

Safety Services

Dangerous Substances and Explosive Atmospheres

Initial Screening Risk Assessment and Points to Consider in a Risk Assessment when DSEAR Applies

1. The Dangerous Substances and Explosives Atmospheres Regulations (DSEAR) 2002 apply in all areas where there are substances that are: flammable, extremely flammable, highly flammable, oxidising, corrosive, explosive, or capable of producing an explosive atmosphere. They also apply where there are compressed gases and aerosols and where flammable dusts can occur (e.g. finely divided metal, organic powders including, sugar, flour, wood dust etc.). Less intuitively, they additionally apply where the behaviour of chemicals in a fire can create a flammable or explosive atmosphere, eg. thermal decomposition of mineral acids.
2. Examples (not an exhaustive list) of areas/activities where DSEAR will apply at the University of Manchester are:

* Generation, handling and storage of waste wood dusts in workshops
* Generation, handling and storage of flammable wastes, including fuel oils and solvents
* Storage and use of flammable materials (eg. solvents, paints, reagents, some metals)
* Storage, use and handling of flammable gases, eg. acetylene for welding, lab analytical techniques etc, propane for glassblowing and Liquefied Petroleum Gas (LPG)
* Transport of flammable substances in containers around the workplace
* Chemical or gas manufacture resulting from processes or research experiments
* Handling, storage and use of inert, oxidising, corrosive or mixed gases under pressure
* Handling, storage and use of substances corrosive to metal
* Handling and storage of fuel for cars, boats, horticultural machinery or test rigs
* Hot work on equipment and containers that have contained flammable material

1. There are two parts to the risk assessment document; the first part will assist with the decision whether the DSEAR apply in your workspace. This assessment template (or equivalent) should be completed for each work area i.e. laboratory, store, workshop, workroom etc. or groups of areas eg. all workshops. It aims to identify any classes and quantities of substances which can cause danger to people, premises or equipment. The danger can come from either energetic events, potential explosive, flammable, oxidising, corrosive or even inert atmospheres, whether they are bought in or occur as a result of a work activity.
2. In open-plan, multi-occupancy spaces it is important to think about the classes and quantities of dangerous substances in the whole space. For further guidance on the management of these areas, please see the following <http://www.healthandsafety.manchester.ac.uk/toolkits/safety_management/> The local health and safety arrangements document may also provide useful information.
3. Following Part 1 there are two rough example calculations which can be adapted to a workspace which may be useful to assist with the decision whether it is necessary to proceed with 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.
4. Part 2 of this document suggests points to be considered in order that there are suitable controls in place to ensure that dangerous substances are transported, stored, used, produced and disposed of in a safe way, and what actions are required to mitigate any effects of an accidental or uncontrolled release.
5. It is not necessary to carry out a separate risk assessment for the ‘dangerous substances’ if the hazards and control measures associated with these are written into a general risk assessment.
6. This risk assessment is not designed to be a comprehensive chemical risk assessment (which is a combination of the requirements of the Control of Substances Hazardous to Health (COSHH) and DSEAR), nor is it designed to be used where chemicals are to be mixed deliberately in order to facilitate a chemical reaction.

References

Dangerous Substances and Explosives Atmospheres Regulations 2002, Approved Code of Practice and guidance, HSE, L138 2nd Edition

University of Manchester Safety Services: Guidance on Best Practice in the Management of Open-Plan, Shared laboratories available at: <http://documents.manchester.ac.uk/DocuInfo.aspx?DocID=12903>

University of Manchester Safety Services: Guidance on the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) available at: <http://documents.manchester.ac.uk/display.aspx?DocID=12845>

Drager Gas List available at: <http://www.draeger.com/sites/assets/PublishingImages/Products/generic/safety-documents/EN/gaslist-ca-9046375-en.pdf>

**Part 1**

**Initial Screening Risk Assessment Template**

|  |  |
| --- | --- |
| Faculty/Directorate | School |
| 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 Chemist 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 | Compressed Gas  Inert | Aerosol - Flammable |
| C:\Users\mbdssema\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\G4H8M2JH\200px-GHS-pictogram-explos.svg[1].png |  |  |  |  |  | C:\Users\mbdssema\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\7H8F7LB2\120px-GHS-pictogram-bottle.svg[1].png | C:\Users\mbdssema\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\7H8F7LB2\120px-GHS-pictogram-bottle.svg[1].png |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Total quantity of substances (defined by physical property) |  |  |  |  |  |  |  |  |  |

\* Cat 1 Flammable liquid, Flash point <23oC, Boiling point ≤ 35oC \*Ignition in air ≤ 13% v/v or flammable range with air of ≥ 12% points

\*\* Cat 2 Flammable liquid, Flash point <23oC, Boiling point > 35oC \*\* Has a flammable range when mixed with air

\*\*\* Cat 3 Flammable liquid, Flash point ≥23oC, Boiling point ≤ 60oC

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 three commonly used substances)

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:

Sugested Review Date:

(Eg annually or upon change in respect of new activities, import of new chemicals etc.)

**Example calculations for two commonly used solvents.**

1. Information for the calculations is available by consulting either the safety data sheet for the solvent concerned or making use of the Drager Gas List (see references).
2. The two examples are:
3. Acetone spill in a room of dimensions 5 x 7 x 3 metres

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

Acetone Mol 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 deg 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, so for acetone this would be 58.1 x 2.5/2.4 = 60.52g/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, though one would have to assume total dispersion.

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

105 x 60.52/0.785 (density) = 8095ml, = 8.095L

1. Ethanol spill in a room dimension 3 x 3 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 3.1/2.4 = 59.55g/m3

Maximum spill in room dimensions 3 x 3 x 3 is 27 x 59.55/0.79 = 2.035L

**Part 2**

**Points to Consider in a Risk Assessment when DSEAR Applies**

1. If the conclusion from Part 1 is that DSEAR applies and a risk assessment is required, please: consult the Safety Service guidance <http://documents.manchester.ac.uk/display.aspx?DocID=12845> and carry out the risk assessment considering the points below. Please note that 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 (eg. 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) has been provided, and users have been trained how to   1. store 2. use 3. put on and remove 4. clean 5. 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  (If not applicable proceed to storage) |
| 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? C:\Users\mbdssema\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\7H8F7LB2\350px-Ex-zeichen.svg[1].png |
| External entrances into classified zones are marked with 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 (eg. flammables, oxidisers, corrosives, combustibles, flammable gases, LPG etc.) |
| Storage areas have been designed to provide explosion relief/ resistance where appropriate |
| Transport |
| Appropriate trolleys or other carriers (eg Winchester carriers) are used to transport flammable solvents 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 emergency procedures have been developed and communicated to the users to deal with fire and evacuation |
| 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:   1. product detail 2. hazard 3. risk reduction methods to be employed 4. management systems to be followed 5. emergency systems etc.? |
| 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 |