

**DAKOTA GASIFICATION COMPANY**

420 Country Road 26
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MATERIAL SAFETY DATA SHEET

RESPONSIBLE CARE[®]
 OUR COMMITMENT TO SUSTAINABILITY

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFIER: Anhydrous Ammonia

GENERAL USE: Fertilizer, refrigerant gas, manufacture of plastics, explosives, pesticides, detergents, and other chemicals.

PRODUCT DESCRIPTION: Anhydrous ammonia is a colorless, highly irritating gas with a pungent, suffocating odor.

MANUFACTURER:

Dakota Gasification Company
 420 County Road 26
 Beulah, North Dakota 58523-9400
 (701) 873-6677

EMERGENCY TELEPHONE NUMBERS:

Dakota Gasification (701) 873-6600
 CHEMTREC (800) 424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENTS	WT. %	CAS Registry #
Ammonia	99.00-99.6	7664-41-7
Ammonium Hydroxide	0.4-1.0	1336-21-6

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):**EXPOSURE LIMITS 8 hrs. TWA (ppm)**

	OSHA PEL	ACGIH TLV
Ammonia	50 ppm	25 ppm

3. HAZARDS IDENTIFICATION / EMERGENCY OVERVIEW:

At room temperature, anhydrous ammonia is a colorless, highly irritating gas with a pungent, suffocating odor. It is lighter than air and is flammable at high concentrations and temperatures. It is easily compressed and forms a clear, colorless liquid under pressure. Inhalation of ammonia can be fatal. Ammonia's odor threshold is sufficiently low to acutely provide adequate warning of its presence. However, ammonia causes olfactory fatigue (loss of sense of smell) or adaptation, making its presence difficult to detect when exposure is prolonged. Inhalation of vapors can cause severe irritation of the respiratory system and pulmonary edema. Combustible when mixtures of ammonia and air are united under favorable conditions.

POTENTIAL HEALTH EFFECTS:

- EYE CONTACT:** Low concentrations of 20-50 ppm may produce eye irritation after five minutes. High concentrations of gas or concentrated ammonium hydroxide, (ammonia dissolved in water), may cause swelling and sloughing of surface cells. High ammonia concentrations can destroy tissues of the eyes causing permanent blindness. Contact with liquid can produce severe frostbite or freezing.
- SKIN CONTACT:** Severe tissue damage to the skin can occur from exposure to liquids if contact is prolonged (more than a few minutes). Dilute aqueous solutions (less than 5%) seldom cause serious burns, but are moderately irritating. Liquids are corrosive to body tissue. Exposure to concentrated vapor or solution can cause stinging pain, redness of the skin, and blisters, especially on moist skin areas. Contact with liquefied ammonia can cause severe frost bite burns resulting in deep ulcerations.
- INHALATION:** Ammonia is extremely destructive to mucous membrane tissue of the upper respiratory tract. Inhalation of elevated concentrations may be fatal. Inhalation may cause inflammation and accumulation of fluid in the lungs.
- INGESTION:** Swallowing ammonium hydroxide, (ammonia dissolved in water), causes immediate burning in the mouth and throat. Concentrated solutions cause severe pain in the mouth, chest, and abdomen; swallowing difficulty; drooling; and vomiting. Acute burns to the esophagus and perforation of the esophagus or stomach may occur.
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4. FIRST AID MEASURES

- EYES:** Remove victim from the source of contamination and take to nearest eye wash or shower. Immediately wipe away any excess chemical very gently and quickly. Wash the affected eye or eyes under slowly running water for 15 minutes or longer, making sure the eyelids are held wide apart and moved slowly in all directions.
- SKIN:** Remove victim from source of contamination and take immediately to nearest shower or source of clean water. Wash victim down taking care to protect eyes. Do not remove contaminated clothing until flushing has begun and the skin has warmed up. Wash until the feeling of stickiness or soapiness disappears. This may take an hour or more.
- INHALATION:** Remove the victim from the contaminated area while protecting yourself. Initiate artificial respiration and supply oxygen if needed. Keep victim warm and at rest. Seek medical attention, pulmonary injury may continue to evolve over 18 to 24 hours. If patient is conscious, the irritation of the throat may be relieved by water in the mouth. Seek medical attention immediately.

FIRST AID MEASURES CONTINUED

INGESTION: Loosen tight clothing around the neck and waist. Flush mouth several times with cold water and spit out. Give victim 1 to 2 cups of milk. **Do not induce vomiting.** Do not give oils or attempt to neutralize with an acid. Do not give sodium bicarbonate or carbonated drinks. If vomiting does occur, hold head down below hip level to prevent vomit from entering lungs. If person is unconscious, do not give anything by mouth.

