

## Element 6: Fire safety risk assessment

### Learning outcomes

On completion of this element, candidates should be able to demonstrate understanding of the content through the application of knowledge to familiar and unfamiliar situations. In particular they should be able to:

- 6.1 Explain the aims and objectives of fire safety risk assessments
- 6.2 Outline the principles and practice of fire safety risk assessments including principles of prevention (measures to remove and reduce risk)
- 6.3 Outline matters to be considered in a risk assessment of dangerous substances
- 6.4 Outline measures to be taken to control risk in respect of dangerous substances.

### 6.1 FIRE SAFETY RISK ASSESSMENT AIMS AND OBJECTIVES

The employer must carry out a fire risk assessment and decide what fire reduction measures are required. This follows very similar principles to that of a general risk assessment as required by the Management of Health & Safety at Work Regulations. This requirement has been reinforced by the Regulatory Reform (Fire Safety) Order 2005.

Fire authorities continue to offer advice to ensure employers are able to discharge their responsibilities and a series of fire guides are available to help the employer. These have key sections which are identical but then specific sections relating to areas such as factories, educational establishments, shops, offices and places of entertainment. They can be downloaded free of charge or purchased via [www.firesafetyguides.communities.gov.uk](http://www.firesafetyguides.communities.gov.uk). T

What are the key aims and objectives of completing a fire risk assessment?

Example aims of the fire risk assessment are:

- To identify the fire hazards.
- To reduce the risk of those hazards causing harm to as low as reasonably practicable.
- To decide what physical fire precautions and management arrangements are necessary to ensure the safety of people in premises if a fire does start
- To comply with legislation
- To prevent loss of life and materials
- To ensure that fires are prevented and steps are taken to minimise the risks should a fire occur
- To ensure that measures needed to reduce the risk are prioritised
- To ensure the safety of employees and others
- To protect the environment from harm caused by fires and fire extinguishing agents
- To meet client, customer or accreditation requirements

### 6.1.1. Meaning of hazard and risk in relation to a fire

**HAZARD** “A condition that has the potential to cause harm” e.g. overheating electrical appliance

**RISK** “The likelihood of harm from the hazard being realised and the severity of the possible injury” e.g. the risk of fire starting from overheating electrical equipment and the severity of the event if it were to occur.

### 6.1.2 Criteria for a ‘suitable and sufficient risk assessment’

The legal requirement is not just for a risk assessment but it must be “suitable and sufficient”, the assessment should:-

- Consider all aspects of work and workplace which could affect the fire risk
- Identify significant risks from work
- Include detail proportionate to risk levels
- Appropriate to work and workplace
- Cover a broad range of hazards/risks
- Be evaluated either using numbers or words
- Identify the risks to employees and others who may be effected
- Identify short and long term controls to prevent and protect from fires
- Allow for co-operation between other employers (shared premises)
- Be valid for a reasonable period of time/reviewed
- Be recorded if there are five employees or more
- Be completed by competent people

The diagram is titled "PAS79 2012" and is set against a background of orange and red gradients. It contains three bullet points:

- Hazard
- Source, situation or unsafe act with the potential to result in a fire
- Fire Risk
- Combination of likelihood of the occurrence of fire and consequences (number & severity of injuries) likely to be caused by fire

### 6.1.3 Objectives of fire safety risk assessments:

A fire risk assessment will help determine the chances of a fire starting and the dangers from fire that premises present for the people who use them and any person in the immediate vicinity.

#### Human Harm

Fires impact people, property and the environment in all countries around the world. In some cases, the resulting losses are extraordinary, causing hundreds of deaths, widespread damage to property and contents and significant impacts on the environment. More often, fires may cause a single casualty or affect a single workplace or home, though the effects are still highly significant to those affected and collectively are substantial.

#### Legal

If an organisation does not manage its fire safety responsibilities there are a range of penalties including an unlimited fine. Individuals who breach the RFRD can also be fined and sent to prison for 2 years. In addition if a fire were to occur and kill or injure employees civil claims for compensation may be sought. In the same way owners of adjacent properties or land could claim compensation for any loss or damage.

#### Example Case 1

##### 2017 London Fire Brigade prosecution results in £20K fine for Hotel

The Central Hotel, London owned by The Hoop Lane Trust have been charged with a £20,000 fine for fire safety failures.

Fire safety inspectors from the London Fire Brigade visited the 24 room premises following a small fire in its annex.

When carrying out the checks inspectors discovered that the hotel had no evidence of fire risk assessments, no smoke alarms, smoke detectors or emergency lighting. They also found inadequate fire doors and no evacuation procedures were in place across the building. An enforcement notice was issued but further follow up visits found that the work required to be done on the premises to improve fire safety standards had not been completed. In addition to the £20,000 fine the Hotel also had to pay prosecution costs amounting to £15,000.

#### Example Case 2

##### Sportswear retail giant JD Sports has been fined £60,000 for blocking fire exits and escape routes at one of its West Midlands stores.

Wolverhampton Magistrates' Court heard the "serious" fire safety dangers came to light during inspection visits by West Midlands Fire Service in the run-up to Christmas 2015 at the company's JD Sports and Scotts stores in Merry Hill shopping centre in Brierley Hill, near Dudley. The officers discovered a fire exit blocked by metal clothing rails and an escape route blocked by crates and stock, reducing its width to just 30cm. Although the officers warned they would be revisiting, fire safety breaches were again identified when they returned two weeks later.

Although the fire officers had instructed the company to clear the blocked fire exit and escape route during their initial inspection visit, when they returned two weeks later they “found the very same protected route and emergency exit blocked”. A risk assessment carried out by JD Sports in May 2014 had concluded an escape corridor to the rear of one of the stores was congested with packaging waste and should be cleared and then checked daily by a store manager, the newspaper reported. “It was plain that the company had been on notice of the problem at least 18 months prior to the December 2015 inspections,” said prosecutor Mark Jackson.

JD Sports Fashion plc, which pleaded guilty to six fire safety offences, reportedly told the court the fire safety breaches “arose from difficulties in managing stock levels” at the store, which had resulted in an “excess of materials”. According to the Express and Star, the company said it had been dealing with “an unprecedented volume of stock” when the inspections occurred, although its other fire detection and prevention systems were all in full working order at the time.



Representing JD Sports, Eleanor Sanderson reportedly said the company sincerely regretted the fire safety breaches, had since moved to a bigger store in the Brierley Hill shopping centre and had improved its stock ordering and management procedures.

After the case, Mick Norton, a fire inspection officer for West Midlands Fire Service, said: “It beggars belief that the company compromised the safety of their staff and Christmas shoppers in this way.

“In spite of our warning that we would be revisiting, breaches were again identified when we returned two weeks later.

“Retailers must realise they can’t put profit before people’s safety by over-stocking, reducing the width of escape routes and blocking fire exit routes.”

JD Sports Fashion plc was fined £10,000 for each of the six fire safety offences and ordered to pay prosecution costs of nearly £7,500.

In a statement issued after the case, JD Sports said: “We regret the circumstances that gave rise to this conviction under the Regulatory Reform Fire Safety Order. We accepted our failings at an early stage and cooperated fully with West Midlands Fire Service.

“The incident related to the high demand and lack of storage for stock in the busy Christmas period. We have since increased the size of the store. The health and safety of our customers and staff is our highest priority and the Court concluded that we have robust systems in place and a good fire safety record prior to this offence, with no previous convictions for an offence of this nature.”

JD Sports Fashion plc reported revenues of £2.3bn in 2017 and “record” headline profits before tax and exceptional items of £244m in 2017, up 56% from £157m in 2016.



