CODE OF PRACTICE

DANGEROUS SUBSTANCES AND EXPLOSIVE ATMOSPHERES REGULATIONS (DSEAR)

Guidance Document for users of dangerous substances

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March 2026	First Draft Replaces Fire and Explosion Standard document and includes updated HSE Guidance.	Debbie Robarts

Contents

Summary

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) require employers to control the risks to safety from fire, explosions and substances corrosive to metals.

Dangerous substances are any substances used or present at work that could, if not properly controlled, cause harm to people because of a fire or explosion or corrosion of metal. They can be found in nearly all workplaces and include such things as solvents, paints, varnishes, flammable gases, such as liquid petroleum gas (LPG), dusts from machining and sanding operations, dusts from foodstuffs, pressurised gases and substances corrosive to metal.

The University is committed to ensuring the health, safety and welfare of all staff, students and visitors. Fundamental to achieving this objective is to identify, assess and control fire and explosion risks in the workplace. To achieve this the University shall aim to make a suitable and sufficient assessment of all significant fire and explosion hazards to reduce the risk of harm to a tolerable level.

The aim of this Code of Practice is to describe the University's arrangements for identifying and assessing risks associated with the use of dangerous substances that could result in a fire and/or explosion, and to ensure that control measures are identified and implemented to reduce the risk of fire/explosion, so far as is reasonably practicable, to a tolerable level.

Scope

DSEAR applies to workplaces where dangerous substances are present (or is liable to be present), used or produced and could be a risk to the safety of people because of fires, explosions or similar energetic events or through corrosion to metal.

Dangerous substances are substances or mixtures of substances (called 'preparations' in DSEAR) that could create risks to people's safety from fires and explosions or similar events, such as 'thermal runaway' from chemical reactions or are corrosive to metal. Liquids, gases, vapours, and dusts that may be found in a workplace can all be dangerous substances.

An explosive atmosphere is a mixture of a dangerous substance or substances (gas, mist, dust or vapour) with the air, which has the potential to catch fire or explode.

In addition to fire and explosion events, DSEAR also applies to "other energetic events" such as runaway exothermic reactions or decompositions of unstable substances, e.g. decomposition of peroxides.

Typical work activities include:

- use of flammable solvents in laboratories
- transporting flammable substances in containers around a workplace
- use of flammable gases, such as acetylene, for welding or hydrogen for research applications (alternative fuel)
- handling and storage of flammable wastes such as fuel oils
- handling, storage and use of gases under pressure
- handling, storage and use of substances corrosive to metal

Examples of Dangerous Substances include:

- Solvents, such as acetone, toluene, diethyl ether
- Paints and varnishes
- Flammable gases such as acetylene, hydrogen, propane
- Liquefied petroleum gas (LPG)
- Dusts from machining and sanding operations

The requirements of this Code of Practice apply to all employees of the University of Bath while undertaking their work activities both on and off campus.

It also applies to all persons including students, members of the public, contractors etc. whilst on University of Bath property and who may be affected by the Universities work activities.

Introduction

Fires and explosive atmospheres can be caused by work which involves storage, use or creation of flammable substances including gases, mists, or vapours or by combustible dusts.

If there is enough of a dangerous substance, mixed with air, then just a source of ignition is needed to cause an explosion.

Most fires and explosions are preventable if the risks are fully understood and properly controlled.

DSEAR requires employers to:

- find out what dangerous substances are in their workplace and what the risks are
- put control measures in place to either remove those risks or, where this is not possible, control them
- put controls in place to reduce the effects of any incidents involving dangerous substances
- prepare plans and procedures to deal with accidents, incidents and emergencies involving dangerous substances
- make sure employees are properly informed about and trained to control or deal with the risks from the dangerous substances
- identify and classify areas of the workplace where explosive atmospheres may occur and avoid ignition sources (from unprotected equipment, for example) in those areas

This Code of Practice document sets out the University arrangements and expectations to meet the above requirements.

Roles and Responsibilities

The University's health and safety policy describes the general roles and responsibilities on all employees to safeguard themselves and others in the workplace.

This CoP sets out the additional specific roles and responsibilities for managing fire and explosion risks.

Heads of Department and Professional Services Directorates are responsible for the day-to-day implementation of this code of practice. Their responsibilities under this CoP include ensuring:

- Suitable arrangements are in place and followed for identifying, assessing and controlling fire and explosion hazards for work areas within department control. This will include ensuring that suitable and sufficient risk assessments have been written.
- The provision of competent persons where necessary to support implementation of these arrangements. Competency requirements could be met through internal resources or by engaging competent third parties.
- Monitoring arrangements to ensure that these are being implemented and that risks are being controlled, so far as is reasonably practicable.

Line Managers/Principal Investigators/Technical Managers responsibilities include:

- Carrying out risk assessment to identify fire and explosion risks associated with the work that they control.
- Identify and implement control measures in accordance with the following hierarchical approach:
    - control measures to **eliminate** or **reduce** the risks where this is reasonably practicable.
    - control measures to **prevent** fire, explosion or similar energetic event.
    - mitigation measures to **reduce** the detrimental effects of a fire, explosion or similar incident.
- Identify and classify areas of the workplace where explosive atmospheres may occur.
- Put in place appropriate arrangements to prepare for accidents, incidents and emergencies.
- Provide appropriate information, instruction and training to users under their supervision.

Employees and others carrying out work where there is a fire and/or explosion risk must:

- Be familiar with and understand the risk assessments for the work that they do and follow the control measures that are described in these assessments.
- Use any equipment, facilities and items such as PPE provided to protect them in the event of a fire, explosion or similar event in accordance with instruction and training.
- Report any concerns or incidents, or accidents or defects associated with these provisions.

General Requirements of DSEAR

The flow diagram provided in Appendix 1 sets out the process for determining if DSEAR applies, and whether a specific risk assessment is required.

A DSEAR Assessment is:

A risk assessment which concentrates on the risks from a fire, explosion or similar event involving a “dangerous substance”.

The control and mitigation measures identified in the risk assessment including emergency arrangements, should be suitable and sufficient enough to reduce the risk to a tolerable level. They must also be appropriate to the nature of the activity or operation.

If after following the process flowchart it is identified that DSEAR **may** apply to the work you are doing, then your will first need to complete the **Part 1 Assessment process**. This initial step is essentially a screening process which will help you determine whether DSEAR applies in your workspace for your activities. Appendix 2 provides a template for completing this process and some example calculations to aide you to determine whether the Lower Explosive Limit could be exceeded.

The Part 1 assessment includes a calculator to determine the lower explosive limit (LEL) or lower flammable limit (LFL) can be reached due to work activities. If they cannot then no further action would be required as there is no potential for a fire or explosion to occur.

