

Storage and Handling of Pressurised Aerosol Containers

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Aerosols can pose a significant fire hazard.
This document provides guidance on issues to consider when storing and handling aerosols.



Storage and Handling of Pressurised Aerosol Containers



Introduction

Aerosols are common and used regularly and repeatedly in day to day life, e.g., air fresheners, medicinal sprays, deodorants, polishes, cleaners, etc. However, aerosols are containers with pressurised contents and they can pose a significant fire hazard.

Aerosols can hold highly flammable or combustible substances combined with a pressurised (liquefied), sometimes flammable gas (called the propellant). When mechanically damaged or exposed to sources of heat or fire, aerosols can expand, release their contents, ignite and even explode.



A fire in an aerosol storage area can spread very quickly, with heated and ruptured aerosol containers releasing their contents (a high fuel load) and potentially becoming projectiles, spreading any fire across a space and also creating potential life safety and environmental exposures. This then can result in a multiple-seat fire, which will be very challenging for any manual firefighting efforts and/or can easily overwhelm any installed fixed fire protection systems such as automatic sprinkler protection.

While volumes of aerosols stored within a workplace will vary immensely, any quantity of aerosols has the potential to start and spread a fire quickly. Therefore, regardless of the volume of aerosols held or stored, the risks posed, their management and their storage need to be clearly understood and effective control measures (including storage locations, physical barriers, handling controls and fixed fire protection) need to be implemented and rigorously maintained.

Finally, when considering aerosols and their storage it is also essential to consider their movement and transportation. How are they safely moved from point A to point B? What assurance is there that all the measures in place when they are 'static', are also considered when they are being moved, including the way they are moved and transported.

Note: Please be aware this guidance does not include aerosol manufacture, filling or dispensing.

Local Regulatory Requirements

It is important that building owners and occupiers understand their local rules, regulations, legislation and requirements in this area, ensuring that any regulatory requirements are the minimum standards applied when considering aerosol storage and handling.

Fire Test Data

Data produced by the National Fire Protection Association (NFPA) as part of Standard 30B - Code for the Manufacture and Storage of Aerosol Products:

Depending on the type of aerosol, in fire tests the first aerosol to rupture has been seen to occur at:

- 30 seconds to 60 seconds after ignition in racked storage arrays
- 90 seconds to 120 seconds in palletized storage arrays

From the above data we can see that in less than 2 minutes after a fire has started, aerosols can potentially start to ignite, projectile and explode. Consider this in relation to life safety, fire spread and fire suppression. Time is definitely of great importance with these hazardous commodities.

LOSS PREVENTION STANDARDS

Key Terminology

Aerosol

A suspension of solid or liquid particles in a gas and contained in a non-reusable container with dispenser.

Aerosol Container

Can be glass, plastic or normally metal cans. They are used for distributing a wide-range of substances via a valve actuated nozzle. In most cases the valve actuated nozzle is of plastic construction.

Aerosol Propellant

The liquefied or compressed gas that expels the contents from an aerosol container when the valve actuated nozzle is depressed. A propellant is considered flammable if it forms a flammable mixture with air or if a flame is self-propagating in a mixture of the propellant and air.

A flammable propellant is generally a hydrocarbon gas, such as butane, isobutane, propane, and various blends of these gases.

In the aerosol container the gas is pressurised as a liquid, when released by depressing the valve/actuator the liquid is depressurised turning it to gas. If exposed to an ignition source this gas will ignite. If the container releases its entire contents the heat release and fire can be significant.

Things to consider are:

- How many aerosol cans there could be on a single pallet load
- **If one or two ignited or were exposed to heat, and then released their contents...**
 - Either simultaneously or in very short time intervals after each other

The domino effect from one container igniting and exposing those adjacent, releasing their contents, exposing those adjacent and so on, can be catastrophic. Add to this the potential for the container to missile and in many cases, there is something similar to a firework display.

In addition to flammable propellants, some aerosols used in food manufacture (common uses are aerosol whipped cream canisters and cooking sprays) and some in the automotive industry have nitrous oxide as the propellant. In some cases, carbon dioxide is also used as the propellant.

Nitrous oxide is a colourless gas (at room temperature and pressure) that is commonly used for sedation and pain relief but is also used by people to feel intoxicated. At room temperature, it is a non-flammable gas, but at elevated temperatures such as when exposed to heat or involved in a fire, nitrous oxide is a powerful oxidiser similar to molecular oxygen. In a fire scenario, this could accelerate and exacerbate any fire dramatically.

While relatively non-toxic, nitrous oxide has a number of recognised ill effects on human health, whether through breathing it in or by contact of the liquid with skin or eyes.

Carbon dioxide is also a colourless gas at room temperature and pressure. It is an asphyxiant gas which is not classified as toxic or harmful. In concentrations up to 1% (10,000 ppm), it will make some people feel drowsy and give the lungs a stuffy feeling. Concentrations of 7% to 10% (70,000 to 100,000 ppm) may cause suffocation, even in the presence of sufficient oxygen, manifesting as dizziness, headache, visual and hearing dysfunction, and unconsciousness within a few minutes to an hour.

