Basic Chemical Safety and Laboratory Survival Skills

For anyone working in Georgia Tech Laboratories
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RTK Class Is an Annual Requirement

- This is NOT RTK Class, if you haven’t done so already, you must take RTK, either on line at: http://www.usg.edu/ehs/training/rtkbasic/
- Or Sign up at www.trainsweb.gatech.edu to take it “live and in person”
First of All- RTK What Is It?

- It is the Georgia Public Employees Hazardous Chemical Protection and Right to Know Law (RTK)
- RTK is the Georgia State Equivalent of the Federal Hazard Communication Standard which does not apply on State property/to State employees
Now let's talk about safety in your lab.

Hopefully this presentation will help you to be:

- More aware of lab hazards
- Less likely to have an accident
- More able to assist someone who has had an accident
- More likely to survive an emergency
What We Will Talk About

- Definition of a “hazardous” chemical
- Labeling
- Health and Hygiene
- PPE
- Safety Equipment
- Spills and Incidents
- Getting Out

- Commonly Seen Mistakes
- Fume Hoods
- Gas Cylinders
- Electrical Safety
- Chemical Waste
What Is a Hazardous Chemical?

- The Occupational Safety and Health Administration defines a hazardous chemical as “any chemical which is a physical or a health hazard”
  - If you wouldn’t eat it or rub it in your eyes— it’s hazardous
Very Basic Safety- Labeling
There is Only one Rule at Georgia Tech Regarding Labeling: Label Everything

- **Immediate use containers:**
  - Only Last 1 shift
  - Never leave your control
  - Secondary Containers (beakers, flasks)

- **Name of the chemical & Your name** (may be written on the container with a marker)

- **Extended Use Containers:**
  - Last more than one shift:
    - Reagent bottles, Squirt bottles, spray bottles

- **Label must have name of chemical and hazard information** (s/a NFPA diamond)
The First and Best Protection Against Unwanted Chemical Exposures Is:

Hygiene
Thou Shalt Not Have Food or Beverage in the Laboratory

- No eating, drinking, smoking, applying cosmetics, lip balm, fussing with contact lenses or even popping a stick of gum in the laboratory
Also

- After removing your gloves and before you leave the lab- wash your hands
- No food in laboratory refrigerators
- No lab samples in food refrigerators
- No washing food dishes in laboratory sinks
- No lab coats in break rooms or offices
After Hygiene We Use:

- Engineering Controls
  - Fume Hoods
  - BSCs
  - Blast Protectors
- Substitution of less hazardous materials
- Administrative Controls
  - Safe Handling Procedures
And, of Course We Also Use

- Personal Protective Equipment (PPE)
  - Safety Glasses or Goggles
  - Face Shield
  - Lab Coat
  - Appropriate Attire
  - Gloves
  - Respirators
Appropriate Eye and Face Protection

- Safety Glasses must be donned before entering ANY wet bench lab (cell culture labs included)
- Safety Glasses must meet ANSI Z87.1 and have side shields for splash protection
- Safety Glasses must be worn over prescription glasses
Eye and Face Protection

- Contact lenses are allowed in most labs, but only with safety glasses.
- Safety Glasses are required in all areas where soldering or machining occurs.
- Safety glasses PLUS a face shield are required around high pressure reactors, high pressure air lines, machining operations, and some cryogenic procedures.
Appropriate Protective Apparel

- Lab coat is required when handling chemicals
- Lab coat must cover the wearer to the knees
- Plastic aprons are allowed only in undergraduate teaching labs
Your Safety in the Lab Starts with What you Wear to Work Today

- Shorts and skirts not recommended
- Nylons also not recommended
- Knee length lab coat when handling splash-able chemicals
- No canvas, open front or back, or open weave shoes
Gloves- What You Don’t Know Can Kill You

- Gloves required when handling chemicals
- The most common PPE mistake seen in laboratories at GT is relying on latex gloves to provide chemical protection from organics/solvents
- Best choice for all all purpose use- nitrile
- Resources for gloves include:
  - Anselpro.com
  - Bestglove.com
- Contact GT EH&S for help
General Classifications of Hazardous Chemicals

- Corrosive
- Irritant
- Asphyxiant
- Toxic
- Flammable
- Reactive
- Explosive
Flammability and Combustibility

- **Flash Point** - Temperature at which a liquid gives off sufficient vapor to support combustion if provided with a source of ignition.

