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## EC94-738 Using Agricultural Anhydrous Ammonia Safely

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## Using Agricultural Anhydrous Ammonia Safely

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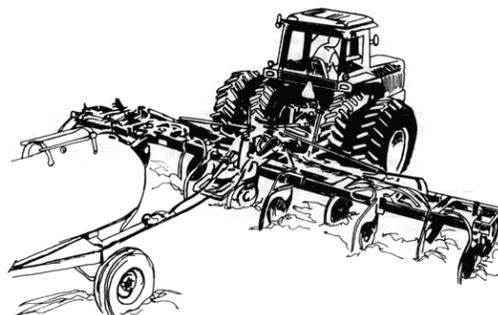
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Anhydrous ammonia is one of the most efficient and widely used sources of nitrogen for row-crop production. Because it is a cheap source of nitrogen and readily available, large quantities of anhydrous ammonia are used as nitrogen fertilizer.

Anhydrous ammonia has disadvantages, especially in handling. It must be stored and handled under high pressure, which requires specially designed and well-maintained equipment (*Figure 1*). In addition, to ensure operator safety, workers must be trained to handle this product and to follow strict work procedures.

What is anhydrous ammonia ( $\text{NH}_3$ ) and why is it so risky to handle? It is a chemical made up of one part nitrogen (N) and three parts hydrogen ( $\text{H}_2$ ). The physical and chemical properties of this fertilizer make it one of the most potentially dangerous agricultural chemicals.



**Figure 1. A nurse tank and three-point tool bar for anhydrous ammonia application.**

Anhydrous means **without water**. Consequently, when  $\text{NH}_3$  contacts water, it rapidly combines with the moisture and forms ammonium hydroxide. When it is injected into the soil, the liquid ammonia expands into a gas and readily combines with soil moisture. Similarly, the liquid or gas that contacts body tissue – especially the eyes, skin and respiratory tract – will remove the water and cause dehydration, cell destruction and severe chemical burns. Victims exposed to even small amounts of ammonia require immediate treatment to avoid permanent injury.

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  $\text{NH}_3$  gas strong enough to damage the nose, throat, lungs, eyes or skin. When people receive burns or eye damage from the product, it is because of a sudden release where the victim is unprotected and cannot escape.

<b>Table I. Concentration of anhydrous ammonia vapor.</b>			
<b>PPM (Parts Per Million)</b>	<b>% (Percent) By Volume</b>	<b>Effect on the Human Body</b>	<b>Exposure Period</b>
50	0.0050	Detectable by almost all persons.	Prolonged, repeated exposure produces no injury.
134	0.0134	Most people experience dryness and irritation of nose, throat and eyes.	Maximum allowable concentration for 8-hour working exposure.
700	0.0700	Coughing. Severe eye irritation, if not treated, may lead to partial or total loss of sight.	Infrequent short (1 hour) exposure ordinarily produces no serious effects.
1700	0.1700	Serious lung damage, death unless treated.	No permissible exposure.
2000	0.2000	Burns and blisters skin after a few seconds of exposure.	No permissible exposure.
5000	0.5000	Death by suffocation within minutes.	No permissible exposure.

*Table I* gives examples of the effects of various concentrations of  $\text{NH}_3$  vapor on the human body. Under atmospheric temperature and pressure,  $\text{NH}_3$  is a colorless gas with a sharp, penetrating odor. For use as an agricultural fertilizer, it is compressed into a liquid so a large volume can be placed into a tank. For example, 855 cubic feet of  $\text{NH}_3$  gas is compressed into one cubic foot of liquid. In the liquid state, under pressure, it is stored in specially constructed tanks strong enough to withstand internal pressures of 250 pounds per square inch (psi). As outside temperature increases, the temperature of the  $\text{NH}_3$  also increases, causing the vapor pressure in the tank to increase (*Table II*). For example, at 60° F, the pressure is 93 psi and at 100° F, the internal tank pressure is nearly 200 psi. Anhydrous ammonia released from this pressure rapidly expands and cools to -28° F. As a result, it can freeze the skin.

<b>Table II. Temperature and pressure relationship of anhydrous ammonia.</b>	
<b>Degrees F</b>	<b>Gauge Pressure, psi</b>
-28	0
0	16
32	48
60	93
100	197

Most NH<sub>3</sub> will not readily corrode iron or steel, but will react rapidly with copper, brass, zinc and many copper alloys. Use only iron or steel for NH<sub>3</sub> containers, fittings and piping. Anhydrous ammonia stored in a tank with brass fittings such as a propane or LPG tank will eventually corrode the safety and control valves. They will fail or become inoperative in a short period of time.

