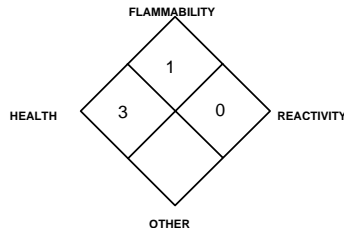




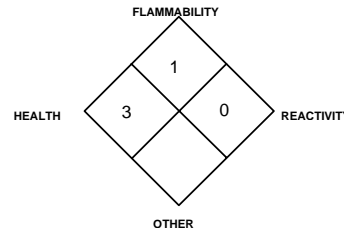
# MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

### NFPA RATING - GAS



### NFPA RATING - LIQUID



## PART I *What is the material and what do I need to know in an emergency?*

### 1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

**AMMONIA - NH<sub>3</sub>**

Document Number: P-0003

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

MESA Specialty Gases & Equipment

ADDRESS:

3619 Pendleton Avenue, Suite C  
Santa Ana, CA 92704

BUSINESS PHONE:

1-714-434-7102

EMERGENCY PHONE:

INFOTRAC: 1-800-535-5053

DATE OF PREPARATION:

May 20, 1996

SECOND REVISION:

January 23, 1998

### 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Ammonia	7664-41-7	99.99%	25	35	NE	50 35 ppm (Vacated 1989 PEL)	300	NIOSH REL: 25 ppm, TWA; 35 ppm STEL DFG MAK: 20 ppm
Maximum Impurities		< 0.01%	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used




NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Ammonia is a pungent-smelling, toxic, corrosive, non-flammable gas having a suffocating odor. Ammonia is shipped both as a gas and a liquefied gas under its own vapor pressure. The gas can burn and damage eyes, skin, mucous membranes, and any other exposed tissue. Inhalation can cause coughing and breathing difficulty. Overexposure to this gas may be fatal. Contact with rapidly expanding gases, or contact with the liquid, may cause frostbite. This gas is lighter than air. Ammonia is not readily ignited, but explosions of Ammonia in confined spaces have been reported. Vapor clouds of the gas may be controlled using a water fog. Persons who respond to releases of Ammonia must protect themselves from inhalation of the Ammonia gases and mists, especially in areas which are downwind of the release. Extreme caution must be used when responding to releases.




**SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:** The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

#### AMMONIA - GAS

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH	(BLUE)	3	
FLAMMABILITY	(RED)	1	
REACTIVITY	(YELLOW)	0	
PROTECTIVE EQUIPMENT			H
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		
For routine industrial applications			

**INHALATION:**  
Inhalation of Ammonia vapors or gases may lead to irritation of the nose and throat. Exposures to high concentrations of Ammonia gas can lead to symptoms such as coughing, labored breathing, sore throat, and in some instances, chemical pneumonitis and pulmonary edema. High concentrations of Ammonia gas may cause an oxygen deficient atmosphere.

#### AMMONIA - LIQUID

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH	(BLUE)	3	
FLAMMABILITY	(RED)	1	
REACTIVITY	(YELLOW)	0	
PROTECTIVE EQUIPMENT			H
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		
For routine industrial applications			

See Section 16 for Definition of Ratings

Exposure to high concentrations may cause unconsciousness, and under some circumstances, death. Exposure to the eyes may cause temporary blindness, leading to permanent vision impairment.

Repeated Ammonia overexposures by inhalation can result in emphysema. The symptoms associated with specific Ammonia concentrations are as follows:

CONCENTRATION	SYMPTOM(s)
0.6 - 53 ppm	Odor threshold.
25 - 50 ppm	Irritation of the eyes and mucous membranes, which can be tolerated for several hours.
100 - 150 ppm	Immediate irritation of the throat, which may be tolerated for an hour.
400 - 700 ppm	Immediate, severe irritation of the respiratory system and eyes occurs.
> 5000 ppm	This level of exposure may result in rapid death due to suffocation or fluid in the lungs. Exposure to concentrations in excess of 5000 ppm may cause laryngeal spasms, resulting in death.

Contact with Liquid Ammonia may cause immediate, severe chemical burns as well as frostbite, and all of the symptoms described for overexposure to the gas.

