

Fire Safety in Laboratories



University of Tennessee Environmental Health and Safety

Fire Safety in Laboratories

- Fire Prevention is a vital aspect of laboratory safety.
- Requires knowledge and constant vigilance of lab workers.



Steps in Fire Safety in Labs

1. Recognize Hazards
2. Evaluate the space before lab tests or chemical reactions have begun. This includes housekeeping and storage practices.
3. Protect yourself through the proper use of PPE (personal protective equipment) and emergency equipment.



Housekeeping

- Housekeeping is an essential component of fire safety in labs:
 - Lab area must be kept clean as work allows.
 - Unused combustible items, such as unused boxes and paper should be cleared from the lab workspace.
 - Stored items should not block access to the fire extinguishers or other safety equipment (eyewashes, safety showers), or block access to exits.



Emergency Equipment in the Lab

- Know where the emergency safety equipment is located in the lab space.
 - There should be access to a fire extinguisher.
 - Know where the closest fire alarm pull station is located.
 - There should be a safety shower and eyewash located within 10 seconds of the area you are working, so keep that in mind when planning work,.



Emergency Egress

- Aisles need to remain clear so that there is a clear path of egress to emergency exits.
- Do not wedge or block doors in the event of a fire.
- Make sure you are familiar with your building's evacuation plan and know where exits are located and learn all of the escape routes from your lab area.



4 Classes of Fire



Class A

Ordinary combustibles or fibrous material, such as wood, paper, cloth, rubber, and some plastics.

Class B

Flammable or combustible liquids such as gasoline, kerosene, paint, paint thinners and propane.



Class C

Energized electrical equipment, such as appliances, switches, panel boxes and power tools.

Class D

Certain combustible metals, such as magnesium, titanium, potassium, and sodium.



Fire Extinguishers

- All lab personnel, including faculty staff and students, should be adequately trained in the use of fire extinguishers and know where the closest fire extinguishers are located.
- There should be at least one ABC extinguisher either inside the lab, or in close proximity.
- Extinguishers should not be blocked access or covered up.
- If a fire extinguisher is discharged in a lab, please contact EHS at 974-5084 for a replacement A.S.A.P.



Use of Fire Extinguishers

- **Use the PASS Method when using a fire extinguisher:**
 - **PULL THE PIN:** This will allow you to discharge the extinguisher.
 - **AIM AT THE BASE OF THE FIRE:** If you aim at the flames (which is frequently the temptation), the extinguishing agent will fly right through and do no good. You want to hit the fuel.
 - **SQUEEZE THE TOP HANDLE OR LEVER:** This depresses a button that releases the pressurized extinguishing agent in the extinguisher.
 - **SWEEP FROM SIDE TO SIDE:** Start using the extinguisher from a safe distance away, then move forward. Once the fire is out, keep an eye on the area in case it re-ignites.



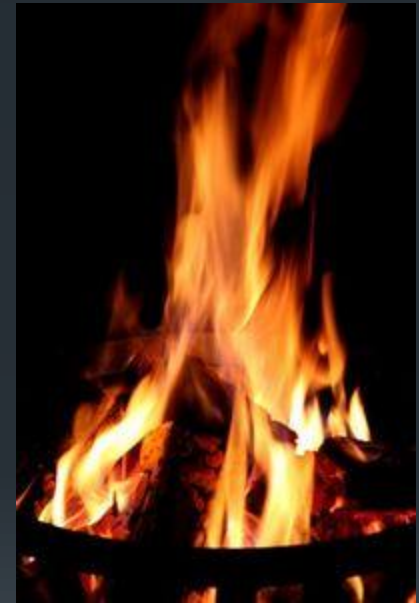
Fighting Fires

- Fires can be very dangerous and you should always be certain that you will not endanger yourself or others when attempting to put out a fire. For this reason, when a fire is discovered:
 - Assist any person in immediate danger to safety, if it can be accomplished without risk to yourself.
 - Activate the building fire alarm system or notify the fire department by dialing 911 (or designating someone else to notify them for you). When you activate the building fire alarm system, some, but not all, will automatically notify the fire department and get help on the way.
 - Only after having done these two things, if the fire is small, you may attempt to use an extinguisher to put it out.