Since NH<sub>3</sub> vaporizes when released to the atmosphere, it is important to minimize the potential for sudden hose release or breakage. One cubic foot of liquid NH<sub>3</sub> will produce 855 cubic feet of gas. Even if the tank valve is closed, a 10-foot hose that contains less than four gallons (.545 cubic feet) of liquid NH<sub>3</sub> will fill a cylindrical area six feet high with a 10-foot diameter. Slowly bleed the tank hose after every application.

### Accidents with Anhydrous Ammonia

Due to its properties and the manner in which it is stored, NH<sub>3</sub> can create a dangerous situation when accidentally released. The following are some examples of how the misuse of NH<sub>3</sub> and its equipment can result in accidents:

- Filling tanks beyond recommended capacity. They should be no more than 85 percent full.
- Knocking open the hose-end valve accidentally.
- Moving applicator tank before filling hoses have been disconnected from the nurse tank.
- Venting pressure release valve while a person is in line of discharge.
- Breaking a transfer hose, especially an old or misused one.
- Failing to bleed hose coupling before disconnecting. On hot days, the black hose gets much hotter than the tank and could result in a higher pressure build up.
- Rupturing of low pressure hose due to pressure buildup when knives plug.
- Releasing ammonia when knives are unplugged.
- Overturning an applicator or nurse tank while in transit or in the field.

All of the above accident situations can result in injury, extensive property damage or both. To minimize the chance of an accident, take steps to ensure all equipment is in top operating condition. Be sure all agricultural workers handling or applying NH<sub>3</sub> have been trained in equipment maintenance and operation, use of appropriate personal protective equipment and emergency first aid.

### Operator Protection

Even with the best precautions, an accidental release may occur. Simple protection can prevent serious

consequences.

A face shield or goggles, rubber gloves and a heavy-duty long-sleeved shirt are recommended as minimum protection for operators routinely handling  $\text{NH}_3$ . Anyone working on or operating anhydrous equipment or handling hoses should wear gloves and eye protection.

Wear properly fitted unvented goggles or a face shield when working with  $\text{NH}_3$ . A face shield will help prevent inhalation of a direct blast of  $\text{NH}_3$  and also will reduce possible eye exposure. Regular glasses do not provide adequate protection. Never wear contact lenses when working with  $\text{NH}_3$ . Anhydrous ammonia might get under the lenses and cause permanent eye damage before the lenses can be removed and eyes flushed with water.

Loose-fitting rubber gloves with an extended cuff are recommended for handling  $\text{NH}_3$ . Turn the extended cuff down so  $\text{NH}_3$  doesn't run down the sleeves when the arms are raised. Gloves that fit loosely can be more easily removed in case of an emergency. Gloves should have a lining to help insulate the hands from the cold when holding metal parts.

Protect arms from liquid splashes by wearing heavy-duty clothing, such as coveralls or work shirts that cover the arms. Thin dress shirts or short sleeves don't provide satisfactory protection.

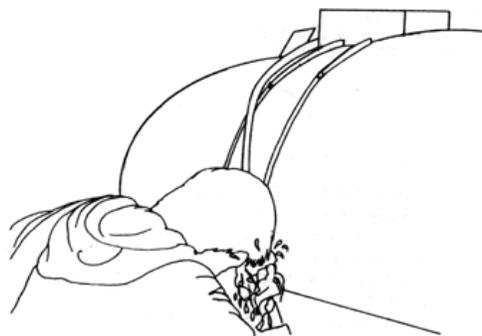
If bulk quantities of  $\text{NH}_3$  are stored on the farm, additional protective equipment is needed. Keep two rain suits or slickers and gas masks with an ammonia canister filter available for emergency work. The protection from a canister filter is limited and should only be used in low concentrations of  $\text{NH}_3$ . When a serious leak occurs, call the local fire department for assistance. Firefighters have the proper training and equipment – including self-contained breathing apparatus and protective clothing – to deal with major  $\text{NH}_3$  leaks where high concentrations of ammonia may be present.

The operator's manual for  $\text{NH}_3$  equipment should include instructions on proper procedures and protective equipment to use when handling ammonia. Review this information before operating the equipment.

### ***First Aid = Water + Water + Water***

Seconds are critical when someone is sprayed with liquid ammonia or engulfed in concentrated vapors. Exposure to  $\text{NH}_3$  is harmful if it contacts the skin and eyes or is inhaled or swallowed. Direct contact with the skin or eyes causes rapid, extensive tissue damage. Immediately flush the exposed body area(s) with copious amounts of water.

Regulations require that all farm vehicles used for  $\text{NH}_3$  carry a container filled with at least five-gallons of water. This water must be readily available for flushing the eyes (*Figure 2*) and skin in case of  $\text{NH}_3$  exposure. Change the water daily to ensure a clean supply. Safety specialists recommend keeping a second five-gallon container of water on the tractor. A pencil size stream of water will consume five gallons of water in 7.5 minutes. The extra five gallons in the tractor provides another source of water for first aid in case the tractor operator is unable to reach the water container on the nurse tank. The water source in the tractor is useful if the  $\text{NH}_3$  release prevents the injured



**Figure 2. The only first aid for**

person from getting near the tank. Also, carry a six- to eight-ounce water-filled plastic eye wash bottle in a shirt pocket. It provides an immediate supply of water if an accident does occur. The objective of the eye wash bottle is to get the excess ammonia out of the eyes in the first few seconds before the victim reaches the larger water supply.