## Economic

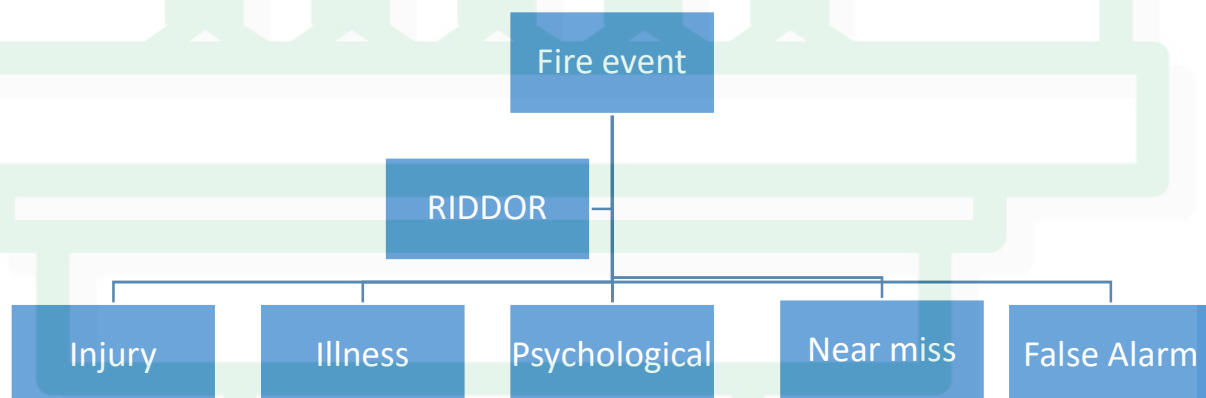
The state of the economy makes it even more important to prevent a fire. They are, after all, one of the most costly, and wasteful things that could ever happen to a business.

In some cases private businesses never recover from a fire due to the loss involved, much of which is not covered by insurance. The loss of data, working hours and replacement materials are simply too much for many businesses to content with, especially at a time when the economy is rocky to say the least.

In 2008, UK insurers were paying out £3.6m every day to pay for fire damage. In the same year, it was estimated that fires cost the UK economy £8.3 billion!

Each and every fire also has a knock on effect on the economy of the individual and local community. Some fires in situations such as waste treatment facilities or mines may not be brought under control easily, leading to loss of job opportunities. The costs of fire incidents also covered in Element 1.

### 6.1.4 Distinction between different types of fire incident:



There are a variety of different incidents which may result from a fire:-

- Injury accident where a members of staff or other person gets injured physically or psychologically by a one off event.
- Ill-health can be caused by some of the hazards generated by fire such as smoke, fumes and gases. Equally severe psychological problems may be experienced by those involved in a fire incident.
- Dangerous occurrence, there are a number of events which may be reportable under the RIDDOR regulations, check Element 1 for further details.
- Near miss, these are accidents which occur but did not result in any injury, this may include false alarms.
- Fire damage-only, a small fire may result in damage to equipment or the building but no loss of life.

## 6.2 PRINCIPLES AND PRACTICE OF FIRE SAFETY RISK ASSESSMENTS

### 6.2.1 Identification of laws, regulations and guidance to be considered

Although a fire risk assessment will focus on fire standards and the requirements of the RFRO, there are a number of other pieces of health and safety legislation which may impact on fire issues. This includes:

Electricity at Work Regulations – portable electrical equipment and the fixed installation can contribute heat sources and fuel.

Provision and Use of Work Equipment Regulations – these cover work equipment which may generate heat or flames.

Control of Substances Hazardous to Health Regulations – some chemicals can react and generate heat.

Dangerous Substances Explosive Atmospheres Regulations – these cover flammables and explosives (covered later in this element).

Guidance from HM Government Local Communities for specific industries should be used along with HSE guidance and British Standards.

#### Sources of information

When a risk assessment is completed an inspection of the workplace should be completed but in addition to this relevant external and internal information sources should be examined to assist in the completion of the assessment to ensure it is comprehensive and suitable and sufficient.

A number of these are identified in Element 1, this will include:-

- Legislation
- Communities and Local Government practical fire safety guidance
- Social Services and Public Safety guidance documents
- Existing fire plan
- Old fire certificate (if available)
- Previous risk assessments and general risk assessments
- General monitoring records including workplace inspections and tours
- Portable appliance tests (PAT) records/electrical checks – fixed installation checks
- Fire log book
- Previous incidents and accident trends
- Signing in book and visitor register
- Current fire precaution checks (fire alarm systems, emergency lighting, fire signs, portable firefighting equipment, etc.)
- Training matrix and records
- Equipment and workplace maintenance records
- Building (Construction, Design and Management Regulations) health and safety file, operator and machine manuals, etc.

#### Additional Considerations (PAS79)

- Systematic & structured format
- Open-minded approach
- Consider relevant fire hazards and the means for their control
- Consider current and improvements in prevention and protection measures
- Make sure you look at the visible fire precautions in place

- Plus Management issues
- Must be carried out on premises when being used



## 6.2.2 Fire hazards

For a fire to start, three things are needed:

- a source of ignition; • fuel • oxygen.

If any one of these is missing, a fire cannot start. Taking measures to avoid the three coming together will therefore reduce the chances of a fire occurring. The remainder of this step will advise on how to identify potential ignition sources, the materials that might fuel a fire and the oxygen supplies which will help it burn.

### Sources of ignition

Potential ignition sources in the premises can be identified by around the site, looking for possible sources of heat which could get hot enough to ignite materials nearby. These sources could include:

- smokers' material, e.g. cigarettes, matches and lighters;
- naked flames, e.g. gas or liquid-fuelled open-flame equipment;
- sparks from burning products, e.g. bonfires in yards;
- vehicle exhausts;
- electrical, gas or oil-fired heaters (fixed or portable), room heaters;
- hot processes/hot work, e.g. welding by contractors or shrink wrapping;
- cooking equipment, hot ducting, flues and filters;

### Sources of fuel

Anything that burns is fuel for a fire. The assessor needs to look for the things that will burn reasonably easily and are in enough quantity to provide fuel for a fire or cause it to spread to another fuel source. Some of the most common 'fuels' found in factories and warehouses are:

- flammable liquid-based products, such as paints, varnishes, thinners and adhesives;
- flammable liquids and solvents, such as petrol, white spirit, methylated spirit, cooking oils and disposable cigarette lighters;
- flammable chemicals, such as certain cleaning products, photocopier chemicals and dry cleaning products that use hydrocarbon solvents;
- flammable gases such as liquefied petroleum gas (LPG), flammable refrigerants and flammable gas propelled aerosols;
- stored goods and high piled or racked storage;
- foodstuffs containing sugar and oils, such as sugar-coated cereal and butter;
- plastics and rubber, such as video tapes, polyurethane foam-filled furniture and polystyrene-based display materials;

### Sources of oxygen including oxidising agents

The main source of oxygen for a fire is in the surrounding air. In an enclosed building this is provided by the ventilation system in use. This generally falls into one of two categories: natural airflow through doors, windows and other openings; or mechanical air conditioning systems and air handling systems. In many buildings there will be a combination of systems, which will be capable of introducing/extracting air to and from the building.

Additional sources of oxygen can sometimes be found in materials used or stored at premises such as:

- some chemicals (oxidising materials), which can provide a fire with additional oxygen and so help it burn. These chemicals should be identified on their container (and Control of Substances Hazardous to Health data sheet) by the manufacturer or supplier who can advise as to their safe use and storage;
- oxygen supplies from cylinder storage and piped systems, e.g. oxygen used in welding processes;
- pyrotechnics (fireworks), which contain oxidising materials and need to be treated with great care.

### 6.2.3 Methods of identifying hazards

In the simplest cases, hazards can be spotted by observation and questioning. They may be identified by individual activities, people or work areas, depending on the nature of the area being assessed. Inspections involved a tour of the workplace looking for fire hazards including sources of ignition and fuel.

Job or task analysis involved identifying the specific hazards associated with an individual tasks such as welding and grinding. By looking at one job the safe system of work can be established to prevent the task causing a fire or an explosion.

A check list may be used to assist in the hazard identification process.

*Tick the appropriate answer*

#### 1.0 Combustible Materials and Resources of Material

1.1 Is the system of controlling the amount of flammable substances and combustible materials operating effectively?

Ye s		No		N/ A	
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- 1.2 Are all flammable substances and combustible materials stored safely? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.3 Are heating appliances fixed in position at a safe distance from any combustible materials and suitably guarded? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.4 Have portable electrical appliances been PAT tested 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.5 Are all electrical protective devices suitable for purpose? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.6 Are lengths of flexible cable kept to the minimum? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.7 Are cables run only where damage is unlikely and not under floor coverings or through doorways? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.8 Is the upholstery of furniture in good condition? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.9 Is the workplace free of accumulations of rubbish, waste paper or other materials, which could catch fire or be set alight? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.10 Are there suitable facilities for the disposal of smoking materials? 

Ye s		No		N/ A	
---------	--	----	--	---------	--
- 1.11 Are there suitable measures to protect against the risk of arson? 

