

# Fact Sheet

## Anhydrous Ammonia

Anhydrous ammonia is one of the world's most commonly used agricultural chemicals. It is highly beneficial but may also be extremely hazardous, and may cause serious injuries or even death.

### Introduction

Anhydrous ammonia is a gaseous form of ammonia. "Anhydrous" comes from the Greek word for "without water."

Ammonia's chemical structure is  $\text{NH}_3$ , meaning it contains one part nitrogen and three parts hydrogen, making it a very desirable fertilizer.

Interestingly, more than 1% of the world's energy production is dedicated to the manufacturing of ammonia.

### Hazards

The main safety hazard of ammonia is that it is extremely corrosive to the skin, eyes, and respiratory tract. Because it does not contain water, it will absorb moisture from any source, including human tissues, causing severe burns. In some cases, these burns may be fatal, especially if they affect the lungs/respiratory tract.

The corrosivity hazard of ammonia is aggravated by two other factors:

- **Pressurization.** Ammonia boils and becomes a gas at temperatures of about 28 below zero F. Therefore, to use it as a liquid

at normal temperatures, it must be pressurized to about 200 psi. So when a leak/release develops, it is almost always under high pressure and is likely to spray operators and others nearby before they have a chance to react and escape the area. This pressurization also results in larger areas of the body being affected, and more material being involved. The pressurization will also tend to knock inadequate PPE, such as loose-fitting safety glasses, off the employee.

- **Gas.** When a leak develops, the liquid ammonia will immediately become a gas, which will make it much more likely to be inhaled into the respiratory tract/lungs, where injuries will be much more serious.

### OSHA regulations

OSHA regulates the storage and handling of anhydrous ammonia in 29 CFR 1910.111. This regulation applies in general industry as well as agricultural settings.

The majority of this regulation pertains to design and construction of containers and related equipment. However, there are also more useful sections pertaining to the use of anhydrous

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ammonia in agricultural settings. These sections are found in 29 CFR 1910.111(g) and (h).

## Personal Protective Equipment

Employees involved in handling anhydrous ammonia, especially during the transfer process, must wear appropriate personal protective equipment (PPE). At a minimum, this includes:

- Tight-fitting eye protection (splash-proof goggles).
- A face shield is strongly recommended in addition to goggles.
- Chemical-resistant gloves
- Long-sleeved shirt
- Long pants
- Leather work shoes/boots.

29 CFR 1910.111(b)(10)(ii) also states that at least two full-face respirators approved for ammonia must be provided in readily accessible locations at all stationary storage installations. *Remember that employees who may be expected to don these respirators must be included in a formal, written respiratory protection program, including respirator training, fit testing, and medical evaluations.*

## Eyewash and showers

In the event of an exposure (i.e., a chemical splash), affected parts of the body must be immediately drenched with copious amounts of clean water. For this reason, ample amounts of clean water must be available at all times and in all affected areas.

Stationary storage locations must be equipped with an ANSI-approved eyewash and shower.

Maintaining access to clean water in the field obviously presents challenges. All nurse tanks and applicator tanks must carry at least one five-gallon container of clean water. This must be changed daily. Additionally, all employees should carry a small container of water on their person at all times.

These small amounts are not sufficient to provide adequate flushing of injuries. Rather, they are intended to be bare minimums, providing just enough water to last a few minutes, until the employee can reach larger supplies of water. Flushing of affected areas should be provided continuously, until the employee reaches a medical treatment center.

All exposures to anhydrous ammonia require immediate medical treatment, no matter how minor the exposure appears to be.

## Flammability

Anhydrous ammonia is not considered a flammable gas. Nevertheless, welding on ammonia containers, piping, transfer equipment, etc. is not permitted, except by suitably qualified personnel (certified welders holding a R-stamp or U-stamp). This is especially true of closed containers, or surfaces that may be contaminated with residual ammonia.

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## Tanks and other equipment

All storage, handling, transfer, and other equipment must be approved for such use. Unapproved equipment may utilize materials or appurtenances (gages, valves, hoses, etc.) that are incompatible with ammonia or with the working pressures involved. Consequently, the unapproved equipment may fail, causing releases and injuries.

When towing, use the proper trailer hitch, safety chains (crisscrossed), and slow moving vehicle sign. Hitch pins must be locked securely.

Tanks should always be painted white or silver to reflect heat. Tanks may never be filled to greater than 85% capacity.

Equipment must be inspected frequently. Inspection checklists should be available from the supplier. Transfer hoses and relief valves are the two most important parts of an inspection program.

- Make sure that relief valves are not beyond their replacement date, stamped on the valve body itself.
- Hoses must be free of cuts, nicks, bulges, worn spots, etc. Hoses must be marked with “anhydrous ammonia” and with the year of manufacture and expiration date. Make sure hoses are not expired. Make sure connections are clean and free of dirt, debris, etc. Make sure threaded connections are in good condition.

## Valve operation

All employees involved in the process must read and understand the Operator’s/Owner’s manual! This must be documented.

Valves may only be operated after the tank is secured in place, so that connections are not accidentally broken. The tank must be located where there are no barriers to emergency escape from the area in the event of a leak. Employees must be able to travel upwind of the equipment, without having to climb over fences, etc.

Manual valves are to be opened wide when transferring liquid.

Employees should stay clear (upwind) of valves and hoses while transfer in progress.

## Methamphetamine manufacturing

Ammonia is an important component in the illegal manufacturing of methamphetamine. It is commonly stolen by those operating meth labs.

Only a few gallons of ammonia are needed to manufacture a large amount of meth, so theft may not be evident. Watch for evidence such as signs of tampering with the tank or valves, footprints, stained soil near the tank, valves that are not tightly closed, items left near the tank such as hoses, duct tape, propane tanks, etc. Placing brightly colored nylon ties on valves will also help to identify when/if valves have been tampered with.

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The most effective and simple means to prevent theft is to use locking devices on tank valves.

Time your ammonia deliveries so they arrive as close to the time of application as possible, and return tanks immediately after application has ended.

Keep tanks in secure, well lit areas. If possible, position tanks where they may be seen from public roads, residences, etc. The most important portion of the tank to be kept visible is the valve.

Access roads that lead to the storage area should be secured or barricaded to prevent theft of the entire tank. "No Trespassing" signs will help in the event of a liability case.

Never confront or attempt to detain anyone you suspect of stealing ammonia. Call the police immediately.

## Training

Under the Minnesota Employee Right to Know Act (MERTKA), as well as a host of other regulations, all employees who are potentially exposed to ammonia, either under normal conditions or foreseeable emergencies, must be trained. Training must occur at the time of assignment, whenever hazards, conditions, or procedures change, and at least annually thereafter.

At a minimum, training must consist of the hazards of anhydrous ammonia, the precautions that are required, procedures to follow in the event of an emergency, etc. This fact sheet may be used as a component of this training.

All training must be adequately documented.

## Questions

If you have questions on this topic, please contact the Office of Occupational Health and Safety at (612) 626-5008 or [uohs@umn.edu](mailto:uohs@umn.edu), or see the website at <http://www.ohs.umn.edu>.