University of St Andrews

Storage of Flammable Solvents

1. Introduction

The large volumes of flammable solvents used within the Purdie Building represent a significant fire risk. it is therefore vital that flammable solvents are stored correctly to keep risk as low as possible.

2. Best Practice

The list below highlights best practice for the storage of flammable solvents:

- Stocks of flammable solvents stored in laboratories are to be kept to a minimum and <50 litres of flammable solvent should be stored in the laboratory wherever possible.
- 2.5 and 5 litre bottles of flammable solvents must be kept in marked fire-resistant storage cupboards at all times except when being dispensed.
- Full waste-solvent containers should be removed to the external waste-solvent store as soon as possible and not allowed to accumulate within the laboratory.
- All solvent bottles must be stored upright to prevent potential leakage
- Bottles of flammable solvents must never be stored on the floor, on benches or in direct sunlight.
- Bottles of tetrahydrofuran, diethyl ether, di-isopropyl ether and other peroxide forming solvents should be marked with the date they were first opened, used in date order and when necessary tested for the presence of peroxides.
- Flammable solvents must not be stored with incompatible chemicals such as oxidising agents or other incompatible materials.

3. Storage of >50 Litres Flammable Solvents

The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) requires employers to control the risks to safety from fire and explosions. This includes managing the storage of flammable solvents within laboratory spaces.

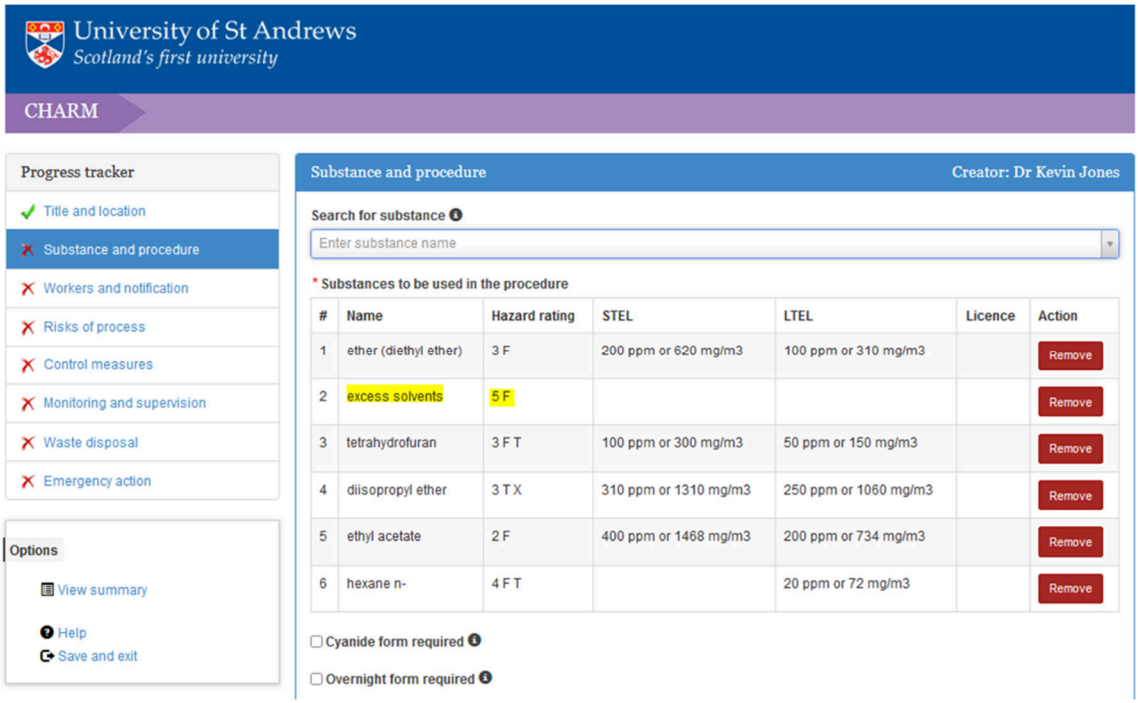
The following excerpt is taken from the Dangerous Substances and Explosive Atmospheres Regulations relating to the storage of flammable solvents in laboratories / work areas.

