St Mary's University Twickenham London

Dangerous Substances and Explosive Atmospheres Regulations (2002) including Compressed Gases – Policy and Guidance on Safe Use and Storage
HSPG 35

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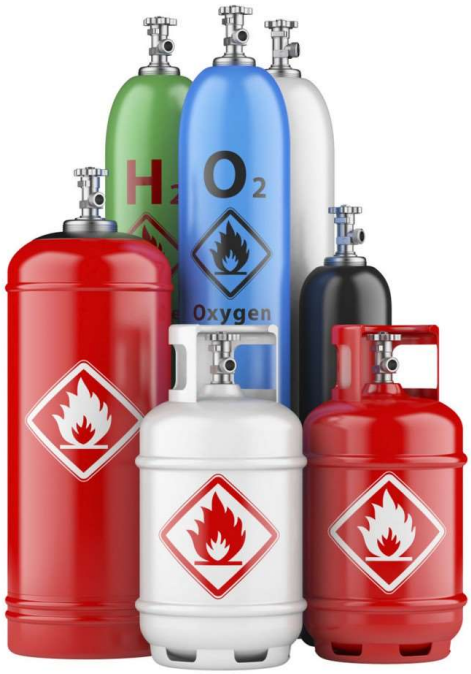

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Executive Summary

1. The Dangerous Substances and Explosive Atmospheres Regulations (2002) are concerned with protection against risks from fire and explosion and now include compressed gases.

2. The key requirements of the Regulations are that risks from dangerous substances are assessed and eliminated or reduced.

3. Principal Investigators are responsible for the implementation of effective risk assessment for work within their control

4. Heads of Department are responsible for the safe use of flammable gases and liquid stores within their area of responsibility

1. Policy

St Mary's University attaches the greatest importance to the health, safety and welfare of its employees, students and visitors, and in particular, recognises the significance of the risks to health caused by the use, handling and storage of dangerous substances, explosive atmospheres including compressed gases at work.

It is the policy of St Mary's University to take all reasonable steps to secure the health and safety of anyone who works with dangerous substances, explosive atmospheres including compressed gases.

No work will be undertaken which is liable to expose any employees, students or visitors to risks from the use, handling and storage of dangerous substances, explosive atmospheres including compressed gases, unless a risk assessment has been carried out.

2. Key legislative requirements

The Health and Safety at Work etc. Act 1974; The Act sets out the general duties which employers have towards employees and members of the public, and employees have to themselves and to each other.

The Management of Health and Safety at Work Regulations 1999; require employers to carry out risk assessments, make arrangements to implement necessary measures, appoint competent people and arrange for appropriate information and training.

The Control of Substances Hazardous to Health Regulations ("COSHH") 2002; require employers to assess the risks from hazardous substances and

take appropriate precautions.

The Dangerous Substances and Explosive Atmospheres Regulations ("DSEAR") 2002; require employers to carry out risk assessments of work activities involving dangerous substances, to provide technical and organizational measures to eliminate or reduce as far as is reasonably practicable the identified risks and, to provide equipment and procedures to deal with accident and emergencies. The update of DSEAR in 2015 merged the legislation so that DSEAR now includes compressed gases;

The Provision and Use of Work Equipment Regulations ("PUWER") 1998; require the risks to people's health and safety, from equipment that they use at work, to be prevented or controlled.

The Manual Handling Operations Regulations 1992; covers the moving of objects by hand or bodily force and requires manual handling tasks to be risk assessed and controlled.

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations ("the Carriage Regs") 2009; impose requirements and prohibitions in relation to the carriage of dangerous goods by road (and rail) and lay down standards of design, manufacture, testing and marking that manufacturers must comply with.

The Confined Space Regulations 1997; require an assessment to be made of the risks to workers from working in confined spaces

The Pressure Equipment Regulations ("PER") 1999; apply to the design and construction aspects of pressure equipment intended to contain a gas or liquid at 0.5 bar gauge or above.

3. Duty holders

3.1 Heads of Faculties / Heads of Services

Heads of Faculties/Heads of Services have responsibility for ensuring compliance with the Regulations in general but in particular that:

- suitable and sufficient risk assessments areundertaken
- any required risk reducing measures, emergency arrangements, etc., are implemented
- sufficient information and training isprovided.

While responsibility lies with the duty holder, the task may be delegated to a supervisor, technical manager, or other designated responsible person (e.g. Departmental Health and Safety Coordinator) within the Department. Where this occurs it should be made explicit in the Departmental safety policy.

N.B. Heads of Faculties / Heads of Services are also duty holders under the University's Fire Safety Policy

3.2 University Health & Safety Office

The Health & Safety Office has responsibility for:

- Monitoring compliance with this policy,
- Reviewing and amending University safety policies,
- Providing information and advice to Heads of Faculties / Support Services and delegated staff.

3.3 Estates and Campus Services

- Estates & Campus Services are responsible for their own compressed gas cylinders.
- Estates & Campus Services shall provide technical assistance to other departments upon request to ensure that any measures necessary to protect against process fire risks are suitable and sufficient.

4. Definitions

4.1 What is DSEAR?

The Dangerous Substances and Explosive Atmospheres Regulations 2002, known by the acronym DSEAR, aim to protect people from the risks from fires, explosions and other similar events that may occur as a result of the presence or use of dangerous substances in the workplace. DSEAR is principally concerned, therefore, with the safe use of substances that can create thermal radiation effects (burns) and over-pressure effects (blast injuries). DSEAR has removed a large amount of old health and safety legislation on flammable substances, for example the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972.
Examples of Dangerous substances include:

Most common organic solvents	Varnishes
Benzoyl peroxide	LPG
Ammonia gas	Methyl ethyl ketone
Oxygen gas	Styrene monomer
Petrol	Acrylamide monomer

The Hazard Classes now include:

- Explosive
- Flammable gases
- Flammable aerosols and aerosols
- Flammable liquids – 'flammable liquid' means a liquid with a flashpoint of 60 °C or below and not 550C as before.
- Flammable solids
- Pyrophoric liquids
- Pyrophoric solids
- Oxidising liquids
- Oxidising solids
- Organic peroxides
- Water-reactive substance/mixture - emits flammable gases
- Self-heating substance/mixture
- Self-reactive substance/mixture
- Gases under pressure
- Corrosive to metals

Examples of activities to which DSEAR applies (the list is not exhaustive, but offered as examples)

- Storage of petrol and LPG as a fuel for cars, boats, horticultural machinery etc.;
- Use of flammable gases, such as acetylene, for welding;
- Handling and storage of waste dusts in woodworking shops;
- Handling and storage of flammable wastes including fuel oils;
- Hot work on tanks or drums that have contained flammable material;
- Work activities that could release naturally occurring methane
- Use of flammable solvents in laboratories
- Storage of flammable goods, such as paints, solvents, reagents;
- Storage, use and handling of flammable gases, including LPG;
- Transport of flammable liquids in containers around the workplace;
- Chemical or gas manufacture resulting from research or teaching

Some definitions from the Regulations are given in Appendix 5. In summary, a dangerous substance is any natural or artificial substance which is explosive, extremely flammable, highly flammable or flammable, including liquids, vapours, gases, dust; and equipment that might leak or generate a dangerous substance. Such substances that are bought in commercially will be recognised by the standard pictograms on the container, e.g.

Explosive

Oxidising

Flammable

The definitions of “dangerous substance” and “substance hazardous to health” contained in DSEAR and COSHH respectively, cover a wide range of substances. As a result, some substances that may be dangerous to safety could also present a health risk.

