



# AMMONIUM NITRATE SAFETY

Many misconceptions exist surrounding the dangers of ammonium nitrate, particularly following the explosion in Beirut, Lebanon in August 2020. Ammonium nitrate is a chemical compound produced in both solid and liquid form that is commonly used in fertilizers. Pure ammonium nitrate is stable, and when stored properly, it poses few safety hazards. But there are some critical issues to understand to best protect a facility that stores or handles ammonium nitrate.

## How and When Ammonium Nitrate Turns Dangerous

Although it is not technically classified as an explosive or flammable material, under certain conditions, ammonium nitrate can present a significant explosive threat because it is an oxidizer — an oxygen-rich compound that can accelerate fires or explosions. Ammonium nitrate, however, needs another element to destabilize it for such a reaction to begin.

Exposure to elements such as fire or heat can start the process of destabilizing ammonium nitrate, making it self-reactive and prone to releasing flammable and ignitable gases.

Code enforcers, business owners, and facility managers can help protect buildings before an incident occurs or before it becomes an enforcement issue by knowing what can make ammonium nitrate dangerous.

## Dangerous Conditions

Ammonium nitrate becomes dangerous if subjected to conditions such as:

- Fire
- Heating in a confined space
- Localized heating potentially leading to the development of high-temperature areas (such as confined areas in which a small amount of a larger store of ammonium nitrate is heated)
- Exposure to strong shock waves
- Contamination by combustible materials or incompatible inorganic substances (such as paint and finely divided metals) and organic substances (such as wood chips, charcoal, baled rags, baled scrap paper, burlap or cotton bags, straw, and sawdust) that can result in sensitivity to explosion
- Low pH or acidic conditions

## Highly Dangerous Conditions

The likelihood of an explosion increases if ammonium nitrate is subject to conditions such as:

- If ammonium nitrate has been changed to liquid form by heat, becomes molten, and accumulates in large pools
- If there is potential for the confinement of molten ammonium nitrate, such as in drains, pits, sumps, sewers, or dead spaces in equipment
- If there is potential for a physical shock to the molten ammonium nitrate, such as high-velocity projectiles generated in a fire
- If ammonium nitrate is or becomes contaminated before or during a fire

## How to Increase Facility Protection

If there are dangerous or highly dangerous conditions in a facility, some initial steps to take immediately include:

- Make sure ammonium nitrate is not confined or contaminated
- Remove ammonium nitrate storage from basements or combustible bins
- Make sure local emergency responders are aware of what is stored in the facility
- Have an emergency response plan prepared
- Have constant fire monitoring

## Safety Requirements

Understanding safety requirements and best practices for storing and using ammonium nitrate can help prevent the loss of lives and property. It can also preserve business continuity.

AMMONIUM NITRATE SAFETY *CONTINUED*

Requirements for safely storing ammonium nitrate can be found in NFPA® 400, *Hazardous Materials Code*. At a minimum, measures should be established to ensure the quantities are:

- Stored away from substances that can cause ammonium nitrate to destabilize
- Stored in facilities located a safe distance from other structures and people

Chapter 11 of NFPA 400 provides additional safeguards for storage quantities exceeding 1,000 lb (454 kg) and covers specific issues regarding new and existing construction, such as the following:

- **New Construction:**
  - Needs to be noncombustible, without exception
  - The use of wooden or other combustible bins for the storage of ammonium nitrate — which was previously allowed if the bins were protected against impregnation by ammonium nitrate — is prohibited
  - Ammonium nitrate storage buildings of any construction type with combustible contents must be sprinklered
  - Floor sloping and drainage is required to provide further protection against the confinement of molten or spilled ammonium nitrate
- **New Construction and Existing Facilities:**
  - Must comply with all the construction requirements that were in place when the facility was built
  - Sprinklers are required retroactively for facilities that are of combustible construction or that have combustible contents
  - Water-based suppression systems are the only type allowed in areas containing ammonium nitrate, as the purpose of the water is both to suppress an exposure fire and to cool the ammonium nitrate. The water helps to prevent both decomposition of ammonium nitrate and the formation of molten ammonium nitrate, which, when confined, can create an explosion hazard.

### Detection and Notification Systems

In both new and existing facilities that store ammonium nitrate, a fire alarm system with fire detection is required throughout under NFPA 400, along with an approved public notification/siren system. Oxidizers such as ammonium nitrate can cause the growth phase of a fire to accelerate rapidly compared to fires involving ordinary combustibles. Given this heightened urgency, building occupants should be notified of the need to evacuate the building faster than they would during an ordinary combustible fire. Individuals in the surrounding area need to be notified too.

### Emergency Response Issues

NFPA 400 also includes suggestions for firefighting procedures and considerations in determining when to fight fires involving ammonium nitrate and when to evacuate. The document provides references, types of ammonium nitrate, and the conditions that can cause explosions. In addition, NFPA 400 includes a table that shows typical ammonium nitrate products and their composition and additional resources for information on the safe handling and storage of ammonium nitrate (see Annex E).

#### Learn More

- ▶ Get free access to the 2019 edition of the code: [NFPA 400, Hazardous Materials Code](#).
- ▶ Access the [latest coverage](#) in the *NFPA Journal*® on the 2020 explosion in Beirut, Lebanon, including a recent podcast and article.
- ▶ Learn about ammonium nitrate [regulatory gaps](#) on NFPA Xchange™.
- ▶ Read the 2017 report, "[Variables Associated with the Classification of Ammonium Nitrate — A Literature Review](#)," from the Fire Protection Research Foundation.



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