

Anhydrous Ammonia, Refrigeration Grade

Section 1. Identification

Product identifier	: Anhydrous Ammonia, Refrigeration Grade
Chemical name	: Ammonia, anhydrous
Other means of identification	: Product code: 2501-13001 Synonym: Ammonia
Product type	: Liquefied compressed gas.

Relevant identified uses of the substance or mixture and uses advised against

Identified uses		
Refrigerant. Manufacture of chemical products.		
Uses advised against	Reason	
Reserved for industrial and professional use only. Product is not intended for consumer use.		Risk assessment.

Supplier's details : Agrium Canada Partnership
13131 Lake Fraser Drive, S.E.
Calgary, Alberta, Canada, T2J 7E8

Agrium U.S. Inc.
5296 Harvest Lake Drive
Loveland, CO 80538

Company phone number (North America):
1-800-403-2861 (Customer Service)

Emergency telephone number (with hours of operation) : Agrium 24 Hr Emergency Telephone Numbers:
English:
Transportation Emergencies: 1-800-792-8311
Medical Emergencies: 1-303-389-1653

French or Spanish:
Transportation or Medical Emergencies: 1-303-389-1654

Section 2. Hazard identification

Classification of the substance or mixture	: FLAMMABLE GASES - Category 2 GASES UNDER PRESSURE - Liquefied gas CORROSIVE TO METALS - Category 1 ACUTE TOXICITY (inhalation) - Category 3 SKIN CORROSION - Category 1B SERIOUS EYE DAMAGE - Category 1
OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
GHS label elements	
Hazard pictograms	:

Signal word : Danger

Section 2. Hazard identification

Hazard statements	<ul style="list-style-type: none"> : Flammable gas. Contains gas under pressure; may explode if heated. May be corrosive to metals. Toxic if inhaled. Causes severe skin burns and eye damage.
Precautionary statements	
General	<ul style="list-style-type: none"> : Not applicable.
Prevention	<ul style="list-style-type: none"> : Wear protective gloves. Wear eye or face protection. Wear protective clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep only in original packaging. Use only outdoors or in a well-ventilated area. Avoid breathing gas. Wash hands thoroughly after handling.
Response	<ul style="list-style-type: none"> : IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or physician. IF SWALLOWED: Immediately call a POISON CENTER or physician. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or physician. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or physician. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leakage, eliminate all ignition sources. Absorb spillage to prevent material damage.
Storage	<ul style="list-style-type: none"> : Store locked up. Protect from sunlight. Store in a well-ventilated place. Store in a corrosion resistant container with a resistant inner liner.
Disposal	<ul style="list-style-type: none"> : Dispose of contents and container in accordance with all local, regional, national and international regulations.
Supplemental label elements	<ul style="list-style-type: none"> : None known.
Other hazards which do not result in classification	<ul style="list-style-type: none"> : Very toxic to aquatic life.

Section 3. Composition/information on ingredients

Substance/mixture	: Substance		
Ingredient name	% (v/v)	CAS number	
Ammonia, anhydrous	99.98	7664-41-7	

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First-aid measures

Description of necessary first aid measures

Eye contact	<ul style="list-style-type: none"> : CORROSIVE. Begin eye irrigation immediately. All eye exposures to anhydrous ammonia require medical evaluation following decontamination. Immediately rinse eyes with large quantities of water or saline for a minimum 20 minutes, longer irrigation time is preferred if possible, due to the chemical reaction that occurs - see Notes to Physician below. If possible, remove contact lenses being careful not to cause additional eye damage. If the initial water supply is insufficient, keep the affected area wet with a moist cloth and transfer the person to the nearest place where rinsing can be continued for the recommended length of time. Call an ambulance for transport to hospital. Continue eye irrigation during transport. For additional advice call the medical emergency number on this safety data sheet or your poison center or doctor.
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Section 4. First-aid measures