Ye s		No		N/ A	
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Notes

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Examine each risk/hazard possibility, can it be:

- Eliminated (use a safer product)
- Protected against (fixed fire protection)
- Transferred (contract-out the process)
- Financed (insure or set up funding process)
- Avoided (don't undertake the activity)
- Accepted (understand the risk and accept any consequences)

#### 6.2.4. People at risk

The employer must consider all the people who use the premises, paying particular attention to people who may be especially at risk such as:

- employees who work alone, e.g. cleaners, security staff;

- people who are in isolated areas, e.g. maintenance staff, staff on cranes or reach trucks
- unaccompanied children and young persons;
- people who are unfamiliar with the premises, e.g. seasonal workers, contractors, visitors and customers;
- people with disabilities or those who may have some other reason for not being able to leave the premises quickly;
- people with language difficulties;
- other people in the immediate vicinity of the premises.

In evaluating the risk to people with disabilities the employer may need to discuss their individual needs with them. In larger premises used extensively for the public more detailed analysis will be needed to ensure arrangements are adequate.

If disabled people are going to be in the premises then the employer must also provide a safe means for them to leave if there is a fire. Employees should be aware that disabled people may not react, or can react differently and will need an individual personal evacuation emergency plan. They may not be aware when a fire warning is given. Consideration must be given to others with special needs such as parents with young children or the elderly.

In premises with a simple layout, a common sense approach, such as offering to help lead a person with a visual impairment or helping an elderly person down steps may be enough. In more complex premises, more elaborate plans and procedures will be needed, with trained staff assigned to specified duties.

Consider the needs of people with mental disabilities or spatial recognition problems. The range of disabilities encountered can be considerable, extending from mild epilepsy to complete disorientation in an emergency situation. Many of these can be addressed by properly trained staff, discreet and empathetic use of the 'buddy system' or by careful planning of colour and texture to identify escape routes.

Where people with special needs use or work in the premises, their needs should, so far as is practicable be discussed with them. These will often be modest and may require only changes or modifications to existing procedures. The employer may need to develop individual 'personal emergency evacuation plans' (PEEPs) for disabled persons who frequently use a building. They will need to be confident of any plan/PEEP that is put in place after consultation with them. As part of the consultation exercise the employer will need to consider the matter of personal dignity.

If members of the public use a building then the employer may need to develop a range of standard PEEPs which can be provided on request to a disabled person or others with special needs. See Element 5 for further details.

Guidance on removing barriers to the everyday needs of disabled people is in BS 8300.14. Much of this advice will also help disabled people during an evacuation.

## 6.2.5 Evaluation of risk and the adequacy of existing fire safety measures

The current arrangements to prevent and mitigate fire need to be identified and assessed to see if they are effective or need to be added to.

	Yes/No	Give details
<b>Fire Exits</b>		
Are all fire exit routes clear and unobstructed? (Consider both sides of any fire doors)		
Do all fire exits lead to a place of safety?		
If the premises has external escape stairs, are these maintained in a safe condition?		
Are all floor stairway surfaces in good condition and free from tripping and slipping hazards ie no upturned carpet or coverings?		
Are fire exit signs fitted, clear and using pictograms?		
Are all fire resisting doors in good condition ie closing fully onto rebates, not wedged open?		
Are self-closing devices (where fitted) effective?		
Are signs fixed on fire resisting doors at eye-level on both sides as follows:		
i) Fire doors to stairways and those provided in corridors or to rooms of high fire risk ie kitchen, boiler room – <b>Fire Door Keep Closed*</b>		
ii) fire doors to cupboards and stores on escape corridors or stairways – <b>Fire Door Keep Locked Closed*</b>		
i) Automatic fire doors fitted with magnetic door release units – <b>Automatic Fire Door – Keep Clear – Close at Night*</b> *Signs should be white writing on a blue background		
Are all final exit doors easily operable? Unlocked/open in the direction of travel		
Is there a designated fire assembly point? Is it signed?		

### Evaluate the likelihood that a fire may occur

This will be influenced by the risk of ignition sources, oxygen and fuel coming together) by either an accidental event, by an act or omission or by deliberate intent.

### Evaluate the consequence to people from a fire starting in the building

The chances of a fire starting will be low if your premises has few ignition sources and if combustible materials are kept away from them.

In general, fires start in one of three ways:

- accidentally, such as when smoking materials are not properly extinguished or when lighting displays are knocked over;
- by act or omission, such as when electrical equipment is not properly maintained, or when waste packaging is allowed to accumulate near to a heat source,
- by storing LPG next to an electric fire or other source of heat;

- deliberately, such as an arson attack involving setting fire to external rubbish bins placed too close to the building.

It is important to look at the premises and try to identify any accidents waiting to happen and any acts or omissions which might allow a fire to start. Additionally situations which may increase the risk of arson need to be identified.

It is unlikely that any employer will conclude that there is no chance of a fire starting anywhere in the premises, which means the next step is to evaluate the actual risk to those people should a fire start and spread from the various locations on site.

While determining the possible incidents, you should also consider the likelihood of any particular incident; but be aware that some very unlikely incidents can put many people at risk.

Smoke produced by a fire also contains toxic gases which are harmful to people. A fire in a building with modern fittings and materials generates smoke that is thick and black, obscures vision, causes great difficulty in breathing and can block the escape routes. It is essential that the means of escape and other fire precautions are adequate to ensure that everyone can make their escape to a place of total safety before the fire and its effects can trap them in the building.

In evaluating this risk to people you will need to consider situations such as:

- fire starting on a lower floor affecting the only escape route for people on upper floors or the only escape route for people with disabilities;
- fire starting in a service room and affecting hazardous materials (such as pyrotechnics or gas cylinders);
- fire developing in an unoccupied space that people have to pass by to escape from the building;
- fire spreading rapidly through the building because of combustible structural elements and/or large quantities of combustible goods;
- rapid vertical fire spread in high rack storage;
- fire or smoke spreading through a building via routes such as vertical shafts, service ducts, ventilation systems, poorly installed, poorly maintained or damaged, walls, partitions and ceilings;
- fire and smoke spreading through a building due to poor installation of fire precautions, e.g. incorrectly installed fire doors
- fire and smoke spreading through the building due to poorly maintained and damaged fire doors or fire doors being wedged open

## **Risk Evaluation**

- Low: hardly any risk from fire, few combustible materials, virtually no heat sources.
- Normal: sufficient quantities of combustibles and heat sources, greater than low risk, but where a fire would be likely to remain confined or grow slowly.
- High: where there is a serious risk to life from fire, where there are large quantities of combustibles or flammables or where fire, heat and smoke are likely to spread rapidly.

## Risk Value Matrix

$$\text{Risk Value} = \text{Probability} \times \text{Severity}$$

### Probability (P)

- 1 Very unlikely
- 2 Unlikely
- 3 Possible
- 4 Very Likely
- 5 Almost certain

### Severity (S)

- 1 Very minor damage effect may not be felt by the customer
- 2 Slight damage will cause problems to customers
- 3 Damage to property, will effect trading and profits
- 4 Major property damage the business may not revocer
- 5 Severe damage/loss to property good possibility the company will go bust

## 25 Square Risk Matrix

	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

1-4 Low risk, 6 -12 Normal risk, 15 - 25 High risk

**PAS 79** considers the evaluation can be subjective or qualitative, using words and descriptors such as:

- Trivial
- Tolerable
- Moderate
- Substantial
- Intolerable

### 6.2.6 Risk to be reduced as far as is reasonably practicable

If a requirement is qualified by the words as **far as is practicable** then it must be complied with in light of current knowledge, technology and invention, regardless of cost or inconvenience. If it is technically possible to take action then action must be taken. Cost and trouble cannot be taken into account when making a decision on what to do. The higher the risk of fire the more precautions or controls need to be taken to reduce the risk

or prevent fires. The lower the risk such as in a small office accommodation the more straightforward the controls will be.

Flexibility will be required when applying this guidance; the level of fire protection should be proportional to the risk posed to the safety of the people in the premises. Therefore, the objective should be to reduce the remaining risk to a level as low as reasonably practicable. The higher the risk of fire and risk to life, the higher the standards of fire protection will need to be.

Any work premises may not exactly fit the solutions suggested in the fire guidance notes, which means some of the issues they contain may need to be applied in a flexible manner without compromising the safety of the occupants.