**anhydrous ammonia is water, water and more water.**

When a victim has been exposed to  $\text{NH}_3$ , move him or her to a safe place and flush the exposed area immediately with water for a minimum of 15 minutes. Remove contaminated clothing as soon as it is thawed.

Remember, the sub-zero temperature ( $-28^\circ \text{F}$ ) of  $\text{NH}_3$  can freeze clothing to the skin. Removing clothing before thawing with rinse water can cause extensive skin damage. Do not apply salves, creams or ointments. They won't stop the damaging action to skin. Contact a doctor or emergency medical services immediately after emergency first aid treatment.

Even if small amounts of  $\text{NH}_3$  enter the eyes, irrigate them immediately with water for 15 minutes or more. Hold the eyelids open during irrigation to ensure water contacts all parts of the eye. Immediate first aid is important to avoid partial or total loss of vision. Again, consult a doctor or emergency medical services after giving emergency first aid. Burn unit physicians recommend continuous flushing until the victim is delivered to the emergency room. Eye burns will be flushed for an additional 24 hours.

Anhydrous ammonia vapors are easily detected because of their pungent odor, even in low concentrations. Inhalation of  $\text{NH}_3$  can irritate the respiratory tract and lungs. At high concentrations,  $\text{NH}_3$  combined with the moisture in the lungs, may damage the alveoli (lung lining) and reduce the ability to transfer oxygen to the bloodstream.

When a person has inhaled ammonia, move the victim to a safe area. Exposures to low concentrations of  $\text{NH}_3$  for a short period of time may not require treatment. Exposure to higher concentrations may cause convulsive coughing and respiratory spasms. Provide rescue breathing if victims are not breathing and CPR if they have no pulse. Obtain medical help as soon as possible.

In case  $\text{NH}_3$  has been swallowed, contact the Poison Control Center immediately. Have the victim, if conscious and able, drink large amounts of water to dilute the chemical. Do not induce vomiting if the victim is in shock or unconscious. If vomiting occurs, keep the head lower than the hips to prevent vomitus from entering the lungs. Review the first aid response (*Table III*) with employees and family members.

**Table III. First aid for anhydrous ammonia injury.**

**Use water in large volumes – gallons, not quarts or pints – as treatment. The Compressed Gas Association gives these recommendations:**

- Persons having chronic lung diseases or persons who have shown evidence of hypersensitivity to ammonia should not be employed where they will be exposed to it.
- The victims of exposure should be removed to an area free from fumes if an accident occurs.
- Victims of exposure should be placed in a reclining position, with head and shoulders elevated. Basic life support should be administered if needed.
- Any person who has been burned or overcome by ammonia should be transported to an emergency room immediately. Irrigate with water immediately. The rescuer should use fresh water if possible. Open water in the vicinity of an anhydrous leak may have picked up enough  $\text{NH}_3$  to be an aqua ammonia solution. This could increase eye or skin damage.
- Victims of exposure should be kept warm and treated for shock.
- Hold the eyelids open and pour water over the eyeballs and lids. Wash thoroughly this way,

- continuously, until seen by a physician or emergency department staff.
- If skin is involved, flood the affected area continuously with water for at least 15 minutes. Do not cover burns with clothing or dressings. Allow them to remain open to the air. Don't worry about removal of clothing at onset. Flush the clothing and body first and then remove the clothing after initial wetting.
  - If the nose and throat are affected, irrigate the nose and mouth with water continuously for 15 minutes.

