E. Working in the Laboratory

1. Emergency Procedures

a. General emergency phone numbers:

911 (from campus phones only)

348-5454 University Police (direct number)

Do not call 911 from your cell phone: the call will be routed to Tuscaloosa City EMS and will delay the dispatch of assistance. Call the UA police direct number (205-348-5454)

Report nature and location of the emergency; give your name, telephone number, building and floor number. Tell the operator where you will meet the emergency vehicle. If an individual is involved, report whether he/she is unconscious, burned, trapped, etc.; whether an explosion has occurred, whether smoke or poison gas may be present; or whether there has been a chemical or electrical fire.

b. In Case of Personal Injury...

i. Take all steps necessary to prevent further injury. Apply first aid if trained and call UA police at 348-5454, if necessary.

ii. If the victim(s) is (are) found unconscious for no apparent reason, **DO NOT ENTER THE ROOM** – a poison gas may be present. Obtain assistance immediately (call police 348-5454) and notify other persons in the area. **NO ONE SHOULD ENTER UNLESS EQUIPPED AND TRAINED IN THE USE OF PROPER EMERGENCY EQUIPMENT.**

iii. Check if the victim is in contact with an electrical circuit; if so, **DO NOT TOUCH HIM/HER WITHOUT DISCONNECTING THE POWER FIRST**, then apply first aid. Call UA police (348-5454) to arrange for medical assistance.

c. While Waiting for Assistance, Do What Is Necessary to Protect Life!

i. Do not move an injured person unless he/she is in further danger. Keep him/her warm.

ii. If his/her clothing is on fire, wrap him/her in a coat, blanket or whatever is available to extinguish the fire (Remember: **Stop, Drop, & Roll**). Remove any clothing contaminated with chemicals. Douse with water to remove heat and place clean, wet, ice-packed cloths on burned areas, and keep warm. Get medical attention immediately.

iii. If injured person is not breathing, provide artificial respiration if you are trained. Mouth-to-mouth method should not be used in cases of gas poisoning.

iv. If the victim is bleeding severely, control the bleeding by compressing the wound with a cloth, and elevate the injury above the level of the heart.

v. If chemicals have been spilled on a person, get him/her under a shower or spigot to wash thoroughly the affected area. If the person has chemicals in his/her eyes, irrigate with water for 15 minutes. Check for and remove any contact lenses.

d. In Case of Fire or Explosion...

i. Evacuate the immediate area.

ii. Attempt to extinguish flames only if you have received the required UA safety training in the use of portable fire extinguishers. Many fires may be extinguished with dry-chemical ABC extinguishers.

P Pull the pin
A Aim at the base of the fire
S Squeeze the trigger
S Sweep

For fires involving metals or metal hydrides, use sand to smother the flames.

iii. If the fire is not completely out after discharging one extinguisher, close the door of the laboratory, call the UA Police (348-5454) and warn other people in the building by sounding the fire alarm. If you decide to continue fighting the fire, **OBSERVE EXTREME CAUTION**. Consider that hot spots can re-ignite, the air in the immediate area may be hot enough to cause lung damage, oxygen in the air may be used up, fire can travel through walls and break out behind or beside you, gas cylinders may explode in the intense heat, smoke and poisonous fumes can kill, and solvent cans or bottles could burst creating an inferno. Do not try to be a hero.

iv. When fire alarm sounds, all persons should shut off gas, water, and appropriate electric-powered equipment, close doors and windows, and immediately exit the building by the nearest unobstructed stairs. **DO NOT USE THE ELEVATOR. DO NOT STOP TO RETRIEVE PERSONAL BELONGINGS. Take your keys and wallet with you (as well as a coat) in case you cannot re-enter the building. Shelby Hall administrative personnel can be found in the North parking lot.**

v. Remain outside the building until permission to re-enter has been given by security personnel.