For example, if the 'travel distance' is in excess of the norm for the level of risk determined, it may be necessary to do any one or a combination of the following to compensate:

- Provide earlier warning of fire using automatic fire detection.
- Revise the layout to reduce travel distances.
- Reduce the fire risk by removing or reducing combustible materials and/or ignition sources.
- Control the number of people in the premises.
- Limit the area to trained staff only (no public).
- Increase staff training and awareness.

### **Avoid or reduce hazards that may cause a fire**

There are various ways that you can reduce the risk caused by potential sources of ignition, for example:

- Wherever possible replace a potential source by a safer alternative.
- Operate a safe smoking policy in designated smoking areas and prohibit smoking elsewhere.
- Replace naked flame and radiant heaters with fixed convector heaters or a central heating system. Restrict the movement of and guard portable heating appliances.
- Separate ignition hazards and combustibles, e.g. ensure sufficient clear space between lights and combustibles, build fire-resistant enclosures for hot processes, and incinerate rubbish off site.
- Inspect and monitor ignition hazards so that preventative corrective actions can be undertaken, e.g. sample temperature on ducts and in oil baths, inspect for hot spots in electrical systems and mechanical systems.
- Ensure electrical, mechanical and gas equipment is installed, used, maintained and protected in accordance with the manufacturer's instructions.
- Strictly control hot processes/hot work by operating permit to work schemes.
- Check all areas where hot work (e.g. welding) has been carried out to ensure that no ignition has taken place and no smouldering or hot materials remain that may cause a fire. The fire watch should be maintained for at least 30 minutes after hot work has been completed.
- Ensure that no one carrying out work on gas fittings which involves exposing pipes that contain or have contained flammable gas uses any source of ignition such as blow-lamps or hot-air guns.
- Ensure that no one uses any source of ignition while searching for an escape of gas.
- Take precautions to avoid arson.

**Remove or reduce sources of fuel, there are various ways that you can reduce the risks caused by materials and substances which burn, for example:**

- Reduce stocks of flammable materials, liquids and gases in open areas to a minimum.
- Keep remaining stock in dedicated metal cabinets, storerooms or storage areas, preferably outside, where only the appropriate staff are allowed to go, and keep the minimum required for the operation of the business.
- Do not keep flammable solids, liquids and gases together.
- Keep areas containing flammable gases ventilated, e.g. fork lift truck charging units.

**Put in place fire safety measures to reduce the risk to persons from fire**

Having evaluated and addressed the risk of fire occurring and the risk to people (preventative measures) it is unlikely to conclude that no risk remains of a fire starting and presenting a risk to people in the premises. Fire risks need to be reduced as low as reasonably practicable, by ensuring that adequate fire precautions are in place to warn people in the event of a fire and allow them to safely escape.

**Means of detecting fire**

Fire-detection and warning systems in some simple, open-plan, single-storey factories and warehouses, a fire may be obvious to everyone as soon as it starts. In these cases, where the number and position of exits and the travel distance to them is adequate, a simple shout of 'fire' or a simple manually operated device, such as a gong, whistle or air horn that can be heard by everybody when operated from any single point within the building, may be all that is needed. Where a simple shout or manually operated device is not adequate, it is likely that an electrical fire warning system will be required.

In more complex premises, particularly those with more than one floor, where an alarm given from any single point is unlikely to be heard throughout the building, an electrical system incorporating sounders and manually operated call points (break glass boxes) is likely to be required. This type of system is likely to be acceptable where all parts of the building are occupied at the same time and it is unlikely that a fire could start without somebody noticing it quickly. However, where there are unoccupied areas, or common corridors and circulation spaces in multi-occupied premises, in which a fire could develop to the extent that escape routes could be affected before the fire is discovered, automatic fire detection may be necessary

**Means of escape**

Once a fire has started, been detected and a warning given, everyone in your premises should be able to escape to a place of total safety unaided and without the help of the fire and rescue service. However, some people with disabilities and others with special needs may need help from staff who will need to be designated for the purpose.

Escape routes should be designed to ensure, as far as possible, that any person confronted by fire anywhere in the building, should be able to turn away from it and escape to a place of reasonable safety, e.g. a protected stairway. From there they will be able to go directly to a place of total safety away from the building.

Those who require special assistance (e.g. very young children in a crèche and some people with disabilities) could be accommodated on the same level as the final exit from the premises to facilitate escape. Where they need assistance to evacuate, you should make sure that there are sufficient staff to ensure a speedy evacuation.

The level of fire protection that should be given to escape routes will vary depending on the level of risk of fire within the premises and other related factors. Generally, premises that are simple, consisting of a single storey, will require fairly simple measures to protect the escape routes, compared to a large multi-storey building, which would require a more complex and inter-related system of fire precautions

### **Means of fighting fires**

Firefighting equipment can reduce the risk of a small fire, e.g. a fire in a waste-paper bin, developing into a large one. The safe use of an appropriate fire extinguisher to control a fire in its early stages can also significantly reduce the risk to other people in the premises by allowing people to assist others who are at risk.

This equipment will need to comprise enough portable extinguishers that must be suitable for the risk, arrangements for action to be taken in event of fire, etc. Equally employees need to be trained in their use.

### **Emergency Plans**

The purpose of an emergency plan is to ensure that the people in your premises know what to do if there is a fire and that the premises can be safely evacuated.

If an organisation employs five or more people, or the premises are licensed or an alterations notice requiring it is in force, then details of your emergency plan must be recorded. Even if it is not required, it is good practice to keep a record.

The emergency plan should be based on the outcome of a fire risk assessment and be available to employees, their representatives (where appointed) and the enforcing authority. In simple premises the emergency plan may be no more than a fire action notice. In multi-occupied, larger and more complex premises, the emergency plan will need to be more detailed and compiled only after consultation with other occupiers and other responsible people, e.g. owners, who have control over the building. In most cases this means that an emergency plan covering the whole building will be necessary.

## **6.2.7 Regulatory Fire Reform Order - Article 10: Principles of prevention to be applied**

Where the responsible person implements any preventive and protective measures, this should be done in accordance with the stated principles which emphasise the need to avoid risks and evaluate the risks that cannot be avoided.

### **Schedule 1 Principles of Prevention**

The principles are—

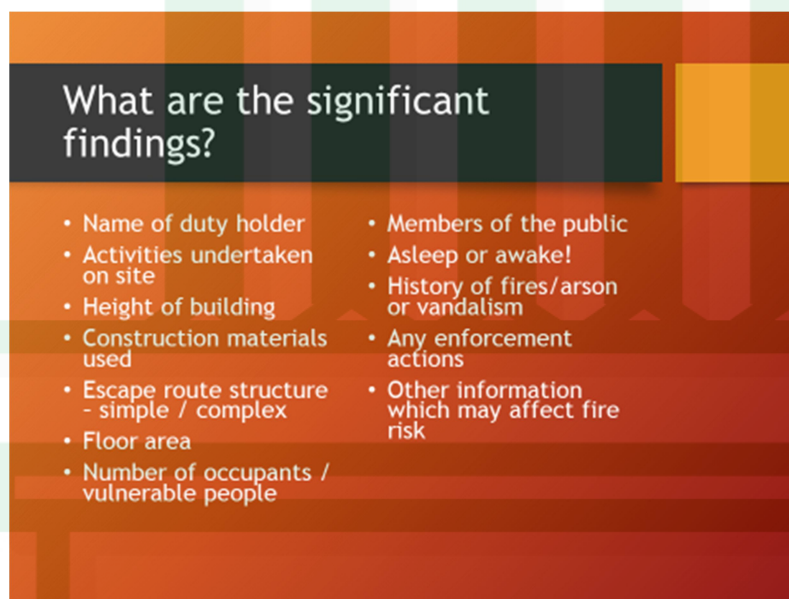
- avoiding risks;
- evaluating the risks which cannot be avoided;
- combating the risks at source;
- adapting to technical progress;
- replacing the dangerous by the non-dangerous or less dangerous;
- developing a coherent overall prevention policy which covers technology, organisation of work and the influence of factors relating to the working environment;
- giving collective protective measures priority over individual protective measures; and
- giving appropriate instructions to employees.