However, the HSE Approved Code of Practice (ACOP) L138 titled "Dangerous Substances and Explosive Atmospheres Regulations 2002" states that:

"Where the presence of a flammable atmosphere is detected at or above 25% of the lower explosive limit (LEL), this should be regarded as a serious risk and immediate action should be taken to reduce the concentration". Therefore, within this calculation the threshold as to whether DSEAR applies is set at 25% of the LEL.

If the screening process identifies that the Lower Explosive Limit could be exceeded, then a Part 2 assessment must be completed. If a part 2 is not required, you should sign the Part 1 and keep for your records. The template for completing the Part 2 assessment will depend on whether you are assessing risks from liquids or gases:

- Appendix 3 provides the Template for DSEAR Assessments for flammable liquids.
- Appendix 4 provides the Template for DSEAR Assessments for flammable gases.

Identify Dangerous Substances and Assess Risk

This should be an identification and careful examination of:

- the dangerous substances in the workplace
- the work activities involving those substances
- the ways in which those substances and work activities could harm people

Dangerous substances are those classified under the Classification, Labelling and Packaging (CLP) Regulations 2009 as: explosive, oxidising, extremely flammable, highly flammable or flammable.

The risks associated with identified fire and explosion hazards must be assessed prior to carrying out any work with these substances. The following should be taken into consideration:

- work processes and substances used and their possible interactions
- amount of substance involved
- risks presented by using more than one dangerous substance in combination
- arrangements for safe handling, storage and transport of dangerous substances

Prevent or control risks

The risks from dangerous substances should be eliminated or reduced as far as is reasonably practicable**.** For example, by

- Replacing with another substance (not classed as dangerous)
- Using a different work process where the risk of fire or explosion is inherently reduced
- Substituting for a less dangerous substance, e.g. one with a higher flashpoint

Control Measures

Where the risk **cannot be eliminated**, DSEAR requires control measures to be applied in the following priority order:

- reduce the quantity of dangerous substances to a minimum
- avoid or minimise releases of dangerous substances
- control releases of dangerous substances at source
- prevent the formation of a dangerous atmosphere
- collect, contain and remove any releases to a safe place (for example, through ventilation)
- avoid ignition sources
- avoid adverse conditions (for example, exceeding the limits of temperature or control settings) that could lead to danger
- keep incompatible substances apart

These control measures should be consistent with the risk assessment and appropriate to the nature of the activity or operation.

Mitigation

In addition to control measures DSEAR requires employers to put mitigation measures in place. These measures should be consistent with the risk assessment and appropriate to the nature of the activity or operation and include:

- reducing the number of employees exposed to the risk
- providing plant that is explosion resistant
- providing plant that is corrosion resistant
- providing explosion suppression or explosion relief equipment
- taking measures to control or minimise the spread of fires or explosions
- providing suitable personal protective equipment

Emergency Plans

Arrangements must be in place to deal with emergency situations. These plans and procedures must be recorded and should cover safety drills, suitable communication and warning systems, and should be in proportion to the risks.

Consider:

- need for any additional first aid facilities
- additional safety drills required and tested
- provision of warning signs and other appropriate communication systems such as alarms, warning lights or Tannoy systems
- provision of any equipment or clothing for persons dealing with an incident
- Appropriate communication of/training in these plans to relevant persons

The information in the emergency plans and procedures must be made available to the emergency services to allow them to develop their own plans if necessary.

Information, Instruction and Training

Appropriate information, instruction and training should be provided to employees including:

- details of dangerous substances in the workplace and the risks they present
- access to any relevant Safety Data Sheets (SDS)
- information on any other legislation that applies to the dangerous substance/s
- the significant findings of the risk assessment
- actions to be taken to safeguard themselves and others (emergency procedures)

The completion of training should be recorded. Refresher training should be identified at appropriate intervals.

Information, instruction and training to other people (non-employees) need only be provided where it is required to ensure their safety, and it should be in proportion to the level and type of risk.

Any equipment, facilities and items such as PPE provided to protect employees in the event of a fire, explosion or similar event should be used in accordance with instruction and training.

Any incidents, accident or defects associated with these provisions should be reported.

Hazardous Area Classification and Zoning

Hazardous areas are defined in DSEAR as "any place in which an explosive atmosphere may occur in quantities such as to require special precautions to protect the safety of workers". The purpose of these special precautions is to control potential ignition sources within a hazardous area, particularly in relation to the construction, installation and use of equipment. There is no lower threshold for quantities of materials or risk for this.

The hazardous area is classified into a zone, its size and location depending on the likelihood of an explosive atmosphere occurring and its persistence if it does. Schedule 2 of DSEAR contains descriptions of the various classifications of zones for gases and vapours and for dusts.

The Regulations define 3 zones that can exist within a hazardous area for flammable gases and Vapours:

Zone 0 - A place in which an explosive atmosphere is present continuously or for long periods.

Zone 1 - A place in which an explosive atmosphere is likely to occur in normal operation occasionally

Zone 2 - A place in which an explosive atmosphere is not likely to occur in normal operation, but if it does occur, will persist for a short period only

Various sources have tried to place time limits on to these zones, but none have been officially adopted. The most common values used are:

- Zone 0: Explosive atmosphere for more than 1000h/yr
- Zone 1: Explosive atmosphere for more than 10, but less than 1000 h/yr
- Zone 2: Explosive atmosphere for less than 10h/yr, but still sufficiently likely as to require controls over ignition sources.

For Dusts the zone definitions are:

Zone 20 - A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.

Zone 21 - A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.

Zone 22 - A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Notes:

1. Layers, deposits and heaps of combustible dust must be considered as any other source which can form an explosive atmosphere.

2. “Normal operation” means the situation when installations are used within their design parameters.

Selection of Equipment and Protective Systems

Areas classified into zones are protected from sources of ignition by selecting equipment and protective systems meeting the requirements of the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 defined by the ATEX Equipment Directive, it should be observed that equipment in use before 1 July 2003 can continue indefinitely provided the risk assessment confirms it is safe.

The following categories of equipment must be used in the zones indicated. They must be suitable for gases, vapours, mists, dusts or a combination of each source, as appropriate.

In Zone 0 or Zone 20, category 1 equipment

In Zone 1 or Zone 21, category 1 or 2 equipment

In Zone 2 or Zone 22, category 1, 2 or 3 equipment

ATEX rated equipment is certified, the equipment is marked with the appropriate conformity assessment mark and by the 'EX' symbol.

Certification ensures that the equipment or protective system is fit for its intended purpose and that adequate information is supplied with it to ensure that it can be used safely.

Storage

DSEAR requires risks from the indoor storage of dangerous substances to be controlled by elimination or by reducing the quantities of such substances in the workplace to a minimum and providing mitigation to protect against foreseeable incidents.

