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## Handling, Use and Storage of Organic Solvents

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## 1. Introduction

Organic solvents are in widespread use within OCDEM. This document is a general risk assessment for their handling, use and storage, and does not address individual chemicals.

## 2. Persons at risk

- Laboratory staff, students and visitors.
- Young persons (those less than 18 years), pregnant or breast feeding woman and other vulnerable persons will require a separate risk assessment.

## 3. Potential hazards

- Health hazards
- Flammability
- Manual Handling

### 3.i Health Hazards

The main route of exposure to organic solvents is through the inhalation of vapours given off by the solvent. Most organic solvents are highly volatile and will readily produce vapours under normal atmospheric conditions.

In many cases short-term exposure to organic solvent vapours will produce a narcotic response caused by the depression of the central nervous system; this effect is usually reversible. Long term exposure or repeated exposure to organic solvent vapours may cause permanent damage to the central nervous system, the liver and other organs depending on the nature of the solvent.

Some organic solvents are known carcinogens. Symptoms of acute exposure to solvent vapours include nausea, euphoria, vomiting, headache and in high enough concentrations unconsciousness and death. Solvent exposure may also result in an inability to think clearly. Persons handling solvents should exercise vigilance in recognising these symptoms in themselves and in others.

Persons may also be exposed to solvents via direct skin contact with the material. Organic solvents may irritate the skin, the respiratory tract and the eyes. Prolonged or repeated skin exposure can cause permanent skin damage.

### 3.ii Flammability Hazards

Many organic solvents are flammable or highly flammable. The following characteristics of organic solvents are important when determining their fire risk:

*Boiling Point:* This is the point at which a solvent vaporises. The lower the boiling point the greater the amount of vapour given off by a solvent under normal laboratory conditions. The ability of a solvent to produce vapour is also affected by its surface area relevant to its volume and any other materials that it may be mixed with.

*Flash Point:* This is the lowest temperature at which the application of a flame to a solvent vapour will produce a flash. A solvent with a flash point of 23°C or less is considered to be highly flammable.

*Explosive / Flammability Limits:* This is the range of concentrations in air of a solvent vapour that will support combustion or within which there is a risk of an explosion on the application of an ignition source. As a general rule: the greater the range of concentrations the more hazardous the chemical. For example *Toluene* has an

explosive range of 1-7% in air, i.e. an atmosphere that contains toluene vapours at a concentration of between 1% and 7% will explode / ignite if a flame is applied.

*Autoignition Temperature:* This is the temperature at which a solvent's vapour in air will spontaneously catch fire while within flammability limits.

*Vapour Density:* This is a solvent's vapour density relative to air; a vapour density of less than 1.0 means a solvent's vapour will rise; while greater than 1.0 means that a solvent's vapour will sink and may collect along on the floor and in ducts and drains.

### 3.iii **Manual Handling**

Many organic solvents are purchased in 2.5 litre bottles (Winchesters), many of which are glass. These bottles can be heavy and awkward to carry and consideration must be given to the person's ability to carry the weight involved; a basket designed for the carrying of Winchesters, or a trolley must be used. When carrying Winchesters outside the laboratory, two people should be present. Never pick up a glass Winchester by the neck of the bottle; this is a weak point.

## 4 **Risk Assessment**

Persons intending to use organic solvents must first assess the risks involved. Many organic solvents involve both fire risk and toxic risk and due consideration must be given to both types of risk.

Although the labels on new bottles of solvent give some indication of the types of risk involved this information will not give a complete risk assessment; a Material Safety Data Sheet (MSDS) is provided with each new purchase and must be consulted before use. The actual risk in any given case must be evaluated by consideration of all the factors involved.

Examples of such factors which must be considered are:-

- probable vapour concentration - obtained by considering temperature, vapour pressure tables, quantity of solvent in use and available ventilation.
- risk of ignition - obtained by considering the probable vapour concentration, flash point, autoignition point and the proximity of ignition sources.
- the toxic risk - obtained by considering the probable vapour concentration and the Workplace Exposure Limit (WEL) or Time Weighted Average (TWA).

This information is all available on the MSDS for the chemical.

If any person proposing to use solvents has any uncertainty about conducting a satisfactory risk assessment, the advice of a more experienced worker or the DSO must be sought.

## 5 **Storage of Flammable Organic Solvents**

- All flammable organic solvents must be stored in a flammable solvents cupboard.
- Provided that a suitable flammable solvent storage cabinet is available then up to 50 litres of flammable solvent may be retained in each laboratory (or other work area). The actual quantities stored, however, must be kept to the absolute minimum and the amount decanted for use must be no more than 500 ml.
- In practice there should not be more than one Winchester bottle of each solvent in the laboratory. Stocks of organic solvents must be stored in the outside solvent store.
- If flammable solvents need to be stored in a refrigerator it is essential that the refrigerator is classified as 'spark free'.

- Organic solvents must not be stored with incompatible chemicals; in particular they should never be stored with acids.
- When not in use Winchester bottles of flammable solvents must be replaced in a solvent cupboard; the door of which must be kept closed and locked when not in use.

## 6 Storage of Non-Flammable Organic Solvents

- Non-flammable organic solvents may be stored in a flammable solvent cupboard provided that the rules on incompatible storage are complied with and that there is adequate space for such storage.
- Stocks of non-flammable organic solvents must be stored in the outside solvent store.
- Non-flammable organic solvents must not be stored with incompatible chemicals; in particular they should never be stored with acids.