LOSS PREVENTION STANDARDS

Classification of Aerosols

Aerosol classification depends on where they are located in the world as different countries have their own classification.

It is important to understand the aerosol classification as it indicates how it will behave in a fire and its heat release potential. This information can be used when undertaking risk assessments and also to drive any protection strategies for fixed fire suppression.

Three good references are:

- UK – RISC Authority/Fire Protection Association - [RC19: Recommendations for the storage of aerosol products](#)
- British Aerosol Manufacturers' Association (BAMA) - [The Warehousing of Aerosols: A BAMA Guide to Safe Storage](#)
- North America – NFPA - [30B - Code for the Manufacture and Storage of Aerosol Products](#)

In the UK aerosols are classified as follows in accordance with a specific testing regime. The aerosol is classified as:

- 'Extremely Flammable' if it contains 85% or more flammable components and the chemical heat of combustion exceeds or is equal to 30kJ/g; or
- 'Flammable' if the contents of the aerosol dispenser include more than 45% by weight or more than 250g of flammable contents
- 'Non-flammable' if it contains 1% or less flammable components and the chemical heat of combustion is less than 20 kJ/g

Aerosols may be classified as 'flammable' after undergoing further tests based on the heat of combustion and an ignition distance test. Those that do not meet the specified requirements are determined to be 'extremely flammable'.

From NFPA 30B, aerosol products are classified as Level 1, 2 or 3 with Level 1 being the least hazardous in a fire and Level 3 being the most hazardous:

- Level 1 aerosol products are those with a total chemical heat of combustion that is less than or equal to 20 kJ/g (8600 Btu/lb). Examples include mostly water-based, toiletries and some cleaning agents
- Level 2 aerosol products are those with a total chemical heat of combustion that is greater than 20 kJ/g (8600 Btu/lb), but less than or equal to 30 kJ/g (13,000 Btu/lb). Examples include water miscible flammable and combustible liquids, furniture polish, hairspray and other cosmetic items, and windshield de-icer
- Level 3 aerosol products are those with a total chemical heat of combustion that is greater than 30 kJ/g (13,000 Btu/lb). Examples include insoluble flammable and combustible liquids, lacquers, spray paints, auto engine cleaning products, insecticides and some antiperspirants

Fire Risk Assessment, Other Risk Assessments and Local Regulatory Requirements

All storage and handling of aerosols should be subject to formal risk assessments in line with relevant local regulations and legislation.

In all territories, a fire risk assessment, undertaken by a competent person in accordance with any national fire safety legislation, should be completed.

In the UK, in addition to the fire risk assessment, an assessment should also be undertaken by a competent person in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 ([DSEAR](#)). Also, premises where 150 tonnes or more of flammable aerosols, including LPG (Liquefied Petroleum Gas) are stored, need to be managed in compliance with the Control of Major Accident Hazards Regulations ([COMAH](#)).

In addition to the above, the Notification of Installations Handling Hazardous Substances (Amendment) Regulations 2002 ([NIHHS](#)) requires any site which contains or is liable to contain 150 tonnes or more of a 'Hazardous Substance', as specified in the Regulations, shall be notified to the Health and Safety Executive (HSE).

In the European Union these assessments are underpinned by the following Directives:

- The ATEX directives are two EU directives describing the minimum safety requirements for workplaces and equipment used in explosive atmospheres. The name is an initialisation of the French term Appareils destinés à être utilisés en ATmosphères EXplosives (French for 'Equipment intended for use in explosive atmospheres')
- Directive 2012/18/EU or the Seveso-III Directive (full title: Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC) is a European Union directive aimed at controlling major chemical accident hazards. Seveso-III is implemented in national legislation and is enforced by national chemical safety authorities

In all territories, planning regulations for any site will obviously apply. The hazards posed by the aerosol storage, the location, the proposed controls, any restrictions, etc. will drive how these regulations are enacted and enforced, so shaping any given site. These should always be followed and adhered to.

Labelling (in the UK)

Aerosols must be labelled as 'flammable' or 'extremely flammable', as determined by the contents, in compliance with the Aerosol Dispensers Regulations. Where an aerosol contains flammable components but the aerosol has been shown by testing to be neither 'flammable' nor 'extremely flammable' it must be labelled with the wording 'X% by mass of the contents are flammable'.

Aerosol Dispensers Regulations 2009: for aerosol dispensers placed on the GB market, the UKCA marking is the new compliance mark and only aerosol dispensers marked with the UKCA marking can be placed on the GB market. [Click here](#) for further guidance.

In some instances, the packaging and labelling can be misleading such as where flammable aerosol products are transported with a 'limited quantity' designation. Further guidance is available [here](#).