- **Flammable**: FP below 100°F (37.7°C)

- **Highly Flammable**: FP <73°F BP<100°F (22.7-37.7°C)
Another Important Concept
Vapor Density

- The weight of a gas or vapor compared to the weight of an equal volume of air at the same pressure and temperature.
- Air = 1,
- If <1, the material is lighter than air and may rise
- If >1, the material is heavier than air and may stay low to the ground
- Examples: H2 = 0.1, Gasoline = 3.0 - 4.0
General Classifications of Hazardous Chemicals

- Toxic
- Corrosive
- Irritant
- Asphyxiating
- Flammable
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- Explosive
Reactivity

- Highly Reactive Substances-
  - Sodium Metal, Pyrophorics (t-butyl lithium, alkali metals), perchlorates, peroxide formers
- Do not open a liquid organic peroxide or peroxide former (such as diethyl ether) if crystals or precipitate is present. These crystals are shock and pressure sensitive.
- If you find a bottle with crystals- do not open, crystals often form under the cap. Opening it could cause an explosion.
- Review available information such as your lab’s SOPs or manufacturer’s technical bulletins before starting to work with pyrophorics
- Make sure needed equipment is available (such as enough nitrogen to purge the glove box)
General Classifications of Hazardous Chemicals

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Health Hazards

- Asphyxiants-
  - Simple- push the air out of the room
  - Chemical- interfere with how the body uses oxygen
- Corrosives and irritants-
  - Injure (or kill) what they touch
- Poisons-
  - Can injure organ systems all over the body by inhalation, ingestion, or skin exposure

- Target organ effects
  - Liver, kidney, CNS, bone marrow
- CNS effects aka Narcotic Effects-
  - Headache, dizziness, nausea
Hazard Recognition

- A bad idea is not always obvious to the person who has it…
- Know what you are working with (read the MSDS)
- Learn to recognize hazards in your lab
Failure to Recognize a Hazard / A Bad Idea-

Georgia Tech
ES&T-2005

**Researcher knew** the products of the experiment were explosive

**Scaled up experiment** without taking any additional precautions

**Exploded** with the force of a ¼ stick of dynamite

Lab Closed for 2 days

Broken glass thrown 22 feet
Another Bad idea:

University of Kentucky –

Incompatible Wastes Combined

Causing fire, broken glass thrown 20 feet
A Really Bad Idea:

University of Virginia
Flammable materials stored in a household refrigerator.

Explosion blew the doors off the refrigerator and melted the interior compartments
MINOR SPILLS

SPILLS YOU CAN HANDLE

- NOTIFY POSSIBLY AFFECTED PERSONNEL
- CLEAN IT UP
- BAG WASTE FOR PROPER DISPOSAL
- REPLENISH SUPPLIES
- EXAMINE WHAT WENT WRONG
MAJOR SPILLS=
SPILLS YOU CAN’T HANDLE

- MEDICAL ATTENTION REQUIRED
- VIOLENT ON-GOING REACTION OR FIRE
- HIGHLY DANGEROUS OR UNKNOWN MATERIAL
- ANY SITUATION WHERE YOU QUESTION YOUR OWN SAFETY S/A YOU WORRY THAT YOU SHOULD HAVE A RESPIRATOR TO REMAIN AND CLEAN UP
WHAT TO DO

- NOTIFY PERSONNEL IN AREA
- CLOSE FUME HOOD/SHUT OFF EQUIPMENT
- POST WARNING SIGN
- PULL FIRE ALARM IF NECESSARY
WHAT TO DO (#2)

- **IF YOU NEED HELP NOW**
- **Call** (911) or GT Police (404-894-2500)
- **Tell** the operator that you are on the Georgia Tech Campus
- **KNOW** The Street Address of Where you are:
  - If possible, remain on or close to phone.
- **REMAIN IN AREA UNTIL RELEASED**
When to Take a Shower

- If you are splashed with a chemical in an area of your body which cannot be put under a sink faucet and flooded immediately, you must use an emergency shower.
How to Take a Shower

- If your clothing is involved - remove it on the way to the shower -
- Shout for help
- Remain in the shower for 15 minutes
- Get someone to call the GT Police
- Do not re-don contaminated clothing
- Print out 3 copies of the MSDS
How to Use an Eye Wash

- Shout for help
- Hold your eyelids open with your fingers as you rinse your eyes
- Have your helper watch a clock for you to make sure that you continue to rinse your eyes for a full 15 minutes
Post Eyewash

- You must seek medical attention immediately afterwards
- GT EH&S recommends you go to Grady Hospital to ensure proper care
- Take a copy of the MSDS with you to the hospital
Access to Safety Equipment must be immediate

- After an eye splash, you have approximately 10 seconds to begin rinsing the chemical out of your eye before corneal damage occurs.
Emergency Equipment

- Eye washes should be flushed once per week
- Take the time to learn how to turn them on today!
Evacuations

- Turn off any equipment that you can as you exit
- Grab the hard copy of the chemical inventory that you keep posted by the lab door on your way out
- Pull the fire alarm if appropriate
Other Safety Concerns

- Respirators: You may NOT use respirators in laboratories at GT without prior permission/certification by EHS (this includes N-95 filtering facepieces)
- Noise: A separate training program
- Laser: A separate training program
About Fume Hoods:

- They are ventilated workspace i.e. “prime real estate"
- They are not for storing chemicals or unwanted equipment
- Sashes need to be closed when you are not standing in front of them
- Lab doors need to be closed to achieve proper ventilation (especially in EST, MSE, and BME)
- Many have an emergency setting to increase ventilation in the event of an accident)
Fume Hood Facts

- Their function depends on unimpeded air flow
- They should be operated with the sash at 18” and closed when not in use
- Work should go 6” inside the hood
Fume Hood Flow Rates

- Flow for most chemicals should be 100 lfm ± 20%
- For carcinogens or highly toxic chemicals, flow should be 120 lfm ± 10%
- Call GT EHS to have fume hood speed adjusted

- Hoods should have a visible indicator that they are working. This could be as simple as a kim wipe taped to the sash or as sophisticated as:
Using Compressed Gas Cylinders

- Gas Cylinders must be restrained with a chain or strap between the “waist” and “shoulder”.
- Remove regulators and cap cylinders before moving.
- Cap unused cylinders
- Never use grease or Teflon tape on cylinder fittings
Using Compressed Gas Cylinders

- Fittings vary between gas types: toxic, corrosive, inert, flammable, oxidizing.
- Never force a fitting- you are probably using the wrong type.
- Cylinder (not the cap) must be labeled as to contents. Do not rely on cylinder color to identify- they vary between manufacturers.
- Always use non sparking tools around flammable and oxidizers
Mishandled cylinders may rupture violently, release their hazardous contents or become dangerous projectiles. If a neck of a pressurized cylinder should be accidentally broken off, the energy released would be sufficient to propel the cylinder to over three-quarters of a mile in height. A standard 250 cubic foot cylinder pressurized to 2,500 PSIG can become a rocket attaining a speed of over 30 miles per hour in a fraction of a second after venting from the broken cylinder connection.
Electrical Safety
In a Nutshell

- All equipment should be grounded (third prong on the plug or one prong wider than the other)
- All equipment should be in good working condition- look for frayed wires, open access panels, etc
- Permanent equipment (>6 months) must have permanent wiring (no extension cords)
- If the equipment is located within 6 feet of a sink, there must be a GFI plug.
Sharps

- Needles, razor blades, broken glass, broken wafers
- MUST go into an appropriate disposal container—not the trash!
Waste
Organic Solvents-

- Bottle it! Use Chematix or call 4-6224 for a waste pick up
- Unless you are physically standing in front of the waste bottle, adding waste, the bottle must be capped.
- Discard bottle by allowing the residue to evaporate off in the hood then deface and discard into glass trash (lid off)
- Glass trash boxes must be taken to the dumpster by you
Waste Acids & Bases

- Bottle it!
- Bottle must be triple rinsed
- **Rinsate** may go down the drain
- Deface the bottle
- Discard (uncapped) into glass trash
Waste
Highly Hazardous (P-list)

- Bottle it!
- Empty stock container is hazardous - treat as hazardous solid waste and call for pick up
- Check [www.ehs.gatech.edu](http://www.ehs.gatech.edu) for the “highly hazardous” list to see what qualifies
  - Acrolein, carbon disulfide + 259 others
Labeling Chemical Waste

(Temporary) Label must be on the bottle before you start adding the waste.

Chematix label or:

- Name and phone number of responsible individual
- Contents: Chemical Name(s) and approximate percentages.
- Other pertinent information
Shipping Chemical and Biological Materials

- From GT to another location
- From another location (such as field samples) to GT
- Involves more than just a box and a stamp
- Could involve hefty penalties and jail time
- NO exemption for small quantities
- Be smart- learn what you need to know now: http://www.ehs.gatech.edu/chemical/#Shipping
Training for Shippers

- Must take on line training
- Must Pass Test
- Must take “hands on” training in packaging biological or chemical samples
INFORMATION SOURCES

- GEORGIA TECH LAB SAFETY MANUAL
- PRUDENT PRACTICES FOR HANDLING CHEMICALS IN LABORATORIES
- MATERIAL SAFETY DATA SHEETS
Georgia Tech Environmental Health and Safety

Department Front Office.................................4-4636
Spills/Waste- Ed Pozniak.................................4-6224
Bio-Hazard- Lisa Broadhurst .........................4-6120
Physical Safety- Aleece Fox .........................5-0263
(Electrical Safety, Ergonomics, Lock-out-tag-out)
Fire Marshal- Mike Hodgson.........................4-2990
Chem-Hazard- D. Wolfe-Lopez......................5-2964
Also Noise, Non-ionizing Radiation, Indoor Air Quality)
Radiation Safety- Nazia Zakir......................4-3621
Laser Safety-Gary Spichiger .......................4-3605
http://www.ehs.gatech.edu