## 7 Use of Organic Solvents

- Organic solvents must only be used in well ventilated areas in order to minimise the risk of vapour build up with corresponding fire or toxic risks. Ideally the dispensing of solvents from a Winchester and work involving more than a few millilitres of solvent should be carried out in a fume cupboard.
- Particular care must be taken to exclude sources of ignition such as open flames, hot surfaces and unprotected electrical switches from areas in which flammable solvent vapours can arise.
- Direct heating of flammable solvents with a Bunsen burner is forbidden under any circumstances. If heating of a solvent is required for a laboratory procedure then another source of heating must be used (eg on a hotplate). Consult the DSO for advice and an adequate risk assessment must be undertaken before work can begin.

## 8 Waste Disposal

Consideration must be given to the disposal of waste organic solvents:

- Some water miscible solvents eg ethanol, acetone can be disposed of via the drains with copious amounts of water. Many have to be disposed of via the University Safety Office.
- Chlorinated solvents and non-water miscible solvents must never be disposed of via the drain; they **must** be disposed of via the University Safety Office.
- Small amounts (<500 ml) of organic solvents can be evaporated in a fume hood.
- Consult the MSDS or the Departmental Safety Officer (DSO) for information on disposal.

## 9 Spillages

- In the event that solvents are spilled or released then all persons in the immediate area are at risk of temporary narcotic effects, especially if the material is very volatile. Solvents also place persons in the immediate vicinity at risk in the event of a fire or explosion, especially those with low flash points and wide explosive ranges.
- All possible sources of ignition, including electrical appliances, should be turned off if safe to do so, do not activate electrical switches if the spill contains solvents which are classified as 'highly flammable' ie they have a low flash point, for example: diethyl ether, acetone, hexane etc.
- For large spillages the area should be evacuated; consult the DSO, Area Safety Officer or the University Safety Office for advice.

- When dealing with spillages the inhalation of large amounts of vapour should be avoided. In the event that a large amount of material is spilled then specialist assistance may be needed and supplied air respiratory protection may be required (which is not available in OCDEM).
- The relevant MSDS for the material in question should be consulted.
- Small spillages (<500 ml) can be cleaned up as detailed on the relevant CoSHH assessment.
- A suitable spill kit containing absorbent sheets, a dry absorbent, heavy duty gloves and a pan and brush for sweeping up contaminated material should be maintained in areas where large amounts of solvents are in use.

## 10 Fire

- Ensure you are familiar with the OCDEM Fire Policy. On finding a fire, activate the alarm and exit the building as detailed in the policy. Solvent fires should only be tackled by experienced fire fighters.

## 11 First Aid

- *Inhalation:* Following exposure to a solvent vapour affected persons should be removed from the source of exposure to fresh air; at no time should persons place themselves at risk when trying to remove affected persons from the source of exposure. If breathing stops then artificial respiration should be administered. If available, oxygen may also be administered. Any exposure which results in vomiting or unconsciousness must be referred to a medical practitioner.
- *Skin Contact:* Remove any contaminated clothing and wash (do not scrub) the skin with soapy water. If the skin blisters or becomes reddened then seek medical advice.
- *Eye Contact:* Wash out eyes with copious amounts of fresh water and seek medical advice.
- *Ingestion:* Refer to the specific MSDS. Always seek medical advice.

## 12 Control Measures

- Risk assessments must be undertaken before any work involving organic solvents can be undertaken.
- When handling organic solvents a MSDS must be readily available for consultation as required to aid in the preparation of a CoSHH assessment.
- Users should make themselves aware of the properties of each organic solvent that they use.
- Many individual organic solvents have a number of commonly used names, and many have similar sounding names. Users must ensure that they know which particular solvent they are handling.
- Work in a fume cupboard; a risk assessment would need to justify why the use of a fume cupboard is not required.
- No more than 500 ml of a solvent should be stored at the bench or outside of a designated flammables cabinet.
- When using solvents, work processes must be designed so as to minimise the amount of vapour given off by the solvent. Solvent Winchesters should be closed when not in use and open containers used to hold solvents should have as small a surface area as possible. Users should never lean over an open solvent container.
- When a toxic or similar agent has been dissolved in a solvent particular care must be taken to prevent the solution coming into contact with the user's skin.

- Pregnant and breastfeeding women must not work with solvents unless a full risk assessment has been undertaken.
- Persons must not enter confined or restricted spaces where it is suspected that solvent vapours may have gathered.
- Persons working with solvents should be aware of the symptoms of solvent vapour exposure (i.e. nausea, euphoria, vomiting, headache, confusion) and cease work immediately if they develop any of the symptoms. Persons should also be vigilant for the development of such symptoms in co-workers.
- When working with solvents as many potential sources of ignition as possible must be removed from the immediate area.
- In so far as is practicable organic solvents should be dispensed from their original containers using a purpose designed nozzle.
- Solvents should be stored in air tight containers in a flammables cabinet away from potential sources of ignition, heat and incompatible chemical agents (particularly acids and oxidising agents).
- Vessels that appear to be empty but which previously contained solvents should not be considered to be free from vapour until they have been left to evaporate in a fume hood and suitably washed.

## Review History

<b>Version</b>	<b>Date</b>	<b>Reason for update</b>	<b>Updated/reviewed by:</b>	<b>Date review due</b>
1	11/11/09	Rewritten risk assessment	Author: SMH	November 2011
1	03/01/2012	Review – no changes	SMH	Jan 2014
1.1	15/01/2015	Updated dept header- no other changes	SMH	Jan 2016
2.0	05/02/2016	HoD and ToC added. Minor changes to text in health hazards	SMH	Feb 2018