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- DANGER - ANHYDROUS AMMONIA

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COOPERATIVE
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SERVICE **EXT**

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CAUTION ANHYDROUS AMMONIA!

Anhydrous ammonia has become one of the most popular forms of nitrogen fertilizer for North Dakota farmers. Low cost, ease of application and availability in many areas have all contributed to the increased use of this form of nitrogen fertilizer.

Figure 1.

1972	32,000 tons
1973	86,000 tons
1974	61,000 tons
1975	103,000 tons
1976	102,000 tons
1977	165,000 tons
1978	211,000 tons
1979	210,000 tons
1980	286,000 tons

Anhydrous ammonia (NH₃) is a chemical compound containing nitrogen and hydrogen. At atmospheric temperature and pressure, ammonia is a colorless gas with a sharp, pungent odor. The gas can be liquified by cooling or applying pressure. Liquid ammonia resembles water.

Used with properly maintained equipment, protective clothing and safety rules, anhydrous ammonia can be handled and applied safely. However, because of its stored pressure, physical and chemical properties, anhydrous ammonia has the potential to cause severe burns, partial or total loss of sight and even death.

Pressure — A tank of anhydrous ammonia, properly filled to 85 percent of its capacity, will be at a pressure of 100 psi (pounds per square inch) at 65° F. Air temperature affects pressure. On warm days, pressure in the tank, hoses, valves and couplings will increase. Compare the following pressures to those in a typical water system (30 to 40 psi).

Degrees F	Anhydrous Ammonia Pressure — PSI
-28	0
0	16
32	48
68	110
100	197

A pressure of 100 psi can put anhydrous ammonia in the face and eyes before a person can react. Many accidents have occurred with the release of anhydrous ammonia isolated in a hose regulator, coupler or plugged applicator tube. On a hot day, the pressure will rise. If an unknowing operator opens a valve or a worn hose ruptures, anhydrous ammonia

will burst into the air endangering the operator or any bystanders. Once released into the atmosphere, one cubic foot of liquid anhydrous ammonia expands to about 900 cubic feet of vapor. Gaseous anhydrous ammonia is lighter than air, and in dry air it will rise and dissipate into the atmosphere. When an accidental release of ammonia occurs, it expands rapidly and cools the air. Rapid cooling of water vapor in the air frequently creates a fog that may hang near the ground until it warms and the fog dissipates.

Temperature — Anhydrous ammonia boils at -28° F (-33.3° C). It must be kept under pressure to be stored as a liquid above this temperature. The subzero temperature, combined with the rapid evaporation of the substance, quickly draws heat out of exposed body tissue. Body cells are composed of 77 percent water. Cells exposed to anhydrous ammonia may freeze and rupture from ice crystal formation. These wounds can be deep and slow to heal. The depth and extent of injury depends on the amount of ammonia involved and the time the skin is exposed.

Dehydration — Anhydrous is a Greek work meaning "without water." Anhydrous ammonia has a tremendous affinity for water. The ammonia draws water out of the cells and tissue, dehydrating and destroying them. Reference to tissue also includes eyes. Dehydration can cause severe damage to eyes, lungs and skin if exposed to ammonia and not flushed immediately with large amounts of water.

Chemical Burns — Anhydrous ammonia is caustic. In addition to temperature and dehydration hazards, anhydrous ammonia is a strong chemical and will produce severe caustic burns.

Anhydrous ammonia has a built-in safety factor because you "can't stand to breathe it." No one can voluntarily remain in a concentration of anhydrous ammonia gas strong enough to cause damage to nose, throat, lungs, eyes or skin. When people do receive burns or eye damage from the product, it is because of a sudden release where the victim is not protected and cannot escape. Figure 2 gives examples of the effects of various concentrations of anhydrous ammonia vapor on the human body.

CONCENTRATION OF ANHYDROUS AMMONIA VAPOR

PPM (parts per million) % (percent) By Volume

EFFECTS ON THE HUMAN BODY

5]	0.005	—Detectable by almost all persons. —Some people complain of nose dryness after 5 minutes of exposure.
134	0.0134	—Most people experience dryness and irritation of nose, throat and eyes.
700	0.07	—Coughing —Severe eye irritation, if not treated, may lead to partial or total loss of sight.
1700	0.17	—Serious lung damage, death unless treated.
2000	0.2	—Burns and blisters skin after a few seconds of exposure.
5000	0.5	—Death by suffocation within minutes.

