



**STORING AND
HANDLING
AMMONIUM NITRATE**

INTRODUCTION

The Health and Safety at Work etc Act 1974 imposes general duties to ensure that workers and others are protected against risks to their health and safety from work activities. This leaflet has therefore been produced to help duty holders to ensure the safe storage and handling of ammonium nitrate at, for example, harbours, merchant stores and manufacturers' premises. The main use of ammonium nitrate is as a fertiliser, marketed either as prills (small spheres) or granules. The different types of ammonium nitrate fertiliser are described at the end of this leaflet.

This leaflet does not apply to the following, although many of the general principles may still be relevant:

- transport;
- ammonium nitrate classified as an explosive and assigned to Class 1 of the UN classification system. This would be subject to controls under the Explosives Act 1875;
- storage of ammonium nitrate fertilisers in quantities below 1 tonne, provided good housekeeping standards and sensible separation from incompatible materials are maintained. For fertilisers that contain 28% or less nitrogen (see the label or other hazard information) this limit is raised to 50 tonnes.

PROPERTIES AND HAZARDS

Ammonium nitrate has a melting point of 170°C and decomposes above 210°C. It is not in itself combustible but, as it is an oxidising agent, it can assist other materials to burn, even if air is excluded.

Ammonium nitrate will not explode due to the friction and impact found in normal handling, but it can be detonated under heat and confinement or severe shock. For example, in a fire, pools of molten ammonium nitrate may be formed and if the molten mass becomes confined (eg in drains, pipes, plant or machinery) it could explode, particularly if it becomes contaminated.

In a fire, all types of ammonium nitrate may melt and decompose with the release of toxic fumes (mainly oxides of nitrogen) which may be yellow or brown. Most types do not continue to decompose once the fire has been extinguished. However, when some types of ammonium nitrate fertilisers (cigar burners) are heated they undergo a smouldering (self-sustaining) decomposition that can spread throughout the mass to give substantial toxic fumes, even when the initial heat source is removed.

The risk of fire or explosion is greatly increased if ammonium nitrate is mixed with combustible or incompatible materials, such as powdered metals, alkali metals, urea, chromium or copper salts, organic and carbonaceous materials, sulphur, nitrites, alkalis, acids, chlorates and reducing agents (consult data sheets to establish if a substance has reducing properties).

PRECAUTIONS

The precautions described here are primarily designed to minimise the risk of explosion, however they can also reduce the risks associated with oxidising properties and the release of toxic fumes in a fire.

Fertilisers that contain 28% or less nitrogen (see the label or data sheets for the percentage of nitrogen present) do not normally present an explosion hazard and therefore, to identify the precautions required, ammonium nitrate based fertilisers can be divided into two groups:

- Fertilisers that contain more than 28% nitrogen. Most of these are straight ammonium nitrate types, although they include a small number of compound fertilisers.
- Fertilisers that contain 28% or less nitrogen. Compound fertilisers form the major proportion of this group. The straight nitrogen types are usually a mixture of ammonium nitrate with limestone or similar inert materials.

AMMONIUM NITRATE AND AMMONIUM NITRATE FERTILISERS

This section concerns ammonium nitrate and ammonium nitrate fertilisers that contain more than 28% nitrogen.

The risk of an explosion is increased by a combination of the following:

- heating ammonium nitrate (eg in a fire);
- contamination;
- serious confinement (eg in drains or enclosed parts of equipment).

To minimise the risk of explosion it is therefore important to take precautions against each of these situations.

The Fertilisers Regulations 1991, as amended, require all straight ammonium nitrate fertiliser with more than 28% nitrogen, sold for final use in the UK, to be packaged and meet certain quality criteria, minimising the risk of contamination and therefore explosion.

Storage areas

Ammonium nitrate should normally be stored in single storey, dedicated, well-ventilated buildings that are constructed from materials that will not burn, such as concrete, bricks or steel. Clean the store before it is used for ammonium nitrate.

