



# Environmental Health Information

## An Overview of Accidental Anhydrous Ammonia Releases in Minnesota

January 2007

Note: If you need emergency information about **ammonia poisoning**, please call the **Minnesota Poison Control System at 1-800-222-1222**. To report a **spill or air release of ammonia** in Minnesota, please call the **Minnesota Duty Officer at 651-469-5451 or 1-800-422-0798**.

Anhydrous ammonia (also called ammonia) consists of nitrogen and hydrogen (NH<sub>3</sub>). Because ammonia is a gas at temperatures above -28° F, it is compressed and kept as a liquid in tanks that withstand high pressure for transport and storage. About 140 million metric tons are produced commercially each year in the United States, with about 90% used as fertilizer for agricultural activities (1). Ammonia is also used as a refrigerant. Illegal use of ammonia to make methamphetamine in clandestine labs has occurred frequently in recent years.

### Unplanned ammonia releases in Minnesota

The Minnesota Hazardous Substances Emergency Events Surveillance (HSEES) program gathers information on accidental short-term ammonia releases in Minnesota. From 1995-2005:

- Ammonia was accidentally released 459 times (about 11.4% of all HSEES events for that time period).
- Over 593,000 lbs were released accidentally, some in the course of illegal drug manufacturing activities.
- Over one-fourth (27%) of these events resulted in evacuations, injuries, or both.
- About 4,150 people had to be evacuated during 96 of these unplanned ammonia releases.
- 136 people were injured during 47 of the accidental ammonia releases (16.8% of all HSEES event victims).
- 391 (85%) of the accidental ammonia releases occurred at fixed facilities.

### Some examples of unplanned ammonia releases in Minnesota include:

- About 1,000 gallons of ammonia were released when a nurse tank pulled by a farmer rolled over on a road. A passer-by was injured and required treatment at a hospital when he tried to assist the farmer. The road was closed for about four hours and five nearby residences were evacuated for two hours.
- A leak from a refrigeration system at a plant resulted in a release of 9,000 lbs of ammonia. Eighteen employees sought medical evaluation for possible respiratory injuries: nine required treatment.
- Anhydrous ammonia in makeshift containers stored for illegal methamphetamine production in a clandestine lab was released when the containers failed. Eleven people were injured: the two perpetrators received chemical burns while six police officers and three emergency medical responders sustained respiratory irritation. Fifteen surrounding residences were evacuated overnight.
- About 375 people were evacuated from homes and residences when a tanker truck full of anhydrous ammonia overturned on a busy highway near a city. The highway was closed for over nine hours while responders offloaded the tanker. Fortunately, only a small amount of ammonia was released in this event.

### Ammonia exposure and how it affects your body

People are exposed to anhydrous ammonia primarily through inhaling (breathing in) and contact of eyes and skin. Effects on health depend on the concentration of the ammonia in the air and the length of time exposed. Both short-term and long-term exposures may have adverse health effects. The information below concerns short-term (acute) exposures. Information on long-term (chronic) exposures can be found in the Agency for Toxic Substances and Disease Registry's ToxFAQs summaries at <http://www.atsdr.cdc.gov/toxfaqs.html>



Minnesota Department of Health ♦ Environmental Health Division ♦ Site Assessment and Consultation

651.201.5000, or 1.800.657.3908, press 0 ♦ [www.health.state.mn.us](http://www.health.state.mn.us) ♦ TTY 651-201-5797

1. *Inhalation.* Signs and symptoms of ammonia inhalation can include (2)(3):

- Cough
- Burning, irritated throat
- Difficulty breathing
- Chest pain
- Swelling or constricted airway

2. *Contact with skin.* Ammonia can cause mild to severe burns on the skin. A victim may also experience inflammation, swelling and blistered or broken skin. Exposure to liquid ammonia can result in frostbite (2).

3. *Contact with eye.* Ammonia can cause inflammation, tearing, swollen eyelids, blurred vision, corneal damage, or blindness (2).

4. *Ingestion.* Ingestion is unlikely to occur because anhydrous ammonia is a gas at room temperature. Anhydrous ammonia dissolved in water forms ammonium hydroxide, which could cause burns to the mouth, throat, and stomach if swallowed (2).

### **Personal protective equipment for use in some work situations**

Personal protective equipment (PPE) is specialized equipment designed for an individual to wear to prevent excessive contact with a hazardous chemical.

*Clothing:* Protective gloves and chemical-protective clothing prevent skin contact. Anhydrous ammonia vapor can collect on the skin and cause irritation and burns. Protective clothing should be inspected and maintained regularly to preserve its effectiveness.

*Eye protection:* Workers who handle ammonia should use ammonia-rated goggles and a face shield to prevent eye, respiratory system and face injury. Gas-proof goggles with a face shield should be worn when there is ammonia gas or vapor exposure or risk of gas exposure. Contact lenses should not be worn when working with ammonia. Alternatively, a full-face respirator may be used.

*Respiratory protection:* Respirator use must be limited to people who have been trained and fitted for a respirator face piece.

1. Respiratory protection should be NIOSH (National Institute for Occupational Safety and Health) approved specifically for ammonia.
2. Respirators must be used in accordance with the Occupational Safety and Health (OSHA) Respiratory Protection Standard, [29 CFR (Code of Federal Regulations) 1910.134].
3. For exposures to unknown concentrations of anhydrous ammonia, such as accidental uncontrolled releases, only a pressure-demand SCBA (self-contained breathing apparatus) is appropriate.

### **Anhydrous ammonia storage**

Minnesota Rules regulate storage and distribution of ammonia. See <http://www.mda.state.mn.us/appd/nh3/default.htm> or contact the Minnesota Department of Agriculture at 651-201-6000 for more information.

