Stopping things going bang at work

Flammable substances such as solvents and fuels are present in many workplaces, but they can cause devastating fires and explosions if handled incorrectly. This can be avoided by properly assessing the risks and adopting precautions such as safe storage.

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The risk of fire and explosion from substances such as chemicals, solvents, fuels and fuel gases is ever present in many working environments. The problem occurs because as well as being highly flammable, if many of these substances are exposed to the air they evaporate, causing dangerous vapours to accumulate. This in turn poses a serious risk of ignition or explosion.

It goes without saying that this scenario can lead to major loss of life and serious injury, as well as significant damage to property. As a result, employers working with and handling dangerous substances such as chemicals, fuels and gases have a legal obligation to tackle the associated fire and explosion risks. This means preventing the release of dangerous substances; preventing or controlling sources of ignition; ensuring that products are stored correctly; and establishing appropriate procedures for the delivery, handling and use of these substances.

DSEAR regulations

The main legislation governing the safe use and storage of flammable substances at work is the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). The regulations require employers to assess and eliminate or, where this is not practicable, control the risk of fire or explosions from dangerous substances.

As well as requiring employers to tackle the risks from substances such as petrol, solvents and liquefied petroleum gas, the regulations require controls to be introduced on explosive dusts which can be ignited by sparks or flames from work processes.

Employers should firstly attempt to completely eliminate the fire and explosion risks from dangerous substances – for example, by using a non-hazardous substance. But if this proves impractical, measures must be taken to control the risks and mitigate the effects of any fire or explosion. Control measures must be applied in a priority order, starting with reducing the quantity of the dangerous substance to a minimum. Mitigation measures will include reducing the number of employees exposed to the hazard and providing staff with suitable personal protective equipment.

INFERNO: Substances such as solvents and fuels can give off vapours which pose a risk of ignition, triggering serious fires.

Safe storage

One area that employers should pay close attention to when preventing fires and explosions is the safe storage of flammable liquids in process areas, workrooms, laboratories and similar working areas. The DSEAR regulations apply to the indoor storage of all flammable substances, which means employers must eliminate or control the risk, reduce the quantity of substances stored on site and mitigate the effect of any foreseeable fire or explosion.

Three elements must be present for a fire to start; heat, oxygen and fuel, and if one of these can be removed, the risk of a fire will also be removed. Heat can be any ignition source which generates heat, such as a mechanical spark, static electricity, or a naked flame from welding equipment. Oxygen is of course present in the air, while fuel can be any flammable or combustible liquid or vapour.

Some of the general principles to follow when storing or working with flammable or explosive substances at work are explained below.

Flammable liquids

Flammable liquids must be stored in a separate area of the workplace in purpose made bins or cupboards that comply with UK regulations. During dispensing, there must be good ventilation and sources of ignition – such as a spark from a tool or electrical component – must be removed. Containers should also be kept closed when not in use, and whenever possible safety containers with self-closing lids and flame arresters should be used. It is also a good idea to have a suitable spill kit on hand to capture any leaks which could pose a safety or pollution risk.

Flammable dusts

If flammable or explosive dusts are present steps must be taken to remove any sources of ignition – for example, by ensuring that no naked flames are present. Work areas should also be regularly cleaned to keep them dust-free.

Flammable solids

Many types of packaging material such as plastic foam, polyester wadding and textiles give off dense black smoke when they burn, so they should not be stored close to heaters or electrical equipment which could act as an ignition source.

Flammable gases

Gases are often stored at very high pressure and any uncontrolled release can fill a large area quickly. This is particularly the case with liquefied gases such as LPG. As a result, gas cylinders should be stored in a designated area in purpose built stores. The cylinders should also be restrained and you should try to protect the valves from potential damage caused by impacts.

Oxygen

Materials that ordinarily burn slowly will burn vigorously in an oxygen rich atmosphere so oxygen cylinders must also be stored in a secure and controlled manner. In addition, oxygen must never be used as a substitute for compressed air, or to sweeten the air in a working area or confined space. Furthermore, grease or oil must not be used on equipment containing oxygen as they can self-ignite.

Reactive chemicals

Some chemical products incorporating organic peroxides can explode if not stored and handled correctly and certain chemical substances can react with incompatible materials or contaminants, causing an explosion. For example, oxidising chemicals can cause flammable materials to ignite and some substances such as sodium react violently when they come into contact with water. In addition, chemical products should be stored and used at the recommended temperatures to prevent dangerous decomposition or unwanted reactions. Information on storage and handling temperatures can be found in the substance's material safety data sheet or by contacting the manufacturer.

Using flammable liquids

If flammable liquids are used in a work process, it is likely that a limited quantity will have to be stored and readily available inside the workplace. In assessing the risks from flammable substances, employers will need to justify the requirement to store any particular quantity of flammable liquid within the work room or working area.

However, the guiding principle is that only the minimum quantity needed for

DESTRUCTION: Sparks from electrical equipment can trigger explosions if dust clouds are present in the atmosphere.

RISKY: Only the minimum quantity of a flammable substance should be present in the actual work area.

frequently occurring activities or an amount required for use during half a day or one shift should be present in the work room. The actual quantities allowed inside the work area or building will depend on the work activity and also the arrangements in place for controlling the fire risks.

