# LABORATORY SAFETY MANUAL
# TABLE OF CONTENTS

## A. RESPONSIBILITIES SUMMARY

At Georgia Gwinnett College (GGC), we are all responsible for our own safety as well as the safety of those we impact. That is why each of us is responsible for and evaluated on how well we know and follow safe work practices.

Safety is a part of every job, and the person most able to ensure the safety of your job is you. Your role is to know the safety and health hazards related to your job. Become skilled at probing for and recognizing unsafe conditions or rescogd t BeAnmpacordantart of evur joj-19.07935 .15 TD-.0003 Tc.0021 Tw[ ((b is yo )Trk prfe land

## 3.0 LABORATORY PERSONNEL

3.1 Plan and conduct each operation in accordance with the standards outlined in the Laboratory Safety Standards Manual.

## B. CHEMICAL HYGIENE PLAN

### 1.0 LABORATORIES COVERED UNDER THIS CHEMICAL HYGIENE PLAN:

Laboratories are defined by the OSHA Standard (29 CFR 1910.1450) as facilities where relatively small quantities of hazardous chemicals are used on a non-production basis. Quality control labs normally do not fall under this standard because QC is considered to be a part of production. Laboratories under the OSHA definition include locations where chemical manipulations are carried out in containers designed to be easily and safely manipulated by one person, excluding preparation of commercial quantities, where multiple chemical procedures or chemicals are used, where procedures are not part of nor simulate a production process, and where laboratory procedures, practices, and equipment are available, effective, and in common use to minimize potential for employee exposure to hazardous chemicals.

### 2.0 CHEMICAL HYGIENE OFFICER

The Chemical Hygiene Officer is responsible for overseeing the implementation of the Chemical Hygiene Plan. The Chemical Hygiene Officer is Janet Whelan ext. 5032.

Although the Chemical Hygiene Officer has been given the responsibility for overseeing the implementation of this plan, it is the responsibility of each faculty/staff member, supervisor to insure that the procedures contained in this manual are followed. See Section A Employee Responsibilities.

This Chemical Hygiene Plan has been incorporated into GGC's already existing Laboratory Safety Standards Manual. This plan was developed and designed to be:

- Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory, and
- capable of keeping exposures below OSHA's PELs and other, more stringent exposure limits.

## C. PRUDENT LAB PRACTICES

### 1.0 GENERAL PRINCIPLES

1.1 Plan your work to avoid working alone in the laboratory.

1.2 Know the safe ways to do your job.

1.3 Do not perform any job task until you have been appropriately instructed on the equipment or process by your supervisor or qualified individual.

1.4 Follow all established safety rules and regulations.

1.5 Report all unsafe conditions or practices to your supervisor.

1.6 NO PRACTICAL JOKES!

1.7 Know the location of and how to use emergency equipment in your area.

1.8 Be familiar with emergency procedures.

1.9 Know the types of protective equipment necessary for the job.

1.10 All mechanical equipment must have guards that prevent access to electrical connections or moving parts.

### 2.0 HOUSEKEEPING

2.1 Work areas should be kept clean and free from obstruction.

2.2 Cleanup should follow the completion of any operation or at the end

## 3.0 GLASSWARE

3.1 Adequate hand protection must be used when inserting glass tubing into stoppers or when placing rubber tubing on glass hose connections.

3.2 Only glassware designed for vacuum work should be used for that purpose.

3.3 Hand protection should be used when picking up broken glass.

3.4 When rinsing glassware that contained chemistry, discard the first rinse volume into the appropriate waste container. Subsequent water rinses can be discarded to the sink.

## D. EMERGENCY PROCEDURES

### 1.0 SUMMONING EMERGENCY ASSISTANCE

The following actions are to be used to activate emergency assistance:

| Emergency Type | Dial or Activate |
|---|---|
| **Chemical spill** | **#5034** |
| **First Aid** | **#5034** |
| **Serious medical injury** | **9-911** |
| **Fire** | **Fire alarm pull box/9-911** |

### 2.0 PERSONAL INJURY

2.1 If you are injured, obtain prompt medical assistance.

2.2 All accidents, injuries, illnesses, and near misses must be immediately reported to your supervisor.

2.3 An “Accident Investigation Report” must be completed within twenty four (24) hours.

2.4 In case of chemical contact:

2.4.1 Flush exposed area with water in the nearest eye wash or safety shower for a minimum of 15 minutes.

2.4.2 Remove contaminated clothing and continue washing.

2.4.3 Get help by dialing #5034 and notify your supervisor and Environmental Health and Safety Officer.

### 3.0 EVACUATION

3.1 Familiarize yourself with the evacuation routes and the location of the nearest exits.

3.2 When the building alarm sounds all employees must evacuate via the nearest designated emergency exit and proceed to the designated assembly areas.