Where flammable liquids are used, there will be a need for a limited quantity to be stored in the work area, this needs to be justified by assessment. However, the guiding principle is that only the minimum quantity needed for frequently occurring activities or that required for use during ½ day, or one shift should be present in the work area. Actual quantities will depend on the work activity and the organisational arrangements for controlling the fire risks in the work area. An absolute maximum of 50 litres stored in cabinets of Dangerous Substances/Flammable Liquids is permitted in an individual work area, but the guiding principle above must always be the priority to minimise holdings.

In large areas/workplace i.e. teaching laboratories an increase in maximum amount will be considered if justified by risk assessment.

When not in use, containers of flammable liquids needed for current work activities should be kept closed and stored in suitable cabinets or bins of fire-resisting construction and which are designed to retain spills (110% volume of the largest vessel normally stored in it). These should be in designated areas that are where possible away from the immediate processing area and do not jeopardise the means of escape from the work area, i.e. they should not be in fire escape routes or corridors. The storage cabinet/bin should indicate the type/class of Dangerous Substances stored i.e. “Highly Flammable Substances” “Corrosive”.

Flammable liquids should be stored separately from other dangerous substances that may enhance the risk of fire or compromise the integrity of the container or cabinet/bin, for example energetic substances, oxidizers and corrosive materials.

DSEAR and Laboratory Operations

For most laboratory operations hazardous area classification or using ignition-protected equipment (AREX rated) is not routinely done, and the risks are usually controlled in other ways. Precautions designed to protect the health of laboratory workers may also help prevent the need to designate any zoned areas such as laboratory ventilation and the use of Local Exhaust Ventilation (LEV) such as fume cupboards.

Sources of gas and vapour release should be identified, including those that arise in normal operation, (primary sources) and those which only occur because of some foreseeable equipment failure or operator error (secondary sources).

On a laboratory scale, a primary source might be the vapour released when a volatile solvent is poured from one container to another, while someone knocking the container off the bench to the floor is a secondary source. Primary sources should normally be so small they can easily be controlled by adequate ventilation, and the extent of any explosive atmosphere is negligible.

It should be noted that where precautions already used are adequate to prevent fire and explosion risks to laboratory workers, then there is no need for zoning and `special precautions'.

Flammable gases

Typical hazards from the use of flammable gases include leaks from piped systems, using flexible rubber or plastic hose which can fail with age, or from unsuitable connection methods or attack from propane, butane or solvents. Equipment could fail from overpressure, or if a regulator is wrongly adjusted. Some types of gas taps on open benches can easily be knocked open inadvertently. Flammable gases have different properties some are lighter than air, others heavier and may not always be easily detected.

The risk assessment needs to consider the potential for build-up and where that could occur, the type of ventilation that is provided and its reliability and the size of leak that could be controlled in this way. The risk assessment should also consider what can be done or provided to minimise the risk of a gas leak, and how any such leak would be identified promptly, so that appropriate action could be taken. Particular account should be taken of the out-of-hours risk if ventilation is shut down, or if systems are left under pressure when unattended.

Liquefied flammable gases

These may be handled either under pressure, or in refrigerated form. A small release of liquid is likely to vaporise immediately, creating a substantial size of explosive gas/ air mixture. here liquids are handled in refrigerated form, the risks from loss of cooling or loss of insulation should be considered. Good ventilation around the apparatus will always be needed, but there may also be a need to designate a zone 2 area. This will depend on the foreseeability of a release of liquid, how rapidly it might be detected, and the ability of the ventilation to disperse it quickly.

Instruments with internal flames

Some types of instrumentation use very small internal gas flames such as Gas Chromatograph. These could ignite any surrounding explosive atmosphere, if there was a release of vapour from some operation nearby. In addition, an explosive atmosphere could form from a leak in the fuel line to the flame, or in some cases from flammable liquids in the instrument. These need to be considered in the DSEAR assessment. However, if the maximum size of leak is very small, any release will form an explosive atmosphere of negligible extent and zoning should not be required.

Flammable liquids

Very small-scale operations

Use at 50ml or less is considered to be very small scale and the spill of this quantity of flammable liquid can be quickly and easily cleaned up before ignition, or if they ignite, so long as the fire does not quickly spread, they may well burn out before anyone is at risk, or before a laboratory worker could take any action to extinguish a fire. If this is demonstrated in a task or laboratory risk assessment along with standard control measures of avoiding ignition sources in the immediate vicinity and potential measures to prevent spread, i.e. use of a spill tray, where practicable, then zoning is not required,

Medium scale operations

This covers quantities up to 2.5 litres used on the open bench. The extent of a flammable atmosphere following a spill could be a radius of up to a metre, but only a very small height above the liquid level. Any ignition of a spreading pool will produce a fire that quickly extends to the whole area of the spill and could be a risk to person present.

Obvious continuous ignition sources should be avoided, as well as direct heating i.e. with Bunsen Burner. Electrical equipment in use such as stirrers, hotplates, etc are most likely potential sources of ignition.

Typical precautions to be in place will include:

- good handling techniques to minimise spills,
- sills, spill trays or other liquid retaining methods to minimise liquid spread
- proper support for glass equipment
- placing electrical equipment where it will not be splashed because of a spill as far as practicable
- supervision by/availability of trained staff when electrical isolations required in emergency response procedures
- Good chemical storage away from use and in appropriate storage areas, i.e. flammable cabinets
- Warning systems in place
- Firefighting equipment and first aid response
- Any other control measure appropriate to task and substances being used.

Where these and similar precautions have been adopted, the risk assessment may conclude that there is no need for hazardous areas and zoning to be specified.

Larger scale laboratory work

This is above a 2-litre scale and pilot scale plants (equipment with a capacity of 50-100 litres or more).

Risks at this scale could include:

- use of all glass equipment that may be fractured by impact, thermal shock, overpressure, assembly technique,
- poor handling with open containers, and
- use of temporary hoses for flammable or other hazardous materials.

The main precaution for managing this risk is to limit the extent of any flammable atmosphere formed. This could be by a combination of carrying out the task in an enclosure with forced ventilation, such as a fume cupboard and ensuring ignition sources, such as electrical equipment are located outside. However, in many laboratory operations the use of electrical equipment within the vicinity will be required, so a hazardous area may be needed considering potential spread of a fire and persons who could be affected.

Fume Cupboards

Use of flammable liquids may be carried out in fume cupboards, or other similar LEV systems. This may not be just due to the fire or explosion risk, but other health hazards present as identified in your COSHH assessment The work should be arranged so that any foreseeable release of gas or vapour will be rapidly diluted below the explosive limit by the airflow through the cupboard.

In addition, the sash can be shut if a fire starts enabling prompt evacuation before fire spread. Many fume cupboards have Fire Trace installed, and this is an additional control measure that should be considered when determining whether a hazardous area zone is required.

In accordance with standard laboratory practice fume cupboards should not be used as storage facilities for any chemicals particularly not for toxic or flammable chemicals while they are also being used for experimental work. Rapid failure of stored bottles in a small fire could produce sufficient vapour to prevent the extract fan diluting vapours sufficiently.

Releases into enclosed spaces

Potential releases of flammable gases and vapours into enclosed spaces such as ovens and fridges need to be considered in the DSEAR assessment, the consequence of an ignition is more likely to be an explosion than a fire.

Fridges have exploded in laboratories, where the light switch or thermostat contact sparked when opening or closing. Purchasing items designed for the purpose with spark proof equipment will mean a zone will not need to be defined, this justification must be recorded in your assessment.

Control measures for ovens could include heating elements below the ignition temperature of any vapour likely to be used, or to provide adequate ventilation to prevent the build-up of vapours. Control will also be needed over the type materials can be used in ovens and the quantities.

Conclusion

Where flammable liquids or gases are used, it is necessary to consider sources of ignition in any risk assessment, and control these closely, even if there are no formally designated hazardous areas. Following the guidance in this CoP in conjunction with reference material, will enable the DSEAR assessment to be completed appropriate to the work, substances being used and control measures applied.

Whether work is done on the open bench, in a fume cupboard or a dedicated facility for larger scale work, a decision in a written risk assessment not to zone the laboratory must justify this on the basis that any incident will be of limited scale and could be safely and quickly controlled by those present; or that they could escape very quickly without leaving others in the building at risk. A high standard of controls will help justify this assessment.

There are circumstances, in particular at the pilot scale, where hazardous area classification, and the associated use of explosion protected (Ex) equipment will be required. In all cases, the design of the facility should aim to minimise the extent of any hazardous area if it cannot be avoided completely.

REFERENCES

The Dangerous Substances and Explosive Atmospheres Regulations 2002 - HSE

https://www.hse.gov.uk/fireandexplosion/about.htm

https://www.hse.gov.uk/fireandexplosion/dsear-regulations.htm

https://www.hse.gov.uk/pubns/priced/l138.pdf

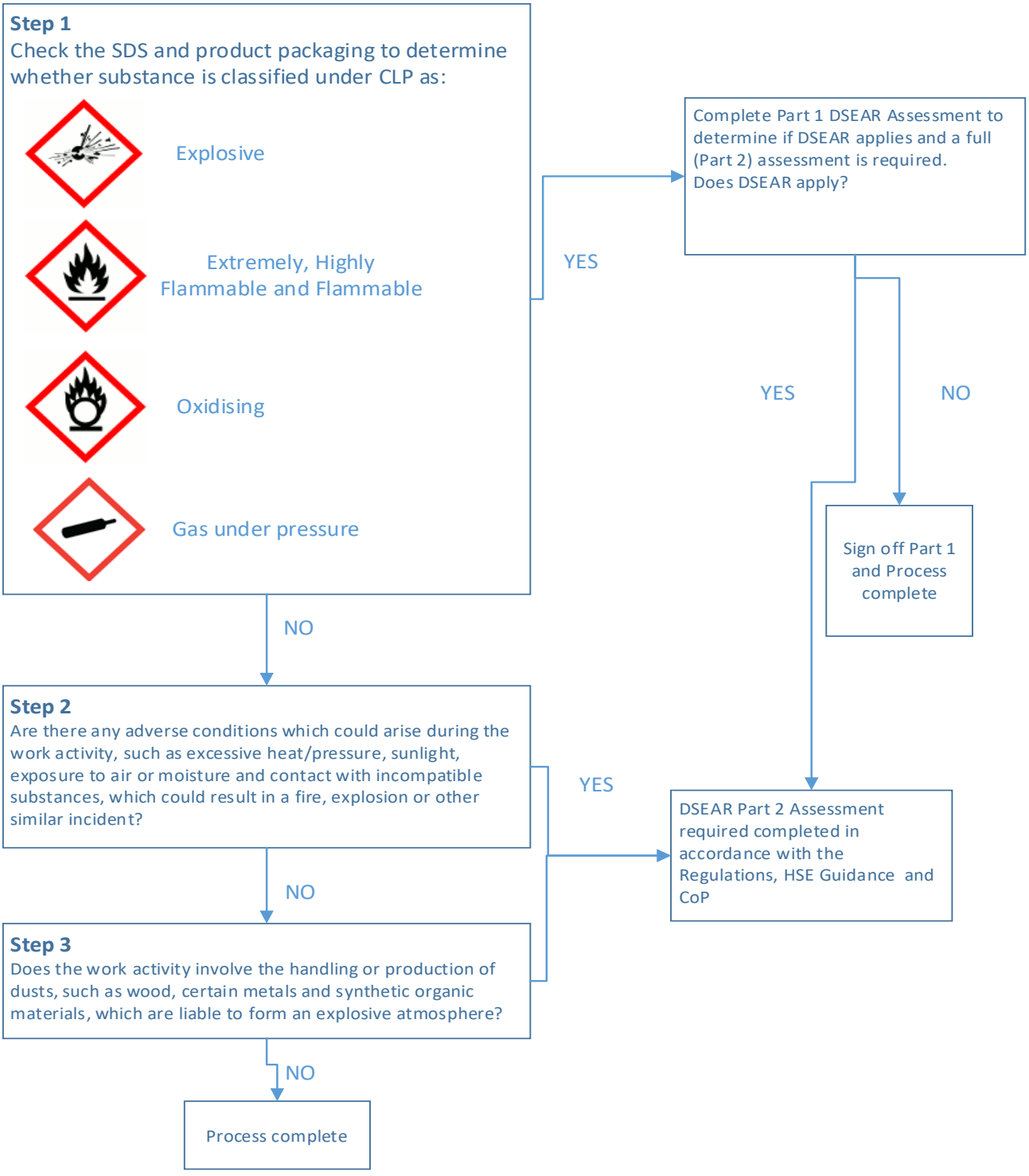
Controlling fire and explosion risks in the workplace - HSE

https://www.hse.gov.uk/electricity/atex/classification.htm

Storage of flammable liquids in process areas, workrooms, laboratories and similar working areas - HSE

https://www.hse.gov.uk/fireandexplosion/assets/docs/zoning.pdf

Appendix 1 Identification of Fire and Explosion Hazards and Assessment Process



Appendix 2 Part 1 Initial Screening DSEAR Assessment

This part 1 assessment template (or equivalent) should be completed for each work area i.e. laboratory, store, workshop, workroom etc. or groups of areas e.g. all workshops. The aim is to identify any classes and quantities of substances which can cause danger to people, premises or equipment. The danger can come from either energetic event, potential explosive, flammable, oxidising, corrosive or even inert atmospheres, whether they are bought in or occur because of a work activity.

In multi-occupancy spaces it is important to think about the classes and quantities of dangerous substances in the whole space not just the individual process and use.

Below there is a link to a calculator and two rough example calculations for liquid releases for common solvents which can be adapted to a workspace, which may be useful to assist with the decision whether it is necessary to proceed to Part 2.

If, for example there is only a small amount of flammable solvent in a large space and the calculations suggest that even if there was a spill of all the solvent the lower explosive limit would not be reached, then no further action would be required.

These calculations along with a blank calculator along with one for flammable gases are available in an editable Excel Spreadsheet below. Double click to access.

flammable_atmosphere_calculator 25%

Example calculations for two commonly used solvents

1. Acetone spill in a room of dimensions 5m x 7m x 3m

Acetone has a molecular weight of 58.1g/mol; liquid density 0.79g/ml, Lower Explosive Limit (LEL) 2.5%v/v

Acetone Molecular wt. is 58.1

Vapour density is thus 58.1/ 28.96 (a constant) = 2.01g/mol (approximately), which indicates that the vapour is twice as heavy as air and will sink (and may collect in drainage traps), which is itself useful information

Relative density of vapour (at 20° C and 1013hPa) can be calculated by multiplying the molecular weight with a constant, 0.04179 = 2.42

Using the LEL (Lower Explosive Limit) in %V/V, it can be converted to g/m3 by multiplication by the molecular weight and dividing by another constant 2.4.

However, the HSE ACoP L138 which supports DSEAR states that a flammable atmosphere at or above 25% of the lower explosive limit (LEL) should be regarded as a serious risk. Therefore, 25% LEL should be used in the calculation.

For acetone this would be 58.1 x 0.625/2.4 = 15.13g/m3.

The above can be put to some practical use in understanding zoning, as it can be used to calculate maximum spill volumes permissible to remain below the LEL in a room of given size, assuming total dispersion.

For a room with dimensions 5m x 7m x 3m = 105m3 volume,

105 x 15.13/0.785 (density) = 2024ml, = 2.024L

2. Ethanol spill in a room dimension 3m x 3m x 3m

Ethanol has a molecular weight of 46.1g/mol; liquid density 0.79g/ml, LEL 3.1%v/v

Vapour density 46.1/28.96 = 1.59g/mol

Relative density of vapour 46.1/0.04179 = 1.93

LEL conversion to g/m3 = 46.1 x 0.775/2.4 = 14.89g/m3

Maximum spill in room volume 27m3 x 14.89/0.79 = 0.509L

Initial Screening Risk Assessment Template

Faculty/Directorate	Department
Building Name	Room number/Location

For any substance transported, stored, used or produced (as a result of a work process or chemical reaction, including by-products and or combustion) in the area, does the hazard information available on either the packaging, in the Safety Data Sheet (SDS) or in the view of a competent person in the absence of specific hazard information indicate that the substance is (or is likely to be):

List substance and total quality transported, stored, used or produced in litres / Kg	Explosive	Oxidising	Extremely Flammable Liquids Cat 1*	Highly Flammable Liquids Cat 2**	Flammable Liquids Cat 3***	Corrosive to metal	Compressed Gas Extremely Flammable* Flammable** Oxidising	Aerosol - Flammable
								
Total quantity of substances (defined by physical property)								

* Cat 1 Flammable liquid, Flash point <23°C, Boiling point ≤ 35°C

** Cat 2 Flammable liquid, Flash point <23°C, Boiling point > 35°C

*** Cat 3 Flammable liquid, Flash point ≥23°C, Boiling point ≤ 60°C

*Ignition in air ≤ 13% v/v or flammable range with air of ≥ 12% points

** Has a flammable range when mixed with air

As a result of either the amounts of substances identified above, or a work process or chemical reaction, including by-products and or combustion, is there likely to be a release of vapour/gas/dust/decomposition products that could produce an explosive atmosphere? See following page for some worked examples using commonly used solvents and a blank calculator to aid in determining this answer Yes ☐ Total Quantity No ☐

If the answers to all the questions are negative, the assessment is complete and should be signed in the box below.

If any answers are positive, please go to Part 2.

Name of Assessor:	Name of Manager/PI
Signature of Assessor:	Signature of Manager/PI
Date:	Date:
Review Date: (Annually or upon change in respect of new activities, use of new chemicals etc.)	

Appendix 3 – Assessment Guidance for DSEAR Part 2: Summary of factors to be considered for Flammable Liquids

This document contains an outline of factors to be considered when assessing all use of flammable gases including Liquefied flammable gas for compliance with the Dangerous Substances and Explosives Atmospheres Regulations 2002.

The assessment within this template is required because it has been determined from the Part 1 assessment that an explosive atmosphere is a foreseeable event.

Each use of a flammable gas must be assessed individually as there are too many variables to consider in a generic assessment. There may be factors discussed in the guidance below which are not relevant to particular situations. For example, different gases may have different properties, usage may vary as well as location variables.

Points to consider before assessment to eliminate or reduce so explosive atmosphere cannot occur:

Can the flammable Liquid be eliminated, i.e. not used or substituted	Yes or No If answer No please Justify:
Can the quantity or volume be reduced so LEL cannot be reached	Yes or No If answer No please Justify:
Can the ventilation be improved so 25% of LEL cannot be reached, i.e. use of fume cupboard, ventilated cabinet	Yes or No If answer No please Justify:

LEL – Lower Explosive Limit

If the answer is Yes to any of the above then it is confirmed that an explosive/flammable atmosphere is no longer possible, the assessment can be concluded with actions identified to implement the measures identified above.

This assessment should be produced in conjunction with HSE Guidance on DSEAR and SHEW Code of Practice.

https://www.hse.gov.uk/fireandexplosion/about.htm

https://www.hse.gov.uk/fireandexplosion/dsear-regulations.htm

https://www.hse.gov.uk/pubns/priced/l138.pdf

https://www.hse.gov.uk/electricity/atex/classification.htm

Points to consider when carrying our risk assessment. Details of the steps taken to comply with any of the points should be recorded in your risk assessment for it to be suitable and sufficient.

Process/Activity
The quantity of the dangerous substance held/used has been reduced to a minimum
Measures have been taken to avoid or minimise releases (intentional or unintentional)
Measures have been taken to control any releases at source.
Measures have been taken to prevent the formation of an explosive atmosphere.
Measures have been taken to collect, contain and remove any releases to a safe place (e.g. by extraction)
Measures have been taken to avoid adverse conditions (e.g. exceeding the limits of temperature or other control settings)
Incompatible substances are kept apart, so far as is reasonably practicable, in use (e.g. oxidisers and combustibles)
The number of people (staff, students, contractors, visitors etc.) exposed to the dangerous substances or explosive atmosphere has been reduced to the minimum.
Plant has been supplied that is explosion resistant where required
Procedures are in place to exclude (or control) all sources of ignition including electrostatic discharges
Explosion suppression or pressure relief has been provided on equipment where required
Adequate measures have been taken to control or minimise the spread of fire or explosion
Suitable Personal Protective Equipment (PPE) (specify what type and which items, e.g. anti-static) has been provided, and users have been trained how to store, use, put on and remove, clean and dispose of it correctly.
Workplace / Process and Management Systems Where appropriate to the nature of the process or activity
The workplace is designed, constructed and maintained so as to provide adequate fire-resistance and / or explosion relief where required

The workplace and storage areas are secured to prevent unauthorised access
Every assembly, construction, installation, plant, rig, piece of equipment, protection system etc. is designed in such a manner as to minimise risk of fire and / or explosion where required
Every assembly, construction, installation, plant, rig, piece of equipment, protection system etc. is used in such a manner as to minimise risk of fire and / or explosion
Appropriate safe systems of work or safe operating procedures have been developed and communicated to the workforce
If a permit to work scheme is required in the work area it is strictly enforced
In the case where there are explosive atmospheres – zoning and control
All such areas where there are likely to be explosive atmospheres have been classified into Zones in accordance with Schedule 2 to the Regulations
Where necessary, the classified zones have been marked at all their entry points with the specified hazard warning sign 
External entrances into classified zones are marked with appropriate signage such as no smoking signs 
All areas that are classified into zones are appropriately protected from sources of ignition through the selection of equipment and protective systems compliant with the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996
Staff and students working in zoned areas are wearing outer clothing that does not create a risk of electrostatic discharge
Areas where explosive atmospheres may be present, before their first operation, have been verified as being safe by a person, or organisation being competent in the field of explosion protection
Storage
Containers containing over 500ml extremely flammable and highly flammable substances are stored in suitable fire-resistant storage containers, to a maximum value of 50 litres of any class of flammable liquid per workspace

Quantities exceeding 50 litres of any class of flammable liquid stored in a workspace are kept in dedicated and appropriately protected flammable stores (or cabinets meeting BS EN 14470-1)
All storage areas are bunded with sufficient capacity in the bund to take 110% of the volume of the largest container or 25% of the total volume of liquid stored, whichever is the greater
Incompatible substances are stored apart (e.g. flammables, oxidisers, corrosives, combustibles, flammable gases, LPG etc.) by appropriate separation distances where relevant
Storage areas have been designed to provide explosion relief/ resistance where appropriate
Transport
Appropriate trolleys or other carriers (e.g. Winchester carriers) are used to transport dangerous substances to and from places of storage to places of work
Appropriate trolleys and equipment are available and used to move gas cylinders
Mitigation of Adverse Situations and Waste Disposal
Suitable emergency procedures have been developed and communicated to the users to deal with spillages or other release of dangerous substances
Suitable procedures have been developed and communicated to the users to deal with adverse process conditions (e.g. exceeding limits of temperature, or other control settings)
Suitable procedures have been developed and communicated to the users to deal with all emergencies including response to alarms
Suitable procedures have been developed and communicated to the users to manage and dispose of waste containing dangerous substances
Information, instruction, training and supervision
Appropriate information, instruction and training, commensurate with the hazard and risks of the dangerous substances, or processes, been provided to the users in respect of: Properties of the dangerous substance Hazard potential

risk reduction methods to be employed management systems to be followed emergency systems etc. Records are kept and Refresher training requirements have been defined.
There is supervision available until the users are familiar with the activities being carried out and are deemed competent by a senior person to carry them out without being closely supervised

Potential Ignition Sources – list is not exhaustive

Hot surfaces (could include piping through buildings)	Electromagnetic radiation of different wavelengths
Open Flames including use of items such as lighters	Vehicles for external areas
Heated process vessels such as ovens, dryers and furnaces	Hot process vessels
Space heating and air conditioning equipment;	Cutting and welding flames;
Electrical equipment and lights including sparks from equipment	Mechanical machinery
Friction heating, grinding or sparks	Spontaneous heating;
Electrostatic discharge sparks	Discharges of static electricity
Chemical energy	Impact and heat-sensitive materials

Hazard Classification Definitions

The Regulations define 3 zones that can exist within a hazardous area based on whether an explosive atmosphere is likely to form and how long it is likely to remain:

Zone 0 - A place in which an explosive atmosphere is present continuously or for long periods.

Zone 1 - A place in which an explosive atmosphere is likely to occur in normal operation occasionally

Zone 2 - A place in which an explosive atmosphere is not likely to occur in normal operation, but if it does occur, will persist for a short period only

[Insert name of activity]

DSEAR Assessment Record

Risk Assessment Title:	Date Produced:	Review Date:
Overview/Description of Activity:	Duration/Frequency of Activity:	
Location of Activity:	Specific Assessment for Compliance with Dangerous Substances and Explosives Atmospheres (DSEAR) Regulations - Flammable Liquids	

Flammable Liquid Name				
Quantity (volume and Number)				
Flash Point				
Lower Explosive Limit				
Other Properties				
Temperature Conditions				

Examples of potential hazards that could result in an explosive/flammable atmosphere (this is not exhaustive)	Potential Outcome
Very small scale operations – up to 50mls Spill on open bench Spread of fire due to presence of other combustible/flammable materials Processes where an ignition source (i.e. heat or flame) must be present, e.g. evaporation	Small Localised fire of small area – easily extinguished or burns out
Medium scale operations – up to 2.5 litres Spill on open bench Spread of fire due to presence of other combustible/flammable materials Processes where a direct heat source (i.e. flame) must be present Use of electrical equipment for heating, etc, e.g. hot plates, stirrers	Fire radius of up to a metre, but only a very small height above the liquid level – spread to whole area of spill quickly
Larger scale laboratory work – over 2.5 litres, pilot scale (50-100litres) Glass equipment broken due to impact, thermal shock, overpressure, poor assembly Poor handling of open containers Deliberate combustion, e.g. fuel	Fire extent will likely depend on the volume of liquid and area of spread

Releases into enclosed spaces Spill into an enclosed space such as a fridge or oven Vapours released into enclosed space – open containers	Explosion due to enclosed space
Transport of flammable liquids on campus: Not using a trolley or incorrect type or other appropriate transport carrier Trolley failure due to lack of maintenance Poor condition of pathway, taking over door thresholds Drop containers when person carrying Lids not fitted or not double contained	External fire – possible entry to drains resulting in explosive atmosphere in enclosed space
Storage of flammable liquids (within and external to labs): Spills due to poor storage practice Trays or bunds not used Incompatible materials stored together Access restriction not controlled Storage of other items in storage area/cabinet – combustibles, oxidisers, poor housekeeping Decanting or similar task when in storage Bulk fuel storage	Fire or explosion extent of which will depend on materials present, volume and spread

Scale of the anticipated effects and extent of harm

Where there is potential for an explosion, determining the scale of effects and the extent of harm will need consideration of:

the substance, the amount involved and how quickly it can be consumed. Internal building configuration or obstructions will have an effect on the rate of burning

the size of the potential flammable/explosive atmosphere and the magnitude of the direct and indirect effects, i.e. fire or explosion itself and resulting effects; smoke, release of toxic substances, further chemical reactions

the amount of heat radiated

how the incident could escalate and whether conditions exist or could develop to cause a further fire, explosion or similar event

Spread to other areas

Appendix 4: Assessment Guidance for DSEAR Part 2: Summary of factors to be considered for flammable gases

This document contains an outline of factors to be considered when assessing all use of flammable gases including Liquefied flammable gas for compliance with the Dangerous Substances and Explosives Atmospheres Regulations 2002.