PREVENTION AND PRECAUTIONS

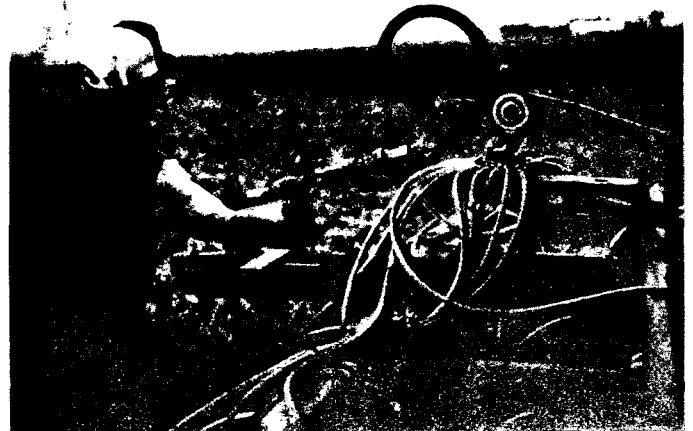
Work Upwind! Work upwind of machinery, the hose-end valve, bleeder valve, coupler, or plugged applicator tubes. This gives an advantage of getting away quickly if anhydrous ammonia is suddenly released. Plan an escape route. Know which way to run.

Handle Valves With Care! Grasp valves by the valve body or the coupling, not by the valve handle — this may accidentally turn and open! Throwing the hose with an end valve over the tank can cause it to open when hitting the tank and spin open the rest of the way. All tanks are fitted with excess flow valves that operate automatically when a hose ruptures. A carelessly handled valve that is partially opened may not provide adequate flow to activate the excess flow valve and the entire tank of ammonia could be lost. Attach the end coupling to the dummy fitting provided when transporting or not using the hose.



A dummy fitting is provided for attaching the end coupling for transport or when not in use.

Respect Pressure! Pressure must be released from the coupler by the use of a bleeder valve before being disconnected. Bleed the pressure off slowly and then disconnect the coupler immediately. On a warm day, leaving a coupler connected for 5-10 minutes after bleeding allows ammonia in the hose to rebuild pressure. On cold days, rubber seals are stiff and may not seal completely. The resulting leak may spray anhydrous ammonia vapors as the tank valve is opened. It may also create a cloud of vapor limiting access to the equipment for reclosing the valve.



The bleeder valve releases pressure to enable safe uncoupling. Work Upwind!

Check The Safety Water Tank! Anhydrous ammonia equipment is required to contain an emergency water supply when being used. Its use is reserved for flushing eyes and other tissue burned by ammonia. Check this water supply (at least 5 gallons) daily. It may freeze in cold weather or become too hot to safely flush eyes on warm, sunny days.

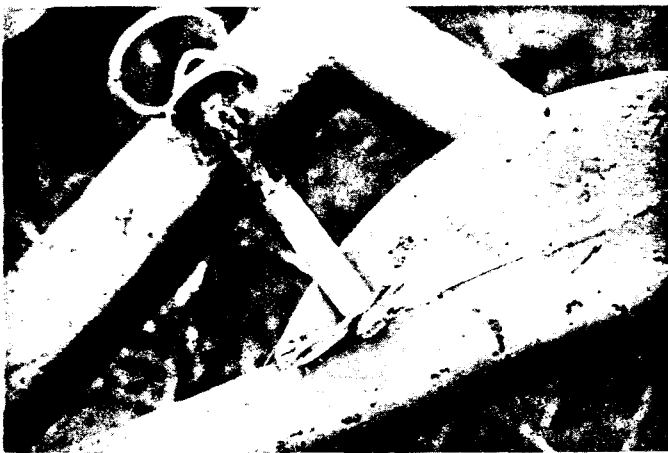
Change the water weekly; it may absorb ammonia from the air and become contaminated. Carrying a water supply on both tank and tractor gives extra protection. A small squirt bottle carried in a shirt pocket can provide immediate relief and help the victim get to the larger water supply.



Always carry at least 5 gallons of water on the nurse tank.