Central to this is the site management, transporter/haulage company, third party logistics provider, etc., all taking ownership of the hazardous materials and actually understanding what is being held, transported and received.

As an example, at Aviva when one of our consultants was undertaking a site visit, we discovered stocks of aerosols in warehouses where a self-adhesive LQ (limited quantity) label was stuck over the 'red flammable hazard' label. At a glance this looked like a different hazard and therefore care and diligence is required when considering the actual risk posed.

Appropriate understanding and assessment of the aerosols in possession is always recommended. To help confirm this or if there is any doubt at all, the Material Safety Data Sheets (MSDS) should be obtained, reviewed and assessed to understand the commodities in store, the classification of the aerosols and the risk posed. The label is just a label.

Regardless of the geographical location, an appropriate understanding of the aerosol(s) proposed to be stored and handled is required, and all of the information detailed below should be detailed:

1. What type of aerosols are to be stored?
2. The quantity of aerosols?
3. How are the aerosols to be stored; in cardboard boxes, shrink wrapped, types of pallets, in metal containers, etc.?
4. What are the proposed storage arrangements; racked, sold pile, storage height, aisle spaces, flue spaces, other commodities, etc.?

Key Hazards

The storage and movement of aerosols pose a wide range of hazards including, but not limited to the following:

- Fire inception risk when they are exposed to sources of heat (from heaters; generated by processes; utilities; mobile plant; sunlight, etc.) they can expand, breach, and ignite leading to fire-inception and growth
 - Aerosols should be stored in a cool dry place out of direct sunlight and away from any heaters
 - **Consideration should be given to potential 'leaking' aerosols**
- Damage to the container and/or the dispensing mechanism, releasing the contents
 - Consider how the dispensing mechanism will behave in the early stages of a fire. These are generally a small plastic component and as such will fail (melt/burn) and release the pressurised contents
 - Piercing of the container, during transport and handling, if damaged or dropped increases the risk of release and fire-inception
 - Consider static or electrical devices as a means of ignition if the contents are released
- Explosion is a risk depending on the substance held within the container and how it is treated, damaged (or leaking), heated, the ventilation and any ignition sources
- Fire load and fire development based on the number, nature and arrangements of the aerosols. Depending on their type, aerosols can provide a significant fire load and any fire can develop very quickly
- Projectiles and missiles are an issue, as the aerosol containers are under pressure and can contain **flammable materials. Once exposed to heat or a fire, a container can 'fire-off' like a firework across a building, creating a flaming missile and multiple seats of fire.** Any number of these projectiles can expose a building to a significant loss in a very short time

Control and Manage the Exposure

When considering how to control and manage the exposure of aerosols all aspects of the arrangements should be considered:

Establishing the Level of Risk

The first step in understanding the level of risk and exposure, is establishing what quantities of aerosols are held on a site, what their hazard classification is and where they are held/proposed to be held. Storage requirements should be based upon the classification of the aerosols being held. These should be fully understood and clearly documented, including with full and expected inventories and material safety data sheets.

- Stocks of aerosols should be kept as low as possible at all times
- Temporary storage arrangements should be prohibited as the potential exposures posed could be significant and potentially catastrophic to the organisation

While guidance in non-sprinklered buildings in the UK does not limit the storage quantities, NFPA 30B does as it details that the maximum quantities in non-sprinklered warehouses should be 454 Kg of level 2 and 3 aerosols.

In the UK within sprinklered buildings, the current restriction is to a single fenced-off/cage size of 125m²; but there is no restriction on height of the storage. There is also no restriction on the number of cages per building or fire area.

In understanding an exposure and risk, consideration should be given to the size of any fire area, fenced-off/caged area and the number of fenced-off/caged areas in any given fire area. Regardless of regulations and rules, it is worth keeping in mind:

- If this number of aerosols actually catches fire, how is it going to be contained and extinguished?
- How will the business mitigate and recover from such an event?

The HSE Guidance HSG71: [Chemical Warehousing – The storage of packaged dangerous substances](#), includes guidance on aerosols storage (paragraphs 164 to 171), but there are no limits indicated with regards to the quantity of storage is permitted.

The British Compressed Gases Association Code of Practice 18 document entitled [The Safe Storage, Handling and Use of Special Gases](#) provides technical and safety guidelines for the safe storage and handling of special gases in transportable containers.

Damaged Aerosols

A further consideration is understanding how many damaged or discharged aerosols are held or stored on site. This should be considered in relation to a site's waste management practices and any associated permissions. If damaged or waste aerosols are held in the UK, then this may impact on any Pollution Prevention and Control Permit issued.

Pollution prevention and control (PPC) regulates certain types of business, such as those carrying out: power generation, manufacturing and other industrial activities.