The assessment within this template is required because it has been determined from the Part 1 assessment that an explosive atmosphere is a foreseeable event. Each use of a flammable gas must be assessed individually as there are too many variables to consider in a generic assessment. There may be factors discussed in the guidance below which are not relevant to particular situations. For example, different gases may have different properties, usage may vary as well as location variables.

Points to consider before assessment to eliminate or reduce so explosive atmosphere cannot occur:

Can the flammable gas be eliminated, i.e. not used or substituted	Yes or No If answer No please Justify:
Can the flammable gas be moved to outside location (see definition in CoP for compressed gases	Yes or No If answer No please Justify:
Can the quantity or volume be reduced so LEL cannot be reached	Yes or No If answer No please Justify:
Can the ventilation be improved so 25% of LEL cannot be reached, i.e. use of fume cupboard, ventilated cabinet	Yes or No If answer No please Justify:

If the answer is Yes to any of the above an it is confirmed that an explosive atmosphere is no longer possible, the assessment can be concluded with actions identified to implement the measures identified above.

This assessment should be produced in conjunction with HSE Guidance on DSEAR and SHEW Code of Practice.

https://www.hse.gov.uk/fireandexplosion/about.htm

https://www.hse.gov.uk/fireandexplosion/dsear-regulations.htm

https://www.hse.gov.uk/pubns/priced/l138.pdf

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Measures have been taken to avoid or minimise releases (intentional or unintentional)
Measures have been taken to control any releases at source.
Measures have been taken to prevent the formation of an explosive atmosphere.
Measures have been taken to collect, contain and remove any releases to a safe place (e.g. by extraction)
Measures have been taken to avoid adverse conditions (e.g. exceeding the limits of temperature or other control settings)
Incompatible substances are kept apart, so far as is reasonably practicable, in use (e.g. oxidisers and combustibles)
The number of people (staff, students, contractors, visitors etc.) exposed to the dangerous substances or explosive atmosphere has been reduced to the minimum.
Plant has been supplied that is explosion resistant where required
Procedures are in place to exclude (or control) all sources of ignition including electrostatic discharges
Explosion suppression or pressure relief has been provided on equipment where required.
Adequate measures have been taken to control or minimise the spread of fire or explosion
Suitable Personal Protective Equipment (PPE) (specify what type and which items, e.g. anti-static) has been provided, and users have been trained how to store, use, put on and remove, clean and dispose of it correctly.

Workplace / Process and Management Systems Where appropriate to the nature of the process or activity
The workplace is designed, constructed and maintained to provide adequate fire-resistance and / or explosion relief where required
The workplace and storage areas are secured to prevent unauthorised access
Every assembly, construction, installation, plant, rig, piece of equipment, protection system etc. is designed in such a manner as to minimise risk of fire and / or explosion where required
Every assembly, construction, installation, plant, rig, piece of equipment, protection system etc. is used in such a manner as to minimise risk of fire and / or explosion
Appropriate safe systems of work or safe operating procedures have been developed and communicated to the workforce
If a permit to work scheme is required in the work area it is strictly enforced
In the case where there are explosive atmospheres – zoning and control
All such areas where there are likely to be explosive atmospheres have been classified into Zones in accordance with Schedule 2 to the Regulations
Where necessary, the classified zones have been marked at all their entry points with the specified hazard warning sign 
External entrances into classified zones are marked with appropriate signage such as no smoking signs 
All areas that are classified into zones are appropriately protected from sources of ignition through the selection of equipment and protective systems compliant with the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996
Staff and students working in zoned areas are wearing outer clothing that does not create a risk of electrostatic discharge

Areas where explosive atmospheres may be present, before their first operation, have been verified as being safe by a person, or organisation being competent in the field of explosion protection
Storage
Incompatible substances are stored apart (e.g. flammables, oxidisers, corrosives, combustibles, flammable gases, LPG etc.) by appropriate separation distances where relevant
Storage areas have been designed to provide explosion relief/ resistance where appropriate
Transport
Appropriate trolleys and equipment are available and used to move gas cylinders
Mitigation of Adverse Situations and Waste Disposal
Suitable emergency procedures have been developed and communicated to the users to deal with spillages or other release of dangerous substances
Suitable procedures have been developed and communicated to the users to deal with adverse process conditions (e.g. exceeding limits of temperature, or other control settings)
Suitable procedures have been developed and communicated to the users to deal with all emergencies including response to alarms
Suitable procedures have been developed and communicated to the users to manage and dispose of waste containing dangerous substances
Information, instruction, training and supervision
Appropriate information, instruction and training, commensurate with the hazard and risks of the dangerous substances, or processes, been provided to the users in respect of: Properties of the dangerous substance Hazard potential

risk reduction methods to be employed management systems to be followed emergency systems etc. Records are kept and Refresher training requirements have been defined.
There is supervision available until the users are familiar with the activities being carried out and are deemed competent by a senior person to carry them out without being closely supervised

Potential Ignition Sources – list is not exhaustive

Hot surfaces (could include piping through buildings)	Electromagnetic radiation of different wavelengths
Open Flames including use of items such as lighters	Vehicles for external areas
Heated process vessels such as ovens, dryers and furnaces	Hot process vessels
Space heating and air conditioning equipment;	Cutting and welding flames;
Electrical equipment and lights including sparks from equipment	Mechanical machinery
Friction heating, grinding or sparks	Spontaneous heating;
Electrostatic discharge sparks	Discharges of static electricity
Chemical energy	Impact and heat-sensitive materials

Hazard Classification Definitions

The Regulations define 3 zones that can exist within a hazardous area based on whether an explosive atmosphere is likely to form and how long it is likely to remain:

Zone 0 - A place in which an explosive atmosphere is present continuously or for long periods.

