Mail Item with Powder or Powdery Substance Spills out of Mail Item:**

1. **Do not try to clean up the powder.** Cover the spilled contents immediately with clothing, paper, trash can, etc. to prevent spreading the powder and do not remove this cover.
2. If possible, place the item in the Glove box until EHS arrives.
3. Leave the area and close any doors, or section off the area to prevent others from entering.
4. **Call Campus Public Safety immediately at 706-721-2911 and the EHS at 706-721-2663.**
5. Wash your hands with soap and water to prevent spreading the powder to your face.

6. Remove any contaminated clothing as soon as possible and place them in a plastic bag or container that can be sealed. This bag or container should be given to the emergency responders for proper handling.
7. Shower with soap and water as soon as possible.
8. **If possible, list all the people who were in the room or area, especially those who had actual contact with the powder. Give this list to either David Heath or Campus Public Safety and EHS.**

You can find more information about bio-threats on the following Web sites:

1. Centers for Disease Control and Prevention: [www.cdc.gov](http://www.cdc.gov)
2. Federal Bureau of Investigation: [www.fbi.gov](http://www.fbi.gov)
3. Environmental Protection Agency, Chemical Emergency Preparedness & Prevention Office: [www.epa.gov/swercepp/](http://www.epa.gov/swercepp/)
4. United States Postal Service: <http://www.usps.com/news/2001/press/>

## APPENDIX W

### Safe Use of Nanoparticles

#### Augusta University - Environmental Health and Safety Division

#### PURPOSE

To provide health and safety guidance to faculty, staff, students and visitors working with nanomaterials at Georgia Regents University.

#### REASON FOR PROCEDURE

To provide a framework for anticipating, recognizing, evaluating and controlling the potential hazards associated with nanotechnology; however, the procedure is not intended to provide stand-alone guidance, it should be used in conjunction with consultation with the appropriate safety offices (Biological, Chemical, Radiation and Industrial Hygiene) depending on the nature of the nanomaterials used.

There are many unknowns as to whether the unique properties of engineered nanomaterials pose health concerns. The potential health and safety risk following exposure to a substance is generally associated with the following:

- Magnitude and duration of the exposure;
- Persistence of the material in the body;
- Fire and/or explosion;
- Inherent toxicity of the material; and
- Susceptibility or health status of the person.

Unfortunately, there is limited data regarding the health and safety risks related to nanomaterials. As such, this document is to provide EHS-accepted recommendations for practicing prudent health and safety measures when working with nanomaterials. EHS recognizes the limitation of creating a set of procedures that will cover all situations. It is strongly recommended that you check with EH&S prior to project initiation.

#### AFFECTED STAKEHOLDER AND ORGANIZATION(S)

All Georgia Regents University organizational elements, as well as faculty, staff, and students.

#### DEFINITIONS

*Nanoparticle* – A substance with dimensions less than 100 nanometers in size.

*Nanotechnology* – The understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications.

*Nanotubes* - A sheet of graphene rolled up into a seamless cylinder with diameter on the order of a nanometer.

#### INTRODUCTION

Nanotechnology involves the manipulation of matter at nanometer scales to produce new materials, structures, and devices. Nano-objects are materials that have at least one dimension (e.g., length, width, height, and/or diameter) that is between 1 and 100 nanometers. A nanometer, or nm, is  $1 \times 10^{-9}$  meters or one millionth of a millimeter. The term nanoparticles typically refer to materials in which all three dimensions are in the nanoscale. In this document, the term nanoparticles or nanomaterials will refer to purposefully created, engineered particles with at least one dimension between 1 and 100 nanometers.

Nanoparticles may be dry particles, suspended in a gas (as a nanoaerosol), suspended in a liquid (as a nanocolloid or nanohydrosol), or embedded in a matrix (as a nanocomposite). Nanoparticles also exist in several structures, such as nanotubes, nanoplates, and nanofibers.

### EXPOSURE RISKS

The most common route of exposure to a nanomaterial is through inhalation. The deposition of discrete nanomaterials in the respiratory tract is determined by the particle's aerodynamic or thermodynamic diameter. Particles that are capable of being deposited in the gas exchange region of the lungs are considered respirable particles. Discrete nanomaterials are deposited in the lungs to a greater extent than larger respirable particles. Deposition increases with exertion (due to an increase in breathing rate and change from nasal to mouth breathing). It also increases among persons with existing lung diseases or conditions. Based on animal studies, discrete nanomaterials may enter the bloodstream from the lungs and translocate to other organs.