Ignition Source Control

When considering aerosols there should be strict control of all potential ignition sources. The basis of this should be formal risk assessments and where appropriate there should be formal hazardous area classification supported by zoned layout drawings and documentation. The following should be considered:

- Arson and malicious damage
- Electrical devices including fixed wiring and portable appliances
 - Inappropriately specified?
 - Faulty?
 - Inspected, tested and maintained in line with good practice and local regulatory frameworks?
- Smoking should be prohibited internally and within 10m of any combustible materials
- Hot work should be prohibited within any aerosol storage and handling area
 - **Any works should be removed to a 'safe' location or only be completed via 'cold' methods**
- Static electricity, including from:
 - Personnel
 - Any shrink wrapping operation
- Lightning protection should be considered for the building in line with local building regulations
- Forklift trucks and battery charging should be appropriately risk assessed, rated and arranged
- Stocks of aerosols should be kept away from sources of heat at all times (including when in storage, at order picking lines and at marshalling areas) including:
 - Any heat generated from work processes, utility pipes, heaters, etc.
 - Sunlight
- Items such as mobile phones, matches, lighters and e-cigarettes should be prohibited in aerosol storage areas

Storage - In Small Quantities

Even when present in small quantities such as a workshop, maintenance area, small stock room, etc., small or limited quantities of aerosols should always be considered as part of the site risk assessments.

Damage, waste, ignition sources and storage arrangements should all be considered, as previously discussed. In simplistic terms, small amounts of aerosols should always be stored in normally closed approved/listed flammable liquids cabinets. The potential for even 1 or 2 aerosols to be exposed to heat or a fire and missile, is enough to warrant their containment and securement. A small number of aerosols has the potential to cause or exacerbate a fire significantly.

Construction and Fire Compartmentation

Bulk aerosol storage ideally should be held in a separate, detached purpose-built building. Aerosols should not be stored with other materials and should be segregated from other storage and other occupancies.

The building should be of fire resisting and/or non-combustible construction and sited away from other structures (at least 10m), to reduce the exposure and the risk of explosion and fire damage to any neighbouring structures.

If directly adjoining another building or within another building, then aerosol storage should ideally be within its own (at least) 3 hour rated fire compartment.

Note: If storage is within a fire compartment with openings such as doors, these should be protected by listed/approved fire doors and/or shutters. In this instance, consideration and thought should be given to the potential for a projectile aerosol passing through the opening, within the early stages of a fire and before the door/shutter has actually closed. Attention should be paid to the means of automatically closing the fire door at the earliest stages of a fire, e.g., automatic smoke detection, and keeping any doors and shutters closed outside of use/outside of operating hours. Remember in less than 2 minutes from a fire-starting aerosols can ignite and start to missile.

Based on the risk assessments (or the requirements of any associated protection systems), the aerosol store may need to be fitted with explosion relief panelling, with physical protection in place to contain the aerosol cans and stopping them from being a missile out of their storage space.

Ventilation

The compressed gases contained within aerosols and therefore potentially released, are generally denser (heavier) than air. Therefore, low level ventilation extraction should be provided (within 300mm of the floor) and to supplement this high level ventilation inlets should also be provided.

If the ventilation is mechanically provided, the nature of the ventilation should form part of the risk assessment, to ensure all ignition sources are minimised. Appropriately rated electrical and non-sparking mechanical devices may be required.

Note: Based on the potential for vapour accumulation at low levels, the use of basement levels for storage and the proximity of basements to ground level storage, should be carefully considered in any risk assessments and the ventilation provision. It is not recommended to store aerosols in any basements.

Smoke Contamination

Consideration should be given to mitigating the effects of smoke-spread and contamination from a fire in an aerosol storage area, e.g., the use of non-combustible draft curtains at the perimeter of the storage area, forming part of any restraining barrier, heat and smoke ventilation, etc.

Storage

Where a dedicated separate detached store cannot be provided, the following measures should be implemented:

- Aerosol stocks should be strictly segregated
 - **They should not be stored with other commodities and definitely not with any other 'high hazard' materials such as flammable or combustible liquids, oxidisers, flammable or combustible gases, etc. or reactively dissimilar materials**
- Aerosols should be skidded on pallets (ideally not plastic pallets)
- Storage spaces for aerosols should be maintained at low levels closest to the ground; lower tiers of racking, etc. to help prevent the potential spread of vapours from high to low, and to other occupied areas
 - Measures to prevent aerosol cans from spilling out of racking should also be considered
- Storage in aisles should be prohibited
- Block stacking is not recommended
 - If needed, the maximum height of block stacking should be determined to prevent pile instability, collapse and spill in any block stack
 - The aisle space between block stacks should be considered in relation to stack height
 - Aerosols should be held within a dedicated fire compartmented storage space with 3 hour fire rated fire walls and protected openings between the aerosol storage and other products

- Stores of aerosols should be held within normally closed caged areas
 - Built from metal/wire mesh at a size no-greater than 25 mm x 25 mm
 - Which is held against an external wall away from all other stock
 - Careful attention should be paid to the entrance of the cage
 - This should be kept normally closed
 - The door should be fitted with a self-closing device
 - The entrance could be arranged with a two door lobby/arrangement where only 1 door can be opened at a time

Moving Aerosols

When aerosols are moved from inward delivery to staging; staging to storage and then the reverse for any shipping activities, the exposure in this period of transition should be carefully considered and fully risk assessed.