For example, certain gases (e.g. hydrogen, methane, propane, etc.) are extremely flammable and come within the scope of DSEAR. However, the gases themselves can also act as asphyxiants, reducing the quantity of oxygen present in a workplace to the extent that life can be put at risk. As a result, they will also satisfy the definition of a substance hazardous to health for the purposes of COSHH. Therefore, where substances that could result in a risk to both safety and health are present, employers have duties to control the risks from those substances under both sets of Regulations.

DSEAR are a complex set of regulations. Not only is the text complex, but the regulations are supported by a set of five Approved Codes of Practice. This document is of necessity a summary of the major points that are perceived by SEPS are being common to science-based departments in the University. It is the responsibility of Principal Investigators and Heads of Department to ensure that all work within their area of responsibility to which DSEAR applies is compliant with the regulations.

4.2 Risk assessment

Risk assessment is the key to compliance with DSEAR. A model assessment form is given at the end of this document. If compliance with DSEAR is the overriding consideration, i.e. flammability risks predominate, this form should be used. If toxic risks predominate, the assessment form from the University’s guidance on the COSHH regulations should be used, with a note to the effect that flammability/explosive risks have been addressed too.

4.3 Compressed Gas

Compressed Gas: a non-flammable material or mixture having in the container a pressure exceeding 41 psia (3 bar) at 70°F (21°C), or any flammable or poisonous material that is a gas at 70°F (21°C) and has a pressure of 14.7 psia (1 bar) or greater. Most compressed gases will not

exceed 2,000 to 2,640 psig (138 to 182 bar), though some do go up to 6,000 psig (414 bar).

4.4 Non-liquefied Compressed Gas

Non-liquefied Compressed Gas: Chemical or material, other than gas in solution, that under the charged pressure is entirely gaseous at a temperature of 70°F (21°C).

4.5 Liquefied Compressed Gas

Liquefied Compressed Gas: Chemical or material that, under the charged pressure, is partially liquid at a temperature of 70°F (21°C).

5. Risk Assessment and Control of Dangerous Substances

5.1 Introduction

The purpose of risk assessment is to enable the University to decide what to do in order to eliminate or reduce so far as is reasonably practicable the safety risks from dangerous substances and ensure that these safety controls are implemented.

The term 'dangerous substance' covers any substance or preparation that could cause harm to people from fire or explosion as a result of its properties or the way it is used. This includes, for example, petrol, LPG, paints, varnishes, solvents, and dusts that could cause an explosive atmosphere with air.

The key requirements of the Regulations are to:

- Assess the risks from dangerous substances;
- Provide measures to eliminate those risks, or reduce them so far as is reasonably practicable;
- Provide equipment and procedures to deal with accidents and emergencies; and
- Provide information and training to employees.

In addition, if there are places where hazardous explosive atmospheres may be present then those places must be classified into zones and marked where necessary. Any new electrical or mechanical equipment used in those zoned places must comply with the requirements of The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations (2016).

5.2 Risk Assessment under DSEAR

The risk assessment under DSEAR is intended to build upon that already required by the Management of Health and Safety at Work Regulations 1999. It should be an identification and examination of the dangerous substances that are (or could be) present, the associated work activities and an analysis of what could go wrong, leading to a fire or explosion. Please refer to Appendix 6.

Responsibility for ensuring risk assessments are completed lies with the Principal Investigator of the work in question. For activities based on departmental work, such as the ownership of a flammable liquid store, responsibility lies with the Head of Department.

As preliminary step, if the assessor quickly comes to the conclusion that hazards from dangerous substance are not present or unlikely to occur no further action is necessary. However, typically in a scientific department, the following steps will be required.

STEP 1 - Check whether the substance has been classified under The Classification, Labelling and Packaging of Chemicals Regulations as: explosive, oxidising, extremely flammable, highly flammable or flammable. The CLP Regulations require dangerous substances to be classified by suppliers using criteria set out into certain categories of danger. **If a substance or preparation is classified as explosive, oxidising,**

extremely flammable, highly flammable or flammable then it is a "dangerous substance".

The GB CLP Hazard class Flammable liquids is divided into three categories:

- Category 1: flashpoint <23 °C and initial boiling point ≤35 °C.
- Category 2: flashpoint <23 °C and initial boiling point >35 °C.
- Category 3: flammable liquids (under CLP) flashpoint ≥23 °C and ≤60 °C; and combustible liquids with a flashpoint above 60 °C

When dangerous substances are used at work, suppliers must provide safety data sheets (an MSDS) that indicate whether the chemical has been so classified.

STEP 2 - Assess the physical and chemical properties of the substance or preparation **and the work processes involved** to see whether that creates a potential for fire, explosion or similar energetic (energy releasing) event4. See Appendix 5 for the full definition as given in the Regulations, and Appendix 6 for the risk assessment pro forma.

Remember, the Regulations apply because of the way a substance is used or present. For example, diesel oil is not classified as "flammable" under CLP. Nevertheless, its physical properties are such that when heated to a high temperature it can present a fire and explosive risk. The key point is that it is not only the substance's fundamental physical or chemical properties, but also the way the substance is used/processed or present that determines whether DSEAR applies. Another example would be substances which on their own or when mixed with others decompose or react to release energy such that there could be a fire or explosion. Examples include certain chemical reactions with the potential for thermal runaway and the handling and storage of unstable substances such as certain types of peroxides. A risk assessment uses information about the physical and chemical properties of the substance and the characteristics of the work processes to determine whether there is a hazard and risk. **If the assessment of the work activity involving the substance or preparation shows that there is a risk of a fire, explosion or similar energetic (energy-releasing) event then the substance or preparation is "dangerous".**

STEP 3 - Check to see if the work activity involves the creation or handling of potentially combustible or explosive dusts

5.3 Control and Mitigation

The most effective control to avoid the risk from dangerous substances is to remove them from the workplace, and DSEAR requires that efforts are made to avoid using dangerous substances where this is possible. Elimination is the best solution and **must** be considered first. This involves replacing a dangerous substance with a substance or process that totally eliminates the risk by avoiding exposure to the hazard. The nature of the work may mean that this is simply not possible - often the properties that make a substance useful or needed in a work activity or process also make it dangerous.

5.4 Substitution and Risk Reduction

In practice it is more likely that it will be possible to replace the dangerous substance with one that is less hazardous (e.g. by replacing a low flashpoint solvent with a high flashpoint one) or to design the process so that it is less dangerous - for example, by reducing quantities of substances in the process. Care must be taken, however, whilst carrying out these steps so as to ensure that no other new safety or health risks are created or increased.

DSEAR also requires mitigation measures to be in place in case an incident occurs. These measures include:

- Preventing fires and explosion from spreading;
- Reducing the number of people exposed to a potential incident; and
- Providing equipment that can safely contain or suppress an explosion or vent it to a safe place.

It may be, however, that the properties of the substance or preparation are such that it meets the technical criteria for classification, but is exempt from CLP. For example, a flammable solvent produced in a chemical process and then used again in another process on the same premises is exempt from CLP. No labelling or provision of safety data sheets needs to be carried out. However, if that substance meets the technical criteria for “flammability” in the Approved Guide, DSEAR applies even though CLP does not. If a substance or preparation meets the criteria for classification as set out in the Approved Guide, it is a “dangerous substance” even if it is exempt from CLP.

