

**BASIC FLAMMABLE and COMBUSTIBLE LIQUIDS HANDLING
STANDARD OPERATING PROCEDURE TEMPLATE**

This SOP is for work in which flammable/combustible liquids are NOT used in operations that often generate static electricity which can act as an ignition source; including the pumping or pouring of solvents between metal containers. Those operations require grounding and/or bonding of the containers to prevent static buildup and a different SOP template in the UCSB SOP Library should be used: **ADVANCED FLAMMABLE AND COMBUSTIBLE LIQUIDS HANDLING**

(See also these related UCSB SOPs: *“Solvent Use: Extractions, Distillations & Still Quenching”* and *“Peroxide-Forming Chemicals”*)

Type of SOP: Process Hazardous Chemical Hazard Class

To customize this SOP, add lab-specific information to the sections below marked in RED, as applicable. Completion of the last section (“Lab-Specific Information”) is required. Also, any of the content below may be amended with lab-specific information to enhance worker safety as desired.

1. HAZARD OVERVIEW

Flammable and combustible organic solvents are amongst the most dangerous chemicals in the lab. A measure of how ignitable a particular solvent is the **flashpoint** ; defined as the lowest temperature at which a material can form an ignitable mixture with air and produce a flame when a source of ignition is present. **The lower the flashpoint, the more easily the liquid can be ignited.** Most common organic solvents in the lab are readily ignited, with the exception of chlorinated solvents like dichloromethane which require more extreme conditions to burn.

Flammable liquids (flash point < 100°F) are divided into three classes:

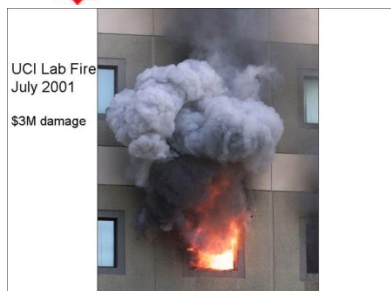
<u>Class</u>	<u>Flash Point</u>	<u>Boiling Point</u>	<u>Examples</u>
IA	Below 73°F	Below 100 °F	Ethyl Ether
IB	Below 73 °F	At or above 100 °F	Acetone, Benzene, Toluene
IC	At or above 73°F and below 100°F		Isopropanol, Xylene

Combustible liquids (flash point > 100°F) are divided into three classes:

<u>Class</u>	<u>Flash Point</u>	<u>Examples</u>
II	100-139 °F	Acetic acid, cyclohexane, and mineral spirits
IIIA	140-199 °F	Cyclohexanol, formic acid and nitrobenzene
IIIB	200 °F or above	Formalin and vegetable oil

A particular organic solvent may have other hazards beyond their flammability. For example, benzene is recognized carcinogen. Check the Safety Data Sheet for the particular solvents in use.

The international symbol ([Globally Harmonized System](#)) for a flammable liquids/gases/solids is:



Diethyl ether initiated fire

2. PERSONAL PROTECTIVE EQUIPMENT (PPE)

See the PPE information under Sec. II of the *UCSB Chemical Hygiene Plan* regarding:

- the UC PPE Policy and policy summary (what PPE is needed and when/where to use)
- obtaining your PPE via use of the *Laboratory Hazard Assessment Tool (LHAT)*
- glove selection criteria
- respirator use, etc.

In general, workers who use flammable liquids will be issued a free fire-resistant Nomex lab coat via the LHAT process.

3. ENGINEERING/VENTILATION CONTROLS

All chemicals should be transferred and used in an annually certified laboratory chemical fume hood with the sash at the certified position or lower. The hood flow indicator should be checked to be operating correctly prior to using the hood. For further information see the following pages in Sec. II of the *UCSB Chemical Hygiene Plan*:

- Fume Hood Usage Guide
- Criteria for Implementing Engineering Controls
- Safety Shielding: Shielding is required any time there is a significant risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of flammable liquids which pose this risk should occur in a fume hood with the sash in the lowest feasible position. Portable shields, which provide protection to all laboratory occupants, are acceptable.
- Special Ventilation: Manipulation of flammable liquids outside of a fume hood may require special ventilation controls in order to minimize exposure and reduce the fire risk. Fume hoods provide the best protection against exposure to flammable liquids in the laboratory and are the preferred ventilation control device. If your research does not permit the handling of large

quantities of flammable liquids in your fume hood, contact EH&S to review the adequacy of all special ventilation.

4. SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

Use in an area that is properly equipped with a certified eye wash and safety shower that is available within ten seconds of travel.

Store in a tightly closed, labeled container and in a cool, dry, well-ventilated area. Segregate from incompatible materials. Repackaged chemicals must be labeled clearly. For example, squirt bottles and acid/base cleaning baths. Follow any substance-specific storage guidance provided in Safety Data Sheet documentation.