NOTES TO PHYSICIAN: After inhalation, watch for delayed symptoms of ammonia exposure such as pulmonary edema. Treat symptomatically, administering analgesics and corticosteroids as necessary. Surgical intervention may be needed to maintain an airway. Watch for chemical pneumonitis.

5. FIRE FIGHTING MEASURES

FLASH POINT: Difficult to ignite.
AUTO-IGNITION TEMPERATURE: 1204^oF
FIRE AND EXPLOSION HAZARDS: See explosive limits.
UPPER EXPLOSIVE / FIRE LIMITS: 25%
LOWER EXPLOSIVE / FIRE LIMITS: 16%
EXTINGUISHING MEDIA: Water Fog, Dry Chemical or CO₂
SPECIAL FIRE FIGHTING PROCEDURES: DO NOT extinguish burning gas if flow cannot be shut off immediately. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. High concentrations of ammonia gas in air can cause an EXPLOSION. Wear full protective clothing and a self contained breathing apparatus. Note that many materials, particularly plastics, become brittle on contact with liquid ammonia. For a serious leak, use fire hose with fog nozzle and plenty of water to absorb the ammonia fumes. Do not direct water streams into pools of liquid ammonia because this will increase the formation of ammonia vapors. The presence of oil or other combustible materials increases the fire hazard.

6. ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES: Evacuate downwind area when significant release occurs. Use self-contained breathing apparatus. Stop source of leak when safe to do so. Major spills should be contained and allowed to evaporate slowly. Diking will contain the liquid and allow it to stabilize. If small

spill, either allow to vaporize or absorb the vapor in water. If large spill, spray the vapor cloud with water or apply chemical foam to pool of liquid to reduce fire and vapor hazard. Do not apply water or foam directly on leak or spill. ONLY small leaks can be searched for with HCL solution, chlorine gas, or SO₂ gas (white cloud is produced) by properly trained personnel. Ammonia can explode or flame at 16% - 25% concentrations in air.

SMALL SPILL: Flush area with flooding amounts of water. First isolate 100 feet in all directions. Then protect persons 0.1 miles downwind during the day, 0.1 mile at night

LARGE SPILL: First isolate 500 feet in all directions. Then protect persons 0.5 miles downwind during the day, 1.4 miles downwind at night.

NEUTRALIZING CHEMICAL: Use water spray to reduce vapors. Never apply water to a liquid ammonia leak or spill, it will cause extreme gassing creating more significant problems. . Neutralizing with acid is not recommended.

7. HANDLING AND STORAGE

STORAGE TEMPERATURE: See below.

SHELF LIFE: Indefinite.

SPECIAL SENSITIVITY: None known.

HANDLING / STORAGE PRECAUTIONS: Storage temperature must be such that the rated pressure of the container does not exceed vapor pressures that equal (126 psi at 68^oF) or (197 psi at 95^oF). Appropriate personal protective gear should be available to personnel handling or transferring product. Protect containers from corrosion and mechanical damage. Separate from other chemicals, particularly oxidizing gases, such as chlorine, bromine, iodine, acids and metallic/elemental mercury.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

RECOMMENDED WORK / HYGIENE PROCEDURES: Personal protective equipment required under normal work conditions; maintenance and repair; spill and clean-up. Emergency showers and eye-wash units should be readily available. In field and mobile operations, at least 5 gallons of water should be available.

EYE PROTECTION REQUIREMENTS: Wear chemical goggles and face shield unless protected by a full face respirator.

