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**How to Reduce
Your Risk of Injury
from Exposure to
ANHYDROUS
AMMONIA**

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Anhydrous ammonia use is growing more rapidly in North Dakota than that of any other farm production chemical. However, grower safety training available when the product was introduced in the 1960s has diminished in scope and intensity. As a result, many first time users and family members of long term users have limited training in procedures necessary for safe use of this product.

Education of everyone on the farm who handles ammonia, family members as well as employees, will reduce the risk of injury from this chemical.

Be Aware of Results of Exposure

Anhydrous ammonia is stored and handled as a liquid under high pressure. When pressure is released, the ammonia chills to -28 degrees Fahrenheit with vaporization and expands to 900 times its liquid volume. Vaporizing ammonia can freeze skin instantly. It is also an extremely caustic compound that can inflict severe burns.

Anhydrous ammonia has a strong affinity for water. Because tissues of the respiratory tract, eyes, and skin contain so much water, they are especially susceptible to caustic burns from contact with ammonia. Clothing can absorb and trap ammonia that has been released in an accident. Immediate removal of clothing saturated with ammonia will reduce skin injury. Similarly, contact lenses can trap ammonia and increase damage to the eyes in case of exposure to ammonia. Eyeglasses and goggles are a safer alternative for the user of anhydrous ammonia.

When Is Exposure Dangerous?

Whenever the volume of escaping ammonia is great enough to form a cloud, a danger exists. Any inhalation or exposure to such a cloud is potentially dangerous, especially to eyes, lungs and skin.

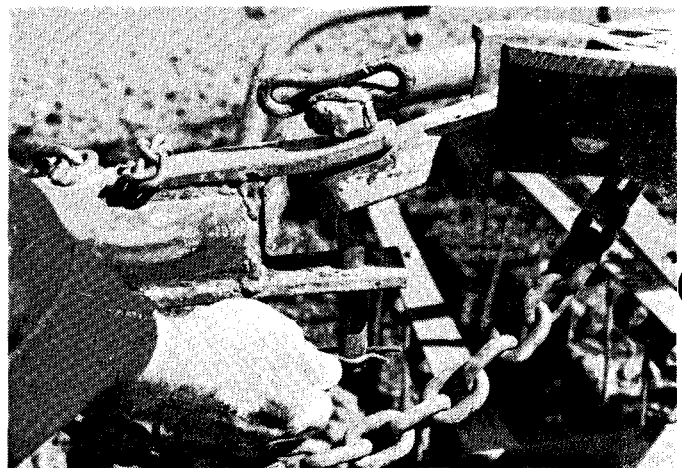
Low volume releases can be dangerous also. Direct blasts of ammonia to the body, such as those from leaky valves, uncoupled hoses, or ruptured joints, are especially dangerous. These sudden, intense blasts of gas can cause severe injury to body areas in most direct contact, as well as considerable damage to more remote body tissue.

Ammonia has a pungent, easily identified odor. Vacating an area where ammonia is detected is an excellent safety precaution. The nose can detect ammonia gas at concentrations of 3-5 parts per

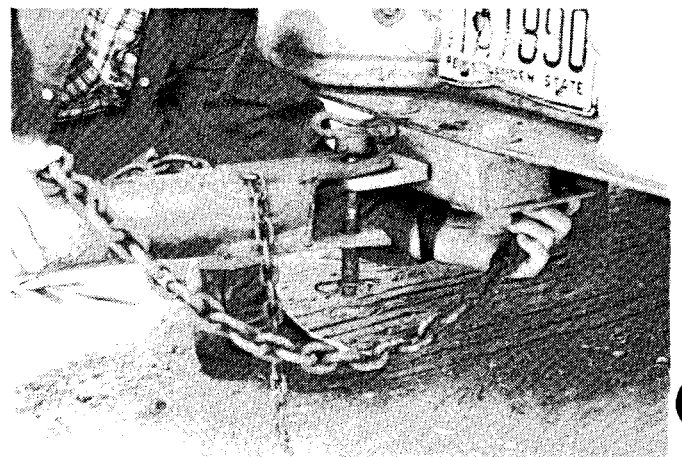
million. Even at much higher concentrations, 100 ppm, exposure to ammonia gas is not considered harmful, however unpleasant.