However, in some circumstances, such as where the stores are located near to densely populated areas, it may be better to store ammonium nitrate outside, provided it is in a secure area away from combustible materials and sources of contamination. Such outdoor storage can remove or reduce the risk of, for example, fires due to electric lights and other equipment. However, if ammonium nitrate is stored outdoors it may be necessary to consider methods to prevent it deteriorating due to sunlight or water (eg covering it with sheets or shrink-wrapping and ensuring that water can run away from the storage area).

Avoid drains, channels or pits where molten ammonium nitrate from a fire could become confined. Where the presence of drains, etc is unavoidable, they should be protected so that molten ammonium nitrate cannot run into them.

Locate storage away from possible sources of heat, fire or explosion, such as oil storage, gas pipelines, timber yards, flammable liquids, flammable solids and combustible materials.

Arson and faulty or damaged electrical equipment are major risk factors for warehouse fires, so prevent unauthorised access to the store. Ensure regular inspection and maintenance of electrical equipment and fittings. Damage from animals can be limited by implementing a pest control system.

Stacks

Self-confinement of straight ammonium nitrate in large stacks can increase the risk of a detonation of the whole stack in a fire, so limit stacks to a maximum of 300 tonnes. This limit may be raised at purpose-built stores at manufacturing sites, provided that the other recommendations in this leaflet are followed and the material complies with the quality specification in the Fertilisers Regulations 1991.

Keep straight ammonium nitrate of relatively low density (ie non-fertiliser grade below 900 kg/m^3 - see the label or other documents)

to stacks of approximately 2 m high and 3 m wide, but again this limit may be raised at purpose-built stores.

To help prevent fires and other heat sources from affecting stored ammonium nitrate, and to allow access to stacks in an emergency, leave a space of at least 1 m between stacks and between the stack and the walls, roof or any electric lights or heating pipes. Check the height of doors, beams and electrical equipment in relation to that of any lifting equipment used, such as fork-lift trucks.

Do not allow ammonium nitrate, including when molten in a fire, to come into contact with materials such as flammable liquids, powdered metals, acids, chlorates, nitrates, zinc, copper and its salts, oils, grease, gas cylinders and chemicals of incompatible or unknown properties. Do not store ammonium nitrate in the same building as such materials.

When it is absolutely necessary to store urea and ammonium nitrate products in the same building, keep them in such a manner that they cannot mix with each other in any likely accident. This can be achieved by keeping the materials in separate bays which have walls that extend at least 1 m beyond the limit of storage of each material.

Do not store ammonium nitrate that contains more than 28% nitrogen in the same stack as other products.

On farms, separate ammonium nitrate fertiliser from hay, straw, grain, feedstuffs, or other combustible materials by a suitable fire break, such as a distance of at least 5 m or a barrier of inert material of at least 1.5 m (eg one pallet) width.

General precautions

For ease of movement and stability of the stacks keep 50 kg bags palletised. To prevent spillage and contamination make sure that the bags have been completely sealed on filling, are made of a material that is impermeable to water or oil, and are strong enough to withstand damage during normal storage, handling and conveyance. Paper packaging alone is therefore unsuitable. It is recommended that 50 kg bags have microvents to avoid ballooning and consequent instability in stacks.

Where wooden pallets are used check that they are not damaged or significantly contaminated. Do not store unused pallets in, or against the walls of, the store because of the increased risk of fire affecting the ammonium nitrate. Where it is necessary to keep the pallets in the store, separate them from the ammonium nitrate by a suitable fire break or partition.

Prohibit smoking in all storage areas and display prominent NO SMOKING notices.

Keep vehicles, fork-lift trucks and mechanical shovels clean and well maintained to prevent ammonium nitrate coming into contact with fuel, oil or grease. It is recommended that mobile equipment is fitted with suitable fire extinguishers of adequate capacity to deal with a fire on the vehicle. Do not leave such equipment running while unattended or store it in the storage area unless separated from the ammonium nitrate by a suitable fire break, preferably in a clearly marked, dedicated area.