This is by no means an exhaustive list as certain specific controls will be needed to suit certain work areas where a more **general hierarchy** may be used:-

- Elimination of the risk or hazard e.g. no smoking on site
- Substitution – replace flammable substances with non-flammable versions where possible – or replace an extremely flammable with one deemed flammable which still has a risk associated with it but it will be lower.
- Utilising engineering controls – fire detection systems
- Administration controls ( including training and SSOW) this could include fire drills and fire signage
- Personal Protective Equipment (PPE)
- Discipline

### 6.2.8 Recording significant findings:



A written record of the significant findings and action taken must be made if the organisation employs five or more people, the premises are licensed, or an alterations notice requiring written assessment is in force.

Significant findings should include details of:

- the fire hazards you have identified (you don't need to include trivial things like a small tin of solvent-based glue);
- the actions you have taken or will take to remove or reduce the chance of a fire occurring (preventive measures);
- persons who may be at risk, particularly those especially at risk;
- the actions you have taken or will take to reduce the risk to people from the spread of fire and smoke (protective measures);
- the actions people need to take in case of fire, including details of any persons nominated to carry out a particular function (your emergency plan);
- the information, instruction and training you have identified that people need and how it will be given.

The employer may also wish to record discussions had with staff or staff representatives (including trade unions). Even where the employer is not required to record the significant findings, it is good practice to do so. In some simple premises, record keeping may be no more than a few sheets of paper (possibly forming part of a health and safety folder), containing details of significant findings, any action taken and a copy of the emergency plan.

The record could take the form of a simple list which may be supported by a simple plan of the premises.

In more complex premises, it is best to keep a dedicated record including details of significant findings, any action taken, a copy of the emergency plan, maintenance of fire-protection equipment and training. There is no one 'correct' format specified for this.

### 6.2.9. Reviewing the fire risk assessment

Once the risk assessment is completed it will need to be reviewed if there is a significant change which will affect the fire risks. There are a variety of reasons which should lead to a review these include:-

- a change in the number of persons present or persons with disabilities
- any alterations to the building - changes to work procedures
- introduction of new equipment
- significant changes to furniture and fittings
- introduction of or storage of dangerous substances
- becoming aware of shortcomings in fire safety measures or improvements, legislative changes
- lapse of time.

There is no exact timescale for reviewing the fire risk assessment as this is based on the fire risks involved it could be in six months, especially if a range of fire issues were spotted which needed to be dealt with. It could be 12 months or longer if the fire risk level is low.

### For information only PAS79 Fire Risk Assessment Stages



### 6.3 DEALING WITH DANGEROUS SUBSTANCES



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.

So just what is a dangerous substance? 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

Examples of substances which can be classified as dangerous include:

- Most common organic solvents
- Benzoyl peroxide
- Ammonia gas
- Oxygen gas
- Petrol
- Varnishes
- LPG
- Explosive dusts e.g. aluminium

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

### 6.3.1 DANGEROUS SUBSTANCES EXPLOSIVE ATMOSPHERES REGULATIONS OVERVIEW

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) came into force on 9th December 2002. They have since been amended by The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004, 2007 and 2011.

A full copy of the Regulations can be printed and/or downloaded from: [legislation.gov.uk/ukxi/2002/2776/contents](http://legislation.gov.uk/ukxi/2002/2776/contents)

Dangerous substances can put peoples' safety at risk from fire and explosion. DSEAR puts duties on employers and the self-employed to protect people from risks to their safety from fires, explosions and similar events in the workplace, this includes members of the public who may be put at risk by work activity.

Dangerous substances are any substances used or present at work that could, if not properly controlled, cause harm to people as a result of a fire or explosion. 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 and dusts from foodstuffs.

Employers must:

- find out what dangerous substances are in their workplace and what the fire and explosion 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;
- identify and classify areas of the workplace where explosive atmospheres may occur and avoid ignition sources (from unprotected equipment, for example) in those areas.

**In addition, employers should consider:**

- Where explosive atmospheres may occur **zone classification must be undertaken** and any equipment used in zoned areas must meet the appropriate criteria. The EX warning symbol must be displayed and the explosion protection controls must be verified by a competent person before the area is first brought into use.
- **Appropriate anti-static clothing** should be provided for use in zone-classified areas.
- **Appropriate warning systems** and emergency procedures must be developed, communicated, implemented and practiced at intervals.
- **Information, instruction and training** dealing with risks and risk control measures must be provided to employees. The employer must provide:

- suitable and sufficient information, instruction and training on the appropriate precautions and actions;
- details of the substances and any relevant data sheets plus legal provisions;
- the significant findings of the risk assessment.

**Contents of containers and pipes** - Containers and pipes must be marked with the content and any hazards clearly identified.

### Enforcement

DSEAR will be enforced by: The HSE or Local Authorities depending on the allocation of premises under the Health and Safety (Enforcing Authority) Regulations 1998. In the main, HSE will enforce at all industrial premises and Local Authorities elsewhere. The Fire Authorities will enforce general fire precautions at most premises subject to DSEAR.

### Supporting HSE ACoPs and Guidance

All HSE documents are available to purchase or to freely download from the [hse.gov.uk](http://hse.gov.uk).

- L138 Dangerous Substances and Explosive Atmospheres. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance
- L134 Design of plant, equipment and workplaces. Dangerous Substances and Explosives Atmospheres Regulations 2002. Approved code of Practice and Guidance
- L135 Storage of dangerous substances. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance
- L136 Control and mitigation measures. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance
- L137 Safe maintenance, repair and cleaning procedures. Dangerous Substances and Explosive Atmospheres Regulations 2002. Approved Code of Practice and guidance
- Other guidance on DSEAR is available from the HSE website: [www.hse.gov.uk](http://www.hse.gov.uk).

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 1996 (EPS).

### 6.3.2 Establishing Flammable Zones

DSEAR requires an assessment of areas where flammables are used, generated or stored. Where flammable materials which are likely to produce a flammable atmosphere are produced, handled, stored etc., each of the locations will be classed as a "flammable zone" and graded according to the potential danger i.e. the degree of risk of ignition. The zones are not related to the type of flammable atmosphere but to the probability of a flammable atmosphere existing. There are three types of flammable zones:

For gases, vapours and mists the zone classifications are:

Zone 0            A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.

**Zone 1** A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

**Zone 2** A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

### Dusts

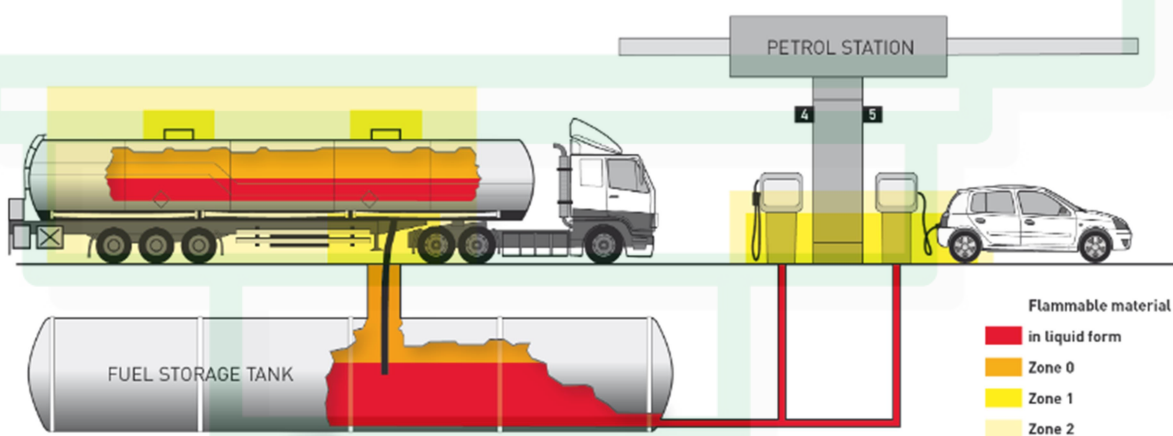
For dusts the zone classifications are:

**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.

A zone is an area around a process or activity where a flammable atmosphere may be present. The zone classification will affect the type and classification of electrical equipment or fittings which are permitted.



### 6.3.3 DANGEROUS SUBSTANCES EXPLOSIVE ATMOSPHERES RISK ASSESSMENT STAGE BY STAGE



The purpose of risk assessment is to enable a Company 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 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. 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. But typically in a scientific department, the following steps will be required.

Before beginning work with a dangerous substance it is a requirement to **carry out a risk assessment**, to review it as necessary and to record the significant findings where 5 or more people are employed. Records must include the usual risk assessment issues (as required by Reg 3 MHSWR 1999) and specific information relating to the DSEAR requirements including information on zone classification and protected equipment.