Ingestion is another route whereby nanomaterials may enter the body. Ingestion can occur from unintentional hand-to-mouth transfer of materials. This can occur with traditional materials and it is scientifically reasonable to assume that it could happen during handling of materials that contain nanomaterials. Ingestion may also accompany inhalation exposure because particles that are cleared from the respiratory tract via the mucociliary escalator may be swallowed.

A few studies suggest that nanomaterials may enter the body through the skin during exposure.

### PROCESS & PROCEDURES

1. **Engineering Controls.** The following engineering controls should be used when handling nanomaterials:
  - a. Use of a chemical fume hood or a ducted biosafety cabinet is recommended for all tasks with potential of aerosolizing nanomaterials in either liquid or powder form (i.e. vortexing, sonicating, pipetting, weighing).
  - b. If heavy usage of aerosolized nanoparticles is in use, a proper decontamination, or buffer, area should be utilized to ensure the nanomaterials are not transported outside of the working area, such as the anteroom area in the BSL2+ facility.
  - c. Safety caps or sealed rotors will need to be used for centrifuging nanomaterials. The buckets and/or tubes will need to be opened only in a chemical fume hood or a ducted biosafety cabinet.
  - d. Hand washing facilities must be available.
  - e. Laboratories and other spaces where nanomaterials are used or stored must be equipped with an eyewash station.
  
2. **Administrative Controls.** All work involving nanomaterials requires approval from the appropriate safety committee (Biological, Chemical and Radiation) depending on the nature of the nanomaterials. The PI will need to ensure that he/she:
  - a. Has an Institutional Chemical Safety Committee (ICC) number
  - b. Has listed the nanomaterials on their chemical inventory
  - c. *If the nanomaterials involve biological hazards*, that they are listed on a Biosafety Protocol Application or Amendment.
  - d. *If the nanomaterials involve radiation hazards*, that they are listed on a Radiation Safety Protocol Application or Amendment.
  - e. Has a written set of Standard Operating Procedures indicating the safety measures that will be employed to address the risks of working with nanomaterials.
  - f. Laboratory personnel must receive the appropriate training, including specific nanomaterial-related health and safety risks, standard operating procedures, and steps to be taken in event of an exposure incident, prior to working with nanomaterials.
  - g. An inspection of the laboratory where the nanomaterials will be used is required to conduct a site-specific risk assessment to determine the potential hazards associated with the experimental procedures involving nanomaterials.
  - h. Exposures involving nanomaterials or any other acutely hazardous material must be reported to Environmental Health and Safety, as soon as possible, after medical

attention has been sought if necessary. Clothing contaminated with nanomaterials should be removed immediately. Do not take contaminated work clothes home – contaminated clothing may require disposal as hazardous waste.

3. **Special Practices.** The following special practices are to be employed in addition to standard/prudent practices for handling materials dispersed via aerosolization.
  - a. Limit the amount of material present in the lab or being worked with at any given time to only the amount necessary to perform the experiments.
  - b. Needles used for nanomaterial injection must be disposed in an approved sharps containers immediately following use.
  - c. Needles used for nanomaterial injection should never be bent, sheared, or recapped.
  - d. Bench paper utilized during preparation of nanomaterial stock should be lined with an impervious backing to limit potential for contamination of work surfaces in the event of a minor spill.
  - e. Work areas should be cleaned at the end of each work shift by wet wiping methods (absorbent material dampened with soap and water following by a disinfectant if necessary for the agent that the nanoparticle is carrying). Dry sweeping or pressurized air should not be used to clean work areas.
  - f. Bench tops, chemical fume hood interiors, biological safety cabinet interiors, equipment, and laboratory surfaces with potential for nanomaterial contamination should be routinely cleaned. Cleanup should be conducted in a manner that prevents worker contact with wastes.
  - g. The disposal of all waste material should occur in a containment device and be bagged upon exiting the containment device. Powdered materials will need to be wetted prior to disposal.
  - h. Laboratory personnel must be instructed to use extreme caution when performing injections involving nanomaterials since accidental needle stick presents an exposure threat.
  - i. The storage and consumption of food or beverages in workplaces is prohibited where nanomaterials are handled, processed, or stored, since exposure may occur via ingestion.
  - j. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the restroom.
4. **Personal Protective Equipment (PPE).** The following PPE will need to be employed when handling nanomaterials:
  - a. *Protective Gloves* - Glove selection is best determined by a risk assessment and the chemicals used for the procedure. Nitrile or rubber gloves, which cover hands and wrists completely through overlapping sleeve of lab coat when working with nanomaterials, may provide adequate protection. Wearing of two sets of gloves (“double gloving”) is advised whenever performing tasks involving nanomaterials and other hazardous substances.
  - b. *Eye Protection* - Safety glasses or goggles are considered to be the appropriate level of eye protection for working with nanomaterials
  - c. *Protective Clothing* - Laboratory coats or disposable gowns that provide complete coverage of skin must be worn when working with nanomaterials.
  - d. *Respiratory Protection* - If engineering controls are not adequate or are not available, and a potential aerosol exposure exists, respiratory protection is required (i.e. filtering face piece (N-95 or greater)). Anyone required to utilize respiratory protection must contact Employee Health and Wellness for medical clearance.
5. **Use of nanoparticles in animals.** *If the nanomaterials will be introduced into animals*, this must be reviewed and approved by the Institutional Animal Care and Use Committee. The standard engineering controls and PPE recommended above should be employed. If manipulation of nanomaterials will need to occur outside of containment, double gloves, gown,