### 3. HAZARD IDENTIFICATION (Continued)

**CONTACT WITH SKIN or EYES:** Contact of the liquid (or gaseous product or the mist produced by Ammonia), with the skin can lead to severe burns or dermatitis (red, cracked, irritated skin), depending upon concentration and duration of exposure. Contact of the liquid (or gaseous product or the mist produced by Ammonia), with the eyes can cause pain, redness, and prolonged exposure could cause blindness. Contact with the undiluted liquid will cause frostbite, ulceration of the skin (which may be delayed in appearance for several hours), blistering, and pain. Contact with the liquid or rapidly expanding gas poses a severe frostbite hazard.

**OTHER POTENTIAL HEALTH EFFECTS:** While ingestion is highly unlikely, ingestion of Ammonia can damage the tissues of the mouth, throat, esophagus, and other tissues of the digestive system. Ingestion of Ammonia can be fatal. Additionally, aspiration by inhalation is possible, causing chemical pneumonia or death.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.** Overexposure to Ammonia may cause the following health effects:

**ACUTE:** This gas is extremely corrosive, and can burn and damage eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, irritation of the respiratory system may occur, with coughing, and breathing difficulty. Overexposure to this gas may be fatal. Though unlikely to occur during occupational use, ingestion of large quantities may be fatal.

**CHRONIC:** Persistent irritation may result from repeated exposures to this gas. Repeated Ammonia overexposures by inhalation can result in emphysema. See Section 11 (Toxicological Information) for additional information.

**TARGET ORGANS:** Respiratory system, skin, eyes.

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## **PART II** *What should I do if a hazardous situation occurs?*

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### 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO AMMONIA WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus Personal Protective equipment should be worn. If necessary, fire protection should be provided.**

Remove victim(s) to fresh air, as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area of the body in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

**SKIN EXPOSURE:** If Ammonia contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

**EYE EXPOSURE:** If liquid is splashed into eyes, or if irritation of the eye develops after exposure to liquid or gas, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s). Refer to "Recommendations to Physicians," Section 11 (Toxicological Information) for additional information on first-aid measures.

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## 5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable. Ammonia can be ignited.

AUTOIGNITION TEMPERATURE: 651°C (1204°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 15.0%

Upper (UEL): 28.0%

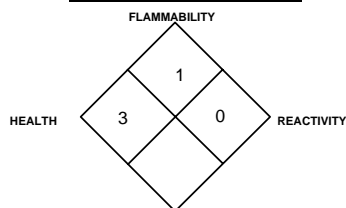
FIRE EXTINGUISHING MATERIALS:

Water Spray: YES      Carbon Dioxide: YES

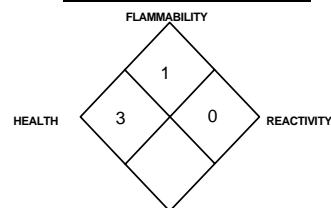
Foam: YES      Halon: YES

Dry Chemical: YES      Other: Any "ABC" Class.

### NFPA RATING - GAS



### NFPA RATING - LIQUID



**See Section 16 for Definition of Ratings**

UNUSUAL FIRE AND EXPLOSION HAZARDS: Ammonia is a toxic, corrosive gas and presents an extreme hazard to firefighters. In the event of fire, cool containers of Ammonia with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Do not direct a water spray at the source of a release. This gas may ignite explosively, if released near an active fire. Ammonia is lighter than air, but conditions associated with a release can cause it to accumulate in low-lying areas.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: There is insufficient information to classify Ammonia as to its sensitivity to static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move fire-exposed cylinders if it can be done without risk to firefighters. Otherwise, cool containers with hose stream and protect personnel. Withdraw immediately in case of rising sounds from venting safety device or any discoloration of tanks due to the fire. If Ammonia is involved in a fire, fire runoff water should be contained to prevent possible environmental damage.

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## 6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a large release, clear the affected area, protect people, and respond with trained personnel. Call CHEMTREC (1-800-424-9300) for emergency assistance. Eliminate sources of ignition. Supply maximum possible ventilation with explosion-proof equipment.

