

Flammable and Toxic Liquid Storage and Dispensing

DESCRIPTION

Fire and explosion hazards of flammable liquids exist in research laboratories throughout the NC State University. Research experimentation in chemistry, for example, requires dispensing significant quantities of flammable and toxic liquids for distillation and liquid chromatography. The safe handling of these materials requires a basic understanding of the hazards and the steps needed to minimize them.

EH&S discourages using 5-gallon or larger containers of flammable and toxic chemicals in research laboratories. This is due to increased risk of fire, spill, and exposure during transferring chemicals from a large container to smaller containers. Furthermore, NC building code has set limits for flammable chemical storage per each control area in a building. The maximum allowable quantity of flammable in a multiple – story building decreases as the story level increases.

FLAMMABLE & COMBUSTIBLE LIQUIDS IN THE LABORATORY

Flammable liquids are commonly divided into three classes

<u>Class</u>	<u>Flash Point</u>	<u>Boiling Point</u>	<u>Example</u>
IA	Below 73°F	Below 100 °F	Ethyl Ether
IB	Below 73 °F	At or above 100 °F	Acetone, Benzene, Toluene
IC	At or above 73°F and below 100°F		Hydrazine and Styrene

Combustible liquids are divided into three classes

<u>Class</u>	<u>Flash Point</u>	<u>Example</u>
II	100-139 °F	Acetic acid, naptha and Stoddard solvent
IIIA	140-199 °F	Cyclohexanol, formic acid and nitrobenzene
IIIB	200 °F or above	Formalin and picric acid

The **flashpoint** of a flammable liquid is the lowest temperature at which it can form an ignitable mixture with air and produce a flame when a source of ignition is present.

STATIC ELECTRICITY HAZARDS IN THE LABORATORY

The flow of flammable and combustible liquids can cause the buildup of static electricity. When enough of a charge is built up, a spark can result and potentially cause a fire or explosion. The likelihood of this happening is dependent upon how well the liquid conducts electricity, the flash point and the capacity to generate static electricity.

Static electricity can be generated when liquid is transferred from one metal container to another. Liquids have the ability to generate static electricity when they move in contact with other materials during pouring, pumping or agitating. The build up of this static electricity can cause a spark to form where the solvent exits the container. This could result in a fire or explosion.

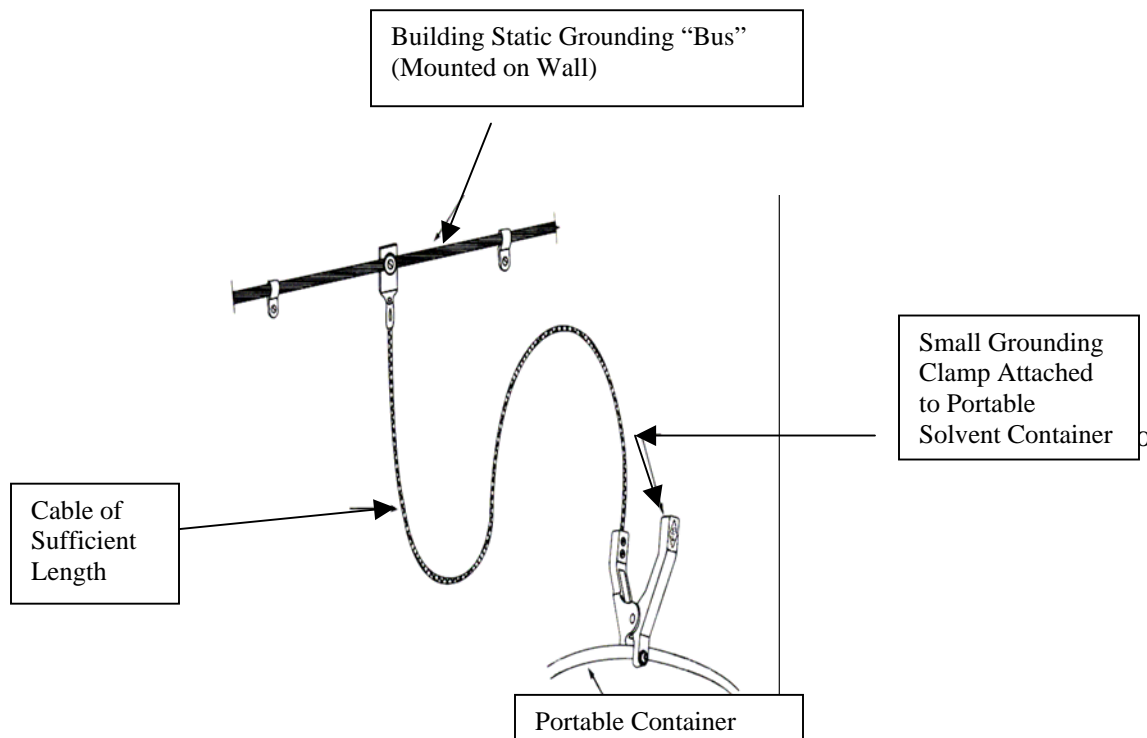
PROCEDURES TO AVOID STATIC ELECTRICITY

To avoid the build up of static electricity that may cause a spark, it is important to bond and ground metal or special conductive plastic containers. **Bonding** eliminates the electrical potential between two containers therefore eliminating the likelihood of sparks. A bonding wire is connected to two conductive objects as seen in the drums pictured below.



Bonding wires between drums

Grounding eliminates the difference in static potential charge between the conductive object and ground. Grounding is accomplished by connecting the conductive object directly to the earth, usually using cold-water copper pipes, building steel or grounding bus/bar.



Bonding and grounding require good electrical connections. Remove any dirt, paint or rust ensuring **metal-to-metal** contact.



Bonding and Grounding wires come in a variety of styles and lengths. They can be purchased through [Fisher Scientific](#), [Justrite Manufacturing](#); and through [Lab Safety Supply](#) . [The Cary Company](#), or other sources.



Hand Clamp



'C' Clamp and Alligator Clip

Static hazards may also exist in non-metallic plastic or glass containers that cannot be grounded. Static may be generated by the free fall and turbulence of the liquid being poured. To minimize this hazard, pour **as slowly as possible** and use a grounded nozzle extension that allows filling the container from the bottom.

DISPENSING FLAMMABLE LIQUIDS FROM 5 GALLON PAILS

Manual dispensing pumps for 5-gallon pails/cans are available. These pumps are specifically designed to dispense liquids into small laboratory-size bottles without spilling. If you are pouring into a conductive container, a bonding wire should be attached from the 5-gallon pail to the container being filled. The 5-gallon pail should be grounded.

The dispenser shown in the pictures below can be purchased through [Fisher Scientific](#) and [The Cary Company](#). The metal strap in the picture hooks over the bottom of the pail and secures the dispenser while pumping.



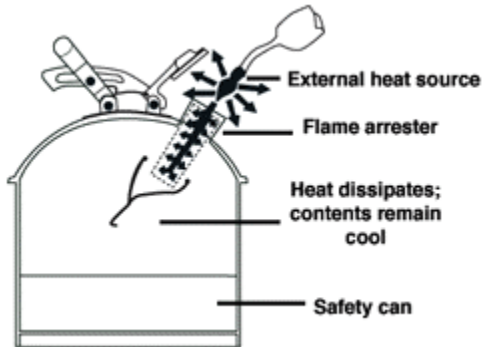
Metal Strap



Dispensing pump with Bonding and grounding wires and alligator clips.

DISPENSING FLAMMABLES FROM SAFETY CANS

Safety cans have self-closing airtight lids and a flame arrester that protects the contents from an external ignition source. Bonding and grounding is still required on safety cans since static electricity generation is possible. The nozzle provides a bonding path to a receiving metallic vessel.



If either of the containers is non-metallic (conductive) it is still important to follow the limited velocity and grounded nozzle extension information given previously.



Safety can with extended nozzle

Safety cans do not offer protection from heat when exposed to fire and should be stored in a flammable liquids storage cabinet when not in use.

FLAMMABLE LIQUIDS STORAGE CABINETS

In most laboratories flammable liquids storage is provided under the chemical laboratory hood in specifically designed vented cabinets. These cabinets are clearly marked “Flammable Storage” (Some of the cabinets under the chemical laboratory hoods **are not** NFPA-approved flammable storage cabinets). Flammable liquids storage cabinets are constructed to limit the internal temperature when exposed to fire. When additional storage is needed, NFPA 30-4.3.3 approved flammable liquids storage cabinet (FLSC) may be purchased. All containers of flammable liquids must be stored in a FLSC when not in use. The following requirements apply:

General Requirements

- Cabinets shall be no larger than 45-gallon capacity
- Cabinets should be located near chemical laboratory hood alcoves
- Cabinets shall be marked “Flammable-Keep Fire Away”
- Freestanding cabinets vent may be hard ducted into laboratory local exhaust system (or a dedicated system for hazardous materials exhaust if present). Facility modification form is required for any exhaust system addition/modification.
- If not vented, vent openings for freestanding cabinets shall be sealed.

Grounding of Flammable Liquids Storage Cabinets

Flammable liquids storage cabinets are equipped with a grounding system that can be connected to a building ground. If you are pouring from a container in the storage cabinet and if the container being poured to is conductive then a bonding strap should be attached between them as explained in ‘PROCEDURES TO AVOID STATIC ELECTRICITY’ found above.

[Fisher Scientific](#) and [Grainger](#) carry a wide variety of flammable liquids storage cabinets.



PERSONAL PROTECTIVE EQUIPMENT

Splash proof goggles and face shield in addition to standard laboratory personal protective equipment (PPE) consisting of a lab coat, closed toe shoes and chemical protective gloves shall be worn while pouring flammable and/or liquids. Pouring larger volumes and dispensing highly toxic chemicals may require additional PPE consisting of thicker gloves and an apron. Follow your laboratory Standard Operating Procedures (SOP) in your Safety Plan. Whenever possible, transfer chemicals inside a laboratory chemical hood.

EMERGENCY PROCEDURES

In the case of a fire, call 911 from a university or cell phone to reach Campus Police, pull the fire alarm and leave the building. Make yourself available to the emergency responders. Follow your laboratory specific SOP for emergencies.

For large spills, leave the area, close the door behind you and contact campus police at 919. See your safety plan and EH&S website for more information on fire, spill, and exposure incidents.

An eyewash/safety shower must be nearby when dispensing flammable liquids. For more information please contact EH&S at 919-513-1282.
