

SAFETY IN THE ANALYTICAL LABORATORY – GUIDELINES AND PRACTICES –

Our primary goal in the Analytical Chemistry Laboratory is your safety and well being. Even learning is secondary, but safety and good laboratory practice enhances learning and success in the lab.

The following pages are intended to provide some *general guidelines* and *mandatory behaviors* for your safety in our lab. These are sincerely meant primarily for your health and benefit. [In addition, they are also intended for your instructors' peace of minds and the preservation of their professional reputations. An instructor is responsible for your well-being in the laboratory; this responsibility is not taken lightly by any intelligent professional, which is what all of you aspire to become.]

Although a chemical laboratory is a dangerous place, it is probably safer than the average household kitchen or, for that matter, trying to cross Rose Street. This is because –

- There are instructors around at all times who are concerned about your safety.
- Safety equipment and help is nearby, readily available, and even works.
- You are or will be aware of dangers and take proper precautions.
- People have spent many hours in designing safe laboratories, safe experiments, and safety procedures.
- Part of your laboratory grade depends on your using safe working practices.

These factors are less true in the case of the kitchen, and probably not true at all for crossing Rose Street.

A lot of wisdom can be summarized in a few short, general phrases.

- **Know** your experiment.
- **Ask questions** if you are unsure.
- **Plan and prepare** thoroughly well ahead of time.
- **Clean** your work area frequently.
- **Orderly** it must also be.
- **Pay attention** and stay alert to what you are doing at all times.
- **Safety goggles** must be worn at all times.

KAP COPS, whatever that means.

Perhaps the best rule for laboratory safety we can give you is to think, and to think ahead. Come to the laboratory prepared and know exactly what you want to do; prepare an outline of your lab work so you know what's next. Work slowly and carefully. Don't try to rush things in the

laboratory. The extra time invested in working carefully and at a measured pace is more than compensated by the efficiency resulting from careful *prior* planning, and your results will undoubtedly be better.

If you have questions about something, or are not sure about the operation of an instrument, *ask*. Don't be afraid of being thought "dumb", it's better than being injured. If, on the other hand, you have many, many, many questions or are unsure of almost everything, you probably haven't prepared well enough to be in lab.

So please read through the following very carefully. If you get the idea that we are at times trying to scare you, you're probably right. At times, these comments may come across as somewhat humorous or sarcastic. This was done with the hope of capturing and maintaining your attention. The comments are meant, however, to be taken with utmost seriousness. If you have any doubt as to the truly valid reasons behind these guidelines, please ask.

Laboratory Signage. When you first walk around the laboratory, note all the signage. The signage is color-coded for your convenience:

- **RED.** For the location of various **Safety** items such as showers and first aid kit, and for disposal of **Hazardous Waste**.
- **GREEN.** For the location of pure **Reagents** to be used in experiments.
- **YELLOW.** For the location of **Miscellaneous** items such as Instruments, Towel Exchange, Drop Off and Pick Up of Unknown Containers.

Safety Glasses. The Department of Chemistry requires that safety goggles must worn at all times in the laboratory. This applies whether you are working at your bench, walking around, or waiting for a friend to finish up his lab work. With permission safety glasses or case-hardened prescription glasses that have side-shields may be worn. If you wish to wait and not wear safety goggles, wait outside the laboratory. Putting on your goggles is the first thing you do when you walk into the lab and the last thing you do just before you leave. [Except, of course, for unlocking and locking your equipment drawer.]

Lab Coats or Aprons. The Chemistry Department requires that students wear laboratory coats or aprons when working in an instructional laboratory. Your normal lab equipment includes a rubber-coated safety apron. There are a few white lab coats available for your use during the semester, and there are also some disposable plastic-lined paper aprons available. If you're interested, ask.