Minimum Personal Protective Equipment should be **Level A: triple-gloves (neoprene rubber gloves and nitrile gloves, over latex or N-Dex™ gloves), fully-encapsulating chemical resistant suit and boots, hard-hat, and Self Contained Breathing Apparatus.** Large releases of Ammonia will be evident by the cloud of ammonia hydroxide mist which is formed. Small releases of Ammonia can be detected by means of an atomizer or squeeze bottle filled with concentrated hydrochloric acid or with wet pH paper, which will turn blue. A white cloud will show the location of the leak. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there. Monitor the surrounding area for Ammonia gas and oxygen levels. The Ammonia level must be below 25 ppm AND the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

If possible stop the gas flow at the source. A water fog or mist can be used to control the vapor cloud resulting from the release.

**THIS IS A CORROSIVE GAS.** Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

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## **PART III** *How can I prevent hazardous situations from occurring?*

### 7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Ammonia ON YOU or IN YOU. Wash hands after handling chemicals. Do not eat or drink while handling chemicals. All work practices should minimize the release of Ammonia. Be aware of any signs of effects of exposure indicated in Section 3 (Hazard Identification); exposures to fatal concentrations of Ammonia could occur rapidly.

## 7. HANDLING and STORAGE (Continued)

**STORAGE AND HANDLING PRACTICES:** All employees who handle this material should be trained to handle it safely. Avoid breathing the gas or sprays or mists generated by Ammonia. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Use only compatible materials for cylinders, process lines, and other Ammonia-handling equipment. Lines should be purged with dry nitrogen both before and after maintenance activity. Copper, tin, zinc and their alloys are not suitable materials for cylinders for Ammonia. Keep container tightly-closed when not in use. Keep cylinders away from incompatible material. Wash thoroughly after using this material. Workers must be thoroughly trained to handle Ammonia without causing overexposure. Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition. Ammonia emergency equipment should be available near the point of use.

- Workers who handle Ammonia should wear protective clothing, as listed in Section 8 (Exposure Controls - Personal Protection).
- Instant-acting showers should be available in the event of an emergency.
- Special eye-wash fountains or similar equipment should be available for eye irrigation.
- Proper respiratory protection equipment must be provided and workers using such equipment must be carefully trained in its operation and limitations.
- Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check-valve, vacuum break, or trap, since suck-back may cause dangerous pressure changes within the cylinder.
- The cylinder valve should be closed after each use.
- Determine Cylinder contents by weight. The tare weight of the cylinder is stamped on the cylinder.

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS:** Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from incompatible materials (see Section 10, Stability and Reactivity) for more information). Use a check valve or trap in the discharge line to prevent hazardous backflow. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to work situations in which cylinders are being used:

**Before Use:** Move cylinders with suitable hand-truck. Secure cylinders firmly. Leave the valve protection cap in place until cylinder is ready for use.

**During Use:** Use designated regulators, CGA fittings, and other support equipment. Do not use adapters. Do not use oil or grease on gas handling fittings or equipment. **All equipment must be properly grounded and bonded.**

Ammonia cylinders should never be directly connected to a vessel containing a liquid since suck-back may occur causing a violent reaction within the cylinder. To prevent suck-back, a trap, check valve or vacuum break should be inserted into the line. The trap should be of adequate size to take the total liquid volume sucked-back.

The rate of gas flow can be increased by improving air circulation about the container or by increasing the temperature of the room if it is below normal. Never apply heat directly to the cylinder for any reason. Do not manifold cylinders to increase output unless check valves have been inserted at the cylinder outputs to prevent exchange of material from one cylinder to another, causing a cylinder to become over-full.

Hoisting of cylinders is not recommended. If hoisting cannot be avoided, always use a lifting clamp, cradle, or carrier -- never use a lifting magnet, rope, or chain spring. Do not store Ammonia cylinders near cylinders of hydrogen, acetylene, fuel gases, ether, turpentine, hydrocarbons, organic matter, or finely-divided metals. Never mix Ammonia with other gases in the cylinder. Do not store Ammonia cylinders near elevators or gangways or in locations where heavy objects may fall and strike them.

Open cylinder valves slowly. The use of large wrenches or pipe wrenches will damage the valve. One complete turn of the valve stem in a counter-clockwise direction opens the valve sufficiently to permit maximum discharge. "Empty" containers still contain Ammonia gas, and should be handled with all precautions described in this MSDS.

If leaks develop in Ammonia lines, they must be given prompt attention because they will become progressively worse. Refer to Section 6 (Accidental Release Measures) for release response protocol.