safety goggles or safety glasses, and N-95 or equivalent respirators will need to be worn. The following additional precautions should be taken:

- a. Animals should be appropriately restrained and/or sedated prior to administering injections and other dosing methods.
  - b. Nanoparticles in suspension should be injected in a chemical fume hood or a ducted biosafety cabinet; however they may be injected in to animal on a bench top covered with absorbent paper. Absorbent paper should be changed after each experiment and disposed as nanoparticles waste. Dispose of the syringe in an approved sharps container.
  - c. If an oral preparation is being administered via a syringe or other feeding device, a fume hood or ducted biosafety must be used. If administration is by food, use of a microisolator cage is recommended.
  - d. If being administered as an aerosol, a chemical fume hood or a ducted biosafety cabinet must be used.
  - e. Exposed animals must be housed under BSL-2 conditions. Downgrading may be considered on a case-by case basis.
  - f. All bedding and waste must be bagged and incinerated.
  - g. All potentially contaminated carcasses, bedding and other materials must be disposed of through incineration.
  - h. Any surplus nanoparticle stocks must be disposed of as hazardous waste.
6. **Spills.** Anyone attempting to manage any spill involving hazardous agents must be wearing the appropriate PPE described above. OSHA advises typically standard approaches to cleaning nanomaterial powder and liquid spills include the use of HEPA-filtered vacuum cleaners, wetting powders down, using dampened cloths to wipe up powders, and applying absorbent materials or liquid traps. At a minimum, the following procedures must be followed when managing an accidental spill of nanomaterials:
- a. *Small spills (typically involving less than 5 mg of material)* of nanomaterials containing powder should be wet-wiped with cloth/gauze that is dampened with soapy water. Affected surfaces should be thoroughly wet-wiped three times over with appropriate cleaning agent and with a clean, damp cloth used for each wipe down. Following completion, all cloth and other spill clean-up materials with a potential for nanomaterial contamination must be disposed of as hazardous waste.
  - b. *Small spills (typically involving less 5 ml of material)* of nanomaterial-containing solutions should be covered and absorbed with absorbent material. Areas affected by liquid spills should be triple cleaned with soap and water following removal of absorbent paper.
  - c. *For larger spills* of nanomaterials, contact the Environmental Health and Safety at 706-721-2663 for assistance.
7. **Wastes.** Surplus stocks and other waste materials containing greater than trace contamination must be disposed of through the Chemical Safety Office. Due to the fact that certain nanomaterials may be unaltered during metabolism, all potentially contaminated animal carcasses, bedding, and other materials must be disposed as Biohazardous waste (through incineration). All potentially contaminated materials in used in the laboratory should be disposed of in the biohazard containers (bagged and/or wetted).

## FORMS AND RELATED DOCUMENTS

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**APPENDICES:**

GRU Safety or Compliance Committees or Offices:

Biological Safety Office:

<http://www.augusta.edu/services/ehs/biosafe/>

Chemical Safety Office:

<http://www.augusta.edu/services/ehs/chemsafe/>

Radiation Safety Office:

<http://www.augusta.edu/services/ehs/radsafe/>