By: -

- Reducing the quantity of dangerous substances to a minimum
- Avoiding or minimising releases
- Controlling releases at source
- Preventing the formation of an explosive atmosphere
- Collecting, containing and removing any releases to a safe place (e.g. by ventilation)
- Avoiding ignition sources
- Avoiding adverse conditions (e.g. exceeding the limits of temperature or control settings) that could lead to danger
- Keeping incompatible substances apart

Measures that mitigate the risk must be applied and these should likewise be consistent with the risk assessment and appropriate to the nature of the activity or operation, these should include:

- Reducing the numbers of employees exposed
- Providing plant which is explosion 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 (PPE)

DSEAR also specifies that the measures taken to achieve the elimination or the reduction of risk should include:

• Design, construction and maintenance of the workplace (e.g. fire-resistance, explosion relief)
• Design, assembly, construction, installation, provision, use and maintenance of suitable work processes, including all relevant plant, equipment, control and protection systems
• The application of appropriate systems of work including: written instructions, permits to work and other procedural systems of organising work

5.5 Emergency Procedures

DSEAR requires employers to put procedures in place to protect people from explosive incidents that may occur, building on requirements established in the Management of Health and Safety at Work Regulations 1999. The nature and extent of these procedures should be based on the findings of the risk assessment and where necessary, should include:

- Warning and communication systems;
- Escape facilities;
- Procedures for people to follow in the event of an incident;
- Appropriate protective equipment; and
- Practice drills.

5.6 Explosive Atmospheres and Classified Zones

Where an explosive atmosphere may occur then such areas must be classified into zones, based on the likelihood and persistence of any such atmosphere. Once zoned, an area must be protected from sources of ignition. The points of entry to zoned areas should be marked with a specified “EX” sign where necessary for safety and employees working in zoned areas must be provided with appropriate anti-static clothing.

New electrical and mechanical equipment and protective systems used in a zoned area must comply with the EPS Regulations (although equipment already in use prior to July 2003 can continue to be used so long as it is safe to do so, i.e. explosion protected).

Before areas zoned under DSEAR are brought into operation the effectiveness of the overall explosion protection measures to each areas must be formally verified.

Appendix 1: Compressed Gases General guidance

1. Introduction

Accidents involving gas cylinders can cause serious injury or even death. This guidance provides simple practical advice on eliminating or reducing the risks associated with using gas cylinders. The guidance is aimed at anyone who uses, handles and/or stores gas cylinders at work.

The legal term that covers gas cylinders is “pressure receptacle”, (or “pressure vessel”). This is a generic term covering a number of types of pressure receptacle: cryogenic receptacle, bundle of cylinders as well as cylinders themselves, plus the valve(s) fitted directly to the receptacle.
But for the purpose of this guidance, the term “gas cylinder” shall be taken to mean all the various types of pressure receptacle.

Gas cylinders used in adverse or extreme conditions, such as for breathing apparatus, may require special precautions. Although the advice in this guidance is valid for all uses of gas cylinders, these special precautions, such as different frequencies for periodic inspections, are not covered.

As an employer, St Mary’s University has a duty to provide a safe workplace and safe work equipment. Designers, manufacturers, suppliers, users and owners also have duties.

Employers have a further duty to consult any safety or employee representatives on health and safety matters. Where none are appointed, employers should consult the workforce directly.

2. Uses of Gas Cylinders

Gas cylinders are a convenient way to transport and store gases under pressure. These gases are used for many different purposes including:

2.1 chemical processes;
2.2 soldering, welding and flame cutting;
2.3 breathing (e.g. diving, emergency rescue);
2.4 medical and laboratory uses;
2.5 dispensing beverages;
2.6 fuel for vehicles (e.g. fork-lift trucks);
2.7 extinguishing fires;
2.8 heating and cooking;
2.9 water treatment.

3 The main hazards:

3.1 impact from the blast of a gas cylinder explosion or rapid release of compressed gas;
3.2 impact from parts of gas cylinders or valves that fail, or any flying debris;
3.3 contact with the released gas or fluid (e.g. Chlorine);
3.4 asphyxiation from the release of inert gases;
3.5 fire resulting from the escape of flammable gases or fluids (e.g. liquefied petroleum gas);
3.6 impact from falling cylinders;
3.7 manual handling injuries;

4 The main causes of accidents:

4.1 inadequate training and supervision;
4.2 poor installation;
4.3 poor examination and maintenance;
4.4 faulty equipment and/or design (e.g. badly fitted valves and regulators);
4.5 poor handling;
4.6 poor storage;
4.7 inadequately ventilated working conditions;
4.8 incorrect filling procedures;
4.9 hidden damage.

5 How to reduce the risks

Under the “Carriage Regs” all gas cylinders must be designed and manufactured to an approved standard, to withstand everyday use and to prevent danger. They must be initially inspected before they are put into service to ensure they conform to the approved standard, and be periodically examined at appropriate intervals to ensure that they remain safe while in service. To reduce the risks of failure you need to know, and act on, the following precautions.

5.1 Training

Anyone who examines, refurbishes, fills or uses a gas cylinder, should be suitably trained and have the necessary skills to carry out their job safely. They should understand the risks associated with the gas cylinder and its contents. In particular:

5.1.1 new employees should receive training and be supervised closely;
5.1.2 users should be able to carry out an external visual inspection of the gas cylinder, and, any attachments (e.g. valves, flashback arresters, and regulators), to determine whether they are damaged. Visible indicators may include dents, bulges, evidence of fire damage (scorch marks) and severe grinding marks etc.
5.1.3 Regulator valves should only be removed by trained personnel using procedures that ensure that either the cylinder does not contain any pressure or that the valve is captured during the removal process.

BCGA Guidance Note GN23; “Identifying gas safety training requirements in the workplace” provides the necessary guidance.in respect of compressed gas safety training.

5.2 Manufacture and initial examination

The law requires that gas cylinders are:

5.2.1 manufactured to an appropriate standard approved under the relevant legislation (the “Carriage Regs” or “PER”); and,

5.2.2 examined by a relevant inspection body (a person or body notified or approved by the Health and Safety Executive (HSE) or the Department of Trade and Industry (DTI) under the “Carriage Regs” or “PER”), to verify that the cylinders are manufactured correctly and conform to the appropriate design standard.

Owners and fillers should satisfy themselves that the manufacturing requirements have been carried out by examining either:

5.2.3 the written certificate which accompanies the gas cylinder; or,

5.2.4 the stamp or mark of the relevant inspection body on the gas cylinder itself.

5.3 Periodic examination

The law requires that all gas cylinders and valves are:

5.3.1 examined and tested by an appropriate inspection body, in accordance with relevant regulations and at specified intervals, (examination and testing to be carried out in accordance with Chapter 6.2 of the European Agreement concerning the international carriage of dangerous goods by road, (ADR), or its rail equivalent (RID) and at the intervals specified in the relevant packing instruction; and,

5.3.2 permanently marked by an appropriate inspection body to show the date of the last periodic examination.

Standards for periodic inspection and testing of cylinders and valves, and for specification and testing for closures, can be found on the HSE web site; **http://www.hse.gov.uk/cdg/pressure.htm**

5.4 Handling and Use

5.4.1 Use gas cylinders in a vertical position, unless specifically designed to be used otherwise.

5.4.1 Securely restrain cylinders to prevent them falling over.

5.4.2 **Always** double check that the cylinder/gas is the right one for the intended use.

5.4.3 Before connecting a gas cylinder to equipment or pipe work make sure that the regulator and pipe work are suitable for the type of gas and

pressure being used.

5.4.4 When required, wear suitable safety shoes and other personal protective equipment when handling gas cylinders.

5.4.5 **Do not** use gas cylinders for any other purpose than the transport and storage of gas.

5.4.6 **Do not** drop, roll or drag gas cylinders,

5.4.7 Close the cylinder valve and replace dust caps when a gas cylinder is not in use.

5.4.8 Where appropriate, fit cylinders with residual pressure valves (non-return valves) to reduce the risk of back flow of water or other materials into the cylinder during use that might corrode it,

5.4.9 Ensure that the valve is protected by a valve cap or collar or that the valve has been designed to withstand impact if the cylinder is dropped.