Applicator Tubes! When removing dirt from a plugged applicator tube, treat it as if it contains pressurized anhydrous ammonia. They often do. This could be of particular concern when working among the knives of an anhydrous ammonia applicator. A worker may not be able to move fast enough to escape the pungent fumes without injury.

Hitch Pins! Use a locking type hitch pin to tow the nurse tank behind the applicator. A loose nurse tank may break the feeder hose.



Locking hitch pins prevent broken feeder hoses.

Transport Tanks Safely! Anyone who knows the danger of anhydrous ammonia, would not approach an overturned tank without caution. Nurse tank overturns can be prevented by following a few safety rules:

- Display a slow moving vehicle on the rear of the tank.
- Use safety chains on hitches.
- Do not attempt sharp turns at high speeds.
- Tow one tank at a time.
- Keep speed low. Implement tires are not recommended for travel over 20 mph, and stopping distances are increased by adding the 7,250 lbs. of an anhydrous ammonia tank to the vehicle weight.

Use Personal Protective Equipment! Always wear chemical goggles or a face mask and rubber gloves when handling anhydrous ammonia equipment. These items of personal protective equipment are the most effective tools available to prevent injury to the eyes and hands.



Chemical goggles and rubber gloves protect you from injury should an accident occur.

Leave Messages! Co-workers should know each others activity schedule when applying anhydrous ammonia. An overdue operator may have had an accident. An accident causing eye damage leaves the operator helpless and stranded. Check operators stopped in the field for an unusual period of time when conditions are normal and equipment should be moving.

FIRST AID!!

Seek professional medical aid after first aid treatment of anhydrous ammonia accidents. If additional information is needed in the treatment of a victim, consult your nearest poison control center.

NORTH DAKOTA POISON CONTROL CENTERS

Bismarck
Bismarck Hospital
300 Block N. 7th St.
Bismarck, N.D. 58501
701/224-6000

Grand Forks
United Hospital
212 S. 4th St.
Grand Forks, N.D. 58201
701/780-5000

Fargo
St. Luke's Hospital
N. 5th and Mills Ave.
Fargo, N.D. 58102
701/280-5575

Minot
St. Joseph's Hospital
3rd St. and 4th Ave. SE
Minot, N.D. 58701
701/857-2553

Skin Contact — Use large amounts of water to rinse ammonia from the skin. Anhydrous ammonia's affinity for water makes this first aid treatment effective when done immediately. Clothing saturated by liquid ammonia may freeze to the skin. Removing frozen clothing may cause skin to come with it. Thaw the clothing with water, then remove and continue flushing with more water. **Apply no salves, creams or ointments for 24 hours!** These products will trap the anhydrous ammonia in the tissue, where it will continue to produce a burn. In 24 hours, the ammonia will be naturally eliminated and the burn should be treated the same as a thermal burn.

Eye Contact — If the eyes are exposed to ammonia, flush with water for at least 15 minutes. Hold the eyes open and flush the entire eye including the inner lining of the eyelid. It is important to get the water on fast, hold the eyes open to ensure complete flushing and use large amounts of water. If you are wearing contact lenses, get them out. They may trap ammonia and prevent thorough flushing. Avoid using pressurized water, such as a full flowing garden hose. A pencil-sized stream of water flowing under gravity pressure is just right.

Inhalation — Immediately get a victim to fresh air. Support respiration with mouth to mouth resuscitation if necessary; the patient may stop breathing if exposed to a large dose. Medical attention is of utmost importance! The victim's throat and lungs may be damaged seriously enough to cause respiratory arrest.

MAINTAIN ANHYDROUS AMMONIA EQUIPMENT

Keep anhydrous ammonia equipment in good condition to permit safe use. Whether or not nurse tanks are leased, be on the lookout for defects. Make periodic inspections and repair or replace equipment. Accident victims are just as injured regardless of who owns the tank! The following procedures for maintenance are taken from guidelines recommended by the Fertilizer Institute. For a complete copy of the detailed guidelines write to: The Fertilizer Institute, 1015 18th St. NW, Washington, D.C. 20036.

DAILY INSPECTION — Each day give the tank and hoses a brief inspection. Look for problems with:

- **Hoses** — Check for cuts, soft spots or bulges, kinking or flattening, slippage of hose at coupler.
- **Tires** — Inspect for proper inflation, cuts, weathering, wear and tightness of lug bolts on wheels.

