

Recommendations

for the storage
of aerosol
products

RC19

LOSS PREVENTION RECOMMENDATIONS

These recommendations are part of a series of insurer documents developed under the Insurers' Fire Research Strategy (InFiReS) Funding Scheme and published by the FPA. InFiReS membership comprises a group of UK insurers that actively support a number of expert working groups developing and promulgating best practice for the protection of property and business from loss due to fire and other risks. The technical expertise for the Recommendations is provided by the Technical Directorate of the FPA and experts from the insurance industry who together form the InFiReS Risk Control Steering Group.

The aim of the FPA series of Recommendations is to provide loss prevention guidance for industrial and commercial premises and systems. The series continues a long tradition of providing authoritative guidance on loss prevention issues started by the Fire Offices' Committee (FOC) of the British insurance industry more than a hundred years ago and builds upon earlier publications from the Loss Prevention Council and the Association of British Insurers.

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Scope

These recommendations are applicable to the storage of self-pressurised flammable aerosol products in warehouses or similar premises and are intended to give guidance on ways in which the risks of fire initiation and fire spread may be reduced to a minimum. This guidance is not intended to be applied to sales areas of retail premises.

Introduction

The hazard potential of aerosols in storage is a combination of fire and exploding aerosols.

The fire hazard depends on the flammability of the contents of the aerosol. On exposure to an ignition source (or heat), flammable aerosols (suspensions of solid or liquid particles in a gas) can readily ignite and burn. Also, leaks of flammable gases can form flammable mixtures with air, which in a confined space with an ignition source can cause rapid fire growth or an explosion. Aerosol contents' flammability will be detailed in suppliers' product safety data sheets in accordance with the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP, ref.1), and aerosol containers' labels carry information about contents and flammability.

Note: The supplier of an aerosol dispenser is required to label the product with the flammability or identify 'X% by mass of the contents are flammable'. Aerosols may be labelled as 'Flammable', 'Highly flammable' or 'Extremely flammable', determined by the contents, in compliance with the CHIP Regulations (ref. 1).

When consideration is being given to the storage of aerosols with flammable contents, they should be the subject of a risk assessment in accordance with the requirements of the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR (refs 2 and 3)). Previously, the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (revoked) (ref. 4) required aerosols with contents totalling more than 500cc of highly flammable liquid to be stored in accordance with the Regulations.

Premises containing in total 25 tonnes or more of liquefied petroleum gases held at a pressure greater than 1.4bar absolute are 'notifiable' under the Notification of Installations Handling Hazardous Substances Regulations 1982 (ref. 5). Those controlling premises containing in total 50 tonnes or more of liquefied extremely flammable gases (including LPG) need to oversee compliance with the Control of Major Accident Hazards Regulations 1999 (COMAH (ref. 6)). There are additional requirements (Regulations 7 to 14) for premises containing more than 200 tonnes (ref. 6).

Aerosols with low boiling point contents present an exploding aerosol hazard. An explosive pressure release, projecting the aerosol, may occur if the aerosols are exposed to heat. In fires, aerosols can be projected considerable distances with their contents or plastic valve parts alight. Projectile distances of over 40m have been recorded (ref. 7) and exploded burning parts may be projected similar distances. This behaviour has resulted in multiple fire starts. Fighting such widespread fires has proved unmanageable for firefighters and has resulted in the loss of entire warehouses.

Further general guidance on the storage of aerosols is given in the BAMA guide (ref. 8).

DEFINITIONS

Aerosol

An aerosol is any suspension of solid or liquid particles in a gas. (Throughout this document the term 'aerosol' refers to an aerosol dispenser together with its contents unless otherwise stated.)

Aerosol dispenser

Any non-reusable container made of metal, glass or plastic containing a gas compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid state. (Throughout this document the term 'aerosol' refers to an aerosol dispenser together with its contents.)

Flammable aerosol

An aerosol is defined as 'flammable' if the contents of the aerosol dispenser include more than 45% by weight or more than 250g of flammable contents. 'Flammable contents' are: gases which are flammable in air at normal pressure; substances and preparations in liquid form which have a flashpoint less than, or equal to, 100°C, as defined in the EEC Directive (ref. 9) relating to aerosol dispensers.

Liquefied petroleum gas (LPG) (ref. 10)

Commercial butane or propane or any mixture of the two.

RECOMMENDATIONS

1. Storage

Aerosols should be segregated and isolated from other stock, preferably in a separate building or fire-resisting enclosure. Where this is impracticable, the aerosols should be totally enclosed within a stout steel mesh cage of appropriate size and strength, including self-closing doors, to prevent projection of exploding aerosols. Expanded metal or wire mesh may be used providing the metal is at least 2mm thick and the mesh size does not exceed 25mm by 25mm. Small quantities of aerosols can be stored in mesh pallets or bins of similar construction.

Other than the aerosol packaging, containers and wooden pallets on which they stand, no combustible material should be stored inside or within 6m of any protective cage. Plastic pallets should not be used.