Eliminate the Most Common Cause of Accidents

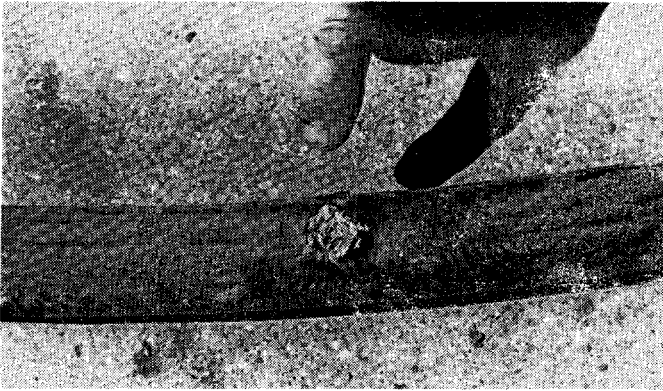
Prevention of uncontrolled ammonia release, injury prevention, and accident prevention are synonymous in anhydrous ammonia use safety. Equipment maintenance neglect and operator carelessness are the dominant causes of anhydrous ammonia accidents. Failure to bleed pressure from hose fittings before they are uncoupled is an example of a common accident cause.



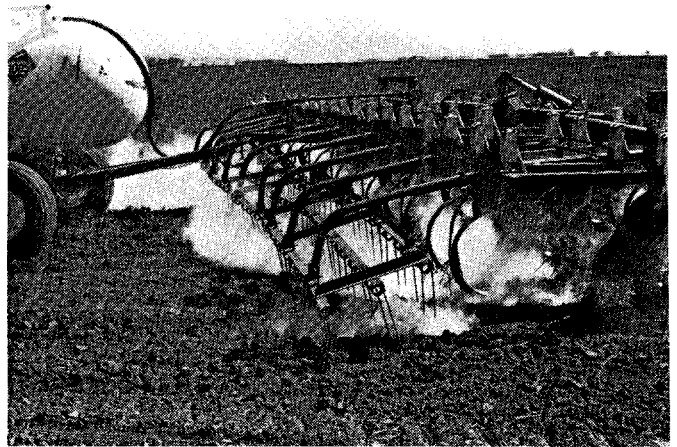
Safety chains and hitch pins securing trailers to field applicators prevent a ruptured ammonia hose.



Safety chains and hitch pins are essential for ammonia transport safety.



Inspection and maintenance is a first priority accident prevention tool.



Work on the upwind side of equipment. Ammonia concentrations in a vapor cloud are hazardous.



Proper gear and procedures make ammonia handling safe.

Equipment available for anhydrous ammonia application is designed and built to rigid safety specifications. Most apparatus designs have been available and used for several decades. With proper maintenance, equipment failures are rare. Indeed, design simplicity prompts user self-confidence and carelessness that can lead to accidents.

Use Personal Protective Equipment

Even with proper equipment maintenance and precautions, an ammonia accident may occur. For example, small controlled releases of ammonia are normal when uncoupling ammonia fittings. Ammonia concentrations are very high as fittings are uncoupled, so hands and fingers in this area are

susceptible to injury. Eyes are close by as hoses are uncoupled. Compared to skin, even lower ammonia concentrations are damaging to eyes. Eye damage is often permanent.

Personal protective equipment is the best safeguard against ammonia injury. Goggles and gloves provide ample protection during normal ammonia handling activities. Tightfitting non-vented goggles designed to prevent leaks are essential. Loose fitting rubber gloves with long gauntlets protect skin areas nearest the ammonia source during equipment manipulations. Protection with both goggles and gloves is needed whenever ammonia is transferred or applied as well as while working on equipment and changing hoses.

Know First Aid

First aid for ammonia exposure is **MOVE IMMEDIATELY TO FRESH AIR, REMOVE AMMONIA SATURATED CLOTHING AND FLUSH EXPOSED TISSUE WITH WATER.**

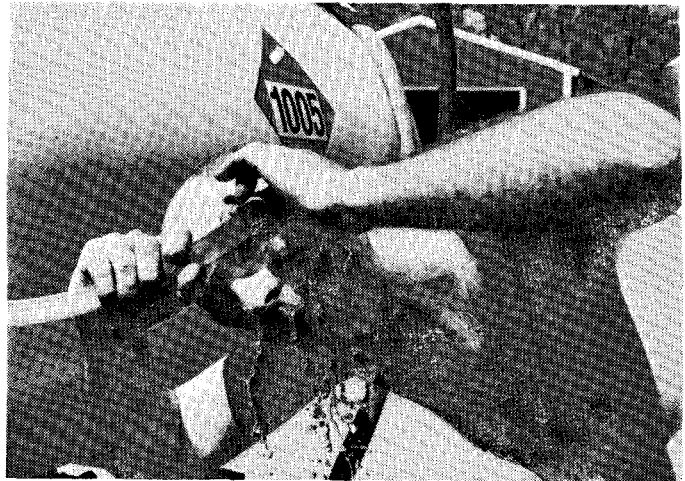
When exposure to ammonia does occur, it is important to understand that the degree of tissue damage depends on the ammonia concentration, the tissue involved and the period of ammonia exposure. Limiting any of these factors will reduce the extent of ammonia injury.

