



Ammonia (NH₃)

What It Is

Ammonia (NH₃) is a colorless liquid or gas having a distinct pungent, irritating odor which serves as a warning signal. It is available as “anhydrous” ammonia, shipped and stored as a liquid under moderate pressure, or it may be distributed dissolved in water (ammonium hydroxide or aqua ammonia). Ammonia gas is slightly lighter than air and ammonia in ammonium hydroxide is very likely to become airborne. The odor threshold range is 5-17 parts per million (ppm).

Uses and Where Ammonia Is Found

Uses

- Farm fertilizers and commercial refrigeration
- Water purification, chemical plants, and high technology manufacturing
- Household cleaners and waterless hand cleaners

Where Ammonia Is Found

- Farm fertilizer distributors
- Meat, poultry, and fish processing facilities
- Water treatment plants
- Chemical plants and cold storage lockers

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SS-416

last updated

July 2009

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This publication provides practical loss control and safety information to assist you in making your workplace safer. It is not legal advice. SAIF Corporation has made every effort to bring significant Oregon Occupational Safety and Health Administration (OR-OSHA) regulations to your attention. Nonetheless, compliance with OR-OSHA remains your responsibility. You should read and understand all relevant OR-OSHA regulations that apply to your job site(s). You may want to consult with your own attorney regarding aspects of OR-OSHA that may affect you.

Note: The information in this publication is time sensitive. Do not rely upon this document if its publication date is more than three years old. Please check the Employer Guide “Safety” section of our web site at www.saif.com/employer for a more recent, printable copy. You’ll also find a variety of other valuable safety information designed to help your business prevent injuries and control costs.

Health Effects of Ammonia Exposure

The liquid or gas may cause severe irritation and/or burns to the eyes, nose, throat and the skin. Ammonia has an odor threshold of 5 -17 ppm (which is lower than its exposure limits). High concentrations can cause permanent injury to the eyes, extensive damage to the throat and upper respiratory tract, and may affect heart action or cause cessation of respiration by reflex action. Anhydrous ammonia gas is explosive in concentrations between 16 and 25 percent volume in air. Ammonia is considered a basic (alkaline) corrosive.

Occupational Exposure Limits

The OR-OSHA Permissible Exposure Limit (PEL) for NH₃ is 25 parts per million (ppm) as an eight-hour Time Weighted Average (TWA). Excursions in the worker levels may exceed three times the PEL for no more than a total of 30 minutes during an eight-hour workday. Under no circumstances should exposure exceed five times the PEL, or 125 ppm, even when the eight-hour TWA is not exceeded.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends an eight-hour TWA of 25 ppm to control potential health hazards. The ACGIH also recommends a Short Term Exposure Limit (STEL) of 35 ppm as a 15-minute average.

The National Institute for Occupational Safety and Health (NIOSH) has also set a Recommended Exposure Limit (REL) of 25 ppm for up to a 10-hour work day during a 40-hour work week. They also recommend not exceeding a STEL of 35 ppm.

Testing for NH₃ Exposure Levels

Monitoring for ammonia can be done primarily in several ways:

1. Colorimetric tubes or direct reading tubes can be used to get an estimate of the eight-hour averages and for the excursion limits. It is important to note the limitations of this method. Colorimetric tubes are regarded as +/- 35 percent accurate with measurements down to one half the exposure limit and +/- 25 percent accurate up to five times the exposure limit.
2. Passive badge personal monitors are a simple way to measure occupational exposure to ammonia. The badge is uncapped and snapped into a holder which is attached to the collar or lapel. When the sampling is complete, it is removed, capped, and returned to the laboratory for analysis. This technology meets or exceeds OSHA requirements for accuracy.
3. Silica gel tubes designed for sampling ammonia in line with an air sampling pump can be worn by employees to measure NH₃ levels. This can be done for the eight-hour exposure readings or the excursion limits. After sampling, the silica gel tube is analyzed by a laboratory and the levels are reported. Careful calibration of air sampling pumps is necessary when utilizing this method.

Recommendations

Storage

- Permanent storage containers should be at least 50 feet from a dug well or water source, unless the container is used for water treatment.
- Containers are to be located outside of buildings, or in a building or section of a building especially provided for that purpose.
- Storage areas are to be kept free of readily ignitable materials such as waste or weeds.
- Ammonia tanks and fittings are to be protected against tampering and physical damage, including vehicles.

Emergency procedures

- Personnel handling ammonia should be informed of its properties and trained in safe operating procedures.
- If splashed into eyes, flush with copious amounts of water for at least 15 minutes. Lift the upper and lower eyelids frequently to ensure complete washing. Call a physician.
- If splashed on skin or clothing, wash under a safety shower for at least 15 minutes. Remove contaminated clothing if necessary.
- If breathing has slowed or ceased, remove the worker from the exposure and activate the emergency medical system (in many cases by dialing 911). If breathing has stopped completely, begin Cardio Pulmonary Resuscitation (CPR).

Protective and Safety Equipment

- When handling anhydrous ammonia or if there is a chance of a large spill of ammonium hydroxide, a chemical type safety goggle, rubber or plastic gloves and impervious clothing is recommended. Depending upon the concentration or potential for airborne exposure, respiratory protection may be necessary.
- Stationary storage installations need at least two suitable gas masks readily accessible. Respiratory equipment must be certified by the National Institute for Occupational Safety and Health (NIOSH). Self-contained breathing apparatus with a full face piece in pressure demand or other positive pressure mode is preferable for emergency use.
- Stationary storage installations shall have an easily accessible shower or a 50 gallon drum of water.
- Each vehicle transporting ammonia in bulk needs five gallons of water and a full face mask. All farm vehicles transporting anhydrous ammonia are required to carry a can with five gallons or more of water. Farm trailers transporting ammonia are to be securely attached to the vehicle drawing them by means of drawbars supplemented by suitable safety chains.

Additional Requirements

There are a variety of specific requirements dealing with ammonia that go beyond the scope of this guide. Two of the more notable requirements are inclusion in OSHA's Process Safety Management Program (PSM) and the Environmental Protection Agency's Risk Management Program (RMP) for ammonia systems containing 10,000 lbs. or greater. See the Resources section below to obtain more information about these requirements.

Resources

A copy of OAR 437, Division 2, Subdivision H, *Storage and Handling of Anhydrous Ammonia*, may be obtained from the Oregon Occupational Safety and Health Division (OR-OSHA) by contacting them at:

Address: 350 Winter Street NE, Salem, OR 97301-3882

Telephone: 503.378.3272 or 800.922.2689

Website: <http://www.orosha.org>

Detailed information on the recognition, evaluation, requirements for control etc. of ammonia are available on the federal OSHA website at:

<http://www.osha.gov/SLTC/ammoniarefrigeration/index.html>

<http://www.osha.gov/SLTC/ammoniarefrigeration/compliance.html>

http://www.epa.gov/oem/content/rmp/rmp_guidance.htm