#### Stage one Identify the hazards

Risk assessment initial considerations

- It should be completed before dangerous substances are used
- What are the hazardous properties of the substances
- Supplier information provided on flammability
- Work processes & substances interactions which may create flammable atmospheres
- Amounts of dangerous substances used or stored
- How dangerous substances are handled, stored and transported

- Is there likely to be any waste which is also classified as a dangerous substance as it is flammable or explosive or oxidising

The risk assessment required by Regulation 5 must include:

- the hazardous properties of the dangerous substance;
- suppliers information and safety data sheet;
- the circumstances of the work including –
- work processes and substances used and their possible interactions;
- the amount of substance involved;
- risks of substances in combination;
- arrangements for safe handling, storage and transport and any waste

Check whether the substance has been classified under the EU Chemicals Labelling and Packaging Regulations as: explosive, oxidising, extremely flammable, highly flammable or flammable. **If a substance or preparation is classified as explosive, oxidising, extremely flammable, highly flammable or flammable then it is a “dangerous substance”.**

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

Employers should also consider:

- The hazardous properties of the substance,
- The safety information provided by the supplier,
- The circumstances of the work, the amounts used, the process and interaction or combined effects of more than one Dangerous Substance (DS), the arrangements for safe storage, transport and handling of the DS or waste containing a DS,
- Activities where there is a high level of risk such as maintenance,
- The effectiveness of measures that are taken,
- The likelihood of an explosion and its persistence or duration / effect,
- The likelihood that ignition sources or electrostatic discharges will be present,
- The scale of the anticipated effects of a fire or explosion,
- Other places which are or could become connected by openings to places in which explosive atmospheres can occur,

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) event.

Remember, the Regulations apply because of the way a substance is *used or present*. For example, diesel oil is not classified as “flammable” under legislation. 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 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”.**

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

### **Stage Two – Who is at risk?**

As this risk assessment focuses on fires and explosions usually this will be all employees, all building users but also potentially neighbours and even members of the public

### **Stage Three Existing Controls**

Consider what existing controls are in place to prevent explosions and fires or minimise their impact if they occur. Many of these have already been covered in the earlier elements of this qualification. Is zoning needed or is current zoning classification correct? Are suitable standards of electrical equipment and connections in place in areas where there are flammable vapours, dust or gases?

### **Stage Four Additional Control measures**

#### **Elimination or Reduction of Risks from Dangerous Substances**

There is a requirement to eliminate risk or, where this is not reasonably practicable, reduce risk by the application of a specified hierarchy of control.

1. Reduce the quantity of dangerous substances to a minimum,
2. Avoid the release or minimise the release of dangerous substances,
3. Control the release of a DS at source,
4. Prevent the formation of an explosive atmosphere which should include the application and use of appropriate ventilation,
5. Ensure that the release of a DS that gives rise to risk is suitably collected, safely contained, removed to a safe place or rendered safe by other appropriate means,
6. Avoid all ignition sources including electro-static discharges to avoid adverse conditions that could cause dangerous substances to give rise to harmful physical effects,
7. Segregate incompatible dangerous substances.
8. The employer is further expected to mitigate the detrimental effects of fire or explosion or the other harmful effects such as inhalation of toxic by-products from the energy release of dangerous substances by:
  - Reducing the number of employees exposed to a minimum,
  - Avoiding the propagation of fires or explosions,
  - Providing explosion pressure relief measures where appropriate,
  - Providing explosion suppression equipment where appropriate,
  - Providing plant that can withstand the likely pressures from an explosion.

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 that make a substance useful or needed in a work activity or process also make it dangerous.

### **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.

### **Consider Emergency Procedures Needed**

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.

Employers should make their emergency procedures available to the emergency services.

### **Stage 5 Record the assessment & Monitor**

Significant findings must be recorded along with afterward the assessment has been undertaken checking and monitoring to ensure improvements and actions required have been completed.

### **Stage 6 Review**

- If there is a significant change
- Regularly – based on the risk evaluation it may be in six months, 12 months or longer

### **Dangerous Substance Risk Assessment Summary**

- the hazardous properties of the substance
- information on safety provided by the supplier
- the circumstances of the work (special/technical/organisational measures
- the substance and possible interactions,
- amount of substance,
- risk presented by combination of substances)
- arrangements for safe handling
- the likelihood that an explosive atmosphere will occur
- the likelihood that ignition sources will be present and become active and effective
- the scale of the anticipated effects - any places which are, or can be connected via openings, to places in which explosive atmospheres may occur
- any additional information which may be needed to completed the assessment.

See Element 3 and section 6.4 of this handout for further details of specific control measures to prevent and mitigate.

### 6.3.4 EXAMPLE DANGEROUS SUSTANCE EXPLOSIVE ATMOPHERES RISK ASSESSMENT FORM

Department	
Date	
Laboratory	
Description of activity involving 'classified' materials (including day to day operation, cleaning and maintenance)	
Storage Location	

Areas identified as using / storing substances captured by the DSEAR requirements are required to complete this risk assessment and ensure that control measures are taken and communicated to all who have the need to work in the laboratory.

Substances being handled, stored or produced	
Name	Quantity

Substances in use / proposed to be used, are they classified as			
Explosive		Oxidising	
Highly Flammable		Extremely Flammable	
Environmental Factors		Release of vapour / gas could produce explosive atmosphere	
		Flammable	
		Flash point <32C	

Conditions for use			
Ambient Temp and Pressure		High Temperature	
Enriched Atmosphere		Inert Atmosphere	
		High Pressure	

Product / bi-product of an in-house process			
Explosive		Oxidising	
Highly Flammable		Extremely Flammable	
Release of vapour / gas could produce explosive atmosphere		Flammable	
		Flash point <32C	

Where no substances have been identified above then there are no further actions in this assessment

Under what circumstances could a failure give risk to fire or explosion, also note any potential sources of ignition

Control Measures	Yes	No	N/A
Can the substance be substituted for less flammable / explosive Where this is 'Yes' a further assessment will be necessary to ensure risk is reduced	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Quantity of substance stored / used reduced to a minimum	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steps been taken to avoid or minimise releases (Intentional & unintentional)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steps taken to prevent the formation of explosive atmosphere <i>Provide detail here</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fume cupboard or ventilation used <i>Give detail below of any other ventilation used / required to remove releases to a safe place</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steps been taken to avoid adverse conditions (e.g. exceeding temperature limits or other controls)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Substances stored in accordance with compatibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has the number of people exposed to the dangerous substances or explosive atmospheres been reduced to a minimum	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others working in vicinity aware of hazards and action	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plant in use is explosion resistant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Explosion pressure relief provided and fit for purpose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adequate controls in place to minimise spread of fire / explosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suitable PPE provided, staff trained in correct use and used when appropriate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>Workplace / process / management systems appropriate to the nature of the activity</b>			
System safety design – e.g. Schrader fittings, bursting discs etc. Provided details below			
	<b>Yes</b>	<b>No</b>	<b>N/A</b>
Workplace designed, constructed and maintained so as to provide adequate fire resistance and/or explosion relief	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Any installation, plant, rig, equipment, protection system etc., designed so as to minimise the risk of fire and / or explosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Any installation, plant, rig, equipment, protection system etc., used in such a way as to minimise the risk of fire and / or explosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Safe systems of work, or other required procedures developed and communicated to all persons who may be affected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flammable substances kept in a suitable fire resistant cabinet, total for laboratory not to exceed 50 litres of highly flammable, flashpoint <32°C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has the Head of Local Safety Committee or other Senior Departmental Administrator been informed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Zoning and control of explosive atmospheres</b>			<input type="checkbox"/>
	<b>Yes</b>	<b>No</b>	

All areas classified into zones in accordance with Schedule 2 of the Regulations	<input type="checkbox"/>	<input type="checkbox"/>
Where necessary, have such classified zones been marked at their entry points with the specified 'EX' hazard warning sign	<input type="checkbox"/>	<input type="checkbox"/>
All such areas 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	<input type="checkbox"/>	<input type="checkbox"/>
People working in protected zones provided with clothing that does not create a risk of electrostatic discharge	<input type="checkbox"/>	<input type="checkbox"/>
Areas where explosive atmospheres may be present, before their first operation been verified as being safe by a person competent in the field of explosion protection	<input type="checkbox"/>	<input type="checkbox"/>

<b>Storage</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>
All flammable substances kept in suitable fire resistant storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All quantities in excess of 50 litres (highly flammable, extremely flammable, flash point <32°C) kept in dedicated and protected flammable store	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Substances stored in accordance with compatibilities / incompatibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Where necessary have storage areas been designed to provide explosion relief	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Emergency Procedures (Inc potential environmental incidents)</b>			
Suitable emergency procedures developed and communicated to all personnel who deal with adverse process conditions (e.g. thermal runaways, exceeding control settings etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suitable emergency procedures developed and communicated to personnel on fire action	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suitable emergency procedures developed and communicated to personnel on action on spillage of a dangerous substance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Waste Disposal</b>			
Suitable procedures developed and communicated to personnel on requirements for safe transport and safe disposal of dangerous substances	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Information, Instruction and Training</b>			
Appropriate information, instruction and training, commensurate with the hazard potential of the dangerous substances or process, provided to personnel inc. product detail, hazards present. Risk reduction methods, management systems to be followed, emergency action etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The risks 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 reasonable practicable.