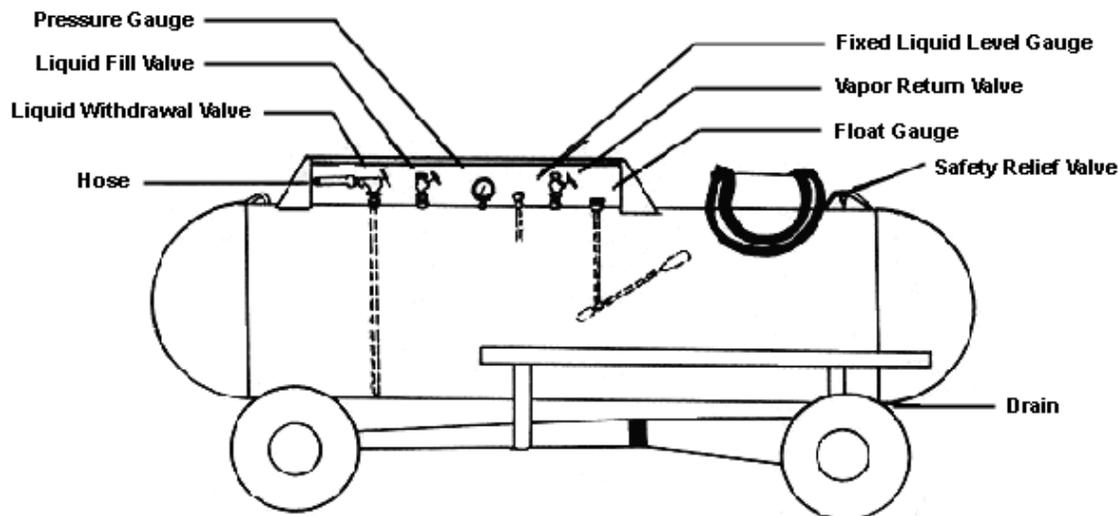
## Prevention and Precautions

**Wear protective equipment.** Always wear gloves, eye protection and other needed safety equipment when working with  $\text{NH}_3$ .

**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  $\text{NH}_3$  suddenly is released. Plan an escape route. Know which way to run.

**Watch downwind.** Watch for houses, businesses, schools or other places where there are likely to be people.

**Keep children away** from the equipment. Federal law states that children younger than 16 are not allowed to handle, transport or transfer  $\text{NH}_3$ .



**Figure 3. Valves and fittings for an anhydrous ammonia nurse tank.**

**Handle valves with care.** Grasp valves by the valve body or the coupling, not by the valve wheel. The valve wheel might accidentally turn and open. Throwing a hose with an end-valve over the tank might cause the valve to open when it hits 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 end valve that is partially opened may not provide adequate flow to activate the excess-flow valve and the entire tank of ammonia could escape. Attach the end coupling to the dummy fitting provided when transporting or not using the hose. On cold days, rubber seals of the valves are stiff and may not seal completely. The resulting leak might release  $\text{NH}_3$  vapors as the tank valve is opened. It also may create a cloud of vapor, limiting access to the equipment

for closing the valve.

**Respect pressure.** Release the pressure from the coupler using a bleeder valve before disconnecting the transfer hose. Bleed the pressure off slowly and then disconnect the coupler immediately. On a warm day, leaving a coupler connected for five to 10 minutes after bleeding allows  $\text{NH}_3$  in the hose to rebuild pressure. If bleeding takes longer than 5-7 minutes, either the tank valve or hose valve may be faulty. Repair immediately.

**Check safety water tank.** Check this water supply (at least five gallons) daily. It may freeze in cold weather or become too hot to safely flush eyes on warm sunny days. Change the water daily. It can absorb  $\text{NH}_3$  from the air and become contaminated. Carrying a water supply on both tank and tractor gives extra protection.

**Check applicator tubes.** When removing dirt from a plugged applicator tube, treat it as if it contains pressurized  $\text{NH}_3$ . This is very important when working between the knives of an  $\text{NH}_3$  applicator.

**Never tamper with the safety relief valve.** This valve, known as a "pop-off" valve, is factory-set (*Figure 3*). If it is malfunctioning, the valve should be repaired or replaced. Always know the location of the safety relief valve and stay away from it. The Fertilizer Institute recommends replacement of safety relief valves every five years unless otherwise required by leakage or other defects.

**Never deactivate the excess flow valve.** When opening the nurse tank valve, open it completely. Failure to open completely may restrict flow and if an accident occurs, the excess flow valve will not operate as designed.

**Avoid kinking the hoses.** Kinks create weak spots in the hose (*Figure 4*). Also, avoid dragging the hose on the ground or running over it with vehicles. In off-season, store hoses indoors. Hang hoses on something smooth with a broad-curved surface, such as an old tire rim. Hang the hose ends down to ensure drainage.

**Leave a message.** Co-workers should know each other's activity schedule when applying  $\text{NH}_3$ . An overdue operator may have had an accident. An accident causing eye damage leaves the operator helpless and stranded. Check if operators are stopped in the field for an unusual period of time when conditions are normal and equipment should be moving.



**Figure 4. Hoses are the weakest link in the anhydrous ammonia application system. Always inspect the transfer and filler hoses thoroughly. If the braided layers show through, or if kinks, bulges or coupling slippage is evident, replace as soon as possible.**

## Transport Safety

Towing a nurse tank presents problems because  $\text{NH}_3$  is a hazardous material. An accident with a nurse tank on the highway can result in serious injury, costly repairs, and liabilities.

