

## SBMS07:

### Guidance on Storage of Hazardous Chemicals

If incompatible chemicals are inadvertently mixed a fire, explosion, or toxic release can easily occur thus it is particularly vital that chemicals be stored safely. This document contains some basic guidelines for chemical storage. Note however, that chemicals can often fall into more than one hazard category and therefore the chemical label and/or Material Data Safety Sheet (MSDS-see *below*) should be reviewed for specific storage requirements and when completing COSHH and DSEAR assessments etc.

#### ***In General:***

1. Chemicals should be dated upon receipt and when opened, as some have limited shelf life and others can form dangerous decomposition products (see [http://www.safety.ed.ac.uk/resources/General/Ethers\\_storage\\_detection.shtm](http://www.safety.ed.ac.uk/resources/General/Ethers_storage_detection.shtm) for further details)
2. Separate incompatible chemicals by adequate distance, or preferably by using physical barriers (e.g. storage cabinets).
3. Avoid using the fume hood for chemical storage - this practice may interfere with the proper air flow of the hood.
4. For especially hazardous materials, use a secondary container (e.g. plastic tub) large enough to contain a spill of the largest container.
5. Ensure storage, use and disposal are considered in a risk assessment (e.g. COSHH and/or DSEAR) BEFORE ordering substances so any additional precautions can be put into place before the material is on site.

#### ***Specific advice :*** ([List of approved workplace exposure limits](#))

#### **1. FORMALDEHYDE**

- Also called methanal, methalaldehyde (in aqueous solution called Formalin).
- Exposure to 19 mg m<sup>-3</sup> vapour concentration causes nasal passage cancers in rats. Skin cancers occurred at 8 ppm.
- The Workplace exposure limit (WEL) is 2.5mg/m<sup>3</sup>, although even at 1mg/m<sup>3</sup> it irritates eyes and nose.
- It sensitises the skin causing painful swelling.
- It also causes difficulty in breathing after prolonged exposure.
- The WEL is the same for short-term (15 min) and long-term (8 h) exposures.
- **Keep exposure to formaldehyde to a minimum.**

### 1.1. BIS-(CHLOROMETHYL)-ETHER (Cl CH<sub>2</sub> OCH<sub>2</sub> Cl):

- Under some conditions formaldehyde can react with hydrogen chloride (HCl) to form bis-(chloromethyl)-ether : a potent lung cancer agent in man. WEL (8 h) 0.005 mg m<sup>-3</sup>.

It is advised that HCl and formaldehyde are **NOT** stored together and are only used together under strictly controlled conditions, for example within a fume cupboard or a fully enclosed system.

#### Labelling

Formaldehyde containers should be treated as a 'suspect carcinogen'. It is also recommended that a further label is used wherever practicable:

#### **"FORMALDEHYDE:**

**DO NOT STORE WITH HCl - [risk of formation of bis-(chloromethyl)-ether]"**

## 2. Ether

Owing to its volatility and extremely low flashpoint temperature of – 40°C , Ether (diethyl ether, ethyl ether) is one of the greatest fire hazards commonly encountered in the laboratory; it is classed as extremely flammable (F+):

See <http://www.safety.ed.ac.uk/newsflashes/incidents/incident24.shtm> for details of an incident that occurred within the University.

**Ether does not require a source of ignition such as a naked flame, or spark to initiate combustion.** Ether vapour may be ignited by hot surfaces such as hot plates, electric lamps and static electricity discharges, and since the vapour is heavier than air, it may travel a considerable distance to an ignition source and flash back. Sufficient static electricity to initiate flash ignition can build up when large quantities of ether is being poured from one vessel into another. Ether vapour forms explosive mixtures with air at concentrations of 1.7% to 48% (by volume). Carbon dioxide or dry powder extinguishers should be used for ether fires.

Ethers absorb and react with oxygen from the air, in the presence of light, forming unstable peroxides that can detonate with extreme violence when they become concentrated through evaporation or distillation and disturbed by heat, shock or friction. For more information on peroxides, please see [http://www.safety.ed.ac.uk/resources/General/Ethers\\_storage\\_detection.shtm](http://www.safety.ed.ac.uk/resources/General/Ethers_storage_detection.shtm)

Ether has been assigned the following EU Safety Phrases:

- S9 Keep container in a well ventilated place
- S16 Keep away from sources of ignition
- S29 Do not empty into drains
- S33 Take precautionary measures against static discharges

and the following EU Risk Phrases:

- R12 Extremely flammable
- R19 May form explosive peroxides
- R22 Harmful if swallowed
- R66 Repeated exposure may cause skin dryness or cracking
- R67 Vapours may cause drowsiness and dizziness

The following tables summarise storage precautions for the commonly used chemicals in the laboratory.