Housekeeping

The following precautions are also essential:

- Store filled bags and intermediate bulk containers (IBCs) in stable stacks.
- Clear spillage up promptly.
- Do not use organic materials such as sawdust as an aid to cleaning floors.
- Put damaged bags into overpacks, ie a secondary bag of sound construction that will prevent further spillage.
- Promptly and safely dispose of contaminated products. Small amounts may be spread thinly on open ground or washed away as permissible, but not into water courses or drains.
- Do not allow pallets, ropes, covers, or other equipment to become impregnated with ammonium nitrate.
- Keep walls, floors and equipment clean.
- Locate electrical equipment where it cannot come into contact with the stored materials.
- Avoid hollow sections in equipment, or where unavoidable wash them regularly (away from the storage area) to prevent any build-up of ammonium nitrate.
- Ensure that bags of ammonium nitrate have been removed from the immediate area and contaminated items have been thoroughly washed to remove ammonium nitrate before allowing any maintenance that involves heat, such as welding or cutting. Apart from the risk of explosion in confined areas there is also a risk of toxic fumes being produced.

Fire precautions

Inform the local fire authority that ammonium nitrate is stored and agree with them the arrangements for giving early warning of a fire, providing suitable access to the site and ensuring that an adequate supply of water is available, or can be made available, to tackle an incident.

Note: Where a site contains 25 tonnes or more of dangerous substances, the Dangerous Substances (Notification and Marking of Sites) Regulations 1990 require the person in control of the site to notify the fire authority and the enforcing authority of certain details.

Employees need to be trained and practised in the actions to take in a fire. This includes using portable fire-fighting equipment to tackle any fire in its early stages. Portable water fire extinguishers or fire hose reels are appropriate where ammonium nitrate is, or might be, involved. To enable employees to deal with such incidents, they need to receive specific training to ensure that they do not put themselves at risk of breathing fumes from decomposing ammonium nitrate.

The effects of the inhalation of these fumes may be delayed so if anyone has, or is suspected of having, inhaled such fumes, remove them to a safe shaded area where they should be kept warm and rested, ideally lying down. Seek immediate medical help.

Additional safeguards may be necessary at some sites where there are large quantities of ammonium nitrate which, due to explosion or fumes in a fire, might affect neighbouring buildings or plant or pose a significant off-site risk. These safeguards may include measures to ensure that the fire brigade is called quickly, for example an automatic fire detection system or continuous supervisory staffing by workers who have ready access to a telephone. Consider the need to install a fixed water deluge system as well, which may also help limit the potential for environmental damage by contaminated water from subsequent fire-fighting. Further advice on the control of fire-water run-off is given in EH 70.

Bulk products

All ammonium nitrate fertilisers with more than 28% nitrogen by weight, sold for final use in the UK, must be packaged. However, bulk products could be stored at, for example bagging plants or premises where they are blended with other ingredients. There is a greater risk of an unpackaged (bulk) product becoming contaminated than there is with a packaged product. Therefore it is essential that precautions are taken to minimise the risk of contamination, especially with combustible or incompatible materials.

The advice already given also applies to bulk products (except for the paragraphs on palletised product which are not relevant). The following advice is additional.

Only store bulk ammonium nitrate inside buildings constructed as described for packaged products, or in silos made from materials that do not readily ignite, such as glass fibre reinforced plastic. Situate such silos at least 10 m from combustible materials. Due to the corrosive nature of ammonium nitrate, avoid using galvanised items such as sheeting, joints and girders.

Whenever possible, only use the buildings for ammonium nitrate and ingredients used in ammonium nitrate fertiliser blends. When the buildings are not being used for ammonium nitrate fertilisers, thoroughly clean them before any other product is introduced.

The building may be subdivided into storage bays of convenient shape and dimensions and constructed of a material that does not burn, preferably concrete. To prevent cross contamination:

- clearly label the bays to indicate what they are intended for;
- do not store other products in the same bay;
- clean bays regularly;
- inspect bays for contamination before new batches are added; and
- clean any mechanical handling equipment before and after it is used for other products.