5.5 Lifting

5.5.1 Use suitable cradles, slings, clamps or other effective means when lifting cylinders with a hoist or crane.

5.5.2 **Do not** use valves, shrouds and caps for lifting cylinders unless they have been designed and manufactured for this purpose.

5.5.3 Gas cylinders **should not** be raised or lowered on the forks of lift trucks unless adequate precautions are taken to prevent them from falling.

5.6 Transport

5.6.1 Fit suitable protective valve caps and covers to cylinders, when necessary, before transporting. **Caps and covers help prevent moisture and dirt from gathering in the valve of the cylinder, in addition to providing protection during transport.**

5.6.2 Securely stow gas cylinders to prevent them from moving or falling. This is normally in the vertical position, unless instructions for transport state otherwise.

5.6.3 Disconnect regulators and hoses from cylinders whenever practicable.

5.6.4 **Do not** let gas cylinders project beyond the sides or end of a vehicle (e.g. fork-lift trucks).

5.6.5 Ensure gas cylinders are clearly marked to show their contents and the danger signs associated with their contents.

5.6.6 It may be necessary to take special measures with certain types and quantities of compressed gases and fluids in order to ensure their safe carriage. If you have any doubts seek further guidance from the H&SS on 222181 or email hse@lboro.ac.uk.

The transport of gas cylinders is subject to carriage requirements. For example, that:

5.6.7 the vehicle is suitable for the purpose;

5.6.8 the vehicle is suitably marked to show that it is carrying dangerous goods;

5.6.9 the driver is suitably trained; and

5.6.10 the driver carries the appropriate documentation about the nature of the gases being carried.

5.7 Storage

5.7.1 Gas cylinders should not be stored for excessive periods of time. Only purchase sufficient quantities of gas to cover short-term needs.
5.7.2 Rotate stocks of gas cylinders to ensure first in is first used.
5.7.3 Store gas cylinders in a dry, safe place on a flat surface in the open air. If this is not reasonably practicable, store in an adequately ventilated building or part of a building specifically reserved for this purpose.
5.7.4 Gas cylinders containing flammable gas should not be stored in part of a building used for other purposes.
5.7.5 Protect gas cylinders from external heat sources that may adversely affect their mechanical integrity.
5.7.6 Gas cylinders should be stored away from sources of ignition and other flammable materials.
5.7.7 Avoid storing gas cylinders so that they stand or lie in water.
5.7.8 Ensure the valve is kept shut on empty cylinders to prevent contaminants getting in.
5.7.9 Store gas cylinders securely when they are not in use. They should be properly restrained, unless designed to be freestanding.
5.7.10 Gas cylinders must be clearly marked to show what they contain and the hazards associated with their contents.
5.7.11 Store cylinders where they are not vulnerable to hazards caused by impact, e.g. from vehicles such as fork-lift trucks.
5.7.12 Display appropriate signage in areas where cylinders are stored, (and used).

6 Risk assessment guidance

This guidance and the “Compressed Gases – Risk assessment form” (Appendix 3), should be used to complete risk assessments for activities involving compressed gases. This guidance is also aimed at laboratory activities involving compressed gases and therefore does not cover bulk storage issues. The basic principles of risk assessment are outlined in the HSE leaflet; “*Five steps to risk assessment” (INDG 163(rev2))*.

BCGA Guidance Note GN13 deals specifically with DSEAR issue, specifically DSEAR risk assessments.

BCGA Guidance Note GN3, “Safe cylinder handling and the application of the Manual Handling Operations Regulations to gas cylinders. Revision 1: 2005” deals with manual handling of cylinders.

STEP 1. Identification of hazards

The main hazards associated with compressed gases are:-

- Impact from the blast of a gas cylinder explosion or rapid release of compressed gas, irrespective of the type of gas.

- Impact from parts of gas cylinders that fail or any flying debris. (As above).

- Contact with the released gas. Specific hazards will vary according to the nature of the gas but inhalation and skin / eye contact are all issues. Non- toxic, non-corrosive gases may cause asphyxiation if they are able to displace oxygen from the local atmosphere.

- Fire resulting from the escape of flammable gas. Leaking flammable gases such as hydrogen may ignite and result in a fire.

- Impact from falling cylinders. This may occur during transit or during storage if not properly secured.
- Use of regulator incompatible with the type of gas used
- Damaged Regulators or Regulators which have not been subject to checking or changing.

Some hazards are common to all types of cylinder, (e.g. sudden release, impact), whilst others (e.g. toxic, flammable), are specific to certain types of gas. It will be necessary therefore to note what types of gases or gas mixtures are used, where they are located and how they are moved between locations.

STEP 2. Identification of people who may be at risk

The risk assessment should identify those who may be at risk. The people directly involved in using the gases are usually at most risk, though others could be affected, e.g. other workers in the vicinity, (a large fire or leak of toxic gas could affect those in a wide area), students, cleaners, maintenance staff and contractors. (Are they introducing additional risks by being there e.g. hot works?), and other visitors. Controls introduced should give priority to protecting the whole workplace and everyone who works there e.g. give collective protective measures priority over individual measures. *(Reg 4; Management of Health and Safety at Work Regulations 1999).*

STEP 3. Evaluation of existing control measures - are they adequate or does more need to be done?

Further assessment

If using toxic or corrosive gases, a separate risk assessment under the *Control of Substances Hazardous to Health Regulations 2002 (as amended),* should be carried out. If manual handling of cylinders is required, a separate assessment is necessary under the *Manual Handling Operations Regulations 1992.* Regarding manual handling, the following points should be considered:

- The material safety data sheet (MSDS) may be used to establish the mass and dimensions of the cylinder.
- Establish hand gripping points before lifting - some cylinders have hand holds such as

the valve guard.

- Use suitable Personal Protective Equipment (PPE) e.g. durable clothing, gloves, eye protection, and foot protection.
- Use suitable cylinder trolleys.
- Gain assistance if necessary.

If you have answered 'no' to any of the questions in Part 3 of the risk assessment form, it is likely that action will be necessary:

Storage - keeping cylinders in laboratories

- Keep the absolute minimum in laboratories.
- Separate cylinders from populated workspaces.
- As far as possible, segregate oxidants from fuels.
- Do not keep very toxic or pyrophoric gases indoors.
- Ensure that area is adequately ventilated.
- Ensure that area is adequately lit.
- Gas detection and alarms should be seriously assessed.
- Ensure that appropriate signage is present.
- Ensure that cylinders are stored upright (unless they are specifically designed to be stored any other way) and are adequately restrained by chains or straps unless they are specifically designed to be free standing.
- Avoid extremes of temperature, including direct sunlight.
- Keep cylinders away from sources of ignition and other flammable materials.

Storage

Keeping cylinders in outside locations, much of the above will apply. Ideally, industrial gases (oxygen, nitrogen, argon etc.) should be stored in a caged compound. The floor should be level, have adequate drainage and be of a construction that is able to support the weight. Some degree of weather protection is recommended – this would assist safe handling, avoid puddles, ice formation in cold weather etc.

Medical gases

Medical gases are classified as medical products and should be stored in a dedicated area separated from non-medical cylinders. A well ventilated area within a building would be suitable – the area should be secure against unauthorised access and display appropriate signage. Large cylinders should be stored upright and smaller (or rounded base) cylinders on suitable racking (ideally between knee and shoulder height). Be aware that some medical gases can be affected by high and low temperatures – be familiar with the products that you are using. Stock rotation should be applied – use the oldest filling date first and do not use out of date cylinders.

Regulators and accessories

You will need to ensure that you have the right regulator for the purpose. Your gas supplier will be able to specify the regulator that you need for your application and safety.