In general:

- Anhydrous ammonia is stored as a liquid under high pressure in steel tanks. Anhydrous ammonia storage tanks are often painted white to reflect light and keep the tank cooler, which keeps the pressure inside the tank lower. If the internal pressure gets too high, the tank could rupture or explode. Tanks must have a pressure relief valve to reduce the excess pressure.
- People using anhydrous ammonia must be trained in its proper handling and storage. They must also have appropriate personal protective equipment and know how to use it.
- For locations where fertilizer grade anhydrous ammonia is stored and handled, such as a farm cooperative, an emergency water supply consisting of a plumbed eye wash and deluge shower or an open top container with 150 gallons of clean water is required.
- Nurse tanks containing anhydrous ammonia for field operations must be equipped with 5 gallons of clean water for emergency decontamination.
- Tampering with anhydrous ammonia tanks and equipment is a felony in Minnesota. (Minn. Stat. 152.136)

## Air releases and spills

In the event of an uncontrolled release, take the following actions:

- Call 911 to notify emergency responders.
- Report spills and air releases to the Minnesota Duty Officer at 651-649-5451 or 1-800-422-0798.
- Notify the National Response Center at 1-800-424-8802 for releases over 100 lbs.
- Stay upwind of the uncontrolled ammonia release.

## Minnesota HSEES Program

The Minnesota Department of Health participates in a program called Hazardous Substance Emergency Events Surveillance (HSEES), funded by the federal Agency for Toxic Substances and Disease Registry. The program collects information about unplanned and illegal acute hazardous substance releases with the goal of recommending ways to protect health and prevent or minimize release events. MN HSEES receives preliminary information about spills and air releases from the Minnesota State Duty Officer, the U.S. Department of Transportation, and the National Response Center.

More information about the MN HSEES program can be found at <http://www.health.state.mn.us/divs/eh/hazardous/surv/index.html> or by calling 651-201-4923.

## References

- 1) Agency for Toxic Substances and Disease Registry. (2004) Toxicological Profile for Ammonia: Production, Import, Use and Disposal, 117-122. Retrieved January 4, 2007 from <http://www.atsdr.cdc.gov/toxprofiles/tp126-c5.pdf>
- 2) Agency for Toxic Substances and Disease Registry. (2004) Toxicological Profile for Ammonia: Relevance to Public Health, 13-21. Retrieved January 4, 2007 from <http://www.atsdr.cdc.gov/toxprofiles/tp126-c2.pdf>
- 3) National Institute for Occupational Safety and Health. International Safety Cards: Ammonia (Anhydrous). Retrieved January 9, 2007 from <http://www.cdc.gov/niosh/ipcsneng/neng0414.html>

## For more information:

Centers for Disease Control and Prevention. Ammonia.  
<http://www.bt.cdc.gov/agent/ammonia/index.asp>

Minnesota Department of Agriculture: Emergency Response to Anhydrous Ammonia Releases (Spills):  
<http://www.mda.state.mn.us/spills/ammonia/> **(includes information on first aid)**

National Institute for Occupational Safety and Health (NIOSH). NIOSH Safety and Health Topic: Ammonia.  
<http://www.cdc.gov/niosh/topics/ammonia/>

**For help with an anhydrous ammonia release  
call the Minnesota Duty Officer at:  
Twin Cities metro area (651) 649-5451 or  
Statewide (800) 422-0798.**

**For emergency poisoning information call  
Minnesota Poison Control System at  
1-800-222-1222**

For health information (non-emergency) contact  
the Minnesota Department of Health at  
651-201-4897 or toll free at (800) 657-3908,  
(press #4 and leave a message)

<b>Anhydrous Ammonia Releases in Minnesota, 1995-2005</b>	<b>Count</b>
Number of anhydrous releases	459
Number of events involving injury	47
Number of injured	136
Factors <ul style="list-style-type: none"> <li>• Equipment failure</li> <li>• Human error</li> <li>• Intentional or illegal</li> <li>• Weather related or other</li> <li>• Unknown and other</li> </ul>	265 93 43 6 52
Types of injuries <sup>a</sup> <ul style="list-style-type: none"> <li>• Respiratory system irritation</li> <li>• Eye irritation</li> <li>• Burns</li> <li>• Trauma</li> <li>• Skin Irritation</li> <li>• Headache</li> <li>• Shortness of breath</li> <li>• Gastrointestinal problems</li> </ul>	117 40 15 4 3 3 2 1
Range of amount released in pounds	Less than 1 lb to 77250 lbs
Path of ammonia release: <ul style="list-style-type: none"> <li>• Air emission</li> <li>• Spill/Air release</li> <li>• Spill</li> <li>• Threatened release</li> <li>• Explosion</li> <li>• Air release/Fire</li> </ul>	347 71 28 8 3 2
Type of industry releasing ammonia <ul style="list-style-type: none"> <li>• Agriculture</li> <li>• Refrigeration systems</li> <li>• Illegal meth-related production</li> <li>• Manufacturing and commercial operations</li> <li>• Transportation (rail, truck and pipeline)</li> <li>• Other</li> </ul>	222 123 44 42 22 6
Top 5 locations within fixed facility <ul style="list-style-type: none"> <li>• Above ground storage</li> <li>• Piping</li> <li>• Ancillary process equipment</li> <li>• Transportation within fixed facility</li> <li>• Material handling (loading/unloading)</li> </ul>	124 101 40 34 29

<sup>a</sup> Number of injuries is greater than the total number of victims because some victims sustained multiple injuries.