Ideally, fertilisers should be taken in and out of a building by a conveyor system. Equipment used in the handling of ammonium nitrate, such as conveyor belts, should be made of material that does not readily ignite or burn. Keep the equipment well maintained to avoid potential heat sources and contamination.

Where a mechanical shovel is used to feed the conveyor or load vehicles it should preferably be kept in the building - in a clearly marked, dedicated area which is separated from the storage area by a suitable fire break - except when it has to be maintained or repaired.

Where it is not reasonably practicable to use a conveyor system, and it is necessary to introduce a road vehicle into the store, it is important that the vehicle is inspected for oil and fuel leaks and the load compartment or the ammonium nitrate carried does not become contaminated. Good maintenance of vehicles is essential to prevent contamination.

To minimise the risk of contamination, keep the doors to the store closed as much as possible and only allow access to authorised people.

Keep any passage next to the storage area clean, and remove any spillage promptly, place it in a dedicated area and dispose of it as soon as possible. Do not allow fertiliser to become compacted into the floor of the passage or bays where it can become contaminated with spilled oil, etc.

Decomposition could occur if heaters are positioned too near to ammonium nitrate or if dust deposits are allowed to accumulate on steam pipes or other heating devices. Do not use direct electrical heaters in ammonium nitrate stores.

In unheated buildings, cover ammonium nitrate with a waterproof sheet to minimise the pick-up of moisture, which could lead to caking of the product and an increased susceptibility to explosion in a fire.

Ensure that light fittings are robust, made of material that does not readily burn and constructed or positioned so that ammonium nitrate dust cannot penetrate them. Locate main electrical switches, fuses, etc outside the storage area to minimise the risk of fire. Do not locate local switches where they could lead to a fire in the store or contact stored ammonium nitrate.

It is important in harbour areas for loading and unloading facilities from ship to shore to be designed to avoid contamination. Loading and unloading during adverse weather such as rain, snow, or hail are not advisable because of the risk of caking.

AMMONIUM NITRATE FERTILISERS THAT CONTAIN 28% NITROGEN OR LESS

The advice already given applies to these fertilisers, except that the limits on stack quantity and size given previously are based on the explosion hazard and therefore need not apply. Also, these fertilisers may be stored with other products provided that they are separated from incompatible materials (see the section on properties, page 2) by a distance of 5 m or a fire-resistant wall.

Separate 'cigar burners' from ammonium nitrate that contains more than 28% nitrogen by a distance of 5 m or a fire-resistant wall. Keep bulk heaps of cigar burners (see the section on properties, page 2) to no more than 2000 tonnes, with each heap separated from the next by walls or 2 m air gaps.

SPECIFIC LEGISLATION (LARGE QUANTITIES)

Premises where ammonium nitrate is stored may be subject to the following regulations, depending on the quantity stored:

- Control of Industrial Major Hazards Regulations 1984, as amended (CIMAH);
- Planning (Hazardous Substances) Regulations 1992 (PHS) or in Scotland, Town and Country Planning (Hazardous Substances) (Scotland) Regulations 1993.

These Regulations contain requirements to notify the authorities of certain information. Depending on the quantity stored, CIMAH may require the preparation and updating of a safety report and the preparation of emergency plans. The table shows the quantities of ammonium nitrate (in tonnes) at or above which these Regulations apply.

Type of ammonium nitrate (AN) ¹	Application of CIMAH reg 4 to storage ²	Application of CIMAH regs 7-12 to storage ³	Application of CIMAH regs 7-12 to industrial activities, other than storage ³	Application of PHS
Straight AN, designated EEC fertiliser	1 250	10 000	5 000	1 000
Compound fertiliser	1 250	10 000	5 000	1 000
Other AN or AN mixtures	350	2 500	2 500	500

1 These categories only apply where the nitrogen content derived from AN exceeds 28% w/w.

2 Regulation 4 of CIMAH requires an operator to be able to demonstrate safe operation.

3 Regulations 7-12 require the preparation of a safety report and emergency plans, and the provision of information to persons liable to be affected by a major accident.

