1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/UNDERTAKING

Identification of the substance/preparation	:	Ammonia
Chemical formula	:	NH3
Other means of identification	:	Ammonia, Anhydrous
Use of the Substance/Mixture	:	General Industrial. Industrial and professional use.
Restrictions on Use	:	No data available.
Manufacturer/Importer/Distributor	:	Air Products Singapore Industrial Gases Pte. Ltd. 2 International Business Park The Strategy, #03-20 Singapore 609930 Toll Free No: 800 448 1755
Email Address – Technical Information	:	GASTECH@airproducts.com
Telephone	:	6332 2440
Emergency telephone number (24h)	:	+65 6853 6800 +1 610 481 7711 International

2. HAZARDS IDENTIFICATION

GHS classification

Flammable gases - Category 2
Gases under pressure - Liquefied gas.
Acute toxicity - Inhalation Category 3
Skin corrosion - Category 1B
Serious Eye Damage - Category 1
Acute aquatic toxicity. - Category 1
Chronic aquatic toxicity - Category 2

GHS label elements

Hazard pictograms/symbols

Signal Word: Danger

Hazard Statements:

H221:Flammable gas.
H280:Contains gas under pressure; may explode if heated.
H314:Causes severe skin burns and eye damage.
H331:Toxic if inhaled.
H410:Very toxic to aquatic life with long lasting effects.
EUH071:Corrosive to the respiratory tract.

Precautionary Statements:

Prevention : P210:Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking.
P260:Do not breathe dust/fume/gas/mist/vapours/spray.
P273:Avoid release to the environment.
P280:Wear protective gloves/protective clothing/eye protection/face protection.

Response : P303+P361+P353 :IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 :IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338 :IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P315 :Get immediate medical advice/attention.
P377 :Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 :In case of leakage, eliminate all ignition sources.

Storage : P403:Store in a well-ventilated place.
P405:Store locked up.

Other hazards which do not result in classification

Flammable.
Vapors may form explosive mixture with air.
Immediate fire and explosion hazard exists when mixed with air at concentrations exceeding the lower flammability limit (LFL).
Wear self-contained breathing apparatus and protective suit.
Direct contact with liquid can cause frostbite.
May react violently with water.
Do not breathe gas.
Corrosive to eyes, respiratory system and skin.
Compressed liquefied gas.

Environmental Effects

Dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture : Substance

Components	Chemical formula	CAS Number	Concentration (Volume)
Ammonia	NH3	7664-41-7	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

4. FIRST AID MEASURES

General advice	:	Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped. Use chemically protective clothing.
Eye contact	:	In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep eye wide open while rinsing.
Skin contact	:	Flush with copious amounts of water until treatment is available. Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and badly.
Ingestion	:	Ingestion is not considered a potential route of exposure.
Inhalation	:	Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Mouth to mouth resuscitation is not recommended. Use a barrier device. If unconscious place in recovery position and seek medical advice. In case of shortness of breath, give oxygen. Consult a doctor.
Symptoms	:	Aspiration may cause pulmonary edema and pneumonitis. Coughing, irritation in the throat and nasal tract. May cause severe chemical burns to skin and cornea. Suitable first-aid treatment should be immediately available. Seek medical advice before using product. Cough. Headache. Nausea.
Notes to physician		
Treatment	:	Treat bronchospasm and laryngeal edema if present. Observe for delayed chemical pneumonitis, pulmonary hemorrhage or edema. Obtain medical attention. If exposed or concerned: Get medical attention/advice.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Water spray or fog. Foam. The product itself does not burn. Use extinguishing media appropriate for surrounding fire.
Extinguishing media which must not be used for safety reasons.	:	Do not use water jet to extinguish.
Specific hazards	:	Extinguish fire only if gas flow can be stopped. If possible, shut-off source of gas and allow the fire to burn itself out. Downwind personnel must be evacuated. Ammonia can form explosive compounds when combine d with mercury. Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Use of water may result in the formation of very toxic aqueous solutions. Move away from container and cool with water from a protected position. Keep containers and surroundings cool with water spray. Do not allow run-off from firefighting to enter drains or water courses. If possible, stop flow of product.

Special protective equipment for fire-fighters	:	In the event of fire, wear self-contained breathing apparatus. Use self-contained breathing apparatus and chemically protective clothing. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask. EN 943-2: Protective clothing against liquid and gaseous chemicals, aerosols and solid particles. Gas-tight chemical protective suits for emergency teams.
Further information	:	Use of water may result in the formation of very toxic aqueous solutions., Combustion by-products may be toxic., If flames are accidentally extinguished, explosive re-ignition may occur; therefore, appropriate measures should be taken (e.g. total evacuation to protect persons from cylinder fragments and toxic fumes) should a rupture occur., In the event of fire, cool tanks with water spray .