HAND PROTECTION REQUIREMENTS: Butyl rubber.
PROTECTIVE CLOTHING REQUIREMENTS: Impervious clothing where contact with liquid is possible.
RESPIRATORY REQUIREMENTS: Chemical cartridge respirator with appropriate NH₃ cartridge(s):
Upper Limit: 100 ppm
Full face chemical cartridge respirator with appropriate NH₃ cartridge(s):
Upper Limit: 300 ppm
Air-purifying full face respirator (gas mask) with appropriate NH₃ canister:
Upper Limit: 500 ppm
Self-contained breathing apparatus with full facepiece in positive pressure mode or full facepiece positive pressure supplies air respirator with auxiliary self-contained air supplied.
Upper Limit - greater than 1000 PPM or unknown concentration.
Note: Higher concentrations will require use of chemical protective clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless liquid or gas.
ODOR: Strong, penetrating, pungent odor. Reported odor thresholds in humans range from 1-50 ppm.
PHYSICAL STATE: At room temperature and atmospheric pressure, ammonia is a pungent colorless gas. It may be compressed and cooled to a colorless liquid.
pH: 10.6-11.6 Ammonia is strongly alkaline when dissolved in water.
VAPOR DENSITY: 0.6 at 32°F (air = 1)
MELTING POINT: -108°F (at one atmosphere)
BOILING POINT: -28°F (at one atmosphere)
SPECIFIC GRAVITY: 0.5970 (of the gas at 32°F and 1atm) (air = 1)
EVAPORATION RATE: Rapid at ambient temperatures (butyl acetate = 1).
PERCENT VOLATILES: 100
BULK DENSITY: 38.00 lb/ft³ liquid at 20°F
SOLUBILITY IN WATER: 510 g/kg
SOLVENT SOLUBILITY: Soluble in water, alcohol, chloroform, or ether.
MOLECULAR WEIGHT: 17.031
CHEMICAL FORMULA: NH₃

10. STABILITY AND REACTIVITY

INSTABILITY CONDITIONS:	Stable.
INCOMPATIBILITIES:	Forms explosive compounds with mercury, halogens, hypochlorites, iodine, and amides. Corrosive to copper, brass, silver, zinc, and galvanized steel. Certain high tensile strength steels have developed stress-corrosion cracking in ammonia contaminated with small quantities of air. Forms explosive products when in contact with calcium, hypochlorites bleaches, halogens, gold, mercury, and silver. Heat is generated when ammonia is dissolved in water, and a harmful visible vapor cloud is typically produced from contact with water.
DECOMPOSITION PRODUCTS:	The products of combustion are mainly nitrogen and water but small traces of ammonium nitrate, nitrogen dioxide are also found. Ammonia begins to dissociate releasing hydrogen and nitrogen when heated to approximately 850°F at atmospheric pressure.
HAZARDOUS POLYMERIZATION:	Will not occur.

11. TOXICOLOGICAL INFORMATION

ROUTES OF ENTRY:	Exposure of the skin and eyes or the respiratory system may occur, but the chief effect of ammonia is local irritation due to its alkalinity when dissolved in body fluids.
EFFECTS OF ACUTE EXPOSURE:	Acute effects occur because of the caustic nature of concentrated solutions, the irritant effects of ammonia gas, and the extreme cooling that arises on contact with liquid ammonia.
SYMPTOMS OF EXPOSURE:	Burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.
EYE EFFECTS:	Eye tearing - 150-200 ppm Severe irritation - 400-700 ppm 5000-6000 ppm for 30-120 min administered to guinea pigs has been reported to cause blindness. Eye burns - Seriousness of eye burns are concentration dependent. Eye burns may result in such effects as opacification, vascularization, ulceration, or

perforation.

SKIN EFFECTS: Severe tissue damage to the skin can occur from exposure to liquids if contact is prolonged (more than a few minutes). Skin contact with liquid ammonia may result in cold burns, usually without blistering or charring. Exposure to concentrated vapor or solution can also cause caustic burns resulting in stinging pain, redness of the skin, and blisters. Deep ulcerations may result.

ACUTE ORAL EFFECTS: Swallowing ammonium hydroxide causes immediate burning in the mouth and throat. Concentrated solutions cause severe pain in the mouth, chest, and abdomen; swallowing difficulty; drooling; and vomiting. Acute burns to the esophagus and perforation of the esophagus or stomach may result. LD₅₀ of 350 mg/kg body weight has been reported for rats.

ACUTE INHALATION EFFECTS: Even fairly low concentrations of ammonia produce rapid onset of eye, nose, and throat irritation; coughing; and narrowing of the bronchi. More severe clinical signs include immediate narrowing of the throat and swelling, causing upper airway obstruction. Accumulation of fluid in the lungs can also occur. LC₅₀- Inhalation, mouse-4230 ppm/1hr.
Rat: LC₅₀ for 60 min, 11,590 ppm. The lowest concentration known to be lethal in humans exposed for 5 minutes via inhalation is 5,000 ppm.

CHRONIC EFFECTS/
CARCINOGENICITY: Ammonia is not a cumulative metabolic poison; Ammonium ions are actually important constituents of living systems. Long-term contact with more dilute ammonia solutions that are not immediately irritating may produce damage to the skin as a result of dissolving protective fats. It is possible that repeated exposure to irritant levels insufficient to cause severe immediate symptoms, may give rise to progressive impairment of lung function.