Inhalation

- : CORROSIVE. If gases or vapors exceed the IDLH or are present in unknown concentrations, rescuers must wear self-contained breathing apparatus and a suit resistant to gases (Level B). In the U.S., OSHA Hazwoper requirements under 29CFR1910.120 overrule the lesser protection requirements given in the anhydrous ammonia standard, 1910.111.
- REMOVE PERSON TO FRESH AIR. Watch closely for signs of wheezing and breathing difficulties. Maintain an open airway. If not breathing, begin CPR. Oxygen may be administered by trained personnel. Affected persons who have stopped breathing or are having difficulty breathing or are unconscious need immediate medical attention. Symptoms may be delayed after exposure to anhydrous ammonia. The exposed person may need to be kept under medical surveillance for 24 - 48 hours. Call an ambulance for transport to hospital. For additional advice call the medical emergency number on this SDS or your poison center or doctor.

Skin contact

- : CORROSIVE. Causes severe burns. Contact with rapidly expanding gas from evaporating liquid or compressed gas may cause cold burns or frostbite. Immediately begin rinsing the affected areas with water. Remove contaminated clothing and shoes. Affected areas should be rinsed for a minimum 20 minutes, longer irrigation time is preferred if possible, due to the chemical reaction that occurs - see Notes to Physician below. Luke-warm water is recommended for prolonged irrigation to prevent hypothermia. Conscious persons without breathing difficulties may benefit from continued irrigation in a fixed shower or bathing facility prior to hospital transport. Call an ambulance for transport to hospital. Continue skin irrigation during transport. For additional advice call the medical emergency number on this safety data sheet or your poison center or doctor.

Ingestion

- : CORROSIVE. May cause severe burns to the mouth, throat, and stomach. If the affected person requires cardiopulmonary resuscitation, avoid mouth to mouth contact. Do not induce vomiting. If vomiting occurs, attempt to keep head lower than the chest so that vomit does not enter the lungs. For signs of breathing difficulties, refer to the INHALATION section. Call an ambulance for transportation to hospital. For additional advice, call the medical emergency number on this safety data sheet or your poison center or doctor.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact

- : Corrosive to eyes on contact. Causes serious eye damage. Eye contact can result in temporary or permanent corneal damage and/or blindness. The full extent of damage to the eyes may not be known for 1 week after injury.

Inhalation

- : Toxic if inhaled. Corrosive to the respiratory system. May cause severe breathing difficulties.

Skin contact

- : Corrosive to the skin. Causes severe burns. Contact with rapidly expanding gas may cause cold burns or frostbite.

Ingestion

- : Will cause cold burns and will evaporate causing massive inhalation overexposure. Corrosive to the digestive tract. May cause burns to the mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact

- : Adverse symptoms may include the following:
pain
watering
redness
loss of vision

Inhalation

- : Adverse symptoms may include the following:
Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.
coughing
respiratory tract irritation
wheezing and breathing difficulties

Section 4. First-aid measures

Skin contact

- : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
Signs of frostbite: redness, blistering may occur

Ingestion

- : Adverse symptoms may include the following:
bloating
difficulty swallowing
throat and stomach pain
nausea or vomiting
respiratory tract irritation
wheezing and breathing difficulties

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician

- : Anhydrous ammonia reacts with moisture to produce ammonium hydroxide. Ammonium hydroxide rapidly penetrates skin's stratum corneum layer, eyes, and mucous membranes causing liquefaction necrosis. In addition, anhydrous ammonia is a cryogenic liquid or compressed gas. Venting or evaporation can cause frostbite. The extent of injury depends on duration of exposure and concentration of gas or liquid. Do not attempt to use chemicals to neutralize the exposure. Gas inhalation may cause delayed pulmonary symptoms (acute lung injury). The exposed person may need to be kept under medical surveillance for 24-48 hours. 24 Hr Medical Emergency telephone number for professional support: English: 1-303-389-1653; French or Spanish: 1-303-389-1654.