Lab Towels. We cannot afford any longer to provide students a brand new cotton lab towel each semester, but we have lots of used ones for you. While your mother wouldn't hang them in your home bathroom or kitchen, they are usable. Whenever you want a new towel, drop your old one off in the Used/Dirty towel box in the back of the room and pick up a New/Clean one. If you've just used your towel to wipe up some concentrated acid or base, please rinse it out in a lot of cold water before you throw it into the Used Towel box. Periodically, the dirty towels are washed, sterilized, dried, and returned to the clean towel box. They may have holes in them and permanent spots, but they have been washed and sterilized.

Safety Equipment. Walk through the laboratory and learn the locations of all the safety equipment well enough so that you can indicate their locations on a map of the laboratory. This is a possible exam question. Know the quickest way to get to any of them from your assigned lab bench and from the instrument area in the front part of the room.

- **2 Exit Doors** opening into the hallway. (There is no egress from the lab through the TA Prep Room in the front of the lab or through the door at the back of the room that leads to a research lab.)
- **3 Fire Extinguishers.**
- **3 Safety Showers.**
- **2 Eyewash Stations.**
- **1 Fire Blanket.**
- **1 First Aid Kit.**

Rubber Gloves. If you wish to use protective gloves in the lab, the Department does provide latex rubber gloves for your use... *on your hands*. Don't try to put one on your head or blow them up to make balloons then look like cows' udders. Their use is not mandatory. If your hands start feeling itchy or you develop a pink or red inflammation on them, you may be allergic to latex. If you still want to use gloves in the laboratory, tell a TA and we'll order you some non-latex gloves to use.

Accidents. Report *all* accidents to a Teaching Assistant or whoever is in charge, no matter how minor, and get first aid. We are obliged to report these to the University. In addition, having data on how students get injured could well help us to clarify instructions or modify experiments or the lab itself. Admittedly, it may be somewhat embarrassing to walk over to the TA with your finger wrapped in a bloody paper towel; but please do not stand around with your hand in your pocket trying to finish up the laboratory period, meanwhile bleeding down your leg and filling up your shoe. Don't be embarrassed to yell and/or scream for help if need be. You can't die from shame, but you can die from an accident.

Unauthorized Experiments. Absolutely no unauthorized experiments are permitted in the laboratory at any time, for any reason. Punishment will be severe. This can include the involvement of campus Security as well as the Dean of Students office.

Normal Laboratory Hours. No laboratory work is allowed outside of the normal laboratory hours (1-5 pm Mondays and Tuesdays) without prior arrangement with a teaching assistant or a staff member each and every time. As a supervisory person is required to be present at all times when a student is in the lab, laboratory work outside the normal hours can only be scheduled at the convenience of an instructor.

Horsing Around. Absolutely no fooling around or horse play will be tolerated in the laboratory. If you want to be a clown, search the Internet under "clown school". If you are also religious, see www.clowning4christ.com.

Shoes. Shoes must be worn in the laboratory at all times. These must be covered-top. **NO sandals** or spaghetti-strap high-heels are permitted. There are invariably bits of broken glass or spilled chemicals on the laboratory floor, or you may well spill something caustic or hazardous

on your feet. How about the total klutz next to you in the lab? Athletic shoes with mesh tops or sides aren't really a very good idea either.

Clothing. The wearing of shorts is forbidden in all Chemistry labs. Long slacks or pants and longish dresses or skirts are required. These offer an added safety margin against spilled chemicals and flying glass. Very loose or floppy clothing is a definite safety hazard. If nothing else, you can succeed in knocking over and spilling a carefully weighed unknown sample. As we don't use open flames in the lab anymore, at least you can't easily set yourself on fire anymore. You'd really have to work at it. *Good, dressy clothing is worn in the lab at your own risk.*

Our Motto: "No shirt, no shoes, no safety glasses – No lab"

Pipetting. Do not mouth-pipet; use a rubber bulb. As a matter of fact, *do not insert any laboratory apparatus, glassware, supplies, or instrumentation into any of your bodily orifices.* Although every effort has been made to avoid or minimize the use of highly hazardous chemicals, you will still come into contact with some fairly corrosive and/or toxic chemicals. Furthermore, anything is toxic and can kill if you get enough of it.