- 1.2 The premises should be sprinkler protected, see Recommendation 2, Fire extinguishment, below.
- 1.3 Aerosols should be stored in a cool, dry, well ventilated area, free from the risk of freezing and where the ambient temperature cannot exceed 40°C.
- 1.4 To prevent the possible accumulation of flammable vapours, which are denser than air, aerosols should not be stored in or adjacent to basements or similar sunken areas.
- 1.5 Smoking, the use of naked flames (e.g. shrink wrapping guns, gas and oil heaters), and battery charging and hot work should be prohibited inside and within 6m of buildings in which aerosols are stored.
- 1.6 All electrical equipment installed within 1m of the floor level or where there is inadequate provision of ventilation should comply with BS EN 60079-14: 2003 (ref. 11).
- 1.7 Special care should be taken in the storage and handling arrangements of aerosols to prevent accidental damage due to crushing, falling or impact. Suitable precautions should include constraint to pallets, well supported stacks or racking. There should also be a clear space between the ceiling and the top of the stack.
Note: LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845 define the clear space limit for sprinkler installations (ref.12).
- 1.8 Aerosol storage areas should be kept clean and tidy at all times.
- 1.9 Any damaged aerosols (aerosols affected by rusting, impact or other causes) should be immediately removed from the storage area to the open air where any vapours can be safely dispersed. Unless all of the contents of the aerosols can be positively identified as non-flammable the

following precautions should be observed, but **EXTREME CARE IS ESSENTIAL WHEN HANDLING LEAKING AEROSOLS**:

- 1.9.1 Powered vehicles must not be used to move damaged stock, unless they are specially adapted for use in flammable atmospheres. Vehicles powered by internal combustion engines should not be used.
- 1.9.2 The route to the open air should be as short as practicable, avoiding any sources of ignition on the way.
- 1.9.3 Once in the open air, the aerosols should be taken to a designated area that is safe, well ventilated, as far as possible from buildings, outside plant and storage, and from ignition sources such as incinerators and vehicles.
- 1.9.4 Any obviously leaking aerosols should be totally discharged into suitable containers so that the contents can be collected and safely treated. Other aerosols should be carefully examined and, if necessary, 'leak tested' in a container of water, so that any found to leak can be treated as above and those found undamaged can be returned to storage.
- 1.9.5 Even when emptied, damaged aerosol containers should be kept in this safe area for at least 24 hours longer to allow any final traces of propellant or flammable contents to dissipate safely.
- 1.9.6 **AEROSOL CONTAINERS MUST NOT BE INCINERATED ON SITE EVEN WHEN EMPTY.** The disposal of aerosol containers is a task which should only be carried out by specialist organisations off-site.

2. Fire extinguishment

The premises should be protected by a sprinkler system, to prevent the fire spreading to aerosols and to limit fire in aerosols. The system should comply with *LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845* and, in particular, Technical Bulletin 216, 'Sprinkler protection of aerosols' (ref. 12). Technical Bulletin 216 makes specific requirements for alcohol-based and hydrocarbon-based aerosols.

- 2.1 In order to extinguish fires and cool aerosols, which are exposed to the heat, it is recommended that hose reels should be installed in accordance with the relevant British Standard (ref. 13).
- 2.2 In certain high-risk aerosol storage (e.g. petroleum-based products), the provision of adequate specialist foam or dry-powder extinguishers appropriate to the hazard should be considered.

REFERENCES

1. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002, Statutory Instrument 2002, No. 1689.
2. Dangerous Substances and Explosive Atmospheres Regulations 2002, SI 2002, No. 2776.
3. Health and Safety Executive, *Dangerous Substances and Explosive Atmospheres*, Approved Code of Practice and Guidance, L138, HSE, 2003.
4. Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972. Statutory Instrument 1721, No. 917.
5. Notification of Installations Handling Hazardous Substances Regulations 1982, Statutory Instrument 1982, No. 1357.
6. Control of Major Accident Hazards Regulations 1999, Statutory Instrument 1999, No. 743.
7. Loss Prevention Council, Report on small scale aerosol fire tests, LPC Report No FE/69/89.
8. British Aerosol Manufacturers Association, *Guide to good practice for the storage of aerosols in manufacturing/wholesale warehouses and retail stores*, see the BAMA web site, www.bama.co.uk
9. Council Directive of 20 May 1975 on the approximation of the laws of the Member States relating to aerosol dispensers, 75/324/EEC, *Official Journal of the European Communities*, 1975, 18 (L 147) 40-47.
This Directive has been implemented in the UK by the following Statutory Instruments and guidance:
 - Aerosol Dispensers (EEC Requirements) Regulations 1977, SI 1977, No. 1140.
 - Aerosol Dispensers (EEC Requirements) (Amendment) Regulations 1981, SI 1981, No. 1549.
 - Aerosol Dispensers (EEC Requirements) (Amendment) Regulations 1985, SI 1985, No. 1279.
 - Aerosol Dispensers (EEC Requirements) (Amendment) Regulations 1996, SI 1996, No. 2421.
10. Fire Protection Association, *Recommendations for the storage, use and handling of common industrial gases in cylinders including LPG*, RC8, FPA, in preparation.
11. BS EN 60079: *Electrical apparatus for explosive gas atmospheres*: Part 14: 2003: *Electrical installations in hazardous areas (other than mines)*, British Standards Institution.
12. *LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845*, Technical Bulletin 216, 'Sprinkler protection of aerosols', Fire Protection Association, 2003.
13. BS EN 671: *Fixed firefighting systems. Hose systems*: Part 1: 2001: *Hose reels with semi-rigid hose*, British Standards Institution.