<p><b>ACIDS</b></p> <p>Acetic Acid                      Hydrofluoric Acid            Chromic Acid                    Nitric Acid            Hydrochloric Acid                Phosphoric Acid               Sulphuric Acid</p>			<p><b>BASES</b></p> <p>Ammonium Hydroxide            Potassium Hydroxide            Sodium Hydroxide</p>	
<p><b>Storage Precautions:</b></p>				
<ul style="list-style-type: none"> <li>• Store bottles on low shelf areas, or in acid cabinets.</li> <li>• Segregate oxidizing acids from organic acids, <b>AND</b> flammable materials.</li> <li>• Segregate acids from bases, <b>AND</b> from active metals such as sodium, potassium, etc.</li> <li>• Segregate acids from chemicals which could generate toxic gases such as sodium cyanide, iron sulphide, formaldehyde etc.</li> </ul>			<ul style="list-style-type: none"> <li>• Separate bases from acids</li> <li>• Store bottles on low shelf areas, or in acid cabinets</li> </ul>	
<p><b>FLAMMABLES</b> - Fuels are reducing agents</p>				
Acetone	Cyclohexane	Methanol	Ethyl Acetate	Hexane
Benzene	Ethanol	Propanol	Ethyl Ether	Toluene
	Isopropyl Alcohol	Tetrahydrofuran	Gasoline	Xylene
<p><b>Storage Precautions:</b></p> <ul style="list-style-type: none"> <li>• Store in approved, labelled flammable storage cabinet(s)</li> <li>• Separate from oxidizing acids and oxidizers.</li> <li>• Keep away from any source of ignition(flames, localized heat or sparks).</li> <li>• Use only "flammable storage" (desparked) refrigerators or freezers.</li> </ul>				
<p><b>OXIDIZERS</b> - React violently with organics.</p>				
<p><b>Solids</b></p> <p>Calcium Hypochlorite            Nitrates, Salts of            Ferric Chloride                    Peroxides, Salts of            Iodine                                Potassium Ferricyanide               Sodium Nitrite</p>		<p><b>Liquids</b></p> <p>Bromine                                Nitric Acid            Hydrogen                              Perchloric Acid            Peroxide                                Chromic Acid</p>		
<p><b>Storage Precautions:</b></p> <ul style="list-style-type: none"> <li>• Keep away from flammables, organic solvents, and other combustible materials (i.e. paper, wood, etc.).</li> <li>• Keep away from reducing agents.</li> </ul>				

<ul style="list-style-type: none"> <li>• Store in a cool, dry place</li> </ul>			
<p><b>PYROPHORIC SUBSTANCES</b>-spontaneously ignite in air . Some finely divided metals Some organoaluminum compounds (LiAlH<sub>4</sub>, Al(CH<sub>3</sub>)<sub>3</sub>) Silane Phosphorus, Yellow Phosphorus, yellow should be stored and cut under water</p>		<p><b>WATER REACTIVE CHEMICALS</b> React violently with water to yield flammable or toxic gases.</p>	
		<p><b>Solids</b> Calcium Carbide Lithium</p>	<p>Magnesium Potassium Sodium</p>
		<p><b>Liquids</b> Phosphorous trichloride</p>	
<p><b>Storage Precautions</b></p> <ul style="list-style-type: none"> <li>• Avoid exposure to water and air</li> <li>• Store away from flammables</li> <li>• Store in a cool, dry place</li> </ul>			
<p><b>HIGHLY TOXICS, CARCINOGENS, REPRODUCTIVE TOXINS</b> May be hazardous alone or in combination with other chemicals.</p>			
<p><b>Liquids</b> Formaldehyde Nickel Carbonyl Mercury</p>	<p>Cyanide solutions Ethidium Bromide</p>	<p><b>Solids</b> Cyanide salts Suphide salts Ethidium Bromide</p>	<p><b>Gases</b> Chlorine HCl Nitric oxide Fluorine</p>
<p><b>Storage Precautions</b></p>			
Seal tightly and store in ventilated cabinet	Store away from acids and other incompatibles	Store in gas cabinet or other ventilated cabinet.	