

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Ammonia, anhydrous
(MSDS No. P-4562-G)

Trade Names: Ammonia

Chemical Name: Ammonia

Synonyms: Ammonia gas, refrigerant gas R717, spirit of hartshorn

Chemical Family: Amine

Product Grades: 4.5, 5.0, research

Telephone: **Emergencies:** 1-800-645-4633*
 CHEMTREC: 1-800-424-9300*
 Routine: 1-800-PRAXAIR

Company Name: Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Corrosive liquid and gas under pressure.

Harmful if inhaled.

Can cause eye, skin, and respiratory tract burns.

May cause kidney and respiratory system damage.

Can catch fire.

**Self-contained breathing apparatus and protective clothing
must be worn by rescue workers.**

Under ambient conditions, this is a colorless gas with a pungent, irritating odor.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Exposure to concentrations moderately above the TLV may irritate the eyes, nose, and throat. Higher concentrations may cause breathing difficulty; chest pain; bronchospasm; pink, frothy sputum; and pulmonary edema (fluid on the lungs).

Skin Contact. Liquid may cause moderate-to-severe redness, swelling, and ulceration of the skin, depending on the degree and duration of contact. At high concentrations, gas may cause chemical burns. Prolonged or widespread skin contact may result in the absorption of potentially harmful amounts of material.

Swallowing. An unlikely route of exposure; this product is a gas at normal temperature and pressure. But exposure, should it occur, may cause chemical burns of the mouth, throat, esophagus, and stomach.

Eye Contact. Liquid may cause pain, severe redness, and swelling of the conjunctiva, damage to the iris, corneal opacification, glaucoma, and cataracts. Gas may cause pain and excessive tearing with acute corneal injury at high concentrations.

Effects of Repeated (Chronic) Overexposure. Chronic exposure may cause chemical pneumonitis and kidney damage.

Other Effects of Overexposure. Asphyxiant. Lack of oxygen can kill. Contact with the liquid may cause frostbite.

Medical Conditions Aggravated by Overexposure. Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease. Skin irritation may aggravate an existing dermatitis.

CARCINOGENICITY: Ammonia is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None expected. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Ammonia	7664-41-7	>99%*

*The symbol > means "greater than."

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration.

WARNING: Rescuer may receive chemical burns from giving mouth-to-mouth resuscitation. If breathing is difficult, qualified personnel may give oxygen. Keep victim warm. Call a physician.

SKIN CONTACT: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing, shoes and gloves. Discard contaminated clothing, shoes and gloves. Call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure. If patient is fully conscious, give two glasses of water or milk at once. Never give anything by mouth to an unconscious person. Do not induce vomiting. Call a physician.

EYE CONTACT: Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Forms explosive mixtures with air and oxidizing agents.

SUITABLE EXTINGUISHING MEDIA: CO₂, dry chemical, water spray, or fog.

PRODUCTS OF COMBUSTION: Nitrogen, water, trace amounts of ammonium nitrate and nitrogen dioxide

PROTECTION OF FIREFIGHTERS: DANGER! Corrosive liquid and gas under pressure. Can catch fire. Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately spray cylinders with water from maximum distance until cool, taking care not to extinguish flames. Remove sources of ignition if without risk. Remove all cylinders from fire area if without risk; continue cooling water spray while moving cylinders. Stop flow of gas if without risk, or allow flames to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. No part of a cylinder should be subjected to a temperature higher than 125°F (52°C). Cylinders are equipped with a pressure-relief device. (Exceptions may exist where authorized by DOT, in this case where cylinders contain less than 165 pounds of product.) If leaking or spilled product catches fire, do not extinguish flames. Flammable and toxic vapors may spread from leak and could explode if reignited. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device. Reverse flow into cylinder may cause rupture. To protect persons from cylinder fragments and toxic fumes should a rupture occur, totally evacuate the area if the fire cannot be brought under immediate control.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Corrosive liquid and gas under pressure. Can catch fire. Forms explosive mixtures with air and oxidizing agents.

Personal Precautions. Evacuate all personnel from danger area. Self-contained breathing apparatus and protective clothing must be worn by rescue workers. Remove all sources of ignition if without risk. Reduce vapors with fog or fine water spray. Reverse flow into cylinder may cause rupture. (See section 16.) Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Flammable vapors may spread from leak. Before entering area, especially confined areas, check atmosphere with an appropriate device.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing (see section 3). Have safety showers and eyewash fountains immediately available. **May form explosive mixtures with air.** Keep away from heat, sparks, and open flame. Use only spark-proof tools and explosion-proof equipment. Static ignition hazard can result from handling and use. **Store and use with adequate ventilation at all times.** Keep away from oxidizing agents and other flammables.

Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. **Open valve slowly.** If valve is hard to open, discontinue use and contact your supplier. Close valve after each use; keep closed even when empty. Keep away from oxidizing agents and from other flammables.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. **Firmly secure** cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). **Store full and empty cylinders separately.** Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Compressed Gas Cylinders and Liquid Containers*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2006)
Ammonia	50 ppm	25 ppm, 35 ppm; 15 min TLV-STEL

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = 300 ppm

ENGINEERING CONTROLS:

Local Exhaust. Use a local exhaust system, if necessary, to prevent oxygen deficiency and to keep hazardous fumes and gases below all applicable exposure limits in the worker's breathing zone.

Mechanical (General). Not recommended as a primary ventilation system to control worker's exposure.