Specific treatments

- : Corrosive hydroxyl ions generated by the production of ammonium hydroxide rapidly penetrate the skin, eyes, and mucous membranes. Outcomes can be improved by minimizing time to decontamination and extending decontamination times to reduce tissue damage. Expert opinion indicates extended decontamination is required to remove corrosive chemicals. Skin and eye decontamination should be performed for a minimum of 20 minutes, longer irrigation time is preferred if possible. Extended decontamination times may be required depending on the exposure. To avoid hypothermia, irrigation water should be maintained at a comfortable temperature. If the patient is not in extremis, it may be necessary to delay transport to emergency care facilities to ensure adequate decontamination time. However, early patient transport may be necessary depending on patient's condition or the availability of water. If possible, continue skin and/or eye irrigation during emergency medical transport. Double-bag contaminated clothing and personal belongings of the patient.

Protection of first-aiders

- : No action shall be taken involving any personal risk or without suitable training. Depending on the situation, the rescuer should wear an appropriate mask, gloves, protective clothing and a respirator or self-contained breathing apparatus. Mouth-to-mouth resuscitation of oral exposure patients is not recommended. First-aiders with contaminated clothing should be properly decontaminated.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

- : In case of fire, use water spray.

Unsuitable extinguishing media

- : Do not use water jet. Do not direct water into spilled anhydrous ammonia. Ammonia is a cryogenic liquid which cools on evaporation limiting vapor release. Water used for fire fighting at supplied temperatures will raise the temperature of ammonia resulting in greater evaporation.

Specific hazards arising from the chemical

- : Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Section 5. Fire-fighting measures

Hazardous thermal decomposition products : Emits toxic fumes when heated to decomposition. Decomposition products may include the following materials: nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. Contact supplier immediately for specialist advice. No action shall be taken involving any personal risk or without suitable training. Refer to protective measures listed in sections 7 and 8.

Eliminate all ignition sources if safe to do so. Approach release from upwind. Stop leak if safe to do so. Cool containing vessels with flooding quantities of water until well after fire is out. Move containers from fire area if this can be done without risk. This product is likely to volatilize rapidly into the air because of its high vapor pressure. Do not direct water into spilled anhydrous ammonia. Ammonia is a cryogenic liquid which cools on evaporation limiting vapor release. Water used for fire fighting at supplied temperatures will raise the temperature of ammonia resulting in greater evaporation. Use water spray to keep fire-exposed containers cool. Use water spray curtain to divert vapor drift. Contain and collect the water used to fight the fire for later treatment and disposal.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Refer to protective measures listed in sections 7 and 8. If gases or vapors are present, rescuers must wear self-contained breathing apparatus and a suit resistant to gases (Level A) under U.S. OSHA requirements. The requirements of 29CFR 1910.120 have been deemed to overrule the lesser protection requirements given in 1910.111. Fully-encapsulating, vapor-protective clothing should be worn for spills and leaks without fire.

Remark : Product will burn with difficulty if kept between the Lower Explosive Limit of 16% and Upper Explosive Limit of 25%. This product is generally regarded as non-flammable due to the difficulty of ignition. However, the presence of oil or other combustible materials will increase the fire hazard, and may ignite with explosive force under favorable conditions.

If mixed with chlorine or hypochlorites, it may form nitrogen trichloride which may explode spontaneously in air.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : Fully-encapsulating, vapor-protective clothing should be worn for spills and leaks without fire. Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Refer to Emergency Response Guidebook, Guide 125 for further information regarding spill control and Isolation/Protective Action Distances Guidelines.

Do not direct water into spilled anhydrous ammonia. Ammonia is a cryogenic liquid which cools on evaporation limiting vapor release. Water used for fire fighting at supplied temperatures will raise the temperature of ammonia resulting in greater evaporation.

Community Emergency Response Instructions for Sheltering-in-Place:

- * Stay indoors (unless evacuation has been called by local authorities)
- * Close all windows and doors, seal with duct tape or wet towels
- * Shut off furnace, exhaust fans, fireplaces, and air conditioners

Section 6. Accidental release measures

- * Wait for and follow advice from local police or authorities
- * If the smell is very strong, breath through a wet cloth and turn on any nearby showers to absorb airborne vapors

Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Environmental precautions

- : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Use water spray curtain to divert vapor drift. Do not direct water into spilled anhydrous ammonia. Ammonia is a cryogenic liquid which cools on evaporation limiting vapor release. Water used for fire fighting at supplied temperatures will raise the temperature of ammonia resulting in greater evaporation. Collect contaminated fire-fighting water separately. It must not enter the sewage system.
- Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused adverse impacts (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill

- : Immediately contact emergency personnel. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.
- Use personal protective equipment as required. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill

- : Immediately contact emergency personnel. Note: see Section 1 for emergency contact information and Section 13 for waste disposal. Evacuate area. Refer to Emergency Response Guidebook, Guide 125 for further information regarding spill control and Isolation/Protective Action Distances Guidelines.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

- : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Do not breathe gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Absorb spillage to prevent material damage.

Advice on general occupational hygiene

- : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities

- : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Keep container tightly closed and sealed until ready for use. Refer to NFPA 400 Hazardous Materials Code for further information on the safe storage and handling of hazardous materials.
- Ensure compliance with OSHA 29CFR1910.111 Storage and handling of anhydrous ammonia and 1910.119 Process safety management of highly hazardous chemicals requirements, if applicable.
- All anhydrous ammonia retail sites in Canada must be compliant with the standards outlined in Fertilizer Canada's Fertilizer Safety & Security Council Ammonia Code of Practice. The Code applies to agricultural ammonia including road and rail transportation, storage and handling of products and outlines best practices applicable to the distribution, storage and handling of anhydrous ammonia to ensure safety and security.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Canadian Regulations: Ammonia	CA Alberta Provincial (Canada, 4/2009). 8 hrs OEL: 17 mg/m ³ 8 hours. 8 hrs OEL: 25 ppm 8 hours. 15 min OEL: 35 ppm 15 minutes. 15 min OEL: 24 mg/m ³ 15 minutes. CA British Columbia Provincial (Canada, 4/2014). TWA: 25 ppm 8 hours. STEL: 35 ppm 15 minutes. CA Ontario Provincial (Canada, 1/2013). TWA: 25 ppm 8 hours. TWA: 17 mg/m ³ 8 hours. STEL: 35 ppm 15 minutes. STEL: 24 mg/m ³ 15 minutes. CA Quebec Provincial (Canada, 1/2014). TWAEV: 25 ppm 8 hours. TWAEV: 17 mg/m ³ 8 hours. STEV: 35 ppm 15 minutes. STEV: 24 mg/m ³ 15 minutes. CA Saskatchewan Provincial (Canada). TWA: 25 ppm 8 hours. STEL: 35 ppm 15 minutes. CA Manitoba Provincial (Canada). TWA: 25 ppm STEL: 35 ppm
U.S. Federal Regulations: Ammonia	ACGIH TLV (United States, 4/2014). TWA: 25 ppm 8 hours. TWA: 17 mg/m ³ 8 hours. STEL: 35 ppm 15 minutes. STEL: 24 mg/m ³ 15 minutes. OSHA PEL 1989 (United States, 3/1989). STEL: 35 ppm 15 minutes. STEL: 27 mg/m ³ 15 minutes. NIOSH REL (United States, 10/2013). TWA: 25 ppm 10 hours. TWA: 18 mg/m ³ 10 hours. STEL: 35 ppm 15 minutes. STEL: 27 mg/m ³ 15 minutes. OSHA PEL (United States, 2/2013). TWA: 50 ppm 8 hours. TWA: 35 mg/m ³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls/personal protection

Hygiene measures

- : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

- : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection

- : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended:
 - butyl rubber
 - nitrile rubber
 - neoprene rubber
 - Viton®
 - Viton®/butyl rubber

Contact your personal protective equipment manufacturer to verify the compatibility of the equipment for the intended purpose.

Body protection

- : Personal protective equipment for the body should be selected based on the task being performed, the risks involved, the materials of construction and its design, and should be approved by a specialist before handling this product. Contact your personal protective equipment manufacturer to verify the compatibility of the equipment for the intended purpose.

Under emergency conditions, or where contact with high concentration gas is probable, a chemically resistant, gas tight, encapsulating suit with positive pressure self contained breathing apparatus is required. For accidental splash protection against the liquid, chemically resistant impervious coveralls or a chemical resistant suit should be worn. When there is a risk of ignition from static electricity, wear anti-static protective clothing.