3.3 Do not call the operator or security unless you have an emergency to report. These lines must be kept open for evacuation-related calls.

3.4 Follow directions given to you by your supervisor, manager or evacuation monitor.

## D. EMERGENCY PROCEDURES – continued

5.4 Clean-up procedure - continued

5.4.3 The spill must be diked, neutralized (if possible) and placed in a labeled container for disposal.

## E. RISK ASSESSMENT - PROCESS OPERATIONS – continued

APPENDIX E1

# JOB SAFETY ANALYSIS (JSA)

| | | |
|---|---|---|
| **Job Description:** | | |
| **Prepared By:** | **Department:** | **Date:** |

**APPENDIX E2**

## PRELIMINARY HAZARD ANALYSIS
## for Laboratory Operations

Author: _____

Date: _____

Instrument or Procedure:_____
Lab location: _____

PHA Participants (other than author): _____

EH&S Review Recommended: Yes No

**MATERIAL:**

_____

_____

_____

_____

Are any new chemical substances (NCS) involved? Yes* No

***If the NCS is shipped outside the laboratory, an MSDS must be sent with it and the recipient notified in writing in advance that an NCS is being sent.***

A. List ALL chemicals to be used in the operation. (Attach a list if more than 6.)

| | |
|---|---|
| 1 | 4 |
| 2 | 5 |
| 3 | 6 |

B. Review the current MSDS sheets for each of the chemicals listed in A.

**PRELIMINARY HAZARD ANALYSIS**

C. List those materials (from above) which will require the use of special protection, handling, medical monitoring, storage, or disposal. Identify the HAZARD and the appropriate precaution to be taken.

| MATERIAL | HAZARD | PRECAUTIONS REQUIRED |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

D. List the spill supplies needed at location of operation.

| |
|---|
| |
| |
| |

E. Identify the waste stream(s) (if applicable).

| |
|---|
| |
| |
| |

**II. PROTECTION:**

In addition to SAFETY GLASSES, list the minimum protective equipment for this operation:

| **Protection** | **Required (Yes/No)** | **Protection** | **Required (Yes/No)** |
|---|---|---|---|
| Splash Goggles | | Respirator | |
| Face Shield | | Safety Shoes | |
| Gloves | | Apron | |
| Ear Plugs | | Other (Specify) | |

Comments: _____

_____

**PRELIMINARY HAZARD ANALYSIS**
**for Laboratory Operations – Page Three**

## III. HAZARDS ASSOCIATED WITH LABORATORY OPERATION:

Carefully consider each question as it applies to your operation. Check (√) those that require clarification and include what safeguards are in place to address the perceived hazards.

### A. REACTIONS/PROCEDURES:

Is there a hazard due to any one of the following?

- ☐ Runaway chemical reaction or side reactions
- ☐ Loss of cooling
- ☐ Blocked vent lines
- ☐ Equipment/power failure
- ☐ Loss of temperature control
- ☐ Loss of pressure control
- ☐ Faulty pressure/temperature monitoring devices
- ☐ Inadequate ventilation
- ☐ Glassware/apparatus failure

### B. EQUIPMENT:

- ☐ Radiation

**for Laboratory Operations – Page Four**

**B. EQUIPMENT:**

- ☐ Pump control failure
- ☐ General power failure
- ☐ Service failure (house/water pressure/hoods/compressed gases/$N_2$)
- ☐ Instrument alarm failure
- ☐ Control system loss (computer failure)
- ☐ Potential hazards not yet mentioned
- ☐ Are there potential hazards associated (e.g., electrical shock)?
- ☐ Out of hours operation