Consider:

- What happens if there is a fire on the delivery or loading vehicle?
- What happens if there is a fire when delivery or loading activities are occurring?
- How are aerosols arranged when received or being shipped out?
- How are aerosols moved around the building interior?
 - Forklift truck, low loader?
 - Is transit via conveyors – what measures are in place to ensure pallets or aerosols do not spill, or fall from the conveyor?
- What procedures are in place to minimise aerosol damage or load dropping in these activities?
 - Punctured by a forklift truck?
 - Run over by a forklift truck?
 - Fall or spill from pallet?

In all of the above scenarios careful consideration should be given to the exposure. While these may be considered as a ‘temporary’ activity, the effects of getting these arrangements wrong can potentially have a significant impact.

Consideration should be given to the use of:

- Caged or fire compartmented receiving and shipping areas
- Caged or fire compartmented staging areas
- Portable cages or metal boxes for inward transportation between caged or fire compartmented storage areas, etc.

Consideration should also be given to how pallet loads of aerosols are actually moved. If using a forklift truck, these should not be moved using clamps or claw type fittings and they should not be moved or lifted using any shrink wrapping.

Human Element Controls

National Occupational Standards (NOS) or local equivalent should be achieved as a minimum, at every site where aerosols are housed.

A NOS is a document that describes the knowledge, skills and understanding an individual needs to be competent at a job. For such hazardous occupancies this is critical.

As part of any storage and high hazard commodity arrangement a formal *Management of Change* process should be in place. This should consider when the site is changing commodities or storage arrangements; stock levels (busy periods); personnel; detections; protections, etc.

All employees (including temporary), should receive induction and follow-up training concerning the:

- Hazards of the aerosols and products stored
- Correct handling techniques
- Appropriate housekeeping and waste handling practices
- Emergency procedures
- Procedures for handling and dealing with damaged or leaking items

Regular formal (recorded) and informal inspections of the aerosol storage and stock levels should be completed to help ensure that:

- Control measures remain in place and are in full working order
- No damage has occurred to aerosol stocks or the storage configurations
- The organisation drives continuous improvement

Housekeeping in aerosol storage spaces should be strictly maintained, with waste and ordinary combustibles, such as packaging, removed from the storage. Aisles between storage piles or racks should be maintained clear and sterile at all times. Housekeeping arrangements should be to the highest standards and there should be strict protocols for the handling and storage of waste materials.

Aerosol fires escalate very quickly and as such a site should have a formal Emergency Response Plan and Emergency Response Team. This should highlight who should do what and what should be done to help mitigate any loss and liaise with the public fire brigade, etc. If the building does not have any appropriately designed fire suppression system, what are realistic expectations from such a manual firefighting response?

Damaged or Returned Stocks of Aerosols

There should be formal training on how to identify damaged aerosols:

- How to check the storage or delivery to understand what damage could look like?
 - Signs of cloudy stretch wrap around the pallet load?
 - Condensation on the inside of stretch wrap?
 - Odours?
 - Signs of physical damage?
- Is there any scope for gas detection or sniffers for any suspected damaged pallets?
 - These could be portable or hand-held devices

Are there plans in place on what to do if there is a damaged pallet or aerosols with a leak?

- If appropriate, what is the role of the manufacturer or haulier in this instance?

There should be formal risk assessments and procedures for handling damaged, returned or waste aerosols.

- A dedicated storage space should be established for holding damaged aerosols, empty aerosol cans and stocks of aerosols returned, e.g., by customers/retailers
- Ideally this should be away from the building in a clear secure space
- Unless all of the contents of the aerosols can be positively identified as being non-flammable, any damaged aerosols should be immediately removed from the storage area to the open air or an appropriately arranged and dedicated degassing area, where any flammable vapours can be safely dispersed and vented
- **The 'waste' storage space should be separate from stocks of unused aerosols**
- **The 'waste' storage location should have sufficient volume to contain damaged/empty/returned containers**
- **This 'waste' storage space and any degassing area should be designed and protected in-line with this document**
 - This should include all fire precaution measures
- Any powered vehicles used to handle damaged stock should be appropriately classified and/or rated to be used on potentially hazardous/flammable atmospheres
- The area(s) should be clearly signed and labelled

Local Fire Brigade

Because of the nature of aerosols and their storage, liaison with the local fire brigade should be a regular occurrence. If there are any incidents on site, particularly fire, then they will respond. Therefore, enabling the brigade to visit and become familiar with a site should be considered integral to a site Emergency Response Plan. This also enables the brigade to share their expertise and experience with the site management team.

