FIRE SAFETY

Fire prevention is a vital aspect of laboratory safety. It requires knowledge and constant vigilance of laboratory conditions.

The following steps should be followed for laboratory fire safety:

- Recognize flammable hazards
- Evaluate working space before you set up experiments. This includes housekeeping and storage practices.
    - Unused boxes and paper should be cleared from workspace.
    - Do not block fire extinguishers, eyewashes, safety showers, or exits.
- Know where the safety showers, fire extinguishers, and fire alarm pull stations are.
- Be familiar with your building's evacuation plan and know where exits are located.

Classes of Fire

A. **Class A** Fire – Ordinary combustibles or fibrous material such as wood, paper, cloth, rubber, and some plastics.
B. **Class B** Fire – Flammable or combustible liquids such as gasoline, kerosene, paint, paint thinners, and propane.
C. **Class C** Fire – Energized electrical equipment such as appliances, switches, panel boxes, and power tools.
D. **Class D** Fire – Certain combustible metals, such as magnesium, titanium, potassium, and sodium.

INSTRUCTIONS FOR EMERGENCY EVACUATIONS

When the AUDIBLE/VISUAL alarm is activated or you are otherwise advised to leave the building.

- ALL employees and guests are to vacate the building immediately (even if it is just a fire drill!).
- Be familiar with the emergency access routes. Refer to the suggested exit or alternate exit routes on the diagram in your area for the closest building exit.
- Carefully touch all doorknobs to insure that they are not hot; if they are do not open the door.
- Enter each area/room (offices, labs, bathrooms, etc.) to look for any personnel who may have missed the evacuation alarm and inform them to leave the building.
- Assist any physically challenged person to evacuate, if doing so will not jeopardize your safety.
- Aisles need to remain clear so that there is a clear path of egress to the emergency exits.

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- If you cannot use the exit because of heavy smoke proceed to the nearest safe exit.
- Close all windows and doors on your way out.
- Do not wedge or block doors in the event of a fire.
- Once outside, please move quickly to the designated census area and remain there until the alarm is silenced or you are given further instructions.
- Do not re-enter the building unless authorized to do so.

Use of Fire Extinguishers

Only attempt to use a fire extinguisher if the fire is small, you know what is burning (so you know what type of extinguisher to use) and you are familiar with the following **PASS** Method procedure:

- **P**ull the Pin – This will allow you to discharge the extinguisher
- **A**im at the Base of the Fire – If you aim at the flames, the extinguishing agent will fly right through and do no good. You want to hit the fuel at the base of the fire.
- **S**queeze the Top Handle or Lever – This depresses a button that releases the pressurized extinguishing agent in the extinguisher.
- **S**weep from Side to Side – Start using the extinguisher from a safe distance away, then move forward.

Never Attempt to Extinguish a Fire if:

- If the fire is too large or you are not comfortable with the extinguisher do not attempt to put it out. Even if you have an ABC extinguisher, there may be something in the fire which is going to explode or produce highly toxic smoke. If you don't know what is burning or how to effectively put it out let the fire department handle it. Do Not endanger yourself or others.
- 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.

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If You Catch on Fire:

- Find a safety shower
- If safety shower is not available close by, then **Stop, Drop, and Roll** covering your face with your hands and roll back and forth to extinguish the flames.

Flammable Storage Cabinets

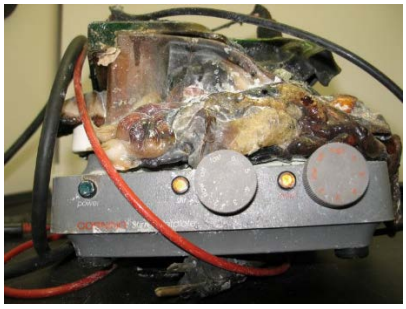
When using flammable storage cabinets:

- 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.

WORKING SAFETLY WITH FLAMMABLES

Flammable and combustible liquid fires are much more volatile than fires fueled by ordinary materials such as wood, paper and cloth. Flammable

vapors ignite with explosive force. The resulting fire gives off twice as much heat, has a greater rate of temperature rise and spreads faster than fires of ordinary materials.

To understand the OSHA requirements for the safe storage, handling and use of flammable and combustible liquids, we must first distinguish between a flammable and combustible.

Flammable Liquids

A flammable liquid is any liquid having a flashpoint below 100^{0}F (37.8 ^{0}C) (except any mixture having components with flashpoints of 100 ^{0}F (37.8 ^{0}C) or higher, the total of which make up 99 percent or more of the mixture) (1910.106(a)(19)). Flammable liquids are known as **Class I** liquids and are divided into the following three groups:

- **Class IA:** Class IA liquids have a flashpoint below 73 degrees F (22.8 C) and a boiling point that's below 100 F (37.8 C)(1910.106(a) (19) (I)).
- **Class IB:** Class IB liquids have a flashpoint below 73 F (22.8 C) and boiling point that's at or above 100 F (37.8 C)(1910.106(a)(19)(ii)).
- **Class IC:** Class IC liquids have a flashpoint at or above 73 F (22.8 C) and below 100 F (37.8 C) (1910.106 (a)(19)(iii)).

Combustible Liquid

A combustible liquid means any liquid having a flashpoint at or above 100 F (37.8 ^{0}C.) (1910.106(a)(18)). Combustible liquids are divided into the following two classes:

- **Class II:** Liquids having flashpoints at or above 100 F (37.8 ^{0}C) and below 140 F (60 ^{0}C.) (except any mixture having components with flashpoints of 200 F (93.3 ^{0}C) or higher, the volume of which make up 99 percent or more of the total volume of the mixture (1910.106(a)(18)(I)).
- **Class III:** Liquids having flashpoints at or above 140 F (60 ^{0}C) (1910.106 (a)(18)(ii)). Class III liquids are further subdivided into the following two subclasses: Class IIIA and Class IIIB.
    - **Class IIIA** liquids have flashpoints at or above 140 F (60 ^{0}C) and below 200 ^{0}F (93.3 ^{0}C.) (except any mixture having components with flashpoints of 200 ^{0}F (93.3 ^{0}C) or higher, the total volume of which make up 99 percent or more of the total volume of the mixture (1910.106(a)(18)(ii)(a)).

- **Class IIIB** liquids have flashpoints at or above 200 F (93.3 ^{0}C) (1910.106 (a)(18)(ii)(b))

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 hearted by gas flames or oil baths.

Static Electricity

Materials are made of atoms that are normally electrically neutral because they contain equal numbers of positive charges (protons in their nuclei) and negative charges (electrons in "shells" surrounding the nucleus). The phenomenon of static electricity requires a separation of positive and negative charges. When two materials are in contact, electrons may move from one material to the other, which leaves an excess of positive charge on one material, and an equal negative charge on the other. When the materials are separated they retain this charge imbalance.

An electrostatic discharge (also called a static spark) is a discharge of electricity across a gap between two points not in contact, resulting from a difference in electrical potential. The spark produced when the electrical charge jumps across the gap usually contains enough energy to ignite flammable vapors if they are in concentrations that will sustain combustion.

The generation of static electricity cannot be totally eliminated because it is normally present at every interface. However, there are ways to reduce the potential for static charge build-up when transferring flammable liquids. The two most important ways to prevent static sparks are bonding and grounding.

Bonding

Bonding is done to eliminate the difference in electrical potential between two or more objects. An adequate bond between two or more conductive objects will allow the charges to flow freely between objects, resulting in no

difference in electrical potential. Bonding will not eliminate the static charge, but will equalize the potential between the objects bonded so that a spark will not occur between them. The likelihood of a spark between the objects is then essentially eliminated. The size of the bonding wire is based on mechanical strength rather than on current-carrying capacity. The attachment point on both objects must be solid and secure and should be on a bare metal surface. The connection must be made prior to beginning the transfer of material between the containers. If the bonding is done after the transfer, the static charge build-up could result in a spark as the bond wire is connected to one of the containers.

Grounding

All electrical equipment must be properly grounded. Grounding an object serves a different purpose than bonding. To ensure that a static charge will not create a spark, a conductive path must be provided to the earth. A proper ground will provide a means for continuously discharging a charged, conductive body to the earth. Grounding may be achieved by attaching a wire conductor between the container and a water pipe or the full length of an 8-foot long copper clad steel rod embedded in the ground.

Rate of Static Discharge

Electrical charges can build up in flammable liquids when the liquids flow through piping systems or when they are agitated in their storage containers as a result of mechanical movement or splashing. The proper bonding and grounding of the system is often enough to control this static build-up. However, if rapid flow rates are used to transfer the liquid into a storage tank or container, high electrical potentials can occur on the surface of the liquid in the tank.

The rate of accumulation of static charge may be much greater than the liquid's ability to transfer it to the grounded metal storage vessel. If the accumulated charge in the container builds up enough, a static spark may result when the liquid level approaches a body with a different potential. This kind of static situation can be controlled by reducing flow rates, avoiding violent splashing in the tank, and allowing for time until the static charges dissipate. Splash filling can be avoided by using a fill pipe designed in accordance with NFPA 77.

GUIDLINES FOR FILLING GAS CANS

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The National Institute for occupational Safety and Health (NIOSH) has received numerous reports of fires occurring during the refilling of gas cans.

To prevent this potentially hazardous situation, NIOSH recommends that gas cans always:

- be placed on the ground before and during refueling
- before removing the can lid, touch the can with the gas dispenser nozzle
- keep the gas dispenser nozzle in contact with the can inlet.

CHARGING BATTERIES

Please be careful when charging car/boat batteries in your labs. Overcharging of batteries will produce hydrogen gas while being charged and can cause a serious explosion. For this reason, you should always charge batteries in a well ventilated area, and try to use a charger which automatically reduces the current as the battery becomes charged.

Other suggestions:

1. Insure that there are no other flammable materials in the vicinity.
2. Monitor the battery and charger often and do not allow a battery to be unmonitored for more than eight hours except overnight. If charged overnight check it first thing in the morning.
3. Wear safety goggles when setting up or dismantling a charging operation.
4. Use a sign to warn others that you are charging a battery in an area of public/employee access, please use caution in the placement of any and all bar-b-que grills, pits, or ovens regardless of fuel type (i.e. charcoal, wood or LP gas).

Door Placards and Chemical Inventories

- Door placards provide important emergency information to fire fighters, or other emergency personnel who need to enter your lab.

For more information and/or suggestions contact the Environmental Safety Compliance Officer (ESCO), Email umces-safety@umces.edu.