Each time the nurse tank is filled, check the liquid level gauge and pressure gauge. The gauges should be working properly and consistent in their readings. Nurse tanks with faulty gauges should not be used. Repairing or replacing faulty gauges requires the tank to be emptied and the tank pressure dropped to zero before faulty parts can be removed.



Check your pressure and liquid level gauge at each fill.

IMMEDIATE REPAIR — Several situations are cause for immediate repair or replacement. Any leak in a liquid or vapor shutoff valve calls for repair or replacement of the valve. In the case of an accident causing a dent, gouge, crack or other damage to the tank which might cause a failure, the tank should be inspected and, if necessary, repaired before being placed back into service. Any welding repairs on the tank must be done by a certified welder and hydrostatically tested to ASME standards. An overturned tank or collision between the tank and other farm machinery are examples of causes for inspection.

ANNUAL INSPECTION — At least once a year, inspect these items carefully and repair or replace as needed:

Hoses — Lay hose out straight and examine carefully for:

- cuts exposing reinforcement fabric
- soft spots or bulges
- blistering or loose outer cover
- unusual abuse such as kinking or flattening by a vehicle
- slippage of hose at any coupling
- brass or copper fittings or waterhose-type clamps
- hoses over ½ inch O.D. NOT marked with the following information:

“Anhydrous Ammonia”
xxx psig (maximum working pressure)
Manufacturers name or trademark
Year of Manufacture

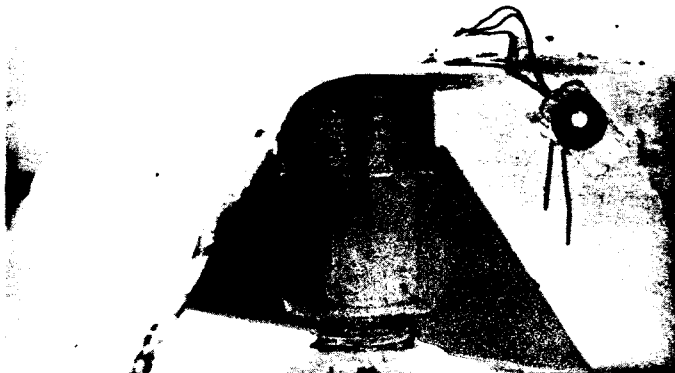
Hoses that show these defects **must** be replaced immediately! Hoses exposed to anhydrous ammonia lose strength and should be replaced according to the following schedule regardless of visible damage:

Braid Material	From Date of Installation
Rayon	2 Years
Nylon/Kevlar	4 Years
Stainless Steel	6 Years



Faulty or damaged hoses should be replaced immediately.

- **Structural Components** — Inspect wagon frame, tongue, reach pole, bolsters, wheel bearings, tie rods and joints, and pins for cracks, excessive wear and adjustment. Also check lugnuts for tightness.
- **Tires** — Inspect for proper inflation, cuts, worn spots and weathering.
- **Lubrication** — Lubricate steering joints and wheel bearings at least once a year.
- **Identification** — All tanks must be identified to meet federal, state and local regulations and codes for anhydrous ammonia.
- **Rust** — Weathering may cause leaks in welds, threaded fittings and loss of wall thickness. If loss of wall thickness is excessive, the tank may need replacement.



The safety relief valve guards against excess pressure buildup.

FIVE YEAR INSPECTION — Every five years, the following parts should receive close attention:

- **General Condition of the Tank** — Inspect the tank for dents, gouges, cracks or rust.
- **Excess Flow Valve** — The excess flow valve should be visually inspected for corrosion or other damage and replaced if defective.
- **Liquid Level Float Gauge** — The liquid float gauge should be removed from the tank and checked for corrosion, bent arm, holes in the bulb, and leaks in the mounting gasket. Defects should be repaired or the item replaced.
- **Safety Relief Valve** — Replace every five years.



Corrosion weakens the tank and may shorten its' useful life.

There are many similarities between an anhydrous ammonia nurse tank and a liquid propane tank, but there is an important difference as well. Liquid propane containers require brass fittings so there will be no sparks generated which may ignite the gas. Anhydrous ammonia is highly corrosive to brass and may destroy a brass fitting overnight, resulting in a large leak. Anhydrous ammonia nurse tanks must be equipped with steel fittings. Be sure your tank is equipped with the proper fittings for the material you are using.

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