- **Flammable Liquid Storage Cabinets**

- ✓ One or more Flammable Liquid Storage Cabinets (**FLSC**) are required by CA Fire Code for laboratories which store, use or handle more than 10 gallons of flammable or combustible liquids.
- ✓ Containers of flammable liquids that are one gallon and larger must be stored in a flammable-liquids storage cabinet.
- ✓ The storage of flammable and combustible liquids in a laboratory, shop, or building area must be kept to the minimum needed for research and/or operations. FLSC are not intended for the storage of highly toxic materials, acids, bases, compressed gases, or pyrophoric chemicals.
- ✓ In most UCSB laboratories, flammable liquids storage is provided under the chemical fume hood. These cabinets are clearly marked “Flammable Storage” and are often ventilated via a stainless steel hose into the fume hood exhaust duct. Flammable liquids storage cabinets are constructed to limit the internal temperature when exposed to fire. When additional storage is needed, NFPA-approved 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 marked “Flammable - Keep Fire Away”
 - Cabinets should be kept in good condition. Doors that do not close and latch must be repaired or the cabinet must be replaced.
 - ✓ 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 into is conductive then a bonding strap must be attached between them as explained in PROCEDURES TO AVOID STATIC ELECTRICITY.



FLSC involved in fire

- **Labeling**

- ✓ All flammable liquids must be clearly labeled with the correct chemical name.
- ✓ Handwritten labels are acceptable; chemical formulas and structural formulas are not acceptable.
- ✓ The label on any containers of flammable liquids should say “Flammable” and should include any other hazard information, such as “Corrosive” or “Toxic”, as applicable.
Example: lab squirt bottles, or acid/base baths.

- **Heating/Open flame**

- ✓ Do not permanently store flammable liquids in chemical fume hoods or allow containers of flammable liquids in proximity to heating mantles, hot plates, or torches.
- ✓ With the exception of vacuum drying ovens, laboratory ovens rarely have any means of preventing the discharge of material volatilized within them. Thus it should be assumed that these substances will escape into the laboratory atmosphere, but may also be present in sufficient concentration to form explosive mixtures within the oven itself. Venting the oven to an exhausted system will reduce this hazard.
- ✓ Drying ovens should not be used to dry glassware that has been rinsed with organic solvents until all of the solvent has had the opportunity to drain or evaporate at room temperature.

5. SPILL AND INCIDENT PROCEDURES

See directions under the “*Chemical Incident*” and “*Medical Emergency*” tabs of the *UCSB Emergency Information Flipchart* – should already be posted in all labs.



For those that routinely use flammable liquids, it is strongly recommended that they attend the live version of the EH&S *Fundamentals of Laboratory Safety* class, where **hands-on fire extinguisher training** is conducted. All campus labs should have a fire extinguisher already on-site, generally near the exit door.

6. DECONTAMINATION

Wear proper PPE, decontaminate equipment and bench tops using [soap and water]. Dispose of all used contaminated disposables as hazardous waste per below.

7. WASTE DISPOSAL

See “Chemical Waste Disposal” in Sec. II of the *UCSB Chemical Hygiene Plan*.

Solvent waste is stored in labeled waste bottles under the two fume hoods on the north wall of the lab. If the waste bottle is full:

1. Note the date on waste label and put the full bottle in the grey tub under the sink by the door.
2. Take an empty bottle from the labeled cabinet on the hood closest to the door and put a new waste label on the empty bottle. On the label note:
 - a. Mixed solvent waste as the material being collected
 - b. The date that the bottle was put into use.

8. PRIOR APPROVAL/REVIEW REQUIRED

Prior approval is not required for using lab supplied flammable solvents (Acetone, IPA, Ethanol, Methanol and Toluene) for substrate cleaning in the fume hoods or other approved locations.

Use of other flammable solvents, or the use of the lab supplied flammable solvents for other processes does require prior approval.

Flammable solvents may not be heated.

9. DESIGNATED AREA

Work should be completed in a laboratory fume hood given the volatility and flammability of most solvents.

10. SAFETY DATA SHEETS and OTHER REFERENCES

Online SDS can be found at: <http://ehs.ucsb.edu/labsafety/msds>

Prudent Practices in the Laboratory, 2011, see Secs. 4.D and 6.F for flammable liquids
http://www.nap.edu/openbook.php?record_id=12654&page=R15

11. LAB-SPECIFIC INFORMATION (required) (*Examples of appropriate content*)

Approved uses of solvents in the Microfluidics Lab:

1. IPA wipe of the Objet print heads
2. Cleaning devices, substrates and tools in the fume hoods.
3. Light cleaning on the lab benches around the lab – take care to keep solvents away from sources of ignition.