Even a few seconds delay in administering first aid may greatly increase the degree of damage.

Use Lots of Water in Case of Exposure

The best measure in case of exposure of skin or eyes to ammonia is to flush with generous amounts of water. Flushing exposed skin and eyes with water will lower the ammonia concentration at the tissue surface and many dramatically lessen the degree of damage.

A 5-gallon container of water on the nurse tank provides an accessible source of water for irrigation wherever ammonia is used. To thoroughly remove traces of the chemical, irrigate exposed skin or eyes for at least 15 minutes. In case of respiratory contact with ammonia gas, staying upwind of a leak or closing a leak will quickly reduce the concentration of ammonia in the lungs.



Proper eye irrigation requires the eyelid be forced open and water applied to both the eye and underside of eyelids.

Carry a Squeeze Bottle for Eye Irrigation

The benefits of carrying a small squeeze bottle of water for irrigating eyes cannot be overstated. When exposed to ammonia, the eyes burn severely, and the victim's reflex holds his eyes tightly closed. Despite his desperate need for water to flush his eyes, he typically cannot see to locate the 5-gallon water container on the nurse tank. A squeeze bottle of water in a shirt pocket is easily located for immediate irrigation of the eyes, making it easier to find the 5-gallon supply.



A shirt pocket water bottle is always accessible for first aid eye treatment.

Assistance at the Scene of an Accident

Ammonia accidents require a specific response. Removing victims to a fresh air location and administering first aid as necessary is a first priority. Safeguarding the area downwind of the accident also requires prompt attention. In populated or public use areas, the local law enforcement agency and fire department should be notified immediately. Staff in these agencies are trained in evacuation and ammonia leak containment procedures.

Recognize Exposure Symptoms

The first effect on tissue exposed to high pressure ammonia release is freezing. The super-cooled liquid ammonia boils at -28 degrees fahrenheit. The second effect is chemical burn due to combination of ammonia and tissue, resulting in tissue dissolution (liquefaction). The chemical reaction of ammonia and the water contained in the skin tissue releases heat, deepening the burn. Burn depth becomes a factor of ammonia concentration and water content of the tissue. There is a direct relation between ammonia concentration in the air and the effect on health.

Ammonia Concentration ppm	Effect on Health
400	Throat irritation.
700	Immediate eye injury; higher concentrations produce greater damage and permanent impairment.
1700	Coughing and laryngospasm (airway tissue spasm) appear upon inhalation and glottal edema (severe constriction and swelling of the upper airway) may follow within a few hours. Spasms may cause momentary inability to breathe and labored breathing may be present for a few hours.
2500-4500	A half-hour exposure can be fatal.
5000 or greater	Death results from respiratory arrest.

Assisting Victims

A direct spray or blast from ammonia requires immediate tissue decontamination.

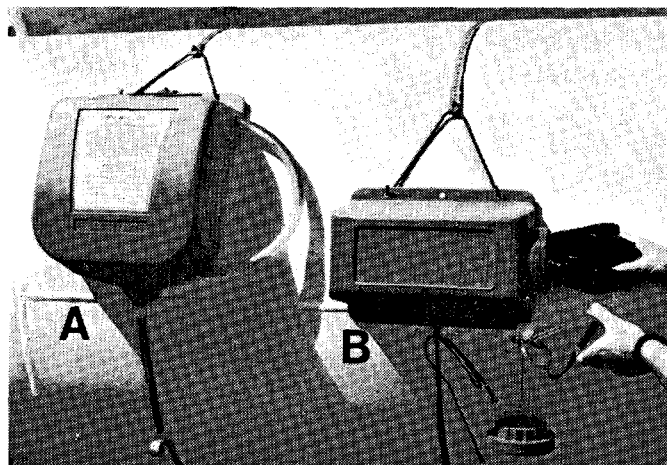
- Be prepared to irrigate eyes and exposed tissue liberally with water. A 5-gallon water source is available on all ammonia

equipment. Assist the victim by holding upper and lower eyelids open for thorough eye irrigation. Use water liberally. Continue exposed tissue irrigation for 15 minutes.