2. Laboratory Safety

Safety is Your Personal Responsibility. You are working with materials that may be extremely hazardous to the safety of yourself and your fellow-workers. Think safety - work safely. You, the Department and the University have legal responsibilities to do your work safely in a safe environment. Safety is not only the safety of you and all others in the areas in which you work but also for the environment. You must successfully complete all UA required safety courses.

- Know the characteristics of each of the chemicals you will use – their toxicity, flammability, reactivity, and environmental impact.

- Know the safety limits of the chemicals you will use – their flash point, their auto-ignition temperature, etc., and what to do if you exceed these limits.

- Check your equipment before you start.

- Be sure that you have installed the necessary mechanical safety devices, shields, hoods, etc., before you start and that they are more than ample to handle any contingency.

- Make sure that electrical connections are made properly.

- Protect your eyes, your face, your hands, and your body. Always wear appropriate eye protection, proper gloves and proper protective clothing. Over-protect yourself rather than under-protect yourself. Closed toe shoes are required in the laboratory. Garments with low-flammability are required especially when working with flames or flammable reagents.

- Contact lenses do not serve as protection against eye injury and do not substitute for safety glass and chemical splash goggles. Many organizations, including the National Institute for Occupational Safety and Health (NIOSH) and the American Chemical Society have removed most restrictions on wearing contact lenses in the laboratory. However, some lens materials are hazardous when worn in the presence of certain chemicals. Before an individual chooses to wear contact lenses in the laboratory, they and their laboratory supervisor must consult SDS for information regarding contact lenses and specific chemicals present. If contact

lenses are deemed safe to be worn in the lab, chemical splash goggles must be worn as primary eye protection.

- Practice good housekeeping. Keep your bench area clean and free from extraneous articles. Wipe up spills immediately. Dispose of waste (chemical and other such as glass) in proper closed receptacles. No food or drink in the laboratory.

- Know the location of eye baths, safety showers, and fire extinguishers, how to get to them quickly, and how to use them. There is no smoking on campus.

- Make safety a habit. THINK SAFETY... The safe habit is always a good one...on the job, at home, everywhere!

3. Minimum Safety Regulations for Research Laboratories

In order to create safer laboratories and also to meet federal and state safety regulations, the safety rules and procedures, as outlined in the booklet, Chemical Laboratory Safety Manual, have been adopted by the Department of Chemistry & Biochemistry. These rules are not attempts to restrict or hamper research. Instead, they are based on common sense and enacted for the benefit and safety of everyone. **Your cooperation is required**. Please bring your laboratories and your laboratory procedures into conformity with these principles. Please remind others to do so. These regulations are mandated by OSHA and the EPA.

The departmental Safety Committee and/or UA Environmental Health and Safety (EHS) personnel will make unannounced inspections of laboratories. All hazards will be recorded, and anyone working in that laboratory will be given a list of deficiencies and instructions on their improvement. The deficiencies will be reported to the faculty research advisor responsible for that laboratory as well as to the Department Chair. Furthermore, the laboratory will be re-inspected to see that the listed deficiencies have been corrected. A comprehensive listing of all deficiencies found will be compiled so that (a) these problems can be discussed at department-wide safety meetings and (b) so that serious problems or frequently encountered problems may be brought to everyone's attention for immediate resolution.

Each of you can make an important contribution by taking this list and systematically checking and correcting unsafe conditions in your laboratory. Please conduct your laboratory operations in accord with these regulations. Most importantly, please develop a positive attitude about this safety effort. It is each of you who stand to benefit most from these efforts. Later in your career, each of you will probably be responsible for the safety of others working with you. Thus, most of the following regulations are nothing more than procedures which will be with you as long as you are in chemistry. A digest of some of the more common rules and procedures is given in the following pages. For a more complete and authoritative coverage of each of these areas, please consult the Chemical Laboratory Safety Manual.

a. Safety Equipment and Familiarity

i. Each student must make know where the fire extinguisher is located in their laboratory. They must know the location of and how to use fire extinguishers and

fire buckets with sand. They must successfully complete the annual UA fire safety course.

ii. Each student must be aware of the location of and know how to use eyewash fountains, showers, fire-blankets, and emergency kits.