Other skin protection

- : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection

- : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Use a NIOSH approved chemical cartridge or canister respirator with a full facepiece for ammonia concentrations up to 300 PPM. Use a positive pressure SCBA for concentrations above 300 PPM, for emergency response, or for entry into unknown concentrations. For U.S. work sites where respiratory protection is required, ensure that a respiratory protection program meeting 29 CFR 1910.134 requirements is in place.

Thermal hazards

- : Contact with rapidly expanding gas may cause cold burns or frostbite. Wear cold insulating gloves.

Section 9. Physical and chemical properties

Appearance

Physical state	: Gas. [Compressed gas.]
Color	: Colorless.
Odor	: Pungent. Ammoniacal. [Strong]
Odor threshold	: Variable. ~ 17 ppm
pH	: 11.6 [Conc. (% w/w): 1.7%]
Melting point	: -77.7°C (-107.9°F)
Boiling point	: -33°C (-27.4°F)
Flash point	: Not available.
Evaporation rate	: Not available.
Flammability (solid, gas)	<p>: Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.</p> <p>Non-flammable in the presence of the following materials or conditions: shocks and mechanical impacts, oxidizing materials, reducing materials, combustible materials, organic materials, metals, acids, alkalis and moisture.</p> <p>Product will burn with difficulty if kept between the Lower Explosive Limit of 16% and Upper Explosive Limit of 25%. This product is generally regarded as non-flammable due to the difficulty of ignition. However, the presence of oil or other combustible materials will increase the fire hazard, and may ignite with explosive force under favorable conditions.</p>
Lower and upper explosive (flammable) limits	: Lower: 16% Upper: 25%
Vapor pressure	: 843 kPa (6323 mm Hg) [20°C] 2032.5 kPa (15244.8 mm Hg) [50°C]
Vapor density	: Vapor Density: Variable, depending on temperature. 0.77 kg/m ³ @ STP
Relative density	: Not available.
Solubility	<p>: Easily soluble in the following materials: cold water.</p> <p>Soluble in the following materials: hot water.</p> <p>Partially soluble in the following materials: Methanol.</p>
Solubility in water	: 540 g/l
Partition coefficient: n-octanol/water	: 0.23
Auto-ignition temperature	: 651°C (1203.8°F)
Decomposition temperature	: Not available.
Viscosity	: Not available.

Section 10. Stability and reactivity

Reactivity	: Reactive with acids Incompatible with halogens, hydrogen peroxide, chlorinated hydrocarbons, fluorine, nitric acid, oxidizing agents and sulfuric acid. Incompatible with copper alloys, copper, and zinc.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Section 10. Stability and reactivity

Incompatible materials

: Extremely reactive or incompatible with acids. Highly reactive with oxidizing agents and reducing agents. Forms explosive compounds with many heavy metals such as mercury or silver. May react explosively with chlorine, hypochlorites such as bleach or chlorinating chemicals and other halogens such as bromine, iodine, fluorine or their compounds. Highly corrosive to copper and its alloys. Slightly corrosive to aluminum and zinc. Very slightly corrosive to mild steel. Non-corrosive to glass or stainless steel (304 or 316). Do not use copper, brass, bronze, or galvanized steel in contact with ammonia. Do not use brazed joints in ammonia service. Contact your sales representative or a metallurgical specialist to ensure compatibility with your equipment.

Hazardous decomposition products

: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Ammonia, anhydrous	LC50 Inhalation Gas. LC50 Inhalation Gas. LC50 Inhalation Vapor	Rat Rat Rat - Male, Female	9500 ppm 2000 ppm 11590 mg/m ³	1 hours 4 hours 1 hours
	LC50 Inhalation Vapor LC50 Inhalation Vapor	Rat Rat	7040 mg/m ³ 18600 mg/m ³	30 minutes 5 minutes
	LD50 Oral	Rat - Male	350 mg/kg	-

Conclusion/Summary : Toxic if inhaled.

Irritation/Corrosion

Not available.