Nurse tanks of 3,000 gallons or less mounted for transport are considered "implements of husbandry" when used exclusively for agricultural purposes. Nurse tanks must have the words "anhydrous ammonia" in large green lettering and a nonflammable gas placard with the words "nonflammable" or "1005" on both sides and on each end of the tank. Applicator tanks must contain the same identification on at least the rear of the container. Motorists on the highway can easily identify ammonia tanks by these markings.

All nurse tank wagons must be securely attached to the vehicle pulling them. Use a drawbar hitch pin, safety clip and safety chain. Before each highway trip, check the hitch pin, safety clip and safety chain to see they are secure.

Nurse tank wagons are designed to follow smoothly in the path of the towing vehicle. Nurse tanks can overturn or collide with another vehicle if the tank wagon swerves from side to side. Make sure your tank wagon is hooked up properly. Also make sure the wheel lug nuts are tight and the tires are in good shape and properly inflated.

Tow only one tank at a time. When hauling a loaded nurse tank, drive at speeds of 30 mph or less. The potential for a serious accident is increased at higher speeds because of insufficient braking capacity to safely control the wagon.

Because farm implement tires are designed for travel at low speeds, allow sufficient time to reach your destination. When towing at 25 mph or less, display a slow-moving-vehicle emblem on the rear.

State law has additional requirements for towing a nurse tank or applicator tank at night. Display two red reflectors, visible to the rear, at the extreme right and left projections of the trailing unit. The law also requires a red light visible to the rear. If the towing vehicle lights are not visible, have lights visible on the tank.

## Container and System Requirements

The specially fabricated and designed pressurized equipment should meet the ANSI guidelines provided in "Safety Requirements for Storage and Handling of Anhydrous Ammonia." All parts and contact surfaces must withstand a minimum working pressure of 250 psi. This includes pressure welds, safety valves, gauges, fittings, hoses and metering devices.

All containers used for storing  $\text{NH}_3$  must be painted white. Light colors reflect heat and this helps keep the temperature and pressure down inside the tank during warm weather.

Since 1972, ANSI standards have specified that breakaway, self-closing coupling (*Figure 5*) must be used if the applicator has a nurse tank to supply  $\text{NH}_3$ . Its primary purpose is to separate and shut off the flow of  $\text{NH}_3$  in case the nurse tank separates from the applicator. The breakaway coupling prevents the hose from rupturing.

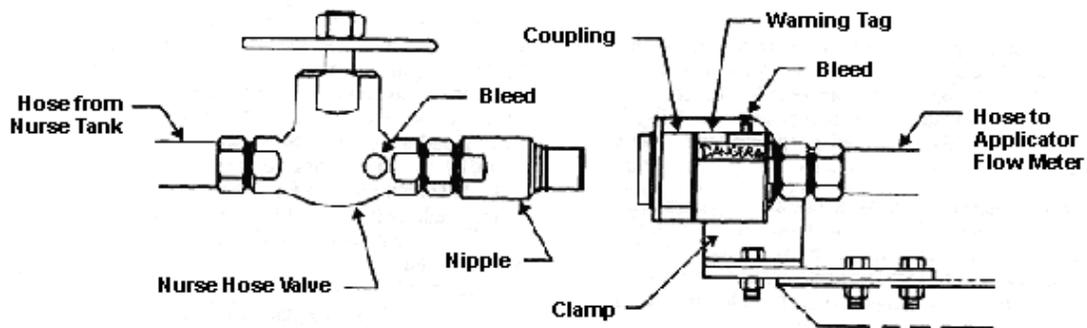
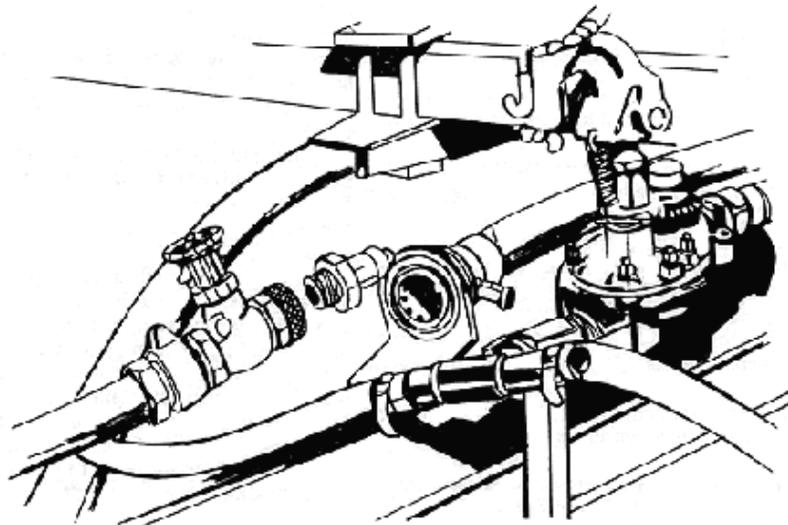
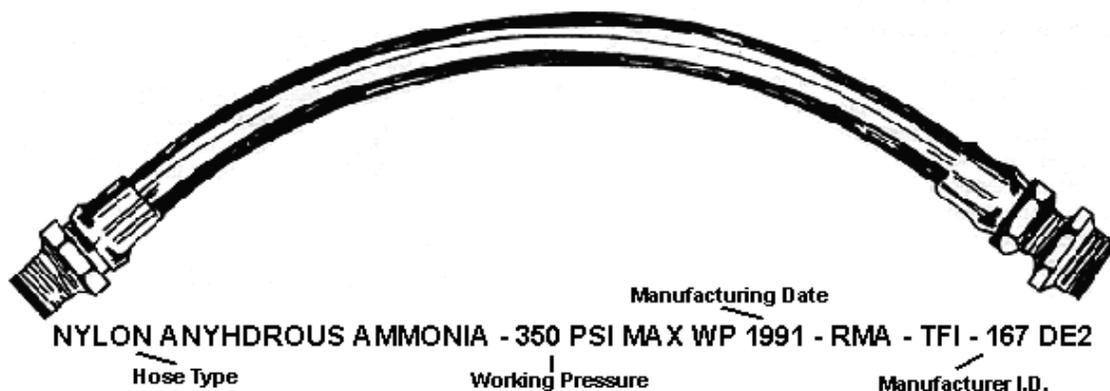