**C. ARE OPERATING INSTRUCTIONS NEEDED?**
YES NO

**IV. OUT OF HOURS OPERATION:** Approved?
YES NO

**V. EQUIPMENT EMERGENCY SHUTDOWN PROCEDURE:**
Describe emergency shutdown for equipment. Post in lab at time of PHA.

| |
|---|
| |
| |

**VI. IMMEDIATE MODIFICATIONS TO BE DONE/GENERAL COMMENTS:**

| |
|---|
| |
| |

**F. EQUIPMENT**

## 1.0 LABORATORY METHODS FOR HEATING SOLUTIONS

### 1.1 SOLUTION HEATING: IMMERSION HEATERS

1.1.1 Immersion heaters *must be an integral part of a heater-controller system.*

1.1.2 For *in situ* heating, use Teflon™ coated immersion heaters only.

1.1.3 Controllers: Must be equipped with the following features:

Thermistor-controlled solution temperature

**Laboratory**

## 2.0 ELECTRICAL EQUIPMENT: GENERAL STANDARDS – cont.

2.2.2 Remove the item to Maintenance to ensure timeliest return to service.

2.3 EXTENSION CORDS: Use only if necessary

2.3.1 When necessary, they must be supported and secured.

2.3.2 They must not lie on the floor or across aisles (lab or office).

2.4 Locate Variacs and other electrical items in a way which protects them from spills or leaks.

2.5 The choice of solution agitation equipment should take into account the flammability rating of the substances.

2.6 Since flammable solvents pose a static discharge hazard during pouring, minimize the container-to-container free fall distance when transferring.

2.7 Switch off all appliances before removing plugs from outlets in order to avoid voltage surges when plug is reinserted to the outlet.

2.8 All appliances must have grounded plugs.

2.9 **Remember** to **unplug** all electrical equipment at the end of each workday.

## 3.0 VACUUM PUMPS

3.1 Distillation or concentration operations using volatile materials should normally be performed using a water or steam aspirator instead of a mechanical vacuum pump.

3.2 Mechanical vacuum pumps should be used for the distillation of less-volatile materials, the removal of final traces of solvents, or other operations that require pressures lower than those obtained via aspiration.

## F. EQUIPMENT – cont.

## 3.0 VACUUM PUMPS - continued

3.2.1 Input lines from the system to the vacuum pump need to be fitted with a cold trap to collect volatile materials from the system and minimize the amount that enters the pump and pump oil.

3.2.2 Do not use liquid nitrogen or liquid air in cold traps. The use of these liquid materials increases the flammability hazard.

3.2.3 The output of each pump should be vented to an exhaust system.

## 4.0 DRYING OVENS

4.1 Volatile materials should not be dried in a conventional laboratory oven unless the oven has continuous ventilation of the atmosphere **inside** the oven.

4.2 "Explosion proof" drying ovens with rear blow-out panels should be used for volatile materials.

4.3 Bimetallic strip thermometers should be used for monitoring oven temperatures. Mercury thermometers should not be mounted through holes in the tops of ovens.

## 5.0 REFRIGERATORS

5.1 Laboratory refrigerators must never be used for the storage of food or beverages.

5.2 "Explosion-proof" refrigerators are to be used for storing flammable or combustible materials.

5.3 Uncapped containers should never be placed in a refrigerator.

## 6.0 STIRRING AND MIXING DEVICES

6.1 Only spark-free induction motors should be used to run stirring and mixing devices.

6.2 Stirring motors that will be left unattended should be fitted with a suitable fuse or thermal-protection device.

6.3 For stirring motors that will be left unattended, it is good practice to attach a stirring impeller to the shaft of the stirring motor by using lightweight rubber tubing. If the motion of the impeller becomes blocked, the rubber will twist until it breaks.

## G. COMPRESSED GASES, PRESSURE REACTIONS,

## AND VACUUM WORK

### 1.0 COMPRESSED GASES

1.1 Gas cylinders must be firmly secured at all times.

1.2 Only Compressed Gas Association (CGA) standard combinations of valves and fittings can be used in compressed gas installations.

1.3 Compressed gas cylinders must be placed so that the cylinder valve is accessible at all times.

1.4 When the cylinder is not in use, the main cylinder valve must be closed.

1.5 The main cylinder valve should be opened slowly and only to the extent necessary. It is never necessary to open the main cylinder valve all the way.