REGULATORS ARE IMPORTANT - OBTAIN THE CORRECT EQUIPMENT AT THE OUTSET AND ENSURE ONGOING SAFETY WITH CARE AND MAINTENANCE.

- Inlet pressure - filled pressures of gas cylinders can vary. Ensure that the maximum rated inlet pressure of your regulators can cope.
- Outlet pressure - check that the regulator will deliver the right outlet pressure for your application (regulators vary in their outlet pressure).
- Material compatibilities - check whether the regulator contains any materials which may react or degrade with the gas you intend to pass through it.
- Consider fitting excess flow valves which isolate the gas supply in the event of a malfunction.

Care and maintenance

- When purchasing a new regulator, make a note of the date of manufacture / purchase. Some suppliers sell regulators that are already tagged with a code, date and 'do not use after' date. If not, it is a good idea to attach a tag to the regulator that contains this information. Laminated tags / pouches are commercially available for this purpose. Some existing regulators can be dated by examining the code imprinted on the reverse side. The code is explained in the following diagram:

C1FS

Denotes:	Decade	Year	Month	New or Service Exchanged
	A = 197- B = 198- C = 199- D = 200-	0 - 9 of decade	A = January B = February C = March etc.	S = manufactured as new X = service exchange

Example: C1FS = June 1991 new

If regulators are not coded and it is not possible to date them, then it is advisable that they are replaced. All new regulators should be sourced from reputable suppliers and conform to appropriate standards (e.g. BS, EN, ISO etc.).

- The lifetime of a regulator is 5 years (2 years for regulators used with corrosive gases). A regulator will age irrespective of the amount of use it is put to. Regulators that become damaged, contaminated or dysfunctional should be replaced as and when necessary.
- User checks should ideally be carried out each time prior to use – these are primarily visual: labelling, contamination, damage etc.
- Maintenance checks should be carried out annually by a competent person. There are

commercially available services for this and also training courses on how to carry out inspections. A typical gas regulator inspection maintenance checklist is given in the Appendix 2.
- Suitable records of user and maintenance checks should be kept.

Personal Protective Equipment (PPE)

The following PPE may be required according to the circumstances: -

- Laboratory coats, goggles, face shields etc.
- Laboratory coats or overalls will protect clothing while moving cylinders.
- Stout gloves and safety footwear will protect the hands and feet while moving cylinders.
- Eye protection should be worn while changing regulators.

For certain specialist applications, full breathing apparatus may be required – the need for this should be determined by risk assessment. If breathing apparatus is required it must be adequately maintained and operated only by trained users.

All PPE should be adequately stored on hooks, in cupboards or in dedicated mountings (e.g. wall dispensers for safety spectacles, purpose built boxes for breathing apparatus) and not left lying around on bench tops where damage and contamination is a risk.

Emergency procedures

Emergency procedures should be defined and users should be familiar with what to do in an emergency:

<u>Fire</u>

- Operate the planned fire drill for the area in question. On arrival, emergency services should be informed of the types of gases present in the area affected.
- If possible, isolate any piped supplies to the area affected **but do not take any unnecessary risks**.
- Cylinders may burst, vent or explode when subjected to extreme temperatures so avoid 'first aid' fire-fighting (e.g. using extinguishers) unless the fire is small and can be dealt with very quickly. Err on the side of safety. If in any doubt, evacuate and leave to the professionals.
- It may be possible to cool cylinders with a hose from a safe distance – the emergency services will decide whether this is appropriate.
- Do not approach any cylinder which has been affected by fire. The emergency services and supplier (e.g. BOC) will deal with matters when safe to do so and the supplier will recover them for disposal.

<u>Leaks of toxic and corrosive gases</u>

Supplies should be isolated if possible. If necessary, appropriate breathing apparatus

should be worn. It is essential to include emergency procedures as part of the COSHH assessment for gases in these categories. First aid measures should also be considered.

Information, instruction and training

All users of gases and cryogenics must receive adequate information, instruction and training.

- Formal training should be delivered by specialists in the gas and cryogenics industry. Check the HEALTH & SAFETY OFFICE web pages for availability of training courses. The Faculty / Support Service should keep formal records of attendees at all training courses provided.
- On-the-job training and instruction and, if necessary, supervision, should be carried out by the department. Gas users should be fully involved in any risk assessment process.

STEP 4. Record the findings

The risk assessment form represents a record of your findings, (**see Appendix 3**). You should file it in a safe place and be able to produce it when required. Part 4 of the form enables all actions to be noted and completion dates recorded. You should communicate all of your finding to the occupants of the laboratories.

STEP 5. Review the assessment

Risk assessments will not remain valid for ever. There will invariably be changes to equipment, substances, physical layout etc. Therefore, the risk assessment must be reviewed periodically. A review is not required for every trivial change which may occur. The risk assessment form should be used to record the dates of any subsequent reviews.

7 Technical references and further reading

- Carriage of Dangerous Goods manual: http://www.hse.gov.uk/cdg/manual/index.htm
- Safety of Pressure Systems, Pressure Systems Safety Regulations, 2014, Approved Code of Practice, L122, HSE Books, ISBN 978 7176 6644 7
- Five steps to risk assessment INDG 163 (rev 4) HSE Books 2014
- The Safe Use of Gas Cylinders, INDG 308 (rev 1), HSE Books, 2002
- Oxygen use in the workplace – fire and explosion hazards. INDG 459 HSE Books
- Working safely with Acetylene INDG 327 (rev 1), HSE Books
- Safety in gas welding, cutting and similar processes INDG 297 (rev 1) HSE Books ISBN 0 7176 6513 6
- Industrial gas cylinder manifolds and distribution pipe work/pipelines (excluding Acetylene). BCGA Code of Practice CP4.
- The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply) BCGA Code of Practice CP7.
- Guidance for the storage of transportable gas cylinders for industrial use; BCGA

Guidance Note GN2.

In addition to the above, the British Compressed Gas Association (BCGA) publish a wide range of guidance notes, technical reports, codes of practice, leaflets and technical information sheets.(Go to www.bcga.co.uk. A full list of documents and the contact details for the BCGA is given in University health and safety guidance note; “Health and Safety Guidance – safe use of Gas cylinders – British Compressed Gases.

Appendix 1

Pressure regulator inspection maintenance checklist

Item Serial Number (s): Faculty:

Location: Regulator type:

		Yes	No	Comments
1.	Are standard operating procedures (SOP's) in place covering the assembly and safe use of gas regulators and associated equipment in the workplace?			
2.	Have all operators been trained in the appropriate SOP's?			
3.	Are the flashback arrestors subject to an asset register system?			
4.	Are inspection records available for all regulators?			
5.	Are all regulators in date (usually 5 years) and not overdue, (the manufacturers recommended), scheduled replacement?			
6.	Is the information clear to the equipment operators? Is the equipment labelled with the next inspection date?			
7.	Are the regulators labelled correctly with: - **A;** name of gas **B;** maximum inlet pressure **C;** maximum outlet pressure **D;** BS EN number **E;** Manufacturer/suppliers name or logo			
8.	Are the correct regulators being used for the gases contained within the cylinders?			

9.	Is the correct regulator type being Used? (Bottom entry for BOC cylinders and side entry for cylinders supplied by other gas suppliers?			
10	Are the regulators in good condition, with clean threads, free of contamination?			
11	Are the gauges in good condition, lenses attached with indicators reading zero?			
12	Is there evidence of any jointing compounds or thread tape (PTFE) on any of the fittings?			
13	Are the regulators free from unauthorized repairs?			
14	Are the regulators free from any heat and/or mechanical damage?			
15	Are the pressure adjusting screws captive on regulators?			
16	Are the correct tools on hand to fit regulators and other control equipment? (Not adjustable spanners)			
17	Are the pressure relief devices fitted and in good condition?			
18	Pass / fail.			
Checked by.				
Date of inspection.				