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Zone 2 - A place in which an explosive atmosphere is not likely to occur in normal operation, but if it does occur, will persist for a short period only

[Insert name of activity]

DSEAR Assessment Record

Risk Assessment Title:	Date Produced:	Review Date:
Overview/Description of Activity:	Duration/Frequency of Activity:	
Location of Activity:	Specific Assessment for Compliance with Dangerous Substances and Explosives Atmospheres (DSEAR) Regulations - Flammable Gases	

Flammable Gas Name				
Quantity (cylinder volume and Number)				
Flash Point				
Lower Explosive Limit				
Other Properties, i.e. lighter/denser than air				
Temperature Conditions				
Typical and Max Pressure Conditions				

Examples of potential hazards that could result in an explosive atmosphere to be considered (this not exhaustive)	Potential Outcome
Primary Hazards that could occur during normal operation: Changing regulator or making connections Regulator failure***?? Primary or secondary*** Leak at connection point in piping into lab Cylinder filling operations	Slow leak due to small release point***?? Better wording??***
Secondary hazards due to a fault condition including: Incorrect setup such as using incompatible tubing or connectors leads to failure Aging or wear and tear on tubing, incompatible material used leads to failure of tubing Loss of cooling or insulation for refrigerated gases Gas tap knocked into on position Escalation of fire/explosion due to presence of other combustible materials, e.g. oxidising gas, excessive packaging Failure of piping due to age, corrosion, external weather factors, lack of maintenance	Extent of explosion depends on volume released, type of gas and potential for spread
Hazards associated with tasks being carried out: Filling balloons with flammable gas Welding Processes including hot work and flame cutting Other processes where an ignition source (i.e. heat or flame) must be present Deliberate combustion, e.g. fuel	Extent of explosion depends on volume released and type of gas

Hazards associated with Equipment being used: Equipment that requires flame such as GLC, i.e. loss of flame, leak from line Release into an enclosed space such as a fridge or oven *Outdoor cooking such as BBQs – include or not?*	Explosive atmosphere in enclosed space
Hazards associated with Transport: Not using a trolley or incorrect type Trolley failure due to lack of maintenance Poor condition of pathway, taking cylinder over door thresholds	Slow release from knock to discharge valve
Hazards associated with Storage: Gas use when in storage Regulators left in place Cylinders not fixed in place singly Separation distances not maintained Access restriction not controlled Storage of other items in store – combustibles, poor housekeeping	

Scale of the anticipated effects and extent of harm

Where there is potential for an explosion, determining the scale of effects and the extent of harm will need consideration of:

the substance, the amount involved and how quickly it can be consumed. Internal building configuration or obstructions will have an effect on the rate of burning

the size of the potential explosive atmosphere and the magnitude of the direct and indirect effects, i.e. fire or explosion itself and resulting blast wave, smoke, release of toxic substances, further chemical reactions

the amount of heat radiated

how the incident could escalate and whether conditions exist or could develop to cause a further fire, explosion or similar event

Spread to other areas

#	Fault that could lead to release	Who affected	Scale of Effect and potential harm	Hazardous Aea Zone (apply definitions above and justify)	Action/control measures to reduce likelihood of harm	Additional actions required
Primary Hazards that could occur during normal operation						

1	*Change of Regulator leads to release as valve not fully closed, connection not remade adequately, release of residual gas in system*	*Technical Staff changing regulator, lab users in vicinity*	*Scale of effect – release of residual gas in system only, small volume approx. 1-2m into lab* *If hydrogen – release rises to ceiling level*	*Zone 2* *Leak could occur in normal operation but for short period only*	*Staff trained in safe practice for regulator changes* *Leak tests carried out after every regulator change* *Leak would only persist for short period of time until detected* *Lab ventilation dilution of release* *No ignition sources present when changing regulator* *Non static clothing worn*	
2						
3						
Secondary hazards due to a fault condition						

4	*Leak into work area due to poor connection, e.g. required fittings not used*			*n/a – should not occur during normal operation* *this must be adequately justified*	*Gas cylinder user trained in Gas Safety – does this include flammable hazards proper connections etc.?* *Number of connections to be fewest possible, to minimise number of potential leak points* *Only required connectors for type of gas to be used be specific* *Leak testing requirements – check* *Identification of leak?? How quickly??*	

5	*Leak due to failure of tubing.*				*Tubing used must be appropriate for the gas used* *Plastic tubing should not be used for flammable gases* *Length of tubing used minimised* *Avoid kinks or passing over abrasive surfaces or other conditions that could cause damage* *Inspect tubing on regular basis and discard when damaged or showing signs of wear*	
Hazards associated with tasks being carried out						
Hazards associated with Equipment being used						

Hazards associated with Transport						
Hazards associated with Storage						

Do provided risk assessment controls reduce risks to a tolerable[1] level? If no, then further controls are required. Advice should be sought from SHEW	Yes / No

Assessor signature:	Print name:	**Date:**

Example Risk Assessment Action Plan

Hazard No.	Action to be taken	By whom	Target date	Review date	Outcome at review date
1	*Define area of zone*				
2	*Eliminate ignition sources from zone area, i.e. antistatic clothing, ATEX rated equipment*				
3	*Produce safe system of work for zone including conditions to control access, ignition sources etc.*				
4	*Produce emergency procedures*				
5	*Train users in safe system of work and emergency procedures, training records to be kept*				
Responsible manager's signature: Print name:					

Date:	

Risk Assessment Sign-On Sheet

Sign-on Sheet to acknowledge understanding of Risk Assessment:

Names and Signatures of other workers/researchers/PG/UG students

All others undertaking the process described must signify that they understand the hazards and risks.

Print name	Signature:	Date

#	Fault that could lead to release	Who affected	Scale of Effect and potential harm	Hazardous Aea Zone (apply definitions above and justify)	Action/control measures to reduce likelihood of harm	Additional actions required
Very small-scale operations – up to 50mls						
1	*Spill when working on open bench*	*Lab users*	*Small, localized fire burns out quickly, easily extinguished*	*n/a – does not occur in normal operation* *Quickly and easily dealt with before fire realised*	*Highly flammable liquids should be handled in fume cupboard* *If open bench work required, carry out in spill tray to prevent spread* *Spill kit and other clean up materials readily available* *Avoid ignition sources in immediate vicinity* *Extinguishers present in lab* *General ventilation in lab* *Persons undertake mandatory basic fire awareness training*	
2						

3						
Medium scale operations – up to 2 litres						
4						
5						
Larger scale laboratory work – over 2 litres, pilot scale (50-100litres)						
Releases into enclosed spaces						

Transport of flammable liquids on campus						
Storage of flammable liquids (within and external to labs)						

Do provided risk assessment controls reduce risks to a tolerable[2] level? If no, then further controls are required. Advice should be sought from SHEW	Yes / No

Assessor signature:	Print name:	**Date:**

Example Risk Assessment Action Plan

Hazard No.	Action to be taken	By whom	Target date	Review date	Outcome at review date
1	*Define area of zone*				
2	*Eliminate ignition sources from zone area, i.e. antistatic clothing, ATEX rated equipment*				
3	*Produce safe system of work for zone including conditions to control access, ignition sources etc.*				
4	*Produce emergency procedures*				
5	*Train users in safe system of work and emergency procedures, training records to be kept*				
Responsible manager's signature: Print name: Date:					

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Sign-on Sheet to acknowledge understanding of Risk Assessment:

Names and Signatures of other workers/researchers/PG/UG students

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Print name	Signature:	Date