Has this been achieved                      Yes                         No  

<b>Name of assessor &amp; Signature</b>	
<b>Date of assessment &amp; Review Date</b>	

## **6.4 MEASURES TO BE TAKEN TO CONTROL RISK IN RESPECT OF DANGEROUS SUBSTANCES**

Regulation 5 of the Dangerous Substances and Explosive Atmosphere Regulations 2002 requires steps to control the risk of dangerous substances

Where it is necessary to work with dangerous substances, employers are not expected to eliminate all risk but to reduce risks and to implement measures to control the remaining risks and mitigate the consequences of any fire or explosion or other harmful physical event that could foreseeably arise so far as reasonably practicable.

Employers should first consider eliminating the risk if a suitable non-harmful (or, failing that, a less harmful) substitute for the dangerous substance is feasible or if a safer process exists. All aspects of the properties of the proposed substitute must be considered when substituting a dangerous substance, and the risks balanced against all the overall risks, not just its flammability or explosion properties.

### **Reduce quantities to a minimum**

The extent of harmful effect from fires or explosions is directly related to the quantity of dangerous substance involved. Employers should ensure their work procedures, including the selection and design of plant, are consistent with minimising the quantity of dangerous substances present in process areas, workrooms, laboratories and similar working areas. Employers should especially consider the risks posed by transfer operations involving dangerous substances and preference should be given to piped and enclosed delivery and export systems to minimise the quantity of dangerous substance in these process areas etc.

### **Avoid/minimise the release of a dangerous substance**

Accumulation of vapours, gases, mists creates the potential for a hazardous area to exist. Vapour emissions resulting from processes can be minimised by:

- the use of enclosed container and transfer systems and vapour recovery connections
- keeping lids open only for the minimum period required for transfer
- minimising exposed surface areas (e.g. area of spread for leaked or spilled liquid)
- avoidance of splash filling
- minimising the temperature of liquids being processed or transferred
- providing ventilation, e.g. mechanical extraction for all sources of vapour and vent to a safe area.

When heated, the vapour pressure of flammable and combustible materials may increase resulting in higher vapour emissions. Containers of hazardous chemicals should therefore be stored away from sources of heat (e.g. heaters or other heating appliances). Heat may also deteriorate packaging and increase the risk of failure of the container and product loss. Hot surfaces may also exceed a substance's auto-ignition temperature.

### **Control the release of a dangerous substance at source**

Elimination or minimisation of the release of dangerous substances by using closed systems or suitable processing and handling methods should be the first consideration. Employers should ensure proportionate, appropriate measures are taken to prevent the formation of hazardous explosive atmospheres or to limit their extent. Ventilation designed to dilute the concentration of any dangerous substances to a safe level (below that which could form an explosive atmosphere).

## **Prevent the formation of an explosive atmosphere (including appropriate ventilation)**

Where the release of a dangerous substance could give rise to explosive atmospheres the following measures, ranked in preference order and forming a hierarchy of control, should be considered in order to dilute the concentration of foreseeable releases to a safe level:

- location in the open air. Where weather protection is required, it should be designed to prevent the accumulation of dangerous substances;
- adequate natural ventilation for any potential source of release inside any enclosure or building where the flow of air is liable to be restricted.
- enclosure within a cabinet or other suitable enclosure which is constructed of fire-resisting materials and directly provided with LEV exhausting to a safe place;
- adequate LEV, provided and positioned to prevent or minimise releases of potentially unsafe concentrations, into the work area or room;

## **Ensure that any release of a dangerous substance which may give rise to risk is suitably collected, safely contained, removed to a safe place, or otherwise rendered safe**

Where appropriate the management arrangements should include:

- consideration of the hazardous properties of the waste materials;
- prevention of waste materials from different sources being mixed without appropriate consideration of their compatibility;
- safe storage in suitable containers clearly labelled
- procedures and precautions for the safe collection and mixing of waste materials;
- prompt removal from workrooms of empty and nominally empty containers which may still contain residues of dangerous substances.

## **Avoid ignition sources and electrostatic discharges**

Controlling potential sources of ignition in a hazardous area may be achieved by:

- use of suitably-rated electrical equipment (e.g. intrinsically safe or flame-proof)
- ensuring electrical equipment is effectively maintained where poorly maintained electrical equipment can present a significant risk for example through worn brushes
- ensuring electrical equipment is properly earthed
- ensuring the auto-ignition temperature of the hazardous chemical is considered as some hazardous chemicals may ignite spontaneously above certain temperatures
- implementing administrative controls such as permit systems preventing hot work (for example, welding) in these areas

Where electrical installations or equipment are required to be located or used in a hazardous area e.g. lighting, mixers and stirrers, pumps, control systems, forklift trucks, detectors, torches etc., these items must be designed and constructed so that they cannot release energy within the hazardous area that is sufficient to cause an ignition. That is, such equipment must be suitably rated for use in a hazardous area.

Such design and construction techniques include 'intrinsically safe' or 'flameproof/encapsulated' equipment. Any equipment designed and constructed to operate within a hazardous area must also be supplied with documentation stating which zone (i.e. 0, 1 or 2) it is suitable to operate within.



## Control of ignition sources

It is impossible to avoid flammable atmospheres during spraying of flammable liquids and so control of ignition sources is essential. Ignition sources include:

- unprotected electrical equipment;
- heating appliances;
- smoking materials;
- welding and other similar hot work activities;
- sparks generated by the discharge of static electricity;
- internal combustion engines.

## Zoning

Flammable zoning is completed, warning signage displayed and standards of equipment based on the zoning.

## *Electrostatic charging*

Precautions should be taken to prevent vapours being ignited by the discharge of static electricity. British Standard BS 595837 gives general advice on the control of static electricity. In particular, non-conducting footwear and clothing made of synthetic fibres can cause electrostatic sparks, especially if they are worn in areas with non-conducting floors. Electrostatic build-up may be reduced by using antistatic footwear, clothing and floors.

## Segregate incompatible dangerous substances

Where mixtures of dangerous substances are incompatible, they should be separated or segregated to minimise the risks. Where limited space at premises means that it is not feasible to separate substances from other substances or hazards by distance alone, then segregation should be achieved by the provision of physical partitions of fire-resisting construction. Where incompatible dangerous substances are separated by distance, the risk assessment should demonstrate that the risk of propagation of fire between those substances is low.

## Reduce number of persons exposed to a minimum

## Provide and maintain fire suppression equipment

Explosion safety includes explosion suppression as well as explosion venting and isolation.

This method extinguishes the explosion just as it is beginning – and well before the pressure rises to a critical level. Explosion suppression systems use sensors to detect sparks or flames as they are created and instantly open connected containers of extinguishing agent. In the blink of an eye, these discharge a highly effective extinguishing powder and smother the germ of the explosion.



## Provide and maintain explosion pressure relief arrangements

Image showing explosion pop out panel

Explosion protection measures for plant and equipment processing dangerous substances include explosion relief venting, explosion suppression equipment, pressure-shock-resistant plant and pressure-resistant plant. The design of the protection measure should mitigate possible explosions by:

- relieving the explosion pressures and/or hot gases to a safe place outside of the workroom;
- suppressing the explosion before dangerous pressures build up;
- safely containing the explosion without the plant rupturing.