Fighting Fires

- NEVER ATTEMPT TO EXTINGUISH A FIRE IF:
 - **You don't know what is burning.** If you don't know what is burning, you don't know what type of extinguisher to use. Even if you have an ABC extinguisher, there may be something in the fire which is going to explode or produce highly toxic smoke. Chances are, you *will* know what's burning, or at least have a pretty good idea, but if you don't, let the fire department handle it.
 - **The fire is spreading rapidly beyond the spot where it started.** The time to use an extinguisher is in the incipient, or beginning, stages of a fire. If the fire is already spreading quickly, it is best to simply evacuate the building, closing doors and windows behind you as you leave.
 - **You don't have adequate or appropriate equipment.** If you don't have the correct type or large enough extinguisher, it is best not to try to fight the fire.



Evacuating from a Fire

- Pull the fire alarm.
- Leave immediately if the fire alarm sounds. Don't ever assume it is just a fire drill.
- Ensure you take any personal belongings.
- Close all doors and windows on the way out.
- Make sure everyone in your lab has been accounted for. Your lab area may want to designate an assembly area outside to meet in the event of an evacuation.
- Do not reenter the building unless authorized to do so.



What if You Catch on Fire

- If your clothes catch on fire, the best thing to do is to find a safety shower.
- If a safety shower is available, then immediately remove your lab coat and use the shower long enough to remove any contaminating material and to cool the skin.
- If there isn't a safety shower nearby, then stop where you are, drop and roll on the floor, covering your face with your hands and roll back and forth to extinguish the flames.



Electrical Safety in Labs

- All electrical equipment must be properly grounded.
- Electrical breaker boxes must be kept clear a radius of 36" surrounding the breaker box,.
- Equipment, appliance and extension cords must be in good condition and not frayed, damaged, or taped.
- Extension cords must never be used as a substitute for permanent wiring.
- Power strips should not be daisy-chained together.
- Multi-outlet plugs should not be used.
- Portable heaters should not be used in labs.
- For more guidance on electrical safety, visit the EHS web-site.



Chemical Storage Safety

- Chemicals (especially liquids) should never be stored in the floor except in closed door cabinets that are suitable for the material to be stored.
- Never store incompatible chemicals together (i.e. oxidizer and flammables; acids and bases). For more guidance on incompatible chemicals, please visit the EHS website.
- Do not store any flammable chemicals near an ignition source.
- All containers should be labeled to their contents.
- Dispose of any unneeded chemicals and chemical waste through EHS.



Refrigerators, Freezers and other Cooling Equipment

- If flammable chemicals need to be refrigerated, then they **MUST** be placed in an appliance designed for flammable liquids.
- This type of refrigerator is designed so that any flammable vapors in the fridge do not attract sparks.
- These should be marked to indicate whether they meet the requirements for safe storage of flammable liquids.



Fume Hoods

- Only items necessary to perform the present experiment should be in the hood. The more equipment in the hood, the greater the air turbulence and the chance for gaseous escape into the lab.
- Keep sash at or below approved level.
- Keep chemicals within the fume hood closed.
- Ensure proper functioning of audible and visual alarms.



Flammable Storage Cabinets

- When using flammable storage cabinets:
 - Store only compatible materials inside the cabinet.
 - Do not store paper, cardboard, or other combustible packaging material in a flammable liquid cabinet.
 - Do not exceed the manufacture's quantity limits, or NFPA limits for the size of the flammable storage cabinet. Do not overload a cabinet.



Bunsen Burners

- Never leave a Bunsen Burner unattended with the flame on.
- Keep away from walls and flammable materials.
- If using alcohol to disinfect the countertop, always allow the alcohol to dry before igniting any open flame.
- If you must leave the burner unattended for any amount of time, turn off the burner and light again when ready to work with the material. This is especially true when you are leaving the laboratory for any reason.