Appendix 2 Safe handling of flammable liquids

Safe handling of flammable liquids
Users must ensure: -

• Minimum quantities only to be used, handled and stored
• Risk assessments are carried out to identify and minimise the potential for an explosive atmosphere when handling and using flammable liquids (required by DSEAR) as well as their health effects (required by COSHH)
• Adequate ventilation is provided where flammables are dispensed, used or stored
• All obvious ignition sources are removed from storage and handling areas
• Electrical items must be safe for use in the zone indicated, or they must be intrinsically safe for use in such areas.
• Nylon lab coats are not used due to potential static problems
• All flammable liquids are in suitable lidded containers and stored in clearly marked bins or cupboards away from other processes and storage areas
• Storage areas with significant solvent vapour present are marked "EX" and all electrical equipment within the storage area is "EX" rated
• Containers are closed, or lid put back on, immediately when not needed and returned to the proper storage bin or cupboard
• Glass containers of flammables are carried so that they cannot be dropped or broken by striking against each other or other items on trolleys - use a suitable carrier and/or plastic sleeves around individual bottles
• Dispensing from large drums to small containers is done by trained staff
• In laboratories, that liquids are dispensed in a fume cupboard over spillage trays and that you have a stock of inert absorbent material to mop up spills. Dispense larger quantities in a dispensary or outside• Solvent contaminated clothing is removed and placed in fume cupboard immediately
• Rags and cloths used for mopping up spills are disposed of in metal containers with well-fitting lids, or placed in fume cupboard, and removed from the workplace at the end of the day
• Dry powder fire extinguishers are present in the lab
• Everyone knows the emergency procedure in the event of a significant spillage of flammable liquid - extinguish all flames and heat sources, do not switch electrical appliances on or off, get out and stay out and alert Central Services on 4444

Operation of a Flammable Solvent Store
Most University flammable solvent stores are solely used to store unopened bottles of solvent as a buffer stock. These are issued as units when required. However, in a few solvent stores, dispensing is carried out. Although solvent stores may have mechanical ventilation, they are not provided with local extract ventilation to control emissions from processes such as dispensing. Mechanical ventilation, if installed, is there to prevent a build-up of flammable vapour over a period from minor leaks from containers. In order to comply with the DSEAR Approved Code of Practice, alternative areas must be found for dispensing solvents safely, away from stored stocks.

"Areas in and around storage facilities where explosive atmospheres could be formed should be designated as hazardous zones according to the principles of Hazardous Area Classification. The employer should implement measures to prevent the ignition of hazardous substances and the flammable atmospheres in the hazardous zones arising from their storage."

The Hazardous Area Classification is based on how often an explosive atmosphere is likely to occur and how long it would be likely to persist. The safety standard necessary for any electrical equipment used in the area will be determined from this Classification. Guidance on storage of flammable liquids in containers is given in the HSE publication HS(G)515. This indicates that the interior of flammable stores, flammable storage cupboards or bins must normally be regarded as a Zone 2 area. Only electrical equipment suitable for use in such a zone may be used. Other areas that may need to be zoned in this way may include oil tank housings, LPG storage facilities, and areas used for the storage of other flammable gases. If you are responsible for such areas, please consult SEPS for advice.
5 The storage of flammable liquids in containers. ISBN 0 11 885533 6

Flammable solvent stores can only be used to store flammable solvents. No other materials can be allowed within the store. Means should be available to deal with any spillage occurring in the store. Adequate firefighting equipment must be provided.

DO
- Restrict access to authorised staff
- Keep stock to a minimum
- Rotate stock (first in, first out)
- Dispose of stock which has been stored for too long
- Check condition of labels and bottles on a regular basis
- Use carriers or trolleys when issuing stock
- Have the electrical fittings checked for safety annually
- Keep the floor clear of solvent bottles and empty boxes
- Keep the area outside clear of any flammable materials
- Keep supplies of absorbent materials, such as dry sand, to control spills in the store
- Keep suitable fire-fighting equipment in the store
- Prohibit smoking

DO NOT
- Dispense solvents in the store
- Put bottles of solvent on shelves above shoulder level
- Allow any hot work to be done
- Allow any power tools to be used
- Allow any smoking next to the store
- Allow vehicles with running motors next to the store

The store must be kept maintained. Faulty lighting or mechanical ventilation should be reported and repaired. Water ingress or structural damage to the store should also be reported and made good. Some solvents, when exposed to the air and then left in stock, will form peroxides that can later explode in use. Common solvents that are prone to do this are ethers, tetrahydrofuran and methyl ethyl ketone. Thus bottles that have been opened and left for any length of time should be handled with caution and disposed of or treated to make them safe.

Appendix 3 - Definitions from the DSEAR Regulations, Reg. 2 – Interpretation

"Dangerous substance" means –

(a) a substance or preparation which meets the criteria in the approved classification and labelling guide for classification as a substance or preparation which is explosive, oxidising, extremely flammable, highly flammable or flammable, whether or not that substance or preparation is classified under the CHIP6 Regulations;

(b) a substance or preparation which because of its physico-chemical or chemical properties and the way it is used or is present at the workplace creates a risk, not being a substance or preparation falling within subparagraph (a) above; or

(c) any dust, whether in the form of solid particles or fibrous materials or otherwise, which can form an explosive mixture with air or an explosive atmosphere, not being a substance or preparation falling within subparagraphs (a) or (b) above.

"Explosive atmosphere" means a mixture, under atmospheric conditions, of air and one or more dangerous substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture;

"Hazard" means the physico-chemical or chemical property of a dangerous substance which has the potential to give rise to fire, explosion, or other events which can result in harmful physical effects of a kind similar to those which can be caused by fire or explosion, affecting the safety of a person.

"Risk" means the likelihood of a person's safety being affected by harmful physical effects being caused to him from fire, explosion or other events arising from the hazardous properties of a dangerous substance in connection with work and also the extent of that harm.

Appendix 4 Risk Assessment under DSEAR and RA Form

Risk assessment under DSEAR has to take a specific form: this is specified in the Regulations themselves. The requirements are repeated here for reference.

Regulations 5 –

(1) Where a dangerous substance is or is liable to be present at the workplace, the employer shall make a suitable and sufficient assessment of the risks to his employees that arise from that substance.
(2) The risk assessment shall include consideration of -

(a) The hazardous properties of the substance;
(b) Information on safety provided by the supplier, including information contained in any relevant safety data sheet;
(c) The circumstances of the work including -

(i) The work processes and substances used and their possible interactions;
(ii) The amount of the substance involved;
(iii) Where the work will involve more than one dangerous substance, the risk presented by such substances in combination; and
(iv) The arrangements for the safe handling, storage and transport of dangerous substances and of waste containing dangerous substances;

(d) Activities, such as maintenance, where there is the potential for a high level of risk;
(e) The effect of measures which have been or will be taken pursuant to these Regulations;
(f) The likelihood that an explosive atmosphere will occur and its persistence;
(g) The likelihood that ignition sources, including electrostatic discharges, will be present and become active and effective;
(h) The scale of the anticipated effects of a fire or an explosion;
(i) Any places which are or can be connected via openings to places in which explosive atmospheres may occur; and
(j) Such additional safety information as the employer may need in order to complete the risk assessment.

