Staying Safe in the Laboratory

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Laboratory Safety Introduction

- Laboratories contain a number of hazards
- It’s important to recognize these hazards and take steps to prevent injuries
- If you have any safety concerns, please contact your supervisor
Reporting Problems

• Contact your supervisor if:
  a. You are injured in the lab
  b. There is a chemical spill or release
  c. Have questions about equipment, a process, chemical or hazard
Common Laboratory Accidents

- Examples of laboratory accidents include:
  - Chemical splashes to face/eyes, body, hands, legs/feet
  - Burns involving hot surfaces
  - Violent chemical reactions/explosions can occur when incompatible chemicals are mixed
  - Cuts involving broken glass
Categories of Chemical Hazards

- Toxic – range from harmful to lethal
- Flammable – readily burn
- Combustible – will burn
- Corrosive – destroys tissue (low or high pH)
- Oxidizer – releases oxygen
- Carcinogenic – potential to cause cancer
- Mutagenic – causes chromosomal damage
- Teratogenic – causes fetal damage
- Pyrophoric – spontaneously ignitable
Container Hazard Symbols

- Flammable
- Oxidizer
- Corrosive
- Toxic
Fire Hazards

- Fire - There are many things that can start a fire in a laboratory

  - Open flame (Bunsen burner) – never leave unattended

  - Flammable chemicals – keep away from any source of ignition (open flames or anything that might spark)
Fire Hazards

- Storing incompatible chemicals together - such as oxidizers and flammables or acids and bases can cause a fire

- Storing flammable chemicals in a refrigerator or freezer not designed for flammable material storage
Fire Hazards

- Electrical Fires
  - Electrical equipment failure due to improper grounding, etc.
  - Never remove the ground prong from any plug
  - Overuse or improper use of extension cords
  - Never overload extension cords or outlets
  - Never use multi-plugs
  - Never plug one extension cord or power strip into another
How to Protect Yourself

• Wear Proper Clothing for Lab Work.

  ▫ Long pants, closed-toed, closed-heeled shoes made of a non-absorbent material are acceptable

  ▫ Do NOT wear sandals, shorts or tops that expose your midriff

  ▫ Keep long hair pulled back in a ponytail
How to Protect Yourself

• Personal Protective Equipment (PPE)
  ▫ Lab Coat – wear it fastened closed – do not wear a lab coat with a zipper
  ▫ Gloves – make sure the protective gloves are made of appropriate material for the chemicals being handled (no latex for chemicals)
    • Know how to remove gloves without contaminating yourself
    • Remove gloves to handle anything you don’t want contaminated
Why Should I Protect my Eyes?

• Because this is NOT a cool look!
Eye Protection

• It important to realize that prescription glasses are not considered acceptable eye protection for lab work
Eye Protection

• Safety glasses with side shields are good for flying particles, but not for chemical work
Types of Eye Protection

• Splash-proof goggles are effective again impact (from flying particles) AND splash-proof!

• Goggles must be worn when a face shield is used.
Comparison of Eye Protection

- The following slide illustrates the effectiveness of several types of eye protection when a chemical explodes in the lab worker’s face. Several manikins were fitted with various types of eye protection and red dye was exploded in front of each. When the eye protection was removed, it is obvious which type gave complete protection to the eye area. Study the following slide carefully.
Comparison of Eye Protection Options

Safety Glasses With Vented Side Shields (Impact Only)

Safety Glasses Without Side Shields (Impact Only)

Visorgogs® (Impact Only)

Impact Safety Goggles (Impact Only)

Chemical Splash Safety Goggles (Impact and Splash Protection)
Safety Shower and Eyewash

- These devices are used to flush hazardous chemicals (generally strong acids or bases) from the eyes, face or body.

- It’s important to know where they are and how to use them in an emergency.

- Make sure the area around the safety shower or eyewash is uncluttered.
How to Use an Eyewash

• Notice how the lab worker is holding her eyelids open with her fingers. This is to insure that all the area inside her eyelids is rinsed properly. What you can’t see, is she is rolling her eyes around in their sockets. This also insures that rinsing is complete.
• This must be done for at least 15 minutes.
• Eyewashes must be hands-free to accomplish this. This means that it stays on until turned off and doesn’t have to be held in the on position.
Chemical Exposure

• If you have skin exposure (hands, arm, leg, etc.) to a hazardous chemical
  ▫ Wash the area with soap and warm water
  ▫ Make sure the area is rinsed thoroughly
  ▫ Notify your supervisor and seek medical treatment if necessary
Material Safety Data Sheets (MSDS)

- MSDS are information sheets that are required for every hazardous chemical.
- They must be readily available to every lab worker.
- They may be found online.
- They must be read before a chemical is used for the first time.
- They should be reviewed periodically to insure understanding of the hazards.
Material Safety Data Sheets (MSDS)

- What information is found in an MSDS

  - Hazards – What are the hazards associated with the chemicals you are working with? These can be very serious.

  - Incompatibilities – Some chemicals can react violently when mixed with certain other chemicals, or in contact with certain metals.

  - Chemical and physical properties of the substance
Material Safety Data Sheets (MSDS)

Other information found in an MSDS includes:

- **First Aid** – How do you treat an injury resulting from contamination? What do you do if you get this chemical on your skin or clothing?