b. Do not smoke in the laboratories or anywhere else on campus

The University of Alabama is a smoke-free campus: smoking and electronic cigarettes are not allowed.

c. Eye Safety

i. Eye protection must always be worn in the laboratory (i.e. safety glasses, goggles, or shields). Per departmental policy, goggles are required in all teaching laboratories. The type of eye protection required in research labs is determined by the faculty supervisor.

ii. If you don't normally wear glasses, consider purchasing a nonprescription, fitted pair.

iii. Contact lenses do not serve as protection against eye injury and do not substitute for safety glass and chemical splash goggles. Many organizations, including the National Institute for Occupational Safety and Health (NIOSH) and the American Chemical Society have removed most restrictions on wearing contact lenses in the laboratory. However, some lens materials are hazardous when worn in the presence of certain chemicals. Before an individual chooses to wear contact lenses in the laboratory, they and their laboratory supervisor must consult SDSs for information regarding contact lenses and specific chemicals present. If contact lenses are deemed safe to be worn in the lab, chemical splash goggles must be worn as primary eye protection.

d. Storage of Solvents

i. All solvents must be stored in appropriate containers.

ii. Solvent bottles or cans should not be left or kept on bench tops or left in hallways.

iii. Solvents must not be stored on shelves above benches (serious fire spreading hazard).

iv. Solvents should be stored in steel solvent storage cabinets.

v. If it is impossible to store solvents in steel solvent storage cabinets, they must be stored in cabinets behind closed doors. In this way, they will not be accidentally broken when something else happens in the lab.

vi. Do not store large quantities of solvents in the lab.

vii. Transportation of chemicals by elevator must be minimized.

viii. Transportation of chemicals should be performed in rubber safety buckets or other appropriate secondary container. Only a single bottle of a dangerous chemical should be carried at a time.

e. Storage of Chemicals

i. Avoid storing chemicals (especially water reactive substances) near sinks.

ii. Do not store flammable chemicals above bench tops.

iii. Do not store any chemicals above eye level.

iv. All chemicals must be clearly labeled with the full written name of the contents (not a chemical formula) and a device such as the NFPA diamond to indicate hazards. Note: very small amounts of chemicals such as research samples can be labeled with a code that can be used to find the identity of a chemical in your research notebook.

v. Old chemicals or excess chemicals must be periodically collected and either discarded, placed in the central storage location of your faculty advisor, or taken to the stockroom.

vi. Chemicals stored in desiccators under vacuum must be kept in closed cabinets, behind shields, or in cages. Never store such desiccators on shelves above bench tops or on lab benches. Label desiccators which are under vacuum.

vii. All gas cylinders must be clamped, and they should be located in areas reserved for gas tanks.

viii. Refrigerators:

- Refrigerators must be regularly defrosted.
- Chemicals must be clearly labeled.
- Chemicals should be stored neatly and carefully – not simply "piled in."
- Do not store food or drinks in refrigerators containing chemicals.

f. Operations under Vacuum

i. Vacuum equipment should be shielded (even glass rotary evaporation units.)

ii. Vacuum pumps must have belt guards. If not, the pumps must be housed in boxes or housings which serve the same purpose.

iii. Never evacuate flat bottom flasks, bottles etc.

iv. All Dewar flasks and desiccators must be carefully taped.

v. Vacuum pump exhausts should have a filter. If not, the pump outlet should be exhausted into a hood.

vi. Glass mercury diffusion pumps should be housed in cases which can catch the mercury if the glass is broken.

g. "Waste" disposal

i. Disposal of unwanted chemicals (waste) must follow EHS (Environmental Health and Safety) rules. Containers for unwanted chemicals must be labeled and kept closed. Do not mix incompatible chemicals in unwanted chemical containers. If any questions arise, please contact your advisor, a member of the safety committee, or EHS (348-5905).

ii. Requests to EHS for pick-up of unwanted chemicals must be made electronically.