Figure 5. The "breakaway coupling" should be mounted between the applicator and nurse tank.

### Maintain Anhydrous Ammonia Equipment

Keep  $\text{NH}_3$  equipment in good condition. Be on the lookout for defects in nurse tanks, regardless of whether owned or leased. Make periodic inspections and repair or replace damaged or defective equipment. The following procedures for maintenance are taken from guidelines recommended by the Fertilizer Institute.



**Figure 6. Hose specifications should be listed on the hose.**

**Daily inspection.** Each day inspect hoses. Look for problems with:

- hose cuts exposing reinforcement fabric,
- soft spots or bulges,
- blistering or loose outer cover of the hose,
- unusual hose abuse, such as kinking or flattening by a vehicle,
- slippage of hose at any coupling,
- brass or copper fittings or waterhose-type clamps, and
- hoses over 1/2 inch O.D. and not marked with the following information (*Figure 6*):
  - "Anhydrous Ammonia"
  - xxx psig (maximum working pressure)
  - manufacturer's name or trademark
  - year of manufacture

Immediately replace hoses that show these defects. Hoses exposed to NH<sub>3</sub> lose strength. Replace them according to the following schedule, regardless of visible damage:

<b>Braid Material</b>	<b>From Date of Installation</b>
Rayon	2 years
Nylon/Kevlar	4 years
Stainless Steel	6 years

Most hose failures occur within 12 inches of the hose end. This is due to the continuous flexing and sharp bending that occurs in that area. Minimize kinking by proper selection of hose end valves. If the hose is used to fill the applicator tank, use an angle valve. If it is used to feed an applicator with the tank towed directly behind, use a straight globe valve.

Give careful attention to how the Acme fitting is placed to secure the hose during transport. If an angle valve is used, the Acme fitting should be welded perpendicular to the long axis of the trailer. If a straight valve is used, the Acme fitting should be located parallel to the long axis of the trailer.

**Annual Inspection**

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

- *Hoses* – As covered in daily inspection.
- *Structural components* – Inspect trailer frame, tongue, wheel bearings, pins for cracks, excessive wear.
- *Lubrication* – Lubricate steering joints and bearings.
- *Identification* – All tanks must be identified to meet federal and state regulations.
- *Rust* – Weathering reduces weld strength, thread and wall integrity.
- *Breakaway coupling* – Check separation force and closure of excess-flow valves (*see below*).

**Five-Year Inspection**

- *Tank condition* – Inspect for dents, gouges, cracks or rust.
- *Excess flow valve* – Visually inspect for corrosion and damage. Testing should be performed.
- *Liquid level float gauge* – Remove from tank and check for corrosion, bent arm, holes in bulb, and

- leaks in mounting gaskets.
- *Safety relief valve* – Replace.