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Remove all sources of ignition. Evacuate personnel to safe areas. Ventilate the area. Approach suspected leak areas with caution. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits.
Environmental precautions	:	Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
Methods for cleaning up	:	Ventilate the area. Wash contaminated equipment or sites of leaks wit h copious quantities of water. Reduce vapor with fog or fine water spray.
Additional advice	:	If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Use equipment rated for cylinder pressure. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment.

Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Keep container valve outlets clean and free from contaminates particularly oil and water. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge air from system before introducing gas. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

Storage

Flammable storage areas should be separated from oxygen and other oxidizers by a minimum distance of 20 ft. (6.1 m.) or by a barrier of non-combustible material at least 5 ft. (1.5 m.) high, having a fire resistance rating of at least 1/2 hour. Post "No Smoking or Open Flames" signs in the storage areas. Full containers should be stored so that oldest stock is used first. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Return empty containers in a timely manner.

Technical measures/Precautions

Containers containing flammable gases should be stored away from other combustible materials. Where necessary containers containing oxygen and oxidants should be separated from flammable gases by a fire resistant partition. Provide sufficient air exchange and/or exhaust in work rooms. Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance whit local regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Handle product only in closed system or provide appropriate exhaust ventilation at machinery.
Provide natural or mechanical ventilation to prevent accumulation above exposure limits.
Provide readily accessible eye wash stations and safety showers.

Personal protective equipment

Respiratory protection : Keep self-contained breathing apparatus readily available for emergency use. Users of breathing apparatus must be trained. Use gas filters and full face mask, where exposure limits may be exceeded for a short-term period, e.g. connecting or disconnecting containers. Gas filters do not protect against oxygen deficiency.

Gas filters may be used if all surrounding conditions e.g. type and concentration of the contaminant(s) and duration of use are known. Standard EN 14387 - Gas filter(s), combined filter(s) and full face mask - EN 136. Consult respiratory device supplier´s product information for the selection of the appropriate device.
Self-contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.
Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.

Hand protection : Wear work gloves when handling gas containers.
Standard EN 388 - Protective gloves against mechanical risk.
Wear chemically resistant protective gloves.
Standard EN 374 - Protective gloves against chemicals.
Consult glove manufacturer´s product information on material suitability and material thickness.
The breakthrough time of the selected gloves must be greater than the intended use period.

Eye protection : Wear safety glasses with side shields.
Wear goggles and a face shield when transfilling or breaking transfer connections.
Standard EN 166 - Personal eye-protection.

Skin and body protection : Use chemically protective clothing.
Safety shoes are recommended when handling cylinders.
Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
Keep suitable chemically resistant protective clothing readily available for emergency use.
Standard EN943-1 - Full protective suits against liquid, solid and gaseous chemicals.

Special instructions for protection and hygiene : Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits.

Exposure limit(s)

Ammonia	Time Weighted Average (TWA) EH40 WEL	25 ppm	18 mg/m3
Ammonia	Time Weighted Average (TWA) EU ELV	20 ppm	14 mg/m3
Ammonia	Short Term Exposure Limit (STEL) EU ELV	50 ppm	36 mg/m3
Ammonia	Time Weighted Average (TWA) EU SCOELS	20 ppm	14 mg/m3
Ammonia	Short Term Exposure Limit (STEL) EU SCOELS	50 ppm	36 mg/m3
Ammonia	Short Term Exposure Limit (STEL) EH40 WEL	35 ppm	25 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Liquefied gas. Colorless gas

Odor : Ammoniacal.

Odor threshold : No data available.

pH : Not applicable.

Melting point/range	:	-108 °F (-77.7 °C)
Boiling point/range	:	-27 °F (-33 °C)
Flash point	:	Not applicable.
Evaporation rate	:	Not applicable.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Upper/lower explosion/flammability limit	:	33.6 %(V) / 15.4 %(V)
Vapor pressure	:	124.73 psia (8.60 bara) at 68 °F (20 °C)
Water solubility	:	517 g/l Hydrolyses.
Relative vapor density	:	0.588 (air = 1)
Relative density	:	0.7 (water = 1)
Partition coefficient: n-octanol/water [log Kow]	:	Not applicable.
Auto-ignition temperature	:	630 °C
Decomposition temperature	:	No data available.
Viscosity	:	Not applicable.
Molecular Weight	:	17.03 g/mol
Density	:	0.044 lb/ft3 (0.0007 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	:	22.49 ft3/lb (1.4040 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	:	Stable under normal conditions.
Conditions to avoid	:	Heat, flames and sparks.
Reactivity/Incompatible Materials	:	Copper, silver, cadmium and zinc and their alloys; mercury, tin, acids, alcohols, aldehydes, halogens and oxidizers. Ammonia can form explosive compounds when combined with mercury. May react violently with oxidants. May react violently with acids. Reacts with water to form corrosive alkalis. Overexposure to the atmosphere results in water absorption.
Hazardous decomposition products	:	No decomposition if stored normally.