1.6 Empty cylinders must be clearly marked as "empty" and returned to a storage area.

1.7 Empty and full cylinders should not be stored in the same place.

### 2.0 PRESSURE VESSELS

2.1 Inspection and Testing

2.1.1 You must always know the allowable working pressure of a vessel. The allowable pressure should be stamped on the vessel or be attached via a name plate.

2.1.2 All pressure equipment must be tested or inspected periodically. Consult the equipment's instructions or manufacturer for the appropriate testing intervals.

2.2 Assembly and Operation

2.2.1 Piping must not be used to support the weight of the equipment.

## G. COMPRESSED GASES, PRESSURE REACTIONS,

## 2.0 PRESSURE VESSELS – cont.

2.2.2 All threaded connections must match correctly and not be forced.

2.2.3 Sharp tubing bends should be avoided.

2.2.4 **All pressure reactions must be shielded**.

2.2.5 Adequate space should be left in all vessels to accommodate the expansion of liquids.

2.2.6 Signs or placards should be placed in the area to inform others of the reaction in progress.

2.3 Pressure-Relief Devices

2.3.1 All pressure or vacuum systems and all vessels that will be subjected to pressure or vacuum must be protected by pressure relief devices. Rupture discs and spring-loaded valves are examples of pressure-relief devices.

2.3.2 The maximum operating pressure of the system must never exceed two-thirds of the rated working pressure of the vessel or system.

2.3.3 The maximum setting for the pressure-relief device must be less than the rated working pressure for the vessel or for the weakest member of the pressure system.

2.3.4 Shutoff valves must not be placed between the equipment and the pressure-relief device.

2.3.5 The discharge side of a pressure-relief device must be vented to a safe area (e.g.: a lab hood).

## G. COMPRESSED GASES, PRESSURE REACTIONS,

## H. CHEMICAL PROCUREMENT, LABELING AND STORAGE

### 1.0 Procurement of Chemicals

1.1 Prior to ordering, determine whether the chemical is in stock.

1.2 Space must be allocated for storage of the chemical before ordering.

1.3 Order only quantities that are necessary for the project. Remember: **"Less is better**".

1.4 Fill out a “Material Request Form” and give it to Lab Support.

1.5 Upon receipt of the chemistry, make sure the date received and the owner’s initials are on the label.

1.6 If unused chemistry is not needed in the laboratory, return it to Lab Support.

### 2.0 Chemical Labeling

2.1 Chemical containers must be labeled.

2.2 Portable chemical containers, intended only for the **immediate** use of the employee, do not require labels. Remember, immediate use means that it can not be left unattended

2.3 Labels on incoming containers of hazardous materials should not be removed or defaced. Other information placed on the container should not obscure or detract from existing labels.

2.4 Recommendations found on labels should be read and followed.

## H. CHEMICAL PROCUREMENT, LABELING AND STORAGE - continued

## 3.0 Chemical Storage

3.1 All chemicals must be stored according to chemical compatibility..

3.2 Chemicals should be stored in areas designed for chemical storage. Storage rooms, storage cabinets, storage shelves and refrigerators are examples of appropriate areas.

3.2.1 Flammable liquids should be stored in approved flammable liquid storage cabinets.

3.2.2 Corrosives should be stored in approved corrosive storage cabinets

3.3 Chemicals must not be stored in offices, desks or file cabinets.

3.4 Chemicals should not be stored on bench tops because they are unprotected from potential exposure to fire and they are more readily knocked over.

3.5 Chemicals should not be stored on the floor or in the aisles.

3.6 Nothing may be stored on top of cabinets, shelves or shelf racks in the laboratory.

3.7 Except for work in progress, chemicals and equipment should not be stored in lab hoods. Lab hoods are designed to provide protection when working with hazardous materials. Storing chemical and equipment in lab hoods can interfere with the air flow in the hood and compromise the protection afforded the hood operator.

# I. HAZARDOUS WASTE DISPOSAL

## J. PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Personal protective clothing and equipment, in conjunction with emergency procedures, help to minimize injuries or damage. Every laboratory worker must be familiar with the location and proper use of the available protective clothing and safety equipment.