12. ECOLOGICAL INFORMATION

If released to surface water, ammonia volatilizes to the atmosphere. The rate of volatilization of ammonia from water will increase with increasing pH and temperature. Atmospheric ammonia can be readily removed from the air by rain or snow washout. It can dissolve in clouds or fog. In surface water, groundwater, or sediment, ammonia can undergo sequential transformation by processes in the nitrogen cycle eventually producing elemental nitrogen. In soil, ammonia can serve as a nutrient source which can be taken up

by plants and other organisms.

Ammonia in soil can be rapidly transformed to nitrate by microbes. Ammonia in soil will either be leached through the soil or be taken up by plants or other organisms. Very high localized concentrations of ammonia could become toxic to plants, organisms, or microbes.

Ammonia in the form of a liquid, concentrated solution, or at a high vapor concentration, will destroy most living organisms. Ammonia present in water as ammonium ions at sufficiently high concentrations can be highly toxic for fish and toxic for aquatic plants.

13. DISPOSAL CONSIDERATIONS

This product, in our opinion, is not listed by the EPA as a Hazardous Waste (40 CFR, Part 261). This product does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity, and is not formulated with the metals or organic in the TCLP test.

This product contains ingredients on the CERCLA list and may be reportable in the event of a spill or an environmental release.

Please be advised that state and local requirements for waste disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations regarding the proper disposal of this material.

14. TRANSPORTATION INFORMATION

D.O.T. SHIPPING NAME:	Ammonia, Anhydrous
D.O.T. HAZARD CLASS:	Poisonous gas, Non-flammable compressed gas
U.N. NUMBER:	1005
D.O.T. PLACARD:	Poison Gas, Non-flammable gas
D.O.T. LABEL CODE:	Inhalation hazard
D.O.T. REPORTABLE QUANTITY:	100 lbs or 20 gallons

15. REGULATORY REQUIREMENTS

OSHA: This material is considered to be hazardous as defined by the OSHA Hazard Communication Standard.

EPA DETERMINATIONS

CERCLA, 40 CFR 302

The material contains the following hazardous substance which, when released in quantities equal to or exceeding the Reportable Quantity, triggers National Response Center notification requirements.

Hazardous Substance	Reportable Quantity
Ammonia	100 lbs.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986,
TITLE III - SECTIONS 302, 304, 311, 312, 313

SECTION 302/304 - Extremely Hazardous Substances (40 CFR 355)

The material contains Ammonia, an extremely hazardous substance, at greater than 1.0 % concentration; however, it is possible that this material may contain extremely hazardous substances at a lower concentration so that a large enough spill could warrant an Emergency Release under section 304.

SECTION 311/312 - MSDS and Chemical Inventory Reporting Requirements (40 CFR 370)
The material should be reported under the following EPA Hazard categories.

- 4 Immediate (Acute Health Hazard)
Delayed (Chronic Health Hazard)
- 4 Fire
- 4 Sudden Release of Pressure
- 4 Reactive

SECTION 313 - List of Toxic Chemicals (40 CFR 372)

The material contains the following chemical(s) at a level of 1.0% or greater (0.1% for carcinogens) on the list of toxic Chemicals and is subject to toxic chemical release reporting requirements.

Toxic Chemical:	Ammonia
CAS Registry Number:	7664-41-7
Approximate Concentration (Upper Bound):	99 wt%

TOXIC SUBSTANCES CONTROL ACT (TSCA) (40 CFR 710)

The chemical ingredients in this material are in the Section 8(b) Chemical Substance Inventory (40 CFR 710) and/or are otherwise in compliance with TSCA

FWPCA/CWA(FEDERAL WATER POLLUTION CONTROL ACT/CLEAN WATER ACT):
Listed as a regulated toxic substance. Reportable quantity is 100 lb. (45.4 kg).

This material is also regulated by the following states: California, Illinois, Louisiana, New Jersey, New York, Massachusetts, Pennsylvania, and Wisconsin.

LIABILITY DISCLAIMER

The information contained in this Material Safety Data Sheet (MSDS) is believed to be correct since it was obtained from sources we believe are reliable. However no representation, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications, hazards connected with the use of the material, or the results to be obtained from the use thereof. User assumes all risks and liability of any use, processing or handling of any material, variations in methods, conditions and equipment used to store, handle, or process the material and hazards connected with the use of the material are solely the responsibility of the user and remain at his sole discretion.

Compliance with all applicable federal, state, and local laws and regulations remains the responsibility of the user, and the user has the responsibility to provide a safe work place to examine all aspects of its operation and to determine if or where precautions, in addition to those described herein, are required.