> The recommended maximum quantities that may be stored in cabinets and bins are as follows:
>
> No more than 50 litres for extremely, highly flammable and those flammable liquids with a flashpoint below the maximum ambient temperature of the workroom/working area
>
> These quantities are intended to be viewed as **recommended maxima representing industry safe practice, rather than absolute limits**. There is some flexibility, where for example the design of modern buildings and the pattern of work can make it difficult to work within these limits, e.g. in large or open-plan workrooms/working areas.
>
> **Where the employer proposes to store quantities in excess of the recommended maxima, a robust justification should be recorded and the risk assessment should take into account:**
>
> - The properties of the materials to be stored or handled in the process areas, workrooms, laboratories and similar working areas (for mixed storage the worst-case situation should be applied, i.e. all materials in the storage cupboard or bin should be considered as being the same material as the one that has the lowest flashpoint)
> - The size of the process area and the number of people working in it
> - The amount of flammable liquids being handled in the process area and the quantities of liquid that may be accidentally released or spilled
> - Ignition sources in the process area and potential fire spread in the event of an ignition
> - Exhaust ventilation provision to the process area and/or the storage cupboard or bin
> - The fire-resisting performance of the storage cupboard or bin
> - The arrangements for closing the cupboard or bin doors/lid in the event of a fire
> - Means of escape from the process area

4. Excess Solvent Risk Assessment

In order to comply with DSEAR as outlined in Section 3, any laboratory wishing to stock more than 50 litres of flammable solvents, must produce a separate risk assessment titled "Excess Solvents" using the University CHARM system.

The chemical entry "excess solvents" should be included in the list of substances used to trigger Safety Coordinator approval (see picture below).



The text below can be used as a template for the "hazards and control measures/details of procedure" section of the CHARM form. Please modify the text to match the requirements of your laboratory.

Text for CHARM Risk Assessment

Lab INSERT NUMBER is dedicated to synthetic chemistry. This research requires flammable solvents to be stored in sufficient quantities for solvent-intensive processes such as chromatography.

Size of the laboratory and number of researchers working in the laboratory

Lab X (INSERT NUMBER) has a floor space measuring ~Y m^2 and is used by X – Y (INSERT NUMBER OF RESEACRHERS) researchers. Each worker uses approximately X litres of flammable solvent per day.

The amount of flammable liquids being handled in the laboratory and the quantities of liquid that may be accidentally released or spilled

The maximum stock level of solvent stored in laboratory X is Y litres. Solvents are divided into 2.5 / 5 litre containers, minimising the quantity of flammable solvent that can accidentally released at one time. Solvent containers will also be stored upright to prevent potential leakage.

Ignition sources in the process area and potential fire spread in the event of an ignition

Hotplates and heat guns represent the most common ignition sources found with laboratory. Bunsen burners / microburners may be used occasionally.

Work involving flammable solvents is carried out in fume cupboards equipped with "fire trace", an automatic fire suppression system that deploys when an uncontrolled fire is detected. Laboratory doors are kept closed to provide a physical barrier to prevent the spread of fire. 2.5 and 5 L solvent containers are kept in fire-resistant storage cupboards when not in use to help prevent the propagation of a fire.

Exhaust ventilation provision in the laboratory and/or the storage cupboard or bin

The laboratory contains multiple fume cupboards that ventilate the work area at the rate of 8 - 12 air exchanges per hour. Solvent storage cabinets are located beneath each fume cupboard and ventilated using the fume cupboard ducts to prevent the development of an explosive atmosphere.

The fire-resisting performance of the storage cupboard or bin

2.5 and 5 L solvent containers are kept in fire-resistant storage cupboards with 30 minutes flame resistance.

The arrangements for closing the cupboard or bin doors/lid in the event of a fire

A maximum of 50 litres of flammable solvents can be stored per cabinet. Solvent cabinet doors are kept closed when not in use.

Means of escape from the laboratory

Solvent storage cupboards are positioned such that they do not block emergency exit routes in the event a fire develops.

Additional Safety Measures

- Bottles of waste solvent will be removed to the external solvent store
- All solvent bottles are stored upright to prevent potential leakage
- Bottles of tetrahydrofuran, diethyl ether and di-isopropyl ether are marked with the date they were first opened, used in date order and when necessary tested for the presence of peroxides.
- Flammable solvents are not stored with oxidising agents or other incompatible materials.