Conclusion/Summary

- Skin** : Causes severe skin burns and eye damage.
- Eyes** : Causes severe skin burns and eye damage.
- Respiratory** : Corrosive to the respiratory tract.

Sensitization

Not available.

Conclusion/Summary

- Skin** : No known significant effects or critical hazards.
- Respiratory** : Non-sensitizer to lungs.

Mutagenicity

Product/ingredient name	Test	Experiment	Result
Ammonia	OECD 471 Bacterial Reverse Mutation Test OECD 474 Mammalian Erythrocyte Micronucleus Test	Experiment: In vivo Subject: Bacteria Experiment: In vivo Subject: Mammalian-Animal	Negative Negative

Conclusion/Summary : No mutagenic effect.

Carcinogenicity

Not available.

Conclusion/Summary

- : No known significant effects or critical hazards.

Reproductive toxicity

Section 11. Toxicological information

Product/ingredient name	Maternal toxicity	Fertility	Development toxin	Species	Dose	Exposure
Ammonia	Negative	-	Negative	Rabbit - Female	Oral: 100 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Not available.

Conclusion/Summary : No known significant effects or critical hazards.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Routes of entry anticipated: Dermal, Inhalation. Routes of entry not anticipated: Oral.

Potential acute health effects

Eye contact : Corrosive to eyes on contact. Causes serious eye damage. Eye contact can result in temporary or permanent corneal damage and/or blindness. The full extent of damage to the eyes may not be known for 1 week after injury.

Inhalation : Toxic if inhaled. Corrosive to the respiratory system. May cause severe breathing difficulties.

Skin contact : Corrosive to the skin. Causes severe burns. Contact with rapidly expanding gas may cause cold burns or frostbite.

Ingestion : Will cause cold burns and will evaporate causing massive inhalation overexposure. Corrosive to the digestive tract. May cause burns to the mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain
watering
redness
loss of vision

Inhalation : Adverse symptoms may include the following:
Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.
coughing
respiratory tract irritation
wheezing and breathing difficulties

Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
Signs of frostbite: redness, blistering may occur

Ingestion : Adverse symptoms may include the following:
bloating
difficulty swallowing
throat and stomach pain
nausea or vomiting
respiratory tract irritation
wheezing and breathing difficulties

Section 11. Toxicological information

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : See above

Potential delayed effects : See above

Long term exposure

Potential immediate effects : See above

Potential delayed effects : See below.

Potential chronic health effects

Conclusion/Summary : Adverse effects are typically the result of acute overexposure. These effects may be long term or permanent in nature. There is no known effect from chronic exposure to this product.

General

: No known significant effects or critical hazards.

Carcinogenicity

: No known significant effects or critical hazards.

Mutagenicity

: No known significant effects or critical hazards.

Teratogenicity

: No known significant effects or critical hazards.

Developmental effects

: No known significant effects or critical hazards.

Fertility effects

: No known significant effects or critical hazards.

Other information

: The odor recognition threshold for ammonia ranges from 0.7 PPM for persons with an acute sense of smell to over 50 PPM for acclimatized individuals. Generally, concentrations of up to 25 PPM are tolerated although unpleasant and pungent. Above this concentration, irritation of the eyes, nose and throat may begin. The extent of irritation increases with increasing ammonia concentration, and decreases with acclimatization.

NIOSH has established 300 PPM as the concentration immediately dangerous to life and health (IDLH), which is defined as the concentration above which self-rescue may be difficult or impossible due to physiological effects. At concentrations over 1000 PPM increasing chest tightness, bronchospasm and severe eye and skin irritation may result. Delayed effects such as chemical pneumonitis and pulmonary edema may develop several hours after exposure. Exposure to high concentrations (>5,000 ppm) may cause death. Effects may be more pronounced at lower concentrations in children, the elderly, and persons with impaired lung function.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Ammonia	Acute EC50 29.2 mg/l Marine water Acute LC50 2080 µg/l Fresh water Acute LC50 0.53 ppm Fresh water Acute LC50 300 µg/l Fresh water Chronic NOEC 1 mg/l Fresh water Chronic NOEC 0.204 mg/l Marine water Acute LC50 0.89 mg/l Acute LC50 450 µg/l Fresh water Chronic LOEL 0.022 mg/l Chronic NOEC 0.79 mg/l Fresh water	Algae - Ulva fasciata - Zoa Crustaceans - Gammarus pulex Daphnia - Daphnia magna Fish - Hypophthalmichthys nobilis Algae - Skeletonema costatum Fish - Dicentrarchus labrax Fish Fish - Oncorhynchus tshawytscha - Underyearling Fish Daphnia	96 hours 48 hours 48 hours 96 hours 3 days 62 days 96 hours 96 hours 73 days 96 hours