**After Use:** Close main cylinder valve. Replace valve protection cap (where provided). Mark empty cylinders "EMPTY".

**NOTE:** Use only DOT or ASME code containers designed for acetylene storage. Earth-ground and bond all lines and equipment associated with Ammonia. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres" and NFPA Bulletin 58.

## 7. HANDLING and STORAGE (Continued)

**TANK CAR SHIPMENTS:** Tank cars carrying Ammonia should be loaded and unloaded in strict accordance with tank-car manufacturer's recommendations and all established on-site safety procedures. Appropriate personal protective equipment must be used during tank car operations (see Section 8). All loading and unloading equipment must be inspected, prior to each use. Loading and unloading operations must be attended, at all times. Tank cars must be level and wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tank (for unloading) must be verified to be correct for receiving Ammonia and be properly prepared, prior to starting the transfer operations. Hoses must be verified to be clean and free of incompatible chemicals, prior to connection to the tank car or vessel. Valves and hoses must be verified to be in the correct positions, before starting transfer operations. A sample (if required) must be taken and verified (if required) prior to starting transfer operations. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

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## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation. A hood with forced ventilation is preferable. Because of the high hazard associated with Ammonia, stringent control measures such as a gas cabinet enclosure or isolation may be necessary. Ductwork should be constructed of non-metallic material, or should be lined to resist corrosion. If necessary, install automatic monitoring devices for Ammonia and oxygen.

**RESPIRATORY PROTECTION:** Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, or applicable State regulations. Use supplied-air respiration protection during emergency response procedures to releases. The following NIOSH respiratory protection recommendations for Ammonia are provided for additional information.

### **CONCENTRATION**

Up to 250 ppm:  
Up to 300 ppm:

### **RESPIRATORY EQUIPMENT**

Chemical cartridge respirator or Supplied Air Respirator (SAR).  
SAR in the continuous flow mode, or a Powered Air Purifying Respirator (PAPR) with Ammonia cartridges, or full-facepiece chemical cartridge respirator with Ammonia cartridge, or a gas mask with an Ammonia canister, or full-facepiece Self-Contained Breathing Apparatus (SCBA), or full-facepiece SAR.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against Ammonia or escape-type SCBA

The IDLH concentration for Ammonia is 300 ppm.

**EYE PROTECTION:** Splash goggles or safety glasses and face shield.

**HAND PROTECTION:** Wear Neoprene Rubber gloves for industrial use. Use triple gloves for spill response (see Section 6 Accidental Release Measures).

**BODY PROTECTION:** Use body protection appropriate for task. An apron, or other impermeable body protection is suggested. Full-body chemical protective clothing is recommended for emergency response procedures.

**PROTECTION FOR TANK CAR OPERATIONS:** Splash-suit, gloves, goggles, face-shield, boots and hard-hat should be worn during operations involving tank-cars or trucks containing Ammonia.

**HAND PROTECTION:** Wear mechanical resistant gloves when handling cylinders of Ammonia.

**BODY PROTECTION:** Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well provide sufficient insulation from extreme cold.

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## 9. PHYSICAL and CHEMICAL PROPERTIES

**VAPOR DENSITY:** 0.77 kg/m<sup>3</sup> (0.048 lb/ft<sup>3</sup>)

**SPECIFIC GRAVITY (air = 1):** 0.6

**SOLUBILITY IN WATER:** 84%

**ODOR THRESHOLD:** 0.6 - 53 ppm (detection)

**SPECIFIC VOLUME (ft<sup>3</sup>/lb):** 22.6

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**FREEZING POINT:** -77°C (-107°F)

**BOILING POINT @ 1 atm:** -33.4°C (-28.2°F)

**VAPOR PRESSURE (psia):** 128.8

**EXPANSION RATIO:** Not applicable.

## 9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

pH: Not applicable. (A 1% solution in water will have a pH > 13)

APPEARANCE AND COLOR: Ammonia is a pungent-smelling, toxic, corrosive gas having a suffocating odor. This gas is lighter than air and fumes strongly in moist air, producing a cloud of ammonium hydroxide mist.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor and dense appearance of this gas are distinctive warning properties associated with Ammonia.

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## 10. STABILITY and REACTIVITY

STABILITY: Stable.

CONDITIONS TO AVOID: Ammonia does not decompose, but reacts with water to form ammonium hydroxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Ammonia is not compatible with most metals, acids, or oxidizers. Ammonia can form explosive compounds with mercury, gold or silver compounds or the elements. Ammonia reacts violently with telluriumtetra bromide and tetrachloride, chlorine, bromine, fluorine, or the interhalogen compounds, and with acid halides, ethylene oxide, and hypochlorites (including household bleach). Poisoning or death can occur if ammonia (or ammonia-containing products) are mixed with household bleach.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Extreme heat, fire, or contact with incompatible chemicals.

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## PART IV *Is there any other useful information about this material?*

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## 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for Ammonia (gas):

LCLo (inhalation, human) = 30000 ppm/ 5 minutes

TCLo (inhalation, human) = 20 ppm; irritation

LDLo (unknown, man) = 132 mg/kg

LD<sub>50</sub> (oral, rat) = 350 mg/kg

LCLo (inhalation, rat) = 2000 ppm/4 hours

LCLo (inhalation, cat) = 7000 ppm/1 hour

TCLo (inhalation, cat) = 1000 ppm/10 minutes

LCLo (inhalation, mammal) = 5000 ppm/5 minutes

LCLo (inhalation, rabbit) = 7000 ppm/1 hour

Mutation in microorganisms (*Escherichia coli*) = 1500 ppm/3 hours

Cytogenic Analysis (rat, inhalation) = 19,800 µg/m<sup>3</sup>/16 weeks

LD<sub>50</sub> (inhalation, mouse) = 4837 ppm/1 hour

SUSPECTED CANCER AGENT: Ammonia is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA or IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Ammonia is severely irritating to contaminated tissue.

SENSITIZATION OF PRODUCT: Ammonia contains no known sensitizer with repeated or prolonged contact.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Ammonia on the human reproductive system.

Mutagenicity: Ammonia has not been reported to cause mutagenic effects in humans. Ammonia has been reported to cause mutagenic effects in specific animal tissues during experimental studies with exposures at relatively high doses.

Embryotoxicity: Ammonia has not been reported to cause embryotoxic effects

Teratogenicity: Ammonia has not been reported to cause teratogenic effects.

Reproductive Toxicity: Ammonia is not expected to cause adverse reproductive effects in humans.

*A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to Ammonia. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms, administer lung function tests and possible chest x-rays. Reduce overexposure. Delayed pulmonary edema may occur, following overexposure by inhalation.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Ammonia.

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## 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** Ammonia is stable and found naturally in the environment (sources include volcanoes). All work practices should be aimed at eliminating environmental contamination. Additional environmental information for Ammonia is available as follows:

**AMMONIA:** Water Solubility: 47% in water at 0°C; 34% in water at 20°C; 28% in water at 31°C. BIOCONCENTRATION: Plants have a high affinity for gaseous ammonia when leaf stomata are open in daylight. BIODEGRADATION: Ammonia is rapidly converted to nitrate by nitrification.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** Due to the corrosive nature of Ammonia, animals exposed to this product will experience tissue damage, burns, and may be killed. Oxygen displacement can also be a factor in the toxicity of Ammonia. Plants contaminated with Ammonia may be adversely affected or destroyed.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** Ammonia is very soluble in water, and even low concentrations of Ammonia in water is detrimental to aquatic life. If a release of Ammonia occurs near a river or other body of water, the release has the potential to kill fish and other aquatic life. Additional aquatic toxicity information is available for Ammonia as follows:

LC (goldfish, yellow perch) = 2.0-2.5 ppm/1-4 days

LC<sub>100</sub> (crayfish) = 60-80 ppm/3 days

TL<sub>m</sub> (fathead minnow) = 8.2 ppm/96 hours

LC<sub>50</sub> (coho salmon) = 0.45 mg/L/96 hours

LC<sub>50</sub> (guppy fry) = 1.2-74 mg/L/72 hours

LC<sub>50</sub> (cutthroat trout fry, *Salmo clarki*) = 0.5-0.8 mg/L/96 hours

LC<sub>50</sub> (rainbow trout: fertilized egg, alevins (0-50 days old), fry (85 days old), adults) = >3.58, >3.58, 0.068, 0.097 mg/L/24 hours

LC<sub>50</sub> (walking catfish) = 0.28 mg/L/48 hours

LC<sub>50</sub> (*Salmo trutta*) = >0.15 mg/L, 0.6-0.9 mg/L / 18