Possibility of hazardous reactions	:	Vapors may form explosive mixture with air.

11. TOXICOLOGICAL INFORMATION

Likely routes of exposure

Effects on Eye	:	Causes eye burns. May cause blindness. Causes severe eye burns. May cause permanent eye injury.
Effects on Skin	:	Causes skin burns. Contact with liquid may cause cold burns/frostbite. Causes skin burns.
Inhalation Effects	:	Toxic by inhalation. Can cause severe eye, skin and respiratory tract burns. Irritating to respiratory system. Can cause severe lung damage. May be fatal if inhaled. Delayed adverse effects possible. Prolonged exposure to small concentrations may result in pulmonary edema. Delayed fatal pulmonary edema possible.
Ingestion Effects	:	Ingestion is not considered a potential route of exposure.
Symptoms	:	Aspiration may cause pulmonary edema and pneumonitis. Coughing, irritation in the throat and nasal tract. May cause severe chemical burns to skin and cornea. Suitable first-aid treatment should be immediately available. Seek medical advice before using product. Cough. Headache. Nausea.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Inhalation	:	LC50 (1 h) : 4000 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.
Skin corrosion/irritation	:	Causes skin burns.
Serious eye damage/eye irritation	:	Risk of serious damage to eyes.
Sensitization.	:	No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity	:	This product contains no listed carcinogens according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater.
Reproductive toxicity	:	No data is available on the product itself.
Germ cell mutagenicity	:	No data is available on the product itself.
Specific target organ systemic toxicity (single exposure)	:	No data available.

Specific target organ systemic toxicity (repeated exposure)	:	No data available.
Aspiration hazard	:	No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	LC50 (96 h) : 0.89 mg/l Species : Fish. EC50 (48 h) : 101 mg/l Species : Daphnia magna. May cause pH changes in aqueous ecological systems.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Biodegradability	:	Readily biodegradable
Mobility	:	No data available.
Bioaccumulation	:	Refer to Section 9 "Partition Coefficient (n-octanol/water)".

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	In accordance with local and national regulations. Return unused product in original cylinder to supplier. Contact supplier if guidance is required. Must not be discharged to atmosphere. Refer to the EIGA code of practice Doc. 30 "Disposal of Gases", downloadable at http://www.eiga.org for more guidance on suitable disposal methods. List of hazardous waste codes: 16 05 04*: gases in pressure containers (including halons) containing hazardous substances.
Contaminated packaging	:	Return cylinder to supplier.

14. TRANSPORT INFORMATION

ADR

UN/ID No.	:	UN1005
Proper shipping name	:	AMMONIA, ANHYDROUS
Class or Division	:	2
Tunnel Code	:	(C/D)
Label(s)	:	2.3 (8)
ADR/RID Hazard ID no.	:	268
Marine Pollutant	:	Yes

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

IATA

Transport forbidden

IMDG

UN/ID No.	:	UN1005
Proper shipping name	:	AMMONIA, ANHYDROUS
Class or Division	:	2.3
Label(s)	:	2.3 (8)
RQ Substance	:	Yes
Marine Pollutant	:	Yes
Segregation Group	:	Alkalis

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.
** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

RID

UN/ID No.	:	UN1005
Proper shipping name	:	AMMONIA, ANHYDROUS
Class or Division	:	2
Label(s)	:	2.3 (8)
Marine Pollutant	:	Yes

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact customer service.

15. REGULATORY INFORMATION

Workplace Safety and Health Act & Workplace Safety and Health (General Provisions) Regulations

Workplace Health and Safety Act , SS586 Labeling.

Poison Act (Health Sciences Authority).

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.
	TCSI	Included on Inventory.

16. OTHER INFORMATION

Ensure all national/local regulations are observed.

Prepared by : Air Products and Chemicals, Inc. Global EH&S Department

For additional information, please visit our Product Stewardship web site at
http://www.airproducts.com/productstewardship/