Manual Fire Fighting Water Supplies

Depending on whether a building is sprinkler protected (to the appropriate design standard) or not, the quantities of aerosols stored and their arrangements, the fire water supplies needed to fight such a fire should be carefully considered. In non-sprinkler protected buildings or buildings where the sprinklers are not designed specifically for the aerosol storage arrangements in place, a fire could be expected to grow quickly and burn for a long period and as such the associated water supplies should be considered.

It is recommended that at least 4,500 lpm is available for at least 4 hours. This should be put into context, as a non-sprinklered aerosol storage building could easily burn for much longer than this.

Note: Are the local fire water supplies known and when was the last time they were tested?

Automatic Fire Detection and Automatic Fixed Fire Protection

As a minimum, automatic fire detection should be provided in all fire compartments connected to a reliable and monitored constantly attended location. There should also be a manual means of raising the fire alarm.

Based on the values and business impact exposed, automatic sprinkler protection fed by a dedicated and reliable fire water supply could also be recommended and installed. This should be designed in accordance with an internationally recognised standard such as the LPCB rules (BS EN 12845) or NFPA 13.

Attention should be given to the following:

- Commodity classification including packaging arrangements
- Storage height
- Building height and roof slope
- Clearance from commodity to sprinkler deflector and building height
- Aisle spaces between loads or racks
- Flue spaces within the storage – longitudinal and transvers
- Distances to any other commodities
- Cage restraints or fire compartments
- The worst case arrangement for storage levels vs any proposed protection arrangements

All designs and installations should be completed by approved/listed companies using equipment that is approved/listed to internationally recognised standards.

For specific guidance and a formal specification on automatic fire detection and fire suppression systems, please contact Aviva Risk Management Solutions.

Environmental and Liability Considerations

When considering such hazardous commodities and their storage, all aspects of their exposure should be considered including if there is actually a fire involving these materials.

- Are there any potential environmental concerns?
 - Including with fire water run-off?
 - How are the local surface drains arranged?
 - Are there any water courses nearby, etc.?
 - Consider how much water the public fire brigade may use in a fire
- Consider the fire load and how far aerosols can missile in an open unabated fire. What is exposed by the building, especially if the integrity of any cages or external walls is lost? Aerosols have been known to travel in excess of 20m
- Consider the liability implications of aerosols in storage and employee welfare, solvent abuse, toxicity, side effects, life safety, etc.
 - Also consider how damaged aerosols are degassed and the exposures to employees and the environment

Checklist

A generic Storage and Handling of Pressurised Aerosol Containers Checklist is presented in Appendix 1 which can be tailored to your own organisation.

Specialist Partner Solutions

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners.

For more information please visit:

[Aviva Risk Management Solutions – Specialist Partners](#)

Additional Information

Relevant Loss Prevention Standards include:

- Storage and Use of Liquefied Petroleum Gas (LPG) Refillable Cylinders
- Contamination Following a Fire
- Control and Management of Combustible Waste Materials
- Electrical Installations - Inspection and Testing
- Emergency Response Teams
- Fire Compartmentation
- Fire Doors, Fire Shutters & Fire Dampers
- Heat and Smoke Venting Systems
- Hot Work Operations
- Housekeeping - Fire Prevention
- Managing Change – Property
- Managing Change - Liability
- Managing Risks Caused by Stockpiling During Crisis Situations
- Manual Fire Fighting Water Supplies
- Smoking and the Workplace
- Smoke Contamination

To find out more, please visit [Aviva Risk Management Solutions](#) or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.*

*Calls may be recorded and/or monitored for our joint protection.

Appendix 1 – Storage and Handling of Pressurised Aerosol Containers Checklist



Location	
Date	
Completed by (name and signature)	

	Assess the Risks	Y/N	Comments
1.	Have all aerosols stored or proposed to be stored been identified?		
2.	Have Material Safety Data Sheets (MSDS) been obtained for all aerosols?		
3.	Have the types and quantities of aerosols been quantified, assessed and classified?		
4.	Are the expected quantities to be stored below thresholds for any regulatory requirements such as COMAH or Seveso Directives?		
5.	Have all storage locations for aerosols been identified? Including: <ul style="list-style-type: none"> • High volume or bulk stocks of aerosols? • Locations for aerosols used in work processes? • Small quantity locations? 		
6.	Unless appropriately arranged in accordance with this document, are temporary storage arrangements prohibited?		
7.	Have risk assessments been completed for the safe handling and storage of aerosols?		
8.	Has a fire risk assessment been completed? Does this include the aerosols and the aerosol storage areas?		
9.	Has a Dangerous Substances and Explosive Atmosphere (DSEAR), ATEX or similar type of risk assessment been completed?		