The Notification of Installations Handling Hazardous Substances Regulations 1982 (NIHHS) apply to premises that contain 500 tonnes or more of ammonium nitrate or mixtures of ammonium nitrate with more than 28% nitrogen. They do not apply to EEC fertiliser or mixtures subject to the Explosives Act.

TYPES OF AMMONIUM NITRATE FERTILISER

The following terms are used to describe the different types of ammonium nitrate fertiliser. The type can be identified in practice from information on the label or data sheets supplied with the product.

Straight ammonium nitrate fertiliser contains ammonium nitrate to provide the essential element nitrogen, although it may also contain fillers such as ground limestone, calcium sulphate, ground dolomite, magnesium sulphate or kieserite.

Compound fertiliser contains ammonium nitrate mixed with potash and/or phosphate to supply the essential elements nitrogen, potassium and phosphorus. They are sometimes referred to as NPK fertilisers.

EEC fertiliser is fertiliser that meets certain quality, packaging and labelling requirements specified in the Fertiliser Regulations 1991, as amended.

EEC grade straight ammonium nitrate fertiliser is straight ammonium nitrate fertiliser that meets certain quality specifications (based on Annex 1 of Directive 80/876/EEC) of the Fertiliser Regulations 1991. The designation 'EEC Fertiliser' therefore distinguishes them as posing less of an explosion hazard than similar products. The consequence is that larger quantities may be stored before certain regulations apply (see the section on specific legislation, page 10).

Cigar burners can sustain a decomposition even when the fire has been extinguished. They are normally compound fertilisers that contain between 5% to 25% nitrogen from ammonium nitrate, up to 20% phosphate (as P_2O_5) and chloride (which may only be present as a small percentage). However, a fertiliser that meets this description is not necessarily a cigar burner. Currently, none are manufactured in the UK, but you should consult the manufacturer or supplier to establish whether their products are cigar burners.

REFERENCES

The Health and Safety at Work etc Act 1974 Chapter 37 HMSO
ISBN 0 10 543774 3

Dangerous Substances (Notification and Marking of Sites)
Regulations 1990 SI 1990/304 HMSO ISBN 0 11 003304 3

The Fertilisers Regulations 1991 SI 1991/2197 HMSO ISBN 0 11 015197 6

The Fertilisers (Amendment) Regulations 1995 SI 1995/16 HMSO
ISBN 0 11 052344 X

80/876/EEC, Council Directive, of 15 July 1980, on the approximation of the laws of the Member States relating to straight ammonium nitrate fertilisers of high nitrogen content, Official Journal of the European Communities, 23 September 1980 Vol L250, p7

The Notification of Installations Handling Hazardous Substances Regulations 1982 SI 1982/1357 HMSO ISBN 0 11 027357 5

The Control of Industrial Major Hazards Regulations 1984 SI 1984/1902 HMSO ISBN 0 11 047902 5

Planning (Hazardous Substances) Regulations 1992 SI 1992/656 HMSO ISBN 0 11 023656 4

The Town and Country Planning (Hazardous Substances) (Scotland) Regulations 1993 SI 1993/323(S31) HMSO ISBN 0 11 033323 3

The control of fire-water run-off from CIMAH sites to prevent environmental damage EH70 HSE Books 1995 ISBN 0 7176 0990 1

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995 Website: www.hsebooks.co.uk (HSE priced publications are also available from bookshops and free leaflets can be downloaded from HSE's website: www.hse.gov.uk.)

For information about health and safety ring HSE's Infoline
Tel: 08701 545500 Fax: 02920 859260 e-mail:
hseinformationservices@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

© *Crown copyright* This publication may be freely reproduced, except for advertising, endorsement or commercial purposes. First published 8/96. Please acknowledge the source as HSE.

Printed and published by the Health and Safety Executive

INDG230

Reprinted 11/04

C30