## Breakaway Coupling Inspection

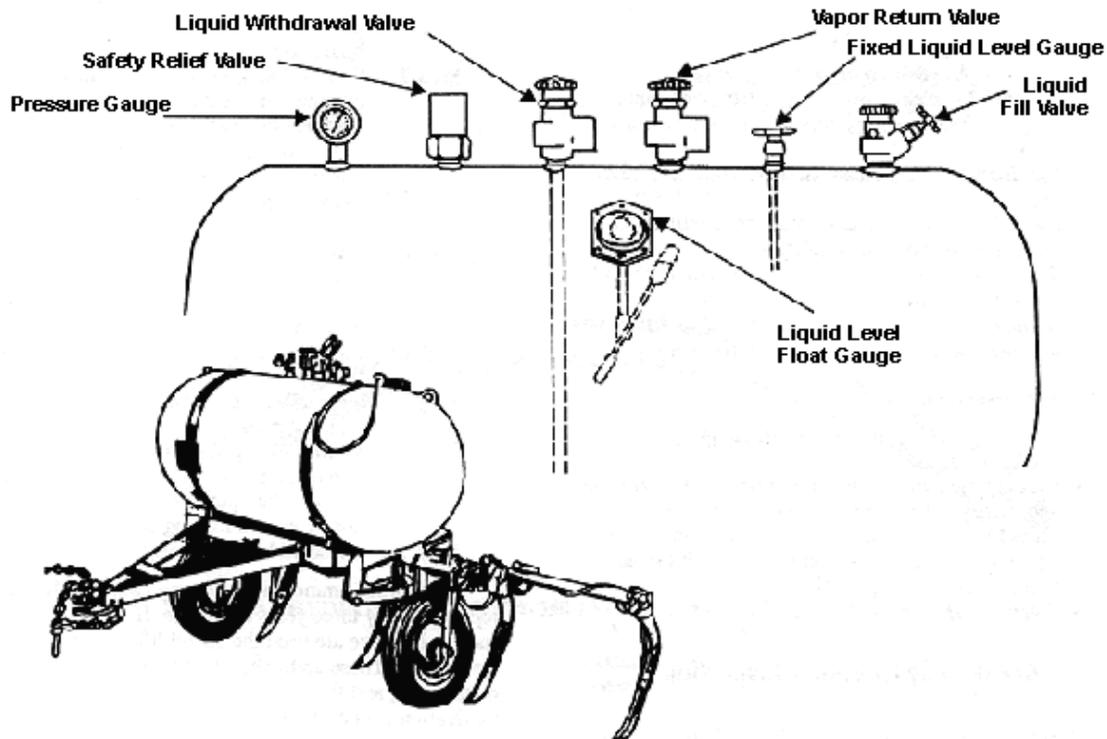
A regular coupling inspection should be performed before each applicator use. In case of rented or borrowed equipment, regular inspection should be done each time the applicator is returned from one user and before issuing to another user. Follow the following procedure for regular coupling inspection.

- Step 1.** Put on protective clothing and safety devices and have emergency water available.
- Step 2.** Close all valves, including the nurse tank valve, nurse tank hose valve and applicator flow meter.
- Step 3.** Slowly open the bleed valve on the coupler to relieve any pressure between coupler and metering system. If coupler does not have a bleed valve, replace with one that does.
- Step 4.** Slowly open the bleed valve on the nurse tank supply-hose valve to relieve any pressure in the supply hose.
- Step 5.** Pull on the supply hose (male-half of breakaway coupling) until it separates from the female coupling. This should require 50 to 100 pounds of pull to separate. Separation is sudden, so use care not to fall when separation occurs. If you are unable to disconnect, the breakaway coupling should be replaced with a workable one before use.
- Step 6.** Push on the small end of the spring-loaded poppet valve to open each coupling half using a screwdriver or appropriate tool. Release it and confirm that the springs return the poppet valve to the fully closed position. If the poppet valve sticks or binds, the coupling should be replaced.
- Step 7.** Pull the ball body of the female coupler out enough to expose the locking balls. Confirm that each locking ball is clean from dirt and corrosion and is free to move in its locking position. Clean and lubricate according to manufacturer's instructions.
- Step 8.** Visually inspect the mounting clamp and confirm the mounting bolts are tight and the pivots are secure. To assure proper separation the coupler must pivot in all directions to allow a straight pull of the hose.
- Step 9.** Reconnect the coupling; if not easily coupled recheck the locking ball as listed in Step 7. Replace breakaway coupler if connecting requires a great effort, requires several attempts, takes more than one person or secure locking is not accomplished.
- Step 10.** Close all bleed valves.

Anhydrous ammonia breakaway couplers should be replaced every three years of service. If NH<sub>3</sub> additives such as N-Serve are used the useful life may be less than three years. These additives shorten the life of rubber and metal parts, and the need of frequent inspection and lubrication cannot be overemphasized.

## Anhydrous Ammonia Transfer

Most NH<sub>3</sub> accidents involve improper handling procedures. Read the owner's manual and follow instructions. Do not leave during the transfer procedure. Check with the dealer if unsure about the correct procedure. Ask for instructions when renting or borrowing equipment. Review procedures with employees to ensure their safety before allowing them to handle equipment.