Conclusion/Summary : Very toxic to aquatic life.

Persistence and degradability

Conclusion/Summary : Not persistent. Readily biodegradable

Section 12. Ecological information

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Ammonia	-	-	Readily

Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
Ammonia	0.23	-	low

Mobility in soil

Soil/water partition coefficient (K_{oc}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Empty pressure vessels should be returned to the supplier. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	TDG Classification	DOT Classification	Mexico Classification	IMDG	IATA
UN number	UN1005	UN1005	UN1005	UN1005	UN1005
UN proper shipping name	Ammonia, anhydrous	Ammonia, anhydrous	Amoniaco, anhidro	Ammonia, anhydrous	Ammonia, anhydrous
Transport hazard class(es)	2.3 (8) 	2.2 Domestic or 2.3 International See below. 	2.3 	2.3 (8) 	2.3 (8)
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	Yes.	No.

Section 14. Transport information

Additional information	<p>ERAP Index 3000</p> <p>Passenger Carrying Ship Index Forbidden</p> <p>Passenger Carrying Road or Rail Index Forbidden</p> <p>TDG Classification: Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.3 and Schedule I</p>	<p>Inhalation hazard zone D</p> <p>Reportable quantity 100 lbs / 45.4 kg Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden. Packaging instructions: 304, 314, 315</p> <p>Cargo aircraft Quantity limitation: Forbidden.</p> <p>Special provisions 13, T50</p>	<p>Special provisions 23</p>	<p>The marine pollutant mark is not required when transported in sizes of \leq 5 L or \leq 5 kg.</p>	<p>The environmentally hazardous substance mark may appear if required by other transportation regulations.</p>
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Special precautions for user : Ammonia shipments between the U.S. and Canada, including empty or residue railcars or trucks is regulated under agreement. Changes in Transport Canada's Transportation of Dangerous Goods Regulations has changed the classification of Anhydrous Ammonia from Class 2.2 to Class 2.3. **Shipment of anhydrous ammonia within Canada using the DOT green 2.2 Placard are prohibited.** **Shipments originating in Canada going to the United States are to be placarded with the White UN 1005 Anhydrous Ammonia Placard.** DOT rules allow shipments to proceed between the U.S. and Canada with this placard. **Domestic shipments within the U.S. must continue to use the green DOT 2.2 Non-flammable compressed gas placard.**

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

Canadian lists

Canadian NPRI : The following components are listed: Ammonia (total)

CEPA Toxic substances : The following components are listed: Ammonia

Canada inventory : All components are listed or exempted.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Section 15. Regulatory information

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia	: All components are listed or exempted.
China	: All components are listed or exempted.
Europe	: All components are listed or exempted.
Japan	: All components are listed or exempted.
Malaysia	: All components are listed or exempted.
New Zealand	: All components are listed or exempted.
Philippines	: All components are listed or exempted.
Republic of Korea	: All components are listed or exempted.
Taiwan	: All components are listed or exempted.
Turkey	: Not determined.
 U.S. Federal Regulations:	 : TSCA 8(a) CDR Exempt/Partial exemption: Not determined TSCA 8(b) inventory: All components are listed or exempted. Clean Water Act (CWA) 311: ammonia, anhydrous Clean Air Act (CAA) 112 regulated toxic substances: ammonia, anhydrous

Clean Air Act Section 112 : Not listed

(b) Hazardous Air Pollutants (HAPs)