### 1.0 EYE AND FACE PROTECTION

1.1 Contact lenses may not be worn when working in a laboratory.

1.2 Safety glasses with side shields must be worn by **all** people (including visitors) entering into or working in a laboratory where chemicals are used or stored. Only glasses meeting the American National Standards Institute requirements or equivalent are acceptable.

1.3 Ordinary prescription glasses are not acceptable unless protective goggles are worn over them.

1.4 Goggles (or face shield) must be worn when splashing is a possibility.

1.5 Full-face shields must be used when working with glassware under reduced or elevated pressure, glassware used in high-temperature operations, or any time there is a possibility of implosions or explosions.

1.6 Specialized eye protection may be needed when working with lasers, ultraviolet light sources, or intense lights sources. Consult with EH&S when choosing specialized eye protection.

### 2.0 HAND AND ARM PROTECTION

2.1 Chemical resistant gloves must be worn when handling corrosive materials, toxic materials, or materials of unknown toxicity.

2.2 Gloves must be selected on the basis of the material being handled and the operation being conducted. One type of glove is not suitable for all chemicals.

.

2.3 Before each use, gloves must be inspected for any defects.

2.4 Gloves must be discarded if any defects are found.

2.5 Gauntlet style (elbow length) gloves should be worn when the potential exists for chemical exposure to the forearm.

## J. PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

### 2.0 HAND AND ARM PROTECTION - continued

2.6 Leather gloves or equivalent should be used for handling broken glassware or manipulating glass tubes.

2.7 Before removal, gloves should be washed appropriately. (NOTE: Some gloves are water permeable.)

2.8 Gloves must be removed before leaving the work area.

### 3.0 FOOT PROTECTION

3.1 Laboratory personnel are required to wear closed toe.

### 4.0 BODY PROTECTION

4.1 Laboratory coats must be worn when working in the laboratory.

4.2 Rubber aprons should be worn when handling corrosive liquids.

4.3 Coats and aprons must be removed when leaving the laboratory. Lab coats are prohibited from being worn in meeting rooms and cafeterias.

### 5.0 RESPIRATORY PROTECTION

5.1 Laboratories are designed so that respiratory protection is not usually needed because of the engineering controls in place (i.e. laboratory hoods).

5.2 When effective engineering controls are not possible, respiratory protection should be provided. Refer to the EH&S “Respiratory Protection Policy”.

### 6.0 SAFETY SHOWERS

6.1 Safety showers must be provided in all areas where chemicals are handled.

6.2 Safety showers must be located in areas that are accessible and unblocked by obstacles.

6.3 The shower should have a quick opening valve which requires manual closing.

6.4 Safety showers must be tested at least quarterly.

## J. PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT - Continued

### 7.0 EYEWASH FOUNTAINS

7.1 Eyewash fountains must be provided in all laboratories where chemicals are handled.

7.2 Eyewash fountains must be capable of providing at least 15 minutes of water in a soft stream.

7.3 Fountains should be located close to the safety showers so that, if necessary, the eyes can be washed while the body is showered.

7.4 Eyewash fountains must be tested at least monthly.

## K. VENTILATION

### 1.0 Laboratory Hoods

1.1 All chemical operations that may generate air contaminants are to be conducted in a hood.

1.2 Conduct all work at least 6 inches back from the face of the hood. Hoods are to be kept clear and the sash at the proper working height.

## L. ENVIRONMENTAL MONITORING

Environmental monitoring is not normally warranted or applicable in a laboratory setting. However, on occasion a situation will arise that requires environmental monitoring. In most cases, the monitoring is conducted to assess the effectiveness of the ventilation equipment.

### 1.0 General Exposure Reduction Principles

1.1 Even for small substances of no significant hazard, exposure should be minimized.

1.2 It should be assumed that any mixture will be at least as toxic as its most toxic component.

1.3 All containers of chemicals must be capped or sealed to avoid escape into the work atmosphere.

1.4 Permissible exposure limits (PEL) and Threshold Limit Values (TLV) should never be exceeded. All routine exposures above 50% of these limits will require engineering or administrative control measures.

1.5 Threshold limit values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.

### 2.0 Monitoring Requests

2.1 If you are concerned about any exposures in your workplace, contact EH&S.

2.2 A job review and workplace assessment will be conducted to determine if environmental monitoring is warranted.

2.3 If monitoring is conducted, you will be notified of the results obtained.