When not in use, containers used for storing flammable liquids needed for ongoing work should be kept closed and placed in suitable fire-resistant cabinets or bins which are also designed to retain spills. The cabinets should be located in designated areas that do not interfere with any escape route from the working area. Ideally, this will be away from the processing area.

Flammable liquids should also be stored separately from other dangerous substances that pose a risk of fire or which could compromise the integrity of the container. For example, substances with oxidising and corrosive properties should not be stored together.

Maximum storage quantities

The Health and Safety Executive has produced guidelines on the maximum quantities of flammable substances that should be stored in cabinets and bins. These are no more than 50 litres for extremely flammable, highly flammable and flammable liquids with a flashpoint below the maximum ambient temperature of the workroom/working area and no more than 250 litres for other flammable liquids with a higher flashpoint of up to 55°C. These quantities are recommended maximums and good practice, rather than absolute limits. As a result, the HSE sometimes allows flexibility on the quantities stored – for example, if the design of the building and/or the pattern of work makes it difficult to comply with the limits.

However, if an employer needs to store quantities of flammable substances in excess of the recommended maximums, they must be able to demonstrate that this is unavoidable and necessary. The risk assessment should therefore take account of:

- The properties of the materials to be stored or handled (for mixed storage the worst case situation should be applied, i.e. all materials in the storage cabinets or bin should be considered as being as dangerous as the one that has the lowest flashpoint).
- The size of the workroom /working area and the number of people working in it.
- The amount of flammable liquid being handled in the working area and the quantities of liquid that may be accidentally released or spilled.

Employers also have a legal responsibility to ensure that any cabinets or bins used for the storage of flammable substances meet the minimum legal requirements and they should not use cabinets with enhanced fire performance to store flammable substances in general work areas if it is possible to provide an outdoor storage area or a dedicated, separate store room.

Outdoor storage

If dangerous substances such as oils and chemicals are stored externally, employers also need to ensure they do not pose a risk of polluting nearby drains or watercourses. Companies can be prosecuted for such incidents even if the problem is caused by vandals.

Employers must therefore think about the amounts of products that need to be stored; the types of containers they are held in (for example, 205 litre drums or 1,000 litre intermediate bulk containers); and the need for spill pallets or standalone stores with built-in sumps to capture spills and leaks.

The bund of any storage unit or a spill pallet must be able to contain at least 110% of the volume of the largest container or 25% of the total volume stored, whichever is greater. They must also be made of a material compatible with the chemical being stored.

Storage areas should also be located

Working with flammable substances – key questions

1. **Is there good natural air movement in and around where the flammable substances are stored and used?**
   If not consider using mechanical air ventilation such as extractors. Good ventilation will mean that any vapours given off from a spill, leak, or release will be rapidly dispersed.

2. **Have all the obvious ignition sources been removed from the storage and handling areas?**
   Ignition sources can be very varied, and include sparks from electrical equipment, welding or cutting tools, hot surfaces, open flames, static charge etc. The simple action of decanting a flammable liquid from one container to another can also cause an explosion if the two containers have not been earthed.

3. **Are flammable substances being kept in the correct types of container?**
   The container may need to be fire rated so it can withstand heat and flames for a set period of time. If there is a spill is there a way of containing it and preventing it from spreading?

4. **Can a flammable substance be substituted for a less flammable one?**
   Or can it be eliminated from the process completely? Processes and products evolve, so it is worth asking suppliers of flammable or explosive substances if they can suggest ways of making the product safer to use.

5. **Are flammable substances stored and used in a different area to other work processes?**
   Separating them will lessen the risk of an incident and improve workplace safety.

in suitable areas, for example, away from drains and staff should also be trained on how to deal with spills. Spill kits and absorbent materials should be present on site and a pollution incident response procedure should be drawn up and followed at all times.

It is always better to try to keep any spill of hazardous substances on the surface, so spill kits should be located next to chemical and oil storage areas and sealing products should be positioned next to the site drains. An inventory of all the chemicals on site should be drawn up and should be kept in a location where it can be easily accessed by spill responders or outside agencies, such as the fire service. The location of spill containment equipment should also be marked on a site plan, and this too should be readily available to staff or emergency responders.

More guidance on the storage of hazardous substances can be found on the HSE's website at www.hse.gov.uk, while guidance on preventing worksite pollution can be found on the Environment Agency's website at: www.environment-agency.gov.uk

Separation distances

Finally, when considering the outdoor storage of flammable liquids, employers should pay attention to separation distances. These are the distances at which flammable liquids should be stored from occupied buildings, boundaries, process units, flammable liquid storage tanks or any sources of ignition.

The distances are:

- up to 1,000 litres – two metres
- 1,000 to 100,000 litres – four metres
- above 100,000 litres – 7.5 metres.

If it is possible to store flammable liquids at the relevant distances a standard, single skinned, fully bunded storage unit can be used. However, if the separation distance cannot be achieved the storage unit must be one-hour fire rated to comply with UK legislation.

Empteezy is a leading manufacturer and supplier of storage containers for polluting substances. For more details see www.empteezy.co.uk

PROTECTED: If possible flammable substances should be substituted for less dangerous ones.