Clean Air Act Section 602 : Not listed
Class I Substances

Clean Air Act Section 602 : Not listed
Class II Substances

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304 Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
Ammonia	99.98	Yes.	500	-	100	-

SARA 304 RQ : 100 lbs / 45.4 kg

SARA 311/312

Classification : Fire hazard
Sudden release of pressure
Immediate (acute) health hazard

Composition/information on ingredients

Section 15. Regulatory information

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard.
Ammonia	99.98	Yes.	Yes.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Ammonia, anhydrous	7664-41-7	100
Supplier notification	Ammonia, anhydrous	7664-41-7	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts	: The following components are listed: Ammonia
New York	: The following components are listed: Ammonia
New Jersey	: The following components are listed: Ammonia
Pennsylvania	: The following components are listed: Ammonia
California Prop. 65	: Not listed.

Section 16. Other information

History

Date of issue/Date of revision : 7/1/2017
Date of previous issue : 6/1/2017
Version : 2.4

► Indicates information that has changed from previously issued version.

This Safety Data Sheet has been revised to comply with Hazcom 2012 and WHMIS 2015 requirements.

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Key to abbreviations : ATE = Acute Toxicity Estimate
 BCF = Bioconcentration Factor
 GHS = Globally Harmonized System of Classification and Labelling of Chemicals
 IATA = International Air Transport Association
 IBC = Intermediate Bulk Container
 IMDG = International Maritime Dangerous Goods
 LogPow = logarithm of the octanol/water partition coefficient
 MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
 UN = United Nations
 HPR = Hazardous Products Regulations

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 2	Weight of evidence
GASES UNDER PRESSURE - Liquefied gas	Weight of evidence
CORROSIVE TO METALS - Category 1	Weight of evidence
ACUTE TOXICITY (inhalation) - Category 3	Weight of evidence
SKIN CORROSION - Category 1B	Weight of evidence
SERIOUS EYE DAMAGE - Category 1	Weight of evidence

Section 16. Other information

References

- : Transportation of Dangerous Goods Act and Clear Language Regulations, current edition at time of (M)SDS preparation, Transport Canada;
- Hazardous Products Act and Regulations, current revision at time of (M)SDS preparation, Health Canada;
- Domestic Substances List, current revision at time of (M)SDS preparation, Environment Canada;
- 29 CFR Part 1910, current revision at time of SDS preparation, U.S. Occupational Safety and Health Administration;
- 40 CFR Parts 1-799, current revision at time of SDS preparation, U.S. Environmental Protection Agency;
- 49 CFR Parts 1-199, current revision at time of SDS preparation, U.S. Department of Transport;
- Threshold Limit Values for Chemical Substances, current edition at time of SDS preparation, American Conference of Governmental Industrial Hygienists;
- NFPA 400, National Fire Codes, National Fire Protection Association, current edition at time of SDS preparation;
- NFPA 704, National Fire Codes, National Fire Protection Association, current edition at time of SDS preparation;
- Corrosion Data Survey, Sixth Edition, 1985, National Association of Corrosion Engineers;
- ERG 2016, Emergency Response Guidebook, U.S. Department of Transport, Transport Canada, and the Secretariat of Transportation and Communications of Mexico
- Hazardous Substances Data Bank, current revision at time of SDS preparation, National Library of Medicine, Bethesda, Maryland
- Integrated Risk Information System, current revision at time of SDS preparation, U. S. Environmental Protection Agency, Washington, D.C.
- Pocket Guide to Chemical Hazards, current revision at time of SDS preparation, National Institute for Occupational Safety and Health, Cincinnati, Ohio ;
- Agency for Toxic Substances and Disease Registry Databank, current revision at time of SDS preparation, U.S. Department of Health and Human Services, Atlanta, Georgia
- National Toxicology Program, Report on Carcinogens, Division of the National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina.
- Registry of Toxic Effects of Chemical Substances. National Institute for Occupational Safety and Health, Cincinnati, Ohio
- The Fertilizer Institute, Product Toxicology Testing Program Results, TFI, Washington , D.C., 2003

Notice to reader

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