Hot Plates

- **Inventory lab hot plate models and understand unique features.**
- **Replace hot plates over 20 years old.** Hot plates purchased prior to 1984 do not have temperature feedback controls. These models include the Corning PC-35 and PC-351 and the Thermolyne Model:SP46925.
- **Periodically test the “off” switch on a hot plate to verify that the unit cools down. Unplug hot plates when not in use. Do not leave a hot plate unattended when in use.**
- **If the hot plate must be used unattended, have a safety plan.** A safety plan should include how to monitor and de-energize the hot plate if overheating occurs.



Compressed Gases

- Gas cylinders must be secured at all times to prevent tipping and should be stored in a well-ventilated area.
- Cylinders should be capped at all times.
- Cylinders containing flammable gases, such as hydrogen or acetylene shall not be stored in close proximity to open flames, areas where electrical sparks are generated or where other sources of ignition may be present.
- Cylinders containing acetylene should never be stored in their side.
- Oxygen cylinders should never be stored in the same vicinity (within 20 ft.) of flammable gases.



Cryogenic Liquids

- Liquid nitrogen nor liquid air should not be used to cool a flammable mixture in the presence of air because oxygen can condense from the air and lead to a potentially explosive condition.
- Adequate ventilation must always be used to prevent the build up of vapors of flammable gases (such as hydrogen, methane and acetylene).
- Adequate ventilation is required when using gases, such as nitrogen, helium, or hydrogen, since oxygen can be condensed out of the atmosphere creating a potential for explosive conditions.



Safe Use and Storage: Flammable & Combustible Materials

- Store in NFPA approved flammable liquid containers (“safety cans”) or flammable liquid storage cabinets or in designated areas.
- When dispensing from metal or other conductive containers proper grounding of the containers is necessary.
- Ensure fire extinguishers and/or sprinkler systems are in the area.
- Flammable liquids should be stored away from strong oxidizers, direct sunlight, and heat sources, such as hot plates.



Safe Use and Storage: Oxidizers

- Oxidizers are agents which are known to readily give up oxygen and gain hydrogen. Fire and explosion hazards.
- Store oxidizers in containers with tight fitting screw-top lids.
- Store away from flammables, organics, and reducers.
- Know the reactivity of the materials you are working with in the experiment or process.
- Ensure there are no extraneous materials in the area that could become involved.
- If the reaction is anticipated to be violent or explosive, use shields or other methods for isolating the materials or the process.
- Strong oxidizing materials, such as perchloric acid, must not be heated by gas flames or oil baths.



Safe Use and Storage: Water Reactives and Pyrophorics

- Water Reactive materials include alkali metals such as lithium, sodium, potassium, acid anhydrides, and acid chlorides. Do not use in the presence of water!
- Pyrophoric materials can ignite spontaneously upon contact with air. Some include silane, silicon tetrachloride, and white or yellow phosphorous.
- Water reactive and pyrophoric materials should be stored in inert environments.
- Know the properties of the material and use proper materials for dispensing.
- Never work alone with pyrophoric materials



Personal Protection

- Long hair should be pinned back.
- Safety glasses and lab coats should be worn at all times while working in the lab. Flame retardant lab coats are recommended. Natural fibers, such as cotton, because they offer better protection in a fire.
- Closed toed shoes (preferably leather) and pants should be worn at all times when working in a lab.
- Other PPE, such as gloves, face shields, respirators, chemically resistant aprons, etc.. should also be worn.



Buddy System

- In the event of an accident, you may be disoriented and need assistance.
- Always work with a buddy in the lab. NEVER work alone in the lab.



Door Placards and Chemical Inventories

- Door placards provide important emergency information to fire fighters, or other emergency personnel who need to enter your lab.
- Door placards should be updated a least once a year (or more frequently if the information changes).
- Chemical inventories must be updated at least annually. This information is also used by the fire department in the event of a fire or other emergency. For questions on updating the inventory, please contact EHS.

Questions and Guidance

- For questions and guidance concerning fire safety in laboratories, please contact EHS at 974-5084.
- EHS can train on proper use of fire extinguishers.
- Visit EHS web-site for more guidance and information:
www.ehs.utk.edu