Risk Assessments Under DSEAR

The purpose of risk assessment is essentially to take cognizance of the hazards inherent in a work process, not the precautions already in place, and guide the decision-making process as to whether more needs to be done to assure continued safety. DSEAR makes no distinction as to the scale of the hazard, but in the University, many users of flammable liquids may use quite small quantities - a few millilitres in a sample, say. Equally a large flammable liquid store may contain hundreds of litres.

The formal risk assessment process is complicated by the fact that most users will already be familiar with the risk assessment requirements of the COSHH Regulations. As will have been noted, DSEAR expands on the scope of the risk assessment requirements with chemicals.

It is not intended that users of chemicals necessarily complete both a COSHH and a DSEAR risk assessment form. It will often be the case that the toxic hazard or the flammability predominates. That being so, the relevant risk assessment form, COSHH or DSEAR, should be completed, and a note made that other hazards have been considered. If this is not a true reflection of the situation then both forms ought to be completed; it is for the Principal Investigator to decide which form(s) are appropriate in the circumstances of each case.

Control of Substances Hazardous to Health (CoSHH)
Risk Assessment

This assessment *only* addresses the risk of harm to health from the substances listed below. Additional risk assessments may be required to control the risk from other hazards associated with this work or working procedure or processes used or generated waste by-products.

Assessment Reference No.		**Activity assessed**	
Assessment date			
Description of activity/procedure (including individual steps, as required)		**Location where the activity or process is taking place**	

Section 1: Hazard Identification – refer to SDS section 2

Section 1.1 Hazard Pictograms (*Tick (✓) all that applies)*

 Health hazard / Hazardous to the ozone layer	☐	 Corrosive	☐	 Flammable	☐	 Oxidising	☐	 Toxic	☐	 Gas under pressure	☐
 Explosive	☐	 Serious health hazard	☐	 Hazardous to the environment	☐	 Biological Agent (blood, bacteria, viruses)	☐	 Non ionising radiation	☐	 Ionising radiation	☐

Section 1.2: List all substance(s) being used									
No	**Name of hazardous substance** Including by-products produced during or as a result of the task or activity.	**SDS available** **Yes** **No** **N/A**	**Properties of hazard** ***State*** how the substance could cause harm. ***Refer to SDS:*** Pictograms, Hazard (H) statements & workplace exposure limit (WEL). ***Consider*** other hazards e.g. biological agent, drugs (medicines/cytotoxic etc.) asphyxiates, other	**Physical form:** ***State*** dust; fume; gas; liquid; mist; solid or vapour	**Quantity** include units e.g. µl, ml, litre, m^3	**Frequency of use:** ***State*** Daily Monthly Weekly Infrequently	**Duration of use:** ***State*** >5 mins 6–30 mins 31-60 mins >1 hour	**Route of exposure:** ***State*** Absorption skin; Absorption eyes; Ingestion; Inhalation; Needlestick/Sharps; Other	**Can the hazardous substance be *Eliminated* or *Substituted*** **If no, explain**
1									
2									
3									

**Insert additional rows as required.*

Section 1.3: Hazard Identification – People					
Who might be at risk? *Tick (✓) all that applies*	**Employees** ☐	**Students** ☐	**Contractors** ☐	**Patients** ☐	**Public /Visitors** ☐
Provide details of specific requirements for people who may be at an increased risk. *Tick (✓) all that applies* ***Note: do not add names of individuals***	**New & Expectant Mothers** ☐				
	Medical Conditions ☐				
	Other (please state) ☐				

Section 1.4: Does Dangerous Substances and Explosive Atmospheres (DSEAR) apply			
Consider substances / by-products identified as flammable, oxidising, gas under pressure and the amounts used, 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	**YES**	**NO**	If you answered **yes**, detail the total quantity

products that could produce an explosive atmosphere? You will need to work out the quantity of the explosive atmosphere - refer to **Example calculations for two commonly used solvents.** If the answer is ***NO***, all control measures are covered above. No further action required. **If the answer is *YES*, a separate DSEAR risk assessment will be required.**	☐	☐	_____

Section 2: Control Measures *(Note: Precautionary (P) statements within the Safety Data Sheet are a useful source of information)*								
	What is required					**Provide details (state type & standard)**	**Used when (refer to your Procedure/SOP)**	**Who requires it (refer to list in 1.2)**
Physical or engineering controls **Specify requirements:** General or Dilution ventilation Local Exhaust Ventilation (LEV) Fume hood Total Enclosure								
Administration Controls **Specify what is required:** Safe Systems of Work/Procedures; Signage and Training Requirements								
Personal Protective Equipment *Tick (✓) all that applies*	**Gloves** 		**Apron** 					
	Lab Coat 		**Overalls** 					
	Eye Protection 		**Visor** 					
	Dust mask		**Respirator**					

							
	Footwear 		**Other**  **(specify)**				

Section 3: Monitoring Exposure					
Is monitoring of exposure to substances hazardous to health required?	**Yes**	☐	**Provide details if required:**		
	No	☐			
Name of hazardous substance	**Workplace Exposure Limit (WEL)**		**Is exposure monitoring required? *State:* Yes / No** *(Note: required if suspected WEL will be exceeded)*	**Provide details of monitoring required**	
	Short-term exposure limit	**Long-term exposure limit**			

**Insert additional rows as required.*

Section 4: Health Surveillance				
Is health surveillance required?	**Skin Health**	**Yes** ☐	**No** ☐	**Provide details if required:**
Tick (✓) all that applies	**Respiratory**	**Yes** ☐	**No** ☐	**Provide details if required:**

	Other (specify)	Yes ☐	No ☐	Provide details if required:

Section 5: Emergency Arrangements				
First Aid Include description of first aid / emergency treatment	**Ingestion**			
	Inhalation			
	Absorption			
	Eye contact			
	Other / Location specific			
Spillages Include details	**Contained Spillage / Release**			
	Small uncontained spillage / Release			
	Large uncontained spillage / Release			
Fire	**Extinguisher. Specify type:**			
	Actions in event of a fire			
Emergency contacts One of these should be the responsible person.		**Name**	**Position**	**Telephone**

Section 6: Storage, Transport & Disposal	
Storage Requirements Include description of how substances will be stored. Describe how incompatible materials will be segregated.	
Transport information Describe how you will transport substances safely between different locations. Where necessary include transporting of waste for disposal.	
Disposal procedures Identify the safest route and when waste should be disposed of by a licensed waste contractor.	

Section 7: Risk Rating Following Control Measures (Refer to the risk matrix below and tick ✓ as appropriate)			
High	**Medium**	**Medium/Low**	**Low / Negligible**

Rating/Descriptors for Severity & Likelihood

Severity of Harm	Rating	Likelihood of Occurrence
Death, major permanent incapacity or multiple casualties	5 - Very High	Certain, near certain or imminent
Major injuries (RIDDOR) or long-term incapacity	4 – High	Likely, probable
Injury/ill health requiring medical treatment or counselling	3 – Medium	Possible
Minor injury/ill health requiring first aid	2 – Low	Unlikely
Minor injury/ill health	1 – Very Low	Remote or very unlikely

Risk Rating = Severity x Likelihood

Severity →						
	Very High (5)	Medium 5	High 10	High 15	Very High 20	Very High 25
	High (4)	Medium 4	Medium 8	High 12	High 16	Very High 20
	Medium (3)	Low 3	Medium 6	Medium 9	High 12	High 15
	Low (2)	Low 2	Medium 4	Medium 6	Medium 8	High 10
	Very Low (1)	Low 1	Low 2	Low 3	Medium 4	Medium 5
		Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
		Likelihood →				

Risk Rating	Risk Outcomes
Very High (20-25)	Unacceptable, consider stopping activity or task. Action must be taken immediately to reduce the risk. Will require considerable resources involving specialist equipment, training, high levels of supervision.
High (10-16)	Will require considerable resources involving specialist equipment, training, high levels of supervision.
Medium (4-9)	Will require an appropriate level of resources to reduce or control risk within a specified timescale.
Low (1-3)	Broadly acceptable – No action required. However, monitor control measures to ensure implementation, as risk rating could increase if risk not adequately managed.

