

ANHYDROUS AMMONIA

handle it safely

EM 3776 (Rep) APRIL 1980 COOPERATIVE EXTENSION WASHINGTON STATE UNIVERSITY PULLMAN

ANHYDROUS AMMONIA, the most common form of liquid ammonia fertilizer used, is essentially dry ammonia gas compressed into a liquid form. At atmospheric temperature and pressure it has a pungent and irritating odor. Its safe use as a nitrogen fertilizer requires a number of precautions.

It is easily compressed and liquified. Since 113 cubic feet of vapor can be condensed into 1 cubic foot of liquid, it is usually handled as a pressurized liquid for ease of storage and transportation. Its boiling point is -28° F, so when it does escape from its container it is extremely cold, in fact nearly -30° F.

Ammonia gas is about half as heavy as air, so it rises rapidly. To ignite ammonia, there must be 16 to 25 percent ammonia by volume in the air and a temperature of 1200° F. The Department of Transportation classifies anhydrous ammonia as a nonflammable compressed gas.

As a liquid, anhydrous ammonia has a density of 37.5 pounds per cubic foot. A gallon weighs 5 pounds and contains 82 percent or 4.1 pounds of nitrogen.

The vapor pressure increases as the temperature is increased. For example, the vapor pressure is approximately zero at -30° F, 75 psi at 50° F, 125 psi at 75° F, 197 psi at 100° F, and 293 psi at 125° F.

Field Tanks

All tanks should have steel fittings, valves, and gauges. Anhydrous ammonia corrodes copper, copper alloys, aluminum alloys, and galvanized surfaces. Thus, propane tanks

should never be used for anhydrous ammonia as they usually have brass and bronze fittings. Ammonia can cause bronze and brass fittings to develop internal corrosion and a slight strain, twist, or blow to such a fitting may cause it to break off.

Field applicator tanks should have the following equipment:

1. 300 psi pressure gauge.
2. Liquid outlet valve, screwed directly into the shell of the tank and connected to a pipe extending inside the tank to within 1/2 to 3/4 inch of the bottom. The bottom end of the pipe should have a 1/64-inch mesh strainer.
3. Pressure relief valve of 3/4 to 1 inch, set for 250 pounds per square inch pressure.
4. A 3/4- or 1-inch automatic back-seating, liquid-filling valve.
5. A liquid-level gauge.
6. Vapor return valves, 1/2- to 3/4-inch, with a short pipe extending into the tank to prevent filling the tank over 85 percent water capacity. This valve is also used for gas escape in bleeding.

Transfer Operation

Special equipment and handling techniques must be used all the way from the production plant to bulk storage, nurse tanks, and field applicators.

Usually the containers have sufficient self-generated pressure so transfer to the soil can simply be done by decompression. Transfer from nurse tank to field applicator is usually accomplished by a pump. Special couplings are necessary to prevent leaking when trans-

ferring or applying ammonia. The present system usually uses a sequence of four or more valves to be opened and closed during a transfer operation. Pressure in the transfer hoses must be released or “vented” after the valves are shut and before releasing the coupling fittings. This is done manually and presents a dangerous situation should the operator fail to secure the valves properly in a closed position. According to the Accident Prevention section of the Institute of Agricultural Medicine, University of Iowa, most ammonia accidents occur during the transfer of ammonia from tank to tank and usually only one or two persons are involved.

Injury Potential

Because of high pressure and low temperature, a stream of vaporizing anhydrous ammonia will penetrate and freeze any body tissue that it strikes. It can cause severe burns by freezing as well as by its caustic action and by dehydration.

Exposure to high concentrate vapor will cause convulsive coughing, respiration spasm, strangulation, and asphyxiation. Thus it is essential to stay clear of clouds formed by escaping gas.

Eye Injuries

The most serious problem with ammonia is that it can cause blindness if it gets into the eyes. One of the properties of ammonia is its extreme solubility in water. One volume of water can dissolve 1300 volumes of the gas. Because of this high water solubility, it can rapidly dissolve water in living tissues, thus, it can quickly dissolve the eye's corneal surface moisture and penetrate rapidly into the cornea and damage it.

This water solubility is also the key to treatment in case of an accident. The eyes or skin must be flooded immediately with water to dilute and wash out ammonia.