- Rinse the mouth aggressively. Contaminated clothing should be removed. Rinse the ears. Skin folds should be irrigated with emphasis on the arm pits, groin and under the chin. Remember that clothing may be frozen to the skin. If so, clothing should be soaked with tepid water for safe removal. Salves and creams should not be applied to skin injured by ammonia.

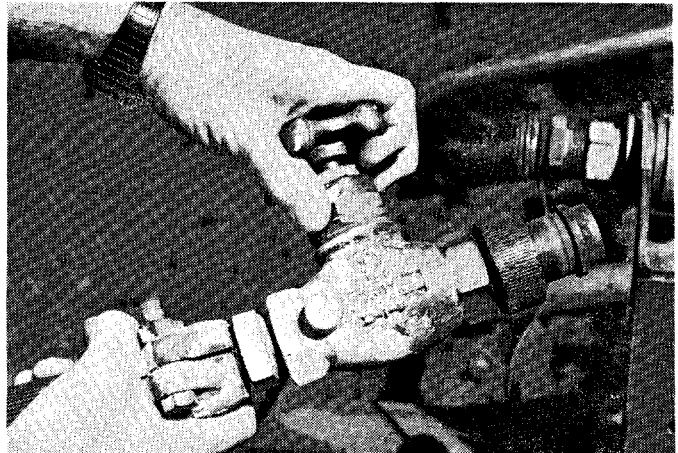


Goggles and long gauntlet rubber gloves are worn for all ammonia equipment contact operations.



A. Check water tanks regularly and fill with clean water.
B. Goggles and gloves should be stored in a convenient and accessible spot.

- c) First aid such as CPR or treatment of shock may be required. Treatment should be instituted immediately, and if not already done, local fire department or emergency medical services should be called. These individuals have protective clothing and they should be the ones to remove individuals from an ammonia vapor cloud. To do otherwise may add to the list of victims.
- d) Ammonia exposure victims can benefit from professional medical help, even if symptoms seem minor. Encourage the injured person to see a doctor immediately, and assist him if necessary.



Accidentally opened valves are a common accident cause. Never use a valve wheel as a hose handle.

Medical Effects

Until recently there had been little information in the medical literature on the effects of exposure to ammonia. Because of this, cases evaluated at different times and with different exposures produced an artificial picture of the effects of the exposure. No one had been able to evaluate the effects of a single exposure over a long time on a large number of victims.

An accident in June of 1981 enabled evaluation of a large number of ammonia-injured patients sequentially over a three-year period. Testing was undertaken immediately following the injury, at six weeks, three months, six months, one year and two years. Those who developed pulmonary abnormalities were more affected at six months, and improvement, if it was to occur, followed. Twenty-five percent of the individuals were left with persisting inflammation of their airways leading to a decreased ability to effectively move air through their lungs. Twenty-five percent of the cases developed allergies to dust, humidity or cold manifested by a cough or wheezing, even though their lungs tested as normal when at rest.

Injuries to the eye, larynx and emotional changes were other significant alterations which led to disability.

When to See a Physician

Medical attention should be sought for any tissue damage following ammonia exposure. An irritating cough that disappears can be misleading. Lung damage may increase for several months after exposure. During this period an exposure victim is susceptible to other pulmonary disorders and infection.

Burned skin or eye tissue is very difficult to access at the time of injury. Burns may be far more



Never attempt field repairs on ammonia metering equipment. This chore is reserved for clean work benches and trained repairmen.

serious than they originally appear. This is especially true of eye damage. Skilled first aid followed by professional medical care will minimize permanent damage from ammonia exposure.

Literature Cited

1. Greene, Jerry, M.D., F.C.C.P. "A Prospective Study of Pulmonary Function Abnormality Following Ammonia Burns" Abstract presented at American College of Chest Physicians, 53rd Annual Scientific Assembly in Atlanta, GA, October 1987.

Photo Credit

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Ammonia IQ Test

- What sign would you expect in someone who had breathed anhydrous ammonia?
- What sign would you expect in someone who had anhydrous ammonia sprayed on the skin?
- What sign would you expect in someone who had anhydrous ammonia sprayed in the eyes?
- If you suspected ammonia inhalation, what procedures would you follow?
- If you suspected anhydrous ammonia had been sprayed on skin or in the eyes, what procedure would you follow?
- What protective gear would you wear while working with anhydrous ammonia?

Answers

1. Flush with water, a minimum of 15 minutes
2. Eye pain, vision disturbance
3. Coughing, breathing difficulty
4. Red, painful skin
5. Move to fresh air, seek immediate medical attention
6. Goggles, rubber gloves
7. Wring hands, run in small circles, curse and shout.

Helping You Put Knowledge To Work

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