- **Spill Response** – What do you do if you have a spill?
  - Hint – Don’t hide it out of embarrassment! It can happen to anyone! Report it to your supervisor or lab manager immediately!!

- **Synonyms** – Other names for this chemical

- **Proper disposal**
Safe Handling of Compressed Gas Cylinders

- The valve protection cap should be left in place until the cylinder has been secured against a wall, a bench, placed in a cylinder stand or on a cylinder cart and is ready to be used.
- Cylinders should always be moved by using a suitable hand truck with retaining straps or chains.
- Cylinders should always be secured.
Safe Handling of Compressed Gas Cylinders

- Never tamper with safety devices in valves or cylinders
- When returning empty cylinders, close the valve, leave some positive pressure in the cylinder, replace the protective cap originally shipped with the cylinder, mark and label the cylinder “EMPTY”
- Know and understand the properties, uses, and safety precautions of the gas before using the gas
Safe Handling of Compressed Gas Cylinders

- Never use oxygen as a substitute for compressed air
- Do not permit cylinders to come in contact with electrical apparatus or circuits
- Always use regulators and pressure relief devices when using cylinders. Only regulators approved for the specific gas should be used. Open the cylinder valve before adjusting pressure on regulator.
Safe Handling of Compressed Gas Cylinders

- Always bond and ground cylinders of flammable gases
- Oxygen cylinder must be separated from flammable gas or combustible materials by at least 25 feet or by a non-combustible wall (this changed recently from 20 ft)
Safe Storing of Compressed Gas Cylinders

- Always store and use cylinders in the upright position

- Segregate full and empty cylinders

- Cylinders should be secured, even if empty. Note the unsecured cylinder that could tip over
Things to Remember About Compressed Gas Cylinders

- Compressed gas cylinders can contain very dangerous gases. Even nitrogen and carbon dioxide can asphyxiate you in a small room or elevator!
Compressed Gas Cylinder

- Compressed gas cylinders are very heavy! You do not want one fall on your foot!

- Compressed gas cylinders contain very high pressure! If the valve is damaged in a fall, a cylinder CAN go through a block wall at a very high rate of speed!
Waste Disposal

- Hazardous waste should not be:
  - Flushed down the drain
  - Placed in the regular trash
  - Allowed to evaporate
  - Poured onto the ground
Hazardous Waste Disposal

• Containers that hold hazardous waste must have
  ▫ *Lid closed except when adding or removing waste*
  ▫ *Be in good condition (no cracks or rust)*
  ▫ *Be clean on outside; leak-proof*

• Use separate waste containers for different waste streams to avoid unwanted reactions; be careful mixing waste.
Hazardous Waste Disposal

- Hazardous waste is often stored in the lab in what is know as a satellite accumulation area.
- These areas are posted with sign that look like this
Hazardous Waste Disposal

- Hazardous waste is collected in waste containers that are properly labeled and kept closed.

**PROBLEM**
Open waste container.
Waste residue on outside of container.
Containers with waste contamination on the outside are not acceptable for waste disposal.

**SOLUTION**
Use a funnel. Close waste container unless actively adding to it.
Closeable funnels may be useful for operations such as this.
Chemical Fume Hoods

- Chemical Fume Hood
  - Are used to control hazardous chemicals that can become airborne
  - Know how and when to use it
  - If in doubt about a chemical’s hazards, use the fume hood

- Knowledge is your best protection!
Fume Hood vs. Biological Cabinet

- Can you spot the differences in the two hoods in the following slide?
Fume Hood vs. Biological Cabinet
Fume Hood vs. Biological Cabinet

- This is a fume hood and typically found in labs where chemicals are used.
- The air is drawn into the hood below the sash and is vented outside the building.
- The sash is adjustable and should be pulled down to the lowest possible level to make work possible.
- This hood is not sterile and is designed to protect the worker from the fumes within.
Fume Hood vs. Biological Cabinet

• This is a biological cabinet (also called a laminar flow hood)
• This hood has a sterile environment inside
• If there is a sash, they are frequently not adjustable
• The air inside is filtered by a HEPA filter
• This hood is designed to protect the cultures inside from contamination from the worker and room air
Fume Hood vs. Biological Cabinet

- Fume hoods and biological cabinets are NOT interchangeable!
- A biological cabinet will NOT protect you from chemical fumes, but will vent them back out into the room.
- A HEPA filter is NOT designed to filter out toxic chemical fumes
What Else?

- Do not eat or drink in the chemical laboratory or use food or drink containers to store chemicals or waste.
- Always wear appropriate gloves and wash hands after handling any chemical.
- Wear protective aprons or lab coats.
- Label all containers even if it’s just water.
- Never block access to emergency equipment or exits.

- Keep all work areas clear of clutter.
- Return chemicals to their proper storage areas at the end of work.
- Properly dispose of all chemical wastes.
- Promptly clean up any spills using appropriate PPE, equipment and procedures.
- Never put any chemicals or chemical waste into the trash or pour down the drain.
Quiz Time

To complete the Staying Safe in the Laboratory Training Module, please click here for the quiz.