LOSS PREVENTION STANDARDS

	Assess the Risks Contd.	Y/N	Comments
10.	<p>Are aerosol storage volumes maintained to as low a level as possible at all times?</p> <p>Is this a constant and repeated challenge to the business?</p> <p>Is this audited?</p> <p>Is stockpiling prohibited?</p>		
11.	Are all potential heat and ignition sources identified and risk assessed?		
12.	Has the risk posed by the aerosol storage (including fire, explosion and smoke contamination risk) been assessed for their exposure to neighbouring processes and structures?		
13.	<p>Has the risk posed by aerosol storage (including fire, explosion and smoke contamination risk) been assessed for liability and life safety exposures?</p> <p>Has this identified the propellant gases that could be present?</p>		
14.	<p>Has the risk posed by aerosol storage (including fire, explosion, fire water runoff and smoke contamination risk) been assessed for environmental impact?</p> <p>Does this include an assessment of local water courses and surface water drains?</p>		
15.	<p>Are all recommended actions generated from any risk assessments:</p> <ul style="list-style-type: none"> • Identified? • Recorded? • Tracked through to completion? • Completed? 		
16.	Is lightning protection provided for the buildings in line with local building regulations?		

	Storage Arrangements	Y/N	Comments
17.	Is the storage of aerosols externally in the yard prohibited?		
18.	Has a dedicated detached or fire compartmented store been designed for the storage of the type, and volume of aerosols on site? Is this as a minimum at least a 3 hour rated fire-resistive structure?		
19.	Is the structure located a sufficient distance away from other structures or buildings to reduce the risk of blast-damage and fire spread?		
20.	If there is not a dedicated storage building, are aerosols held in a dedicated room or chamber? Is this a 3 hour rated (minimum) fire compartmented structure?		
21.	Where fire compartments are provided are all openings and penetrations appropriately protected with fire stopping, automatically closing fire doors/shutters, etc.?		
22.	Are fire compartments or cages kept closed at all times? Are any doors provided automatically closing? Are any doors provided in an arrangement with 2 doors in series, similar to an air lock, where one door can only open when the other is fully closed? Are the automatic closing mechanisms enabled to close on the most appropriate variable, to ensure the door is only open for the minimum amount of time?		
23.	Based on appropriate risk assessments, has low level and high level ventilation been installed to a recognised standard?		
24.	Based on the gases present within the aerosols being heavier than air, are aerosols stored closer to the ground in racked storage arrangements?		

	Storage Arrangements Contd.	Y/N	Comments
25.	<p>Are any basements and sub-ground areas identified?</p> <p>Does the ventilation consider the aerosol storage at ground level and the potential for vapours accumulating in the basement?</p> <p>Is aerosol storage prohibited?</p>		
26.	<p>Has an assessment for explosion exposure and associated relief been completed?</p> <p>Have explosion relief panels been installed?</p>		
27.	<p>Are all aerosol stocks held inside self-closing metal cages (consisting of metal meshing/welded metal with gaps no-greater than 25mm x 25mm)?</p> <p>Are any openings protected by approved/listed appropriately rated automatically and self-closing fire doors and/or shutters?</p> <p>Is the actuation mechanism for these doors understood?</p> <p>Is the actuation arranged to close the door to prevent rocketing aerosols passing through the opening?</p> <p>Are all doors closed when not in use, at the end of the shift, etc.?</p>		
28.	<p>Are stores of aerosols held away and segregated from other stored commodities?</p> <p>Including other high hazard commodities such as flammable liquids?</p>		
29.	Are plastic pallets prohibited?		
30.	Are aerosol stores held against an external wall?		
31.	<p>Are all potential heat and ignition sources identified?</p> <p>Are all aerosols stored well away and segregated from ignition and heat sources?</p>		

	Storage Arrangements Contd.	Y/N	Comments
32.	Are all aerosols stored: <ul style="list-style-type: none"> • Out of direct sunlight? • Away from heaters or heated surfaces? 		
33.	Where small quantities of aerosols are stored are these held in normally closed approved/listed flammable liquids cabinets, such as those stored in a workshop or maintenance department, etc.?		
34.	Are aerosols stored in the lower tiers of any racking?		
35.	Are measures in place to prevent aerosols falling from racks?		
36.	Is storage prohibited in aiseways?		
37.	Is lighting located over aiseways and not over the racking?		
38.	Are there formal racking inspections to check for rack damage and leg integrity?		
39.	Is the storage of aerosols in solid piles prohibited or at least limited? Are the pile heights based on pile stability and the potential for collapse? Are the aisle spaces based on pile height?		