Other Injuries

Inhalation of ammonia gas at low concentration will affect the mucous membranes in the respiratory tract. Depending on concentration and length of exposure, acute and chronic respiratory problems may occur.

Skin injuries due to freezing and alkaline caustic action can be severe and very painful. The “chemical burn” is much more significant than the “freeze” and it produces much wider and deeper destruction of tissues.

In Case of Accident

Water and time are the keys to effective treatment. Nothing else will work. Immediate effective action is essential.

Water is the best emergency first-aid treatment in case of ammonia accidents. Eyes and skin should be flushed with clean water for at least 15 minutes. It is essential that one starts flushing immediately, especially the eyes. The first ten seconds are critical and any delay in flushing may end up in severe eye damage, possibly blindness. Hold the eyelids open so that the water can reach all surfaces.

A person should not wear contact lenses when handling anhydrous ammonia. But if any contact lens wearer gets ammonia in his eyes, the lenses should be removed immediately and eyes flushed. Otherwise ammonia will get under the lenses and damage the eyes.

If the burns are extensive and a water tank is nearby, get the victim into the water. After he is in the water, remove his clothes. Any time clothing is soaked with ammonia, remove it to prevent caustic burns.

Immediately after first-aid treatment with water get the victim to a doctor or hospital as soon as possible. Don't use any

salves, ointments, or oils on ammonia burns for at least one day; they will cause deeper burns.

Safety Precautions

Anhydrous ammonia fertilizer can be used as safely as any other liquid or gas under pressure. Safety precautions must be taken to prevent accidents. Be sure that each and every worker understands the hazards of ammonia.

Remember that most accidents occur when the material is being transferred from one tank to another. Several valves have to be opened and closed in a certain sequence. **BE SURE THAT YOU KNOW AND ALWAYS FOLLOW THE PRECISE SEQUENCE OF EVENTS FOR CONNECTING AND DISCONNECTING LINES AND HOSES.** One of the major causes of accidents is hoses coming loose or bursting.

Equipment Safety

Good equipment is essential for safe anhydrous ammonia application. Be sure that all equipment meets federal standards. Keep equipment in good repair and periodically inspect the conditions of hoses, valves, and all connections, also transfer pumps and metering devices. If repair is needed, have a qualified person do it.

Use only extra-heavy steel fittings. Do not use brass or bronze fittings.

Do not weld on ammonia tanks.

Personal Protective Equipment

Tight-fitting goggles or a full face shield are a must. The National Society for the Prevention of Blindness believes that serious and blinding injuries from ammonia fertilizers could be virtually eliminated if all chemical handlers wore face shields and protective

goggles with hooded vents and carried adequate supplies of clean water with them. **FEDERAL STANDARDS REQUIRE THAT YOU CARRY A CAN CONTAINING 5 GALLONS OR MORE OF WATER ON THE TANK-TRANSPORTING VEHICLE.** Wear gloves made of rubber or other material impervious to anhydrous ammonia.

Safety Commandments

The Anhydrous Ammonia Institute has released the following safety rules:

1. Always have ample clear water available.
2. Always stay clear of hose and valve openings.
3. Always wear gloves and goggles when transferring ammonia.
4. Always close valves and disconnect hoses when equipment is unattended.
5. Be sure pressure is relieved before disconnecting hoses or parts.
6. Never fill tank over 85 percent of capacity.
7. Never leave transfer operation unattended.
8. Never tamper with relief valves or other safety devices.
9. Never try to "get by"; use only approved ammonia equipment.
10. Never tow a trailer without secure connecting parts and safety chain.

Federal Regulations

Under the Occupational Safety and Health Act (OSHA) which also covers agricultural employees, the Department of Labor has issued standards covering the use of anhydrous ammonia. If you employ persons and provide the equipment to apply anhydrous ammonia fertilizer, you are required by law to adhere to these federal standards.

These standards cover the safe use of containers, their construction, location and installations; valves and fittings; and safety relief devices. Standards most applicable to

farmers are those on nurse tanks and on the application rigs.

Rules and regulations covering storage and handling of anhydrous ammonia can be found under section 1910.111, Federal Register, Vol. 37, No. 202, Wednesday, October 18, 1972. Copies of sections of the federal standards applicable to farm use, entitled "Safety and Health Standards for Agriculture," may be obtained from the nearest OSHA office.

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