iii. Never dispose of waste alumina or silica gel (i.e., from column chromatography) by dumping into waste cans. Instead, thoroughly soak with water before discarding.

iv. Never dispose of rags or paper towels which are wet with solvents into the trash cans. Instead, thoroughly soak them with water prior to discarding them.

v. Broken glassware and other sharps should be not be thrown into trash cans (this endangers the housekeeping staff). Sharps should be stored in closed containers and labeled. Housekeeping will not handle sharps containers; therefore lab personnel are responsible for removing full containers to the dumpster.

h. Safety with electricity

i. Periodically check the electrical cords on variacs, heating mantles, motors, etc. for damage. Have them repaired when not in excellent shape.

ii. No power cords should be warm to the touch.

iii. Electrical cords should not be strung across aisles or along the floor without being properly protected.

iv. Have all electrical cords carefully placed out of the way of jacks, hot plates, solvents, etc. when in use.

v. Electrical plugs should be three-pronged (grounded).

vi. Avoid overloading a circuit by plugging too many devices into a single outlet.

vii. Know where the fuses are for each lab.

viii. High voltage circuits (over 600 volts) should be labeled.

ix. Do not touch any person who has received an electrical shock and appears to still be in contact with the electrical source without disconnecting the electricity. Call campus police (348-5454) for assistance.

i. General Laboratory Operations

i. Specialized training is necessary before performing experiments that pose special risks. Some training will be performed by your research advisor. Other areas (such as radiation, laser safety, biosafety, bloodborne pathogens, animal care, human research, etc.) will require documented training by EHS. **Your advisor will inform you what additional training is required.**

ii. Each laboratory has an inventory of all chemicals stored online (CISPro). Contact your research advisor for details on access to the inventory in your laboratory.

iii. SDSs (Safety Data Sheets) are available for all chemicals in your laboratory via the ChemWatch database: http://jr.chemwatch.net/chemwatch.web/dashboard.

iv. All reactions must be labeled. This includes operations under vacuum. (Write on a card exactly what your reaction is). Tape the card to the reaction vessel or nearby. Then if an accident occurs when you are not in the laboratory, others will be able to deal with it. If the power goes off, others will be able to anticipate problems, etc.

v. Solvent stills should be labeled.

vi. All reactions should be shielded when not attended. (Have your research advisor provide lab shields if you don't have enough shielding).

vii. All permanent solvent stills should be carefully shielded (your faculty advisor should arrange for the necessary shielding).

viii. Cylinders should be moved only with the aid of cylinder carts. Pressure regulating gauges should be removed, and cylinder caps should be on. Return cylinders to stockroom while a positive pressure still exists in the cylinder.

ix. Dewars in use should be clamped. When not in use, store in closed cabinets, not on benchtops.

x. Water hoses on condensers must be clamped on or wired. Flooding has serious consequences for other labs as well as your own.

xi. Water hoses draining to sinks must be securely anchored in place.

xii. Solvents should not be exposed to air for long periods (for example, during chromatography operations).

xiii. Appropriate personal protective equipment (PPE: glasses, goggles, face shields, gloves, aprons, lab coats, etc.,) must be worn at all times.

xiv. Open-toed shoes are not permitted in the laboratories.

xv. Do not eat in the lab. Food is allowed in areas such as offices and break rooms where research chemicals are not present.

xvi. Bench tops, hoods, passageways, and floors should be kept neat. The single largest cause of accidents is a cluttered and messy work area.

xvii. Emergency phone numbers are affixed outside the doors of the laboratory. Emergency telephones can be found on each floor; you should know the location of the telephone nearest to your laboratory.

xviii. After fire extinguishers are discharged, contact Environmental Health & Safety (348-5905) to have them replaced.

xix. Because of the possible presence of reproductive toxins, persons who are pregnant are encouraged to inform their supervisor and/or EHS who will provide additional personal protective equipment if necessary.

xx. Gloves, lab coats and other PPE should not be worn outside of the lab. If you need to wear PPE to transport hazardous chemicals outside of the lab, use unsoiled or new PPE.