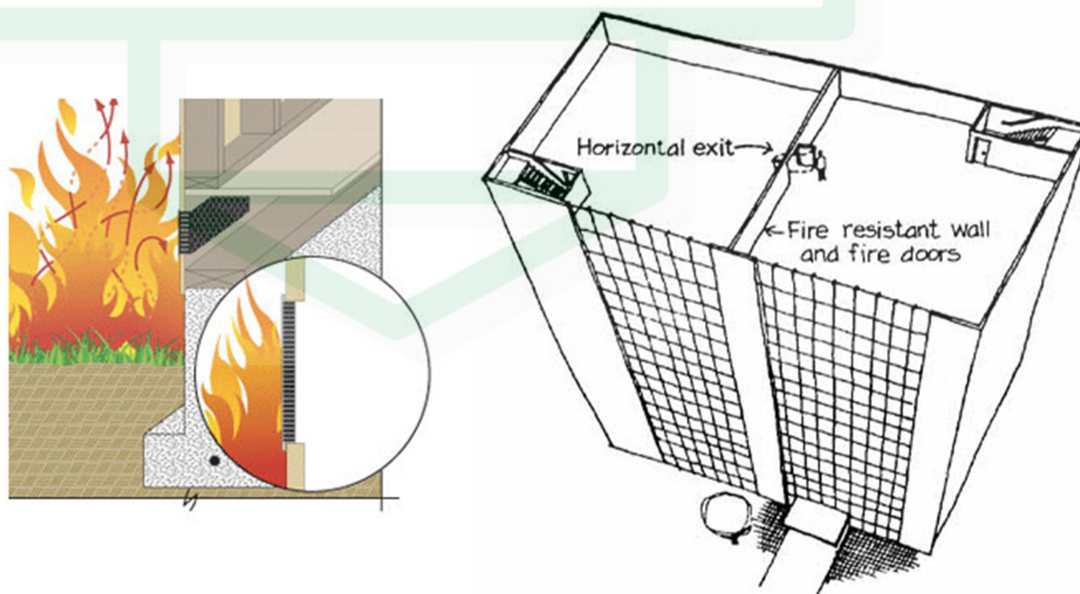


## Measures to avoid propagation of fires/explosions

Premises layout and equipment installation can mitigate the effects of a fire or explosion in cases where substance quantity/properties would have particular influence on the scale or nature of an incident. The following list is not in priority order.

- adequate separation of process areas from: other parts of the premises;
- measures are taken to prevent fire and explosion from spreading to other equipment;
- process areas are separated from the rest of the building by physical barriers
- physical barriers to prevent damage to containers, vessels & pipework
- ensure empty containers are removed from work areas
- adequate separation of storage areas from work areas

## Ensure premises are designed, constructed and maintained so as to reduce risk



The periods of fire resistance required should be determined by assessment of the fire hazard, taking account of its anticipated duration and severity. Physical barriers of fire-resisting construction should be capable of maintaining adequate fire protection to allow

sufficient time for evacuation and for emergency procedures to be implemented. Fire walls are a physical barrier of fire-resisting.

Storerooms and workrooms required to be of fire-resisting construction (i.e. fire resisting) should meet the following minimum requirements: every enclosing element that acts as a fire-resisting physical barrier should provide a minimum of 30-minutes' fire resistance in respect of integrity, insulation and, where applicable, load-bearing capacity.

**Any hazardous jobs involving dangerous substances are carried out under an appropriate system of work including permit-to-work.**

Hot work is any process involving grinding, welding, brazing, oxy cutting, heat treatment or any other similar process that generates heat or continuous streams of sparks. Undertaking hot work in areas where flammable or combustible chemicals or other materials are present creates a significant risk of fire or explosion. A hot work permit system is a system designed to eliminate or minimise risks from these activities by controlling when and how hot work is undertaken in these areas.

#### **6.4.1 EXAMPLE DSEAR Policy**

##### **1. General Statement**

It is the policy of the organisation to take all reasonable steps to secure the health and safety of employees or contractors who are required to work in potentially flammable atmospheres.

The organisation acknowledges that an explosion and fire incident can occur from the exposure of a flammable atmosphere to an ignition source. It is the intention of the organisation to ensure that any risks are reduced to a minimum.

The implementation of this policy requires the total cooperation of all members of management and staff. There will be full consultation with employee representatives through existing channels of communication.

This policy is intended to eliminate, prevent, minimise or control the risks associated with working in flammable atmospheres and to provide guidance on the measures that should be taken to ensure the safety of all staff, employees and others in the workplace.

The person with overall responsibility for implementing the provisions of this policy is:

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##### **2. Arrangements for Securing the Health and Safety of Workers**

The organisation will ensure that all operations with the potential to form explosive atmospheres are made as safe as is reasonably practicable given the constraints of current known technology.

###### **1. Elimination and Substitution**

The organisation will ensure where there is the potential for an explosive atmosphere to occur to investigate alternative means by which the tasks can be carried out to:

- a. eliminate the formation of flammable atmospheres or, where this is not reasonably practicable

- b. provide less hazardous alternatives.

## 2. Risk Assessment

Risk assessments on the potential formation of flammable atmospheres in the workplace will be carried out by those staff and employees that have been trained and are competent to do so. Risks that are identified will then be eliminated, minimised or controlled as far as is reasonably practicable.

## 3. Hazardous Area Classification

Where there is the potential for an explosive atmosphere to form, the location will be designated a hazardous area and classified in zones taking into account the likely frequency and duration of occurrence. Suitable warning signs will be displayed as appropriate.

## 4. Ignition Sources

Potential sources of ignition within the hazardous areas will be identified. Electrical equipment and protective systems will be selected taking into account the hazardous area classification. Other sources of ignition will only be introduced under the safe working practices of a hot work permit.

## 5. Arrangements for Accidents, Incidents and Emergencies

- a. Systems, training and any information required will be put in place so that staff and employees are able to manage and control any unwanted events if they occur.
- b. Emergency evacuation procedures will be practiced on a regular basis together with unscheduled rehearsals.
- c. All necessary warning signs and other information required will be clearly displayed.
- d. Warning systems will be checked and tested on a regular basis and in line with installers and suppliers instructions and other recommendations.

## 3. Duties of Managers and Supervisors

All managers and supervisors whose staff and employees work in potentially flammable atmospheres must ensure that:

- 1. dangerous substances which could result in the formation of an explosive atmosphere are not introduced into the workplace until a risk assessment has been undertaken and necessary risk control measures implemented
- 2. risk assessments are carried out and recorded only by those who are trained and are competent to do so
- 3. written instructions are available for all activities in hazardous areas and adhered by relevant employees
- 4. control measures are adequately maintained
- 5. staff and employees are provided with information instruction and training in how to work safely in areas with the potential for a flammable atmosphere to form

6. all accidents including fires, explosions, substance releases and other incidents are thoroughly investigated, remedial action taken and if required reported to the enforcing authority under the requirements of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013
7. employees follow all instructions given by managers and supervisors and adhere to any safe systems of work, permit to work systems and other safe working practices
8. managers and supervisors will not act foolishly in the workplace environment with work equipment and dangerous substances and ensure that their staff and employees do likewise
9. evacuation and other emergency procedures are practiced on a regular basis and emergency systems and equipment checked at pre-determined intervals and any shortcomings found rectified
10. no smoking rules are enforced and applied to all staff, supervisors and employees.

#### **4. Duties of Employees**

Employees must:

1. avoid introducing any source of ignition into a hazardous area, other than as authorised by a hot work permit
2. report immediately any shortcomings that are detected in working practices to supervisors and/or managers
3. comply with all instruction, training and other information provided to them for their safety
4. adhere to hazardous area specifications
5. use only equipment authorised for the hazardous area
6. not put the safety of others at risk by acting in a foolish manner
7. wear and use the appropriate personal protective equipment supplied.

#### **5. Information and Training**

Suitable, sufficient and appropriate training will be provided to all staff, supervisors and employees engaged on work in potentially flammable atmospheres. Training needs will be identified by \_\_\_\_\_ managers and \_\_\_\_\_ supervisors and reviewed regularly. Refresher training will also be provided on a regular basis. All training given will be recorded. All staff and employees understanding of the training given will be tested and validated.

#### **6. Directors of the organisation**

All directors and other board members of \_\_\_\_\_ Ltd will support the policy. They will ensure that the necessary resources, finances and management support are made available to ensure the health and safety of all who work for the organisation.