Pouring. *NEVER, NEVER* pour reagent solutions above eye level. The container can slip out of your hand, you can over-pour, you can miss completely, or the friendly buffoon at the next lab station can bump your arm and leave you with a faceful of reagent. In filling your burette, carefully place the ringstand on which it is mounted on the floor or on one of the pull-out shelves. Alternatively, you can remove the burette from the clamps, hold it below eye level and pour the solution in carefully. Use of a small funnel helps to avoid spilling. If filled only with distilled or deionized water, you may use your wash bottle to squirt down the inside of a burette mounted on the benchtop.

Heat Burns. Avoid burning yourself or others in the Chemistry laboratory. As there are no longer open flames in the lab, about the only way this can happen is if you put some bodily part on a hot plate, grab a flask or beaker containing a very hot solution, or remove something from a drying oven with your bare hands. Or, I suppose, if you're fool enough to hold your hand above the natural-gas/oxygen flame if you're doing the sodium atomic-emission experiment. Don't do these things.

Probably the best immediate relief from the pain of mild heat or fire burns is a lot of cold water, followed by the application of burn ointment if needed and a sterile bandage.

Chemical Burns. *Immediately* run copious amounts of cool water to the affected area. After prolonged water-wash, you can remove the last traces with ordinary soap and water in the lavatory. The affected area may need drying and a bandage. If you get any chemicals in the eye, you should head right for an Eye Wash Station if you can. If you can't, get to a water tap and call for help.

NEVER apply an acid (base) to neutralize any base (acid) you may have gotten on you. Depending on the concentrations, the resulting heat generated can be enough to cause first- and second-degree burns. Always wash with large amounts of cold water.

If you feel a strange itching or burning sensation on some part of your body, this may be due to the inadvertent application of some corrosive chemical. Wash with lots of water first. Ask questions later.

Cuts. Small cuts are generally best rinsed in cold running water, allowed to bleed a bit to further clean out the wound, dried with a sterile pad, and bandaged. Serious cuts are probably best treated by application of pressure with a cloth pad to the immediate area. Clean, preferably sterile, pads are preferable. **DON'T USE YOUR LAB TOWEL.** If necessary, grab a clean brown paper towel or a couple of KimWipes, or use a clean handkerchief or Kleenex you may have on you. Serious cuts will require help and medical follow-up.

Puncture Wounds. All puncture wounds, such as spearing yourself with a glass or metal rod, ramming a pipet end into your hand, or stepping on a nail are very dangerous because of the possibility of tetanus. These will require further, professional medical care. Lockjaw is not very pleasant.

“Pointing” Lab Equipment. Never point the top of a test tube, beaker, flask, wash bottle, reagent bottle, etc., at yourself or anyone else. It may be loaded.

Jewelry. Do not wear rings, watches, or other types of jewelry in the laboratory if at all possible. You will be asked to remove what we might consider excessive amounts of hand and wrist jewelry. Such items can catch on protruding objects, serve as nice traps for spilled chemicals keeping them in contact with the body, function as nice “wires” to lead current into the body from electrical equipment resulting in shocks and/or electrocution. Generally the clean, dry skin of the body has a high resistance to electrical current; but the skin under a ring, for example, is often soft, damp, and has much lower resistance. This is especially true if you have gotten some electrolyte solution under a ring. Probably the best procedure is not to bring jewelry to the laboratory unless you have an available pocket, in order to avoid loss of the articles by misplacement or theft. In addition, jewelry can be seriously damaged by chemicals. We reserve the right to require you to remove any object that we consider to be dangerous.

Fires. Fires are highly unlikely in the Analytical Laboratory, but do avoid setting fire to yourself, other students, instructors, or any parts of the laboratory. The laboratory is equipped with several fire extinguishers. Learn where they are, and for what types of fires they are meant. Try to avoid fires, but be prepared for one. Never use organic solvents when open flames are around. Do not use organic solvents in those fume hoods that have an electric or gas hot plate or furnace. If necessary warn others of fire by yelling “Fire!”... loudly, really loudly.