Section 8: Assessment Outcome		
Are you satisfied that the control measures outlined above are adequate to control the risks to health from the hazardous substances used in the work activity described?	YES	
	NO	
If **NO**, what further action is required?		

Section 9: Assessment Confirmation/Authorisation					
Assessor:		**Print Name:**		**Date:**	
Approved by:		**Print Name:**		**Date:**	

Section 10: Assessment Review
***Note* – CoSHH assessments must be periodically reviewed at least annually but no later than 3 years, particularly after changes to legislation, changes to the task, use of different equipment, use of different chemical and following an accident/near miss investigation.**

Reviewed by (Print Name):	Signature:	Date:	Date of next review:

St Mary's University Twickenham London

Dangerous Substances and Explosive Atmosphere Regulations 2002
Risk Assessment
Faculty of STHS

Date:

If a proprietary product, does the Material Safety Data Sheet or labelling on the product packaging indicate that it is (tick box): -

- ☐ Explosive
- ☐ Oxidising
- ☐ Extremely Flammable
  (Or has a flashpoint lower than 32^0C. Or, that release of vapour or gas may produce an explosive atmosphere)
- ☐ Highly Flammable
- ☐ Flammable

If the substance is produced as a result of an in-house process, or as a by-product of such a process, is that substance (tick box):-

- ☐ Explosive
- ☐ Oxidising
- ☐ Extremely Flammable
  (Or has a flashpoint lower than 32^0C. Or, that release of vapour or gas may produce an explosive atmosphere)
- ☐ Highly Flammable
- ☐ Flammable

If **No** has been answered to all the questions above, you may finish at this point. Otherwise continue

Note here the names of the products being handled, stored or produced.

[Please refer to SHAS 'DSEAR RA total chemical inventory' document attached for details including relevant MSDS and CAS numbers]

Note here how a system of work, or activity could fail and give rise to fire or explosion. Also note any sources of ignition.

If personnel do not adhere to the separation of storage of substances in the allocated cabinets in the store and mix the types of substances stored this could lead to an explosion or fire when the fumes or liquids react together. This is to be monitored and recorded on a regular basis by the designated inspector. Someone smoking near the Hazchem store could be a source of ignition, therefore clear signage should be erected. All electrical sources must be sealed units including lighting so as to not provide an ignition source. Adequate ventilation will also ensure that there is not a build-up of flammable gases in the store and that personnel are able to enter the store without breathing apparatus.

Control Measures (tick as appropriate)

	Yes	No	N/A
Has the quantity of the dangerous substance held or used been reduced to a minimum?			
Have steps been taken to avoid, or minimise releases (intentional or unintentional)?			
Have steps been taken to control release at the source?			
Have steps been taken to prevent the formation of an explosive atmosphere?			
Have steps been taken to collect, contain, and remove any releases to a safe place (e.g. ventilation)?			
Have steps been taken to avoid adverse conditions (e.g. exceeding temperature limits or other control settings)?			
Are incompatible substances kept apart in storage, and so far, as practicable, in use (e.g. oxidisers and combustibles)?			
Has the number of people exposed to the dangerous substances, or the explosive atmosphere been reduced to a minimum?			
Is plant in use that is explosion resistant?			
Is explosion suppression or relief provided on equipment?			
Have adequate measures been taken to control or minimise the spread of fire or explosion?			
Has suitable personal protective equipment been provided and have staff been trained how to wear it properly?			

Workplace or process and management systems, where appropriate to the nature of the activity or operation.

	Yes	No
Is the workplace designed, constructed and maintained so as to provide adequate fire-resistance and /or explosion relief?		
Is any assembly, construction, installation, rig, plant, equipment, protection system etc., designed in such a manner as to minimise the risk of fire and/or explosion?		
Is any assembly, construction, installation, rig, plant, equipment, protection system etc., used in such a way as to minimise the risk of fire and/or explosion?		
Have appropriate systems of work, or other required procedural systems of organising work, been developed and communicated to all persons who might need to know, either by way of this form or document?		
Is a permit to work scheme required for working with the substance(s) or in the work area, and are these strictly enforced?		

Zoning and control of explosive atmospheres (if not applicable, tick here ☐ and proceed to next section)

	Yes	No	N/A
Have all such areas been classified into the zones in accordance with Schedule 2 of the Regulations?			
Where necessary, have such classified zones been marked at their entry points with the specified 'EX' hazard warning sign?			
Are all classified zones 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?			
Are people working in zoned areas provided with clothing that does not create a risk of electrostatic discharge?			
Before their first operation, have areas where explosive areas may be present been verified as being safe, by a competent person?			

Storage

	Yes	No	N/A
Are all flammable substances kept in suitable fire resistant storage?			
Are all quantities of flammable substances in excess of 50L kept in dedicated and appropriately protected flammable stores?			

Are incompatible substances stored apart (e.g. flammables, oxidisers, combustibles, flammable gases, LPG) – Compressed Gas Cylinders (CGC) – L202/L39/R27/L8			
Where appropriate, have storage areas been designed to provide explosion relief or resistance?			

Emergency Procedures

	Yes	No	N/A
Have suitable emergency procedures been developed and communicated to personnel to deal with adverse process conditions (e.g. exceeding limits of temperature, or other control settings)?			
Have suitable emergency procedures been developed and communicated to personnel to deal with fire and evacuation?			
Have suitable emergency procedures been developed and communicated to personnel to deal with a spillage of dangerous substances?			

Waste Disposal

	Yes	No
Have suitable procedures been developed and communicated to personnel and implemented to deal with the safe transport and disposal of dangerous substances?		

Information, instruction and training

	Yes	No
Has appropriate information, instruction and training, commensurate with the hazard potential of the dangerous substances, or process, been provided to personnel as regards; product detail, hazard, risk reduction methods to be employed, management systems to be followed, emergency systems, etc.?		

Where any questions relevant to a dangerous substance being used, produced, handled or stored has returned a 'No' response, the subject area should be revisited to ensure that all required and reasonably practicable risk reducing methods have been implemented.

Conclusion
The risk(s) from the hazard potential of the dangerous substances and/or explosive atmospheres identified in this risk assessment must be reduced to the lowest possible level reasonably practicable.

Is this the case?

☐ Yes

☐ No

Name of Assessor	
Signature	
Date	
Date review required	

Safe System of Work (DSEAR)

As a result of the risk assessment under the Dangerous Substances and Explosive Atmospheres regulations of the work processes involving the following dangerous substance(s):

[Please refer to SHAS 'DSEAR RA total chemical inventory' document attached for details including relevant MSDS and CAS numbers]

This includes their handling, storage and ability, in the form they present in the work situation, to result in an explosive atmosphere, the following safe system of work (rules of work) **must** be always observed and adhered to.

Only authorised personnel are to enter the Hazchem store at all times. The user will be wearing full PPE and use carriers to transport these materials at all times. Storage of all these substances to be kept to a minimum. Personnel to carry to the fume cupboard in the labs and dispense volumes in the fume cupboard. Location of compressed gas cylinders are found on the CGC inventory stored and updated with appropriate staff members (Technical Services & St Marys Security).

(Continue on another sheet if required)
In the event of an emergency, actions laid out in the safe system of work that are designed to minimise damage to equipment or property should be undertaken **only** if this does not put yourself or others at risk: personal safety and that of others must take priority.

I have read and understood the above safe system of work.

Signature:	Date: