

## STANDARD OPERATING PROCEDURE

**FOR FLAMMABLE SOLVENTS IN LABORATORY Room 419/429**

## I. ASSOCIATED RISKS

The most common fire hazard in the lab is flammable liquids and the vapors produced from such liquids. Although the primary hazard arises from the solvents property of being highly or extremely flammable, several are also described as harmful and/or toxic. Solvents frequently affect the central nervous system and at high concentration can cause sedation, coma, and death. For these reasons, flammable solvents should be regarded as very hazardous. Flammable solvents frequently found in most laboratories include, but are by no means limited to, acetone, methanol, ethanol, etc.

## II. RISK MANAGEMENT

- C Mixing or dispensing should be done in a fume hood with all ignition sources eliminated.
- C Use with adequate ventilation.
- C Keep away from ignition sources.

## III. OPERATOR INSTRUCTION

## 3.1 Training

- C All users must be WHMIS trained.
- C The MSDS for the appropriate solvent must be reviewed.
- C The SOP must be reviewed.
- C Users must know the location of, and be familiar with the use of the closest fire extinguisher, fire retardant blanket, and safety shower.
- C Users must be able to recognize sources of ignition.

## 3.2 Use

Before you begin work with flammable solvents, you must

- C Review the MSDS for the solvent you are working with.
- C Know the location of the closest fire alarm, fire extinguisher, fire retardant blanket, and safety shower.
- C Know the location of the closest spill pillows and/or spill kit and be trained in its use.
- C All newly developed protocols involving flammable solvents should be discussed with your supervisor including needs for fire-retardant equipment and clothing.

For flammable solvents it is actually the vapors that burn. The *flash point* of a solvent is the lowest temperature at which a solvent gives off enough vapor to start burning when a heat source is present. The lower the solvent's flash point the more dangerous the fire hazard. It is important to realize that most common solvents have a flash point below room temperature (example: acetone -18 EC). In conditions of poor ventilation, vapors can be found far from the liquid and a fire can start where these invisible vapors accumulate resulting in 'vapour flashback'. It is also important to understand that dilution of the solvent in water most often will NOT eliminate the hazard - methanol has a flash point below room temperature at only a 10% concentration.

You must make yourself aware of ignition sources. Some solvents do not require an open flame for ignition, in fact some solvents have an auto-ignition point (a temperature above which the solvent will spontaneously ignite). Common ethers can be ignited by a hot-plate. The most common sources of ignition are:

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Reviewed by Env Health & Safety:	15 Aug 2002

- C open flame
- C heating elements
- C refrigerator motors
- C stir plate motors
- C static electricity discharge
- C radiant heat
- C frictional heat
- C heat producing chemical reactions

Eliminate ignition sources from your work area before using flammable solvents. If electrical equipment is required, it must be CSA certified for hazardous locations and used in a fumehood to ensure adequate ventilation (this includes equipment such as blenders and stirring motors).

Ethanol use in laminar flow benches is a common hazard in the department because of the concurrent need for an open flame for sterilizing culture equipment. Since the use of ethanol for this purpose is not likely to be eliminated in the lab constant vigilance is required by the users.

- C Turn on laminar flow bench blower prior to using ethanol.
- C Use only ethanol-squirt bottles with a flame arrestor in place.
- C Once the surface of your bench has been sterilized with ethanol, remove both the wipe rag and the dispensing bottle from the bench. Ensure the bench is completely dry before lighting the alcohol burner.
- C Ensure the flame from the alcohol burner is kept well away from any open sources of ethanol.
- C Do not leave a lit alcohol burner unattended. Extinguish the flame prior to leaving the work area.
- C Always extinguish a burner prior to refilling.
- C Ensure any open sources of ethanol are kept in containers not easily knocked over by accident.

All dispensing of flammable solvents shall be performed in the fume hood. Such operations must be stopped upon failure of the ventilation/exhaust system.

Flammable solvents (pure or waste) may never be poured down sinks.

### 3.3 Storage

- C Quantities of flammable solvents ordered shall be kept to a minimum. Ordering "extra" solvent simply because it is cheaper to buy larger volumes, is often false economy because the larger bottles take up more space in the cabinet, present a greater potential hazard, and may eventually be a disposal problem.
- C Keep only the minimum reasonable quantity in your immediate work area (this volume must be under 0.5 liters). Note: there must not be, at any one time, a *total* of more than 5 liters of flammable solvent stored outside of the solvent cabinet, in any one lab. All containers must be labelled to indicate content and show WHMIS labels and owner identification. All containers will be kept closed when not in use.
- C Larger volumes (one 4 liter original bottle or less) must be stored in the flammable solvent storage cabinet, away from other combustible materials and oxidizers. The door of this cabinet must be kept closed. Volumes of any one solvent greater than 4 liters must be kept in the outside solvent storage vault (located next to the side loading doc of the Crop Science building). Containers larger than 5 liters must be approved safety containers.
- C If possible, avoid the use of metal storage containers. If unavoidable, be sure to ground and bond metal containers when transferring flammable solvents. This procedure prevents the build up and discharge of static electricity sparks (a source of ignition). This is accomplished by connecting

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- containers to each other and to an electrical ground using clamps and wires, or by direct metal to metal contact. Get your supervisor to show you the correct procedure for your situation or contact the University of Guelph Fire Prevention Services. Bonding and grounding are not required for plastic containers because these containers are non-conductive. However, you should still minimize the potential for static charges to develop (limit the distance the liquid falls and slow the rate at which the liquid is transferred).
- C Materials requiring refrigeration must be stored in the flammable solvent (spark proof) CSA Standard certified refrigerator/freezer. Refrigerators have, in the past, exploded due to flammable vapors. To elaborate- flammable solvents (including ethanol) may not be stored in your everyday-variety refrigerator or freezer as this situation would be a serious fire hazard.

Waste solvent is as flammable as pure solvent and containers must be used, labeled, and stored accordingly.

#### IV. EMERGENCY PROCEDURES

##### 4.1 Spills

Serious - toxic solvents or large quantities of any solvent:

- C Evacuate the area, closing doors and eliminating the sources of ignition IF SAFE TO DO SO.
- C Phone Ext 2000 and request assistance. Do not attempt to clean up a major spillage by yourself.

Minor

- C Ventilate the affected area and eliminate any sources of ignition.
- C Try to prevent the solvent from seeping into floor drains and absorb the liquid with a solvent-spill pillow.
- C Transfer used pillow to a fumehood with no ignition sources and dispose of as hazardous waste.

##### 4.2 Fire

If the fire is extremely small, does not involve an immediate threat to you or any coworker, and does not involve a solvent that would release toxic fumes upon combustion, you may briefly attempt to extinguish the fire using an empty inverted glass beaker to smother it, a fire retardant blanket, or a fire extinguisher. This type of fire would most commonly be associated with the small volume ethanol fires that unfortunately have occurred on flow benches. If a fire extinguisher has been discharged, it must be immediately reported to the campus Fire Prevention Services Ext 2000.

If there is any danger to yourself or co-worker, if the fire can not be extinguished with the use of only one extinguisher, or if the fire involves a toxic solvent then:

- C Evacuate the lab immediately
- C Close the doors as you leave
- C Do not use the elevators
- C Activate the nearest fire alarm
- C Leave the building
- C Call Ext 2000 from a safe location and report to the attending fire officer

##### 4.3 Exposure

- C Wash exposed areas of skin with mild soap and copious quantities of water.
- C Rinse eyes, holding the lids open, for 15 minutes at the eye wash station.

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- C Seek medical attention. Know the symptoms of accidental exposure for your solvent. The most common immediate symptoms associated with solvent poisoning are dizziness, nausea, headache and contact dermatitis.

Further information is available from the University Safety Policy Manual Policies

- 851.02.05 Fire alarm systems and suppression systems
- 851.03.01 Fire emergencies
- 851.02.01 Fire safety code
- 851.02.02 Fire safety plans
- 851.08.06 Flammable, combustible, and pyrophoric materials