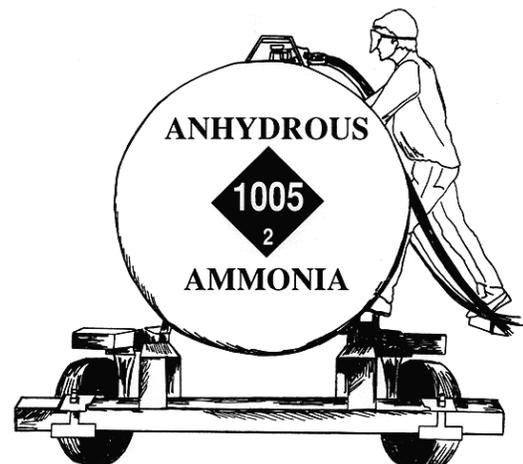
**Figure 7. Valves and fittings used on a complete applicator.**

When filling a nurse or applicator tank (*Figure 7*), be thoroughly familiar with the equipment and procedures prior to any transfer. Because most accidents occur when transferring NH<sub>3</sub>, it is very important to wear a protective face shield or goggles and rubber gloves (*Figure 8*). Make sure the five-gallon container is full of clean water.

Park the nurse tank on level ground, downwind from the filling operation. Place it close to the filling point to eliminate any stress on the hose. Avoid parking near any obstacles such as fences, buildings or ditches that would make evacuation difficult. Block the wheels to prevent movement of the nurse tank. A serious situation could develop if the tank moved and a hose tore loose during the filling operation.

Before connecting the hose, make sure the coupling and connections are free of dirt and other foreign material. Visually check to see that the threads are not damaged. This will reduce the chance of an ammonia leak when pressure is applied.

Workers should carry the filler hose by the valve body or



**Figure 8. Wear goggles and rubber**

coupling, not by the valve wheel. This reduces the chance of the valve wheel opening unexpectedly and releasing  $\text{NH}_3$ .

Remember the valve wheel and fitting are designed to be closed by hand pressure only. Don't use a wrench; it can damage the fitting. If the valve will not close by hand pressure, repair the valve.

**gloves while transferring anhydrous ammonia. Transferring anhydrous ammonia is the most dangerous job.**

If using a compressor to transfer ammonia, follow recommended instructions in the operator's manual. Maintain a vapor pressure 5 to 10 psi lower in the tank being filled to maintain flow in the proper direction.

Do not overfill the nurse or applicator tank. Keep a check on the liquid level by opening the 85 percent fill bleeder valve. A white fog will appear when it reaches this level. As a part of the normal loading procedure, check the liquid level float gauge accuracy by comparing with the fixed liquid level gauge. It is important to fill only to 85 percent or less of the total liquid capacity of the tank. As the outside temperature increases, the temperature of the liquid increases and the liquid expands, causing the vapor pressure in the tank to increase. If the tank is overfilled and no vapor space is available, the safety relief valve might fail, causing the tank to rupture or explode.

After the filling operation is complete, secure the hose in the storage position for transit. The transfer hose should be drained of all  $\text{NH}_3$  and the valve left open. Take a final walk around the nurse or applicator tank to confirm that all steps have been taken.

## Other Uses for Anhydrous Ammonia

In addition to its use as a nitrogen fertilizer,  $\text{NH}_3$  has other purposes on the farm. Anhydrous ammonia also is used to add non-protein nitrogen to wheat straw, silage, and hay. Anhydrous ammonia also can be used as a cooling agent in some processes.

## Summary

Anhydrous ammonia is perhaps the most dangerous chemical on the farm. It can be handled safely when following proper procedures. Wear personal protective equipment and provide plenty of clean water for first aid. Keep the equipment in good condition and observe proper procedures when transferring  $\text{NH}_3$ . When transporting  $\text{NH}_3$  on the highway, travel at a safe speed and use a safety chain and a safety clip on the hitch pin. By following recommended procedures, the chance of an accident is reduced.

## References

- The Fertilizer Institute, *External Visual Inspection Guidelines for Anhydrous Ammonia Nurse Tanks and Applicator Tanks*, 1982. The Fertilizer Institute, 1015 18th Street, NW, Washington, D.C. 20036.
- American National Standards Institute, Inc., *Safety Requirements for the Storage and Handling of Anhydrous Ammonia*, Publication K61.1-1981, ANSI, 1430 Broadway, New York, NY 10018.
- Aherin, R. and L. Schultz, *Using Anhydrous Ammonia Safely on the Farm*, Educational Package AG-EP-2192, Agricultural Extension Service, University of Minnesota, 1984.
- National Safety Council, *Safe Handling of Anhydrous Ammonia*, Accident Prevention Bulletin 699.41-11. NSC, 1121 Spring Lake Dr, Itasca, IL 60143-3201.

- *Fire Protection Handbook*, Fourteenth Edition, National Fire Protection Association.

**Contact your Extension Office for more information concerning anhydrous ammonia. The following are available:**

- Video – Calibrating Anhydrous Ammonia;
- EC-94-737 – Calibrating Anhydrous Ammonia Applicators.

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