	Waste and Damaged Aerosols	Y/N	Comments
40.	Is there training for employees to understand what to look for with damage aerosols?		
41.	Are (portable) gas sniffers available to help identify damaged aerosols?		
42.	Are there formal risk assessments and procedures for identifying, handling and managing damaged or waste aerosols?		
43.	Has a dedicated space been established for damaged aerosol cannisters, empty cannisters and returned stock? Is this located externally, a safe distance from any buildings and combustible storage? Are appropriate fire precautions in place?		
44.	Is there a dedicated external area or appropriately arranged internal area for holding and degassing damaged aerosols? Is this appropriately vented? Are appropriate fire precautions in place?		
45.	Are damaged/empty/returned aerosols held in arrangements consistent with the storage of undamaged aerosols? <ul style="list-style-type: none"> • Construction? • Fire compartmentation? • Fire doors? • Cages? • Ventilation? • Location? • Ignition sources, etc.? 		
46.	Are stores of damaged/empty/returned aerosols held away and segregated from other stored commodities and undamaged aerosols?		

	Staging and Internal Movements	Y/N	Comments
47.	<p>Has the process of receiving aerosols, staging them, moving them through the building to storage and then the reverse when they are shipped out been risk assessed?</p> <p>Has this assessment considered what would happen if there was a fire during any of these activities and how the aerosols need to be segregated?</p>		
48.	Is the staging and dispatch area fire compartmented or protected with appropriate cages?		
49.	Is the movement of aerosols internally within cages?		
50.	<p>Are conveyors used at all in the movement of aerosols?</p> <p>Has aerosol damage and/or falling been considered from the conveyor?</p>		
51.	Are forklift trucks and battery charging areas appropriately risk assessed, rated and arranged?		
52.	Is the lifting of pallets using any shrink wrapping prohibited?		
53.	Are clamps and claws prohibited in the lifting or movement of the aerosols?		
54.	<p>Has a fire been considered starting on the delivery vehicle in transit through the building and on the export vehicle?</p> <p>Have the exposures caused by this been risk assessed?</p>		

	Management Programmes	Y/N	Comments
55.	Is there a formal Management of Change process?		
56.	Is security considered for the potential threat of malicious damage and arson? Does this take into account any yard storage or external waste arrangements?		
57.	Is there a formal smoking policy? Is smoking prohibited internally and within 10m of any yard storage where external?		
58.	Are fixed wiring tests of the electrical system completed and up to date? Are all recommended remedial measures addressed and completed?		
59.	Are all portable appliances regularly inspected and tested as part of a formal testing regime?		
60.	Are thermographic surveys completed on the electrical and heating systems?		
61.	Is hot work prohibited from within 10m and inside all aerosol storage areas? Are only 'cold' working methods used within aerosol storage areas?		
62.	Are items such as mobile phones, matches, lighters and e-cigarettes prohibited in aerosol storage areas?		
63.	Is static electricity considered as a potential ignition source and are these exposures mitigated?		

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	Management Programmes Contd.	Y/N	Comments
64.	Are regular, formal (recorded) and informal inspections completed of all aerosol stores?		
65.	Do such inspections cover: <ul style="list-style-type: none"> • Condition of stored aerosols (checking condition of cartons to identify pierced/damaged cannisters)? • Condition of the storage space (including condition of walls/roofing)? • Condition of storage arrangements? • Condition of any storage cages? • Adherence to local site rules (smoking controls, prohibition of mixed storage in aerosol storage spaces)? • Housekeeping, including ensuring that aerosol storage remains clear of all other stored materials, waste and packaging? 		
66.	Is there a formal Emergency Response Plan? Is there a formal Emergency Response Team with clearly designated and defined duties?		
67.	Are aerosol storage areas formally identified, documented and included in site emergency plans and drawings?		
68.	Have the local fire services been invited to site? Are they familiar with the aerosol storage areas and the site emergency plans?		
69.	In relation to fire water run-off and emergency response, are there any concerns or exposures with local water courses and surface water drains?		
70.	Does the site have formal Business Continuity or Contingency Plans?		

	Fire Detection and Suppression	Y/N	Comments
71.	Is automatic fire detection provided throughout the building in all rooms/compartments including within the aerosol storage areas?		
72.	Is there a manual means to raise the fire alarm in all areas including the aerosol storage areas?		
73.	Are the manual and automatic fire alarms connected to a reliable constantly attended location or approved/listed remote monitoring station? Is the communication line between the alarm panel and constantly attended monitoring area/alarm receiving centre monitored for fault conditions?		
74.	Is automatic fixed fire protection installed over the aerosol storage? Is this extended to the waste storage and degassing areas?		
75.	Is this design known and fully documented?		
76.	Is this protection philosophy approved by insurers for property insurance purposes?		
77.	For the installed protections are the storage heights and configurations maintained at the required levels? <ul style="list-style-type: none"> • Aisle spaces? • Flue spaces? • Storage heights? • Clearance from storage to sprinkler head deflectors? • Clearance from storage to roof/ceiling deck height? 		
78.	Are all fire detection and fire protection systems inspected, tested and maintained in line with a recognised standard?		
79.	Are manual firefighting water supplies in the area understood and documented? <ul style="list-style-type: none"> • Are these tested to assure of the quantity and reliability of the water supplies? • Is this at least 4,500 lpm for 4 hours? 		

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80.	Additional comments:
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