Electrical Equipment. Anything, particularly aqueous electrolyte solutions, spilled around or on electrical equipment can serve as a path for the conduction of lethal amounts of electrical current. If you're not sure just what to do in the event of an accident with or spillage near electrical equipment, just get away from it and call the Teaching Assistant or send someone else to get him or her. Do not, of course, leave the equipment completely unattended so that some poor, unsuspecting soul walks into a trap.

Ingestion. Never put anything into your mouth or nose, or any other bodily orifice for that matter, in the laboratory. Not even your finger. Food, drinks, drinking, or eating is strictly forbidden in the laboratory. Go into the hallway for a snack or swig of “yuppie water” from a bottle. Smoking is not permitted anywhere in the building by State law and by the University law. Take it outside. No tobacco chewing or snuff; those are just plain disgusting.

Long Hair. Loose long hair can be a danger. For example, bending over a burner can ignite it. Hair spray, especially large amounts of a heavily lacquered type, can make hair extremely flammable. If you bend over, you can dip the ends into something caustic or toxic. Please try to keep your hair bound in some manner.

Waste. Use the **PROPER** container to dispose of all waste generated in the Laboratory.

Hazardous Waste. **All** hazardous waste generated in the 226 Lab has a specific, labeled container designated for its disposal. Use the proper one. If unsure, ask.

Non-Hazardous Waste. A couple of experiments generate some non-hazardous waste, such as the dilute NaCl solutions in the Atomic Emission experiment. These can be safely disposed of **down a sink drain** with lots of running water. Non-hazardous wastes are clearly indicated so in the lab handouts, with instructions to run down the drains. Be sure before you do this. If not, ask.

Glass. **All** broken or chipped glassware or other sharp objects must be disposed of in the **cardboard Broken Glass container** located near the central hoods. **NO EXCEPTIONS.**

Other Waste. Other **non-chemical** wastes to be disposed of in the lab can usually be placed in the “**regular**” **wastebaskets or ceramic waste crocks** underneath some of the sinks. Such items can include paper products that are listed as not suitable as office mix grade on the blue card, plastic, some metal items, a weeks-old pair of dirty socks you just found in your backpack (unless they qualify as Hazardous Waste), etc.

Absolutely no glass or anything sharp may go into the “regular” wastebaskets or crocks. If you’re unsure, ask.

Underwear. Always wear clean underwear to lab. That way, if you have an accident and have to go to the emergency room, the medical personnel can see that you wore clean underwear, and will no doubt comment that you are wearing such nice clean underwear. In addition, your mother will be very proud of you. All her years of nurturing and nagging have paid off.

Good Housekeeping. The last rule of laboratory safety, but one of the most important, is cleanliness and neatness. Clean up all spills immediately. There is a dustpan and broom available near the TA Prep Room to sweep up broken glass. Try to wash and rinse glassware as soon as possible. Keep your locker drawer and door closed unless you are moving something in or out. Keep your coat and 100-pound backpacks out of the aisles. There’s a coat rack in the back of the lab. The areas underneath the overhang at the end of the lab benches are also reasonable places for backpack storage.

*If you spill it, clean it up.
If you opened it, close it.
If you used it, clean it.
If you break it, replace it.
If you borrow it, return it.
If you turned it on, turn it off.
If you took it, put it back where it belongs.*

LP. Finally, in the armed forces, they have KP – Kitchen Police. In the 226 Laboratory, we have LP. You can probably figure out what that means. A student adjudged to be guilty of excessive, egregious, or repeated safety, cleanliness, or lab-rule violations will be sentenced to perform general laboratory cleanup tasks. The time and tasks involved will be proportional to the degree of sins committed that are in need of expiation. Think Purgatory.

Flesh-Kincaid Grade Level: 8.5

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