

References

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For More Information:

Agency for Toxic Substance and Disease Registry (ATSDR). HSEES
www.atsdr.cdc.gov/HS/HSEES/hsees.html

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

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

Occupational Safety and Health Association (OSHA) Ammonia Refrigeration E-Tool
http://www.osha.gov/SLTC/etools/ammonia_refrigeration/

Utah Department of Environmental Response and Remediation
www.environmentalresponse.utah.gov/

Utah Department of Health Office of Epidemiology. Hazardous Substance Emergency Events Surveillance
www.health.utah.gov/enviroepi/

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An Overview of Accidental Anhydrous Ammonia Releases in Utah

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Note: If you need emergency information about ammonia poisoning, please call the Utah Poison Control Center at 1-800-222-1222. For emergencies dial 911. To report a release of ammonia in Utah, call the Utah Department of Environmental Quality Emergency Notification Hotline (801) 536-4100 as well as the Utah Hazardous Substance Emergency Events Surveillance (HSEES) program at (801) 538-6191 within 48 hours of the release.

Anhydrous ammonia (also called ammonia) consists of nitrogen and hydrogen (NH₃). Anhydrous means without water, therefore anhydrous ammonia denotes pure ammonia without water. 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). Other uses of ammonia include use as a refrigerant and use by power generation plants in emission control (4). Illegal use of ammonia to make methamphetamine in clandestine labs has occurred frequently in recent years in the United States.

Liquid anhydrous ammonia will expand by 850 times when evaporating into air, forming large vapor clouds. Anhydrous ammonia gas is lighter than air, so will rise in dry air, but may react with water vapor and remain close to the ground, increasing the potential for exposure of workers and the public. The low odor threshold for anhydrous ammonia (5-50 parts per million (ppm) of air) serves as a good warning sign of its presence.

Utah HSEES Program

The Utah Department of Health participates in a program called Hazardous Substance Emergency Events Surveillance (HSEES), funded by the Agency for Toxic Substances and Disease Registry (ATSDR). 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.

Utah HSEES receives preliminary information about spills and air releases from the Utah Division of Environmental Quality/Division of Emergency Response and Remediation, the U.S. Department of Transportation and the National Response Center. The Utah HSEES program then may follow up with the responsible party for more specific public health information.

More information about the Utah HSEES program can be found at www.health.utah.gov/enviroepi/. If you have questions or comments please email Eep@utah.gov or call (801) 538-6191.

Unplanned Ammonia Releases in Utah

The Utah HSEES program gathers information on accidental short-term ammonia releases in Utah. From 2002-2006:

- Ammonia was accidentally released 24 times (Five events from 2006).
- Over 15 of these events resulted in evacuation, injuries or both.
- About 400 people had to be evacuated during nine of these unplanned ammonia releases.
- 22 people were injured during six of the accidental ammonia releases (Employees injured most often).
- 22 (91.7%) of the accidental ammonia releases occurred at fixed facilities.

Examples of Unplanned Ammonia Releases from 2007 in Utah Include:

- A release occurred of anhydrous ammonia from a ruptured tank at a farm supply store. An employee was splashed with material and inhaled and swallowed some of it. The employee was decontaminated on site and also decontaminated at the care facility and treated for burns.
- A release of 2300 pounds of ammonia occurred at a refrigerated storage facility. A three hour evacuation of 200 people affected a two block radius around the facility. Fire fighters shut down the valve to stop the leak.
- An ammonia leak at an indoor ice rink resulted in the evacuation of 67 people. The ammonia began leaking via a slow pinhole leak in the system due to a rupture in a heat exchanger beneath the ice.
- A dairy experienced a release of 15.6 pounds of ammonia. The liquid was observed from a ¼ inch bleed line from a pump. Release was secured with no injuries
- A refrigeration warehouse/storage facility experienced a valve failure in an industrial freezer unit. This ammonia leak released 85 pounds of ammonia and resulted in the evacuation of 18 employees. Two victims were hospitalized

General Hazardous Substance Facts from ATSDR: (3)

- Approximately 9,000 hazardous substances releases occur annually in the 15 states reporting.
- Releases at facilities account for 70%-75% of reported events.
- Transportation-associated releases account for 25%-30%, of reported events.
- Most releases occur on weekdays between 6 AM and 6 PM.
- Releases tend to increase in spring and summer when there are more shipments of pesticides and fertilizers for agricultural activities.
- Equipment failure and human error cause most releases at facilities.
- Human error and equipment failure cause most releases during transport.
- More than 90% of events involve the release or threatened release of only one hazardous substance.
- Releases of hazardous substances most often injure employees, followed by the general public and less frequently, first responders and school children.
- Respiratory irritation and eye irritation are the most commonly reported symptom or injury.
- Approximately 50% of people who reported developing symptoms or injuries from a HSEES event are treated at a hospital and released.

Anhydrous Storage

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.
- Because of the corrosive nature of anhydrous ammonia, specific valves and hoses that do not readily corrode must be used.
- 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 recommended.
- Nurse tanks containing anhydrous ammonia for field operations should be equipped with five gallons of clean water for emergency decontamination.

Federal rules such as Emergency Planning and Community Right-To-Know Act (EPCRA), and Occupational Health and Safety Administration (OSHA) regulate storage and distribution of ammonia(4)(6).

Ammonia Exposure and How it Affects Your Body

People are exposed to anhydrous ammonia primarily through inhaling (breathing in), and contact with eyes and skin. Effects on health depend on the concentration of the ammonia in the air and the length of exposure. 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>

1. *Inhalation.* Signs and symptoms of ammonia inhalation can include (2)(6):

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

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

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 Utah Department of Environmental Quality 24 Hour Emergency Phone Number for Incident Spills (801) 536-4123.
- Notify the National Response Center at 1-800-424-8802 for releases over 100 pounds.
- Stay upwind of the uncontrolled ammonia release.
- Report spills to the Hazardous Substance Emergency Events Surveillance (HSEES) Program within 48 hours via phone (801) 538-6191 or email eeep@utah.gov.