Special. Use only in a closed system. An explosion-proof, corrosion-resistant, forced-draft fume hood is preferred.

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Metatarsal shoes and work gloves for cylinder handling; protective clothing where needed. Wear neoprene gloves during cylinder changeout or wherever contact with product is possible.

Eye/Face Protection. Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or wherever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133.

Respiratory Protection. Use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Pungent, irritating
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm:	-107.93°F (-77.74°C)
BOILING POINT at 1 atm:	-28.17°F (-33.43°C)
FLASH POINT (test method):	Flammable Gas
EVAPORATION RATE (Butyl Acetate = 1):	High
FLAMMABILITY:	Flammable
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: 16% UPPER: 25%
VAPOR PRESSURE at 70°F (21.1°C):	128.8 psia (888 kPa abs)
VAPOR DENSITY at 70°F (21.1°C) and 1 atm:	0.0440 lb/ft ³ (0.705 kg/m ³)
SPECIFIC GRAVITY (H ₂ O = 1) at 27.4°F/ 39.2°F (-33°C/4°C):	0.6819
SPECIFIC GRAVITY (Air = 1) at 32°F (0°C) and 1 atm:	0.588
SOLUBILITY IN WATER , vol (liq.)/vol (liq.) at 68°F (20°C) and 1 atm:	Total
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	1204°F (651.1°C)
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	17.031
MOLECULAR FORMULA:	NH ₃

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: None known.

INCOMPATIBLE MATERIALS: Gold, silver, mercury, oxidizing agents, halogens, halogenated compounds, acids, copper, copper-zinc alloys (brass), chlorates, zinc.

HAZARDOUS DECOMPOSITION PRODUCTS: The normal products of combustion are nitrogen and water. Hydrogen may be formed at temperatures above 1,544°F (840°C).

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Contact with incompatible materials may result in explosive or violent reactions or form explosive mixtures with air.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC₅₀ = 7338 ppm, 1 hr, rat.

MUTAGENIC EFFECTS: In-vitro studies have shown toxic levels of ammonia to be mutagenic in e-coli bacteria. Mutagenic effects have also been reported in drosophila (fruit flies). There is no evidence that ammonia is mutagenic in mammals.

12. Ecological Information

ECOTOXICITY: No adverse ecological effects expected.

OTHER ADVERSE EFFECTS: Ammonia does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Ammonia, anhydrous

HAZARD CLASS:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.2 (domestic shipment) 2.3 (international shipment)	UN1005	100 lb (45.4 kg)

SHIPPING LABEL(s): **Domestic Shipment:** NONFLAMMABLE GAS *with the words "inhalation hazard" shown near the proper shipping name on the label or on the cylinder near the diamond label.*

International Shipment: POISON GAS, CORROSIVE*

PLACARD (when required): **Domestic Shipment:** NONFLAMMABLE GAS

International Shipment: POISON GAS, CORROSIVE*

*The POISON GAS diamond must be as shown in the UN Model Regulations. In addition, a (domestic) POISON GAS label with the words INHALATION HAZARD must be applied to the cylinder near the international POISON GAS label.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Additional Marking Requirement: INHALATION HAZARD

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Ammonia is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): 100 lb (45.4 kg)

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: 500 lb (226.8 kg)

EHS RQ (40 CFR 355): 100 lb (45.4 kg)

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: Yes

REACTIVITY: No

FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Ammonia is subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Ammonia, anhydrous is listed as a regulated substance in quantities of 10,000 lb (4536 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Ammonia is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Ammonia, anhydrous is listed in Appendix A as a highly hazardous chemical in quantities of 10,000 lb (4536 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: Ammonia is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Ammonia is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Corrosive liquid and gas under pressure.* Use only with compatible materials and equipment. Use only in a closed system. *Prevent reverse flow.* Reverse flow into cylinder may cause rupture. Use a check valve or other backflow prevention device in any line or piping from the cylinder.

Ground all equipment. Electrical equipment must be non-sparking or explosion-proof. *Never work on a pressurized system.* If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. *Follow safe practices when returning cylinder to supplier,* be sure valve is closed; then install valve outlet plug, leak-tight. *Never place a compressed gas cylinder where it may become part of an electrical circuit.*

NOTE: *Prior to using any plastics, confirm their compatibility with ammonia.*

Mixtures. When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

RECOMMENDED EQUIPMENT: In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, continuous gas monitors, fire sprinkler, heat sensor for fire monitoring and Class 1, Division 2 Hazard Class electrical inside the gas cabinet.

HAZARD RATING SYSTEMS:**NFPA RATINGS:**

HEALTH = 3 (gas), 3 (liq.)
 FLAMMABILITY = 1 (gas), 1 (liq.)
 INSTABILITY = 0 (gas), 0 (liq.)
 SPECIAL = None

HMIS RATINGS:

HEALTH = 3*
 FLAMMABILITY = 1
 PHYSICAL HAZARD = 2

NFPA RATINGS:**HMIS RATINGS:**

**An asterisk used in conjunction with HMIS health hazard ratings designates a carcinogenic or reproductive hazard.*

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-705, CGA-240 standard, CGA-660 limited standard
PIN-INDEXED YOKE:	Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-720

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

P-1	<i>Safe Handling of Compressed Gases in Containers</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Fourth Edition</i>

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current MSDSs for these products, contact your Praxair sales representative or local distributor or supplier, or download from www.praxair.com. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14151-0044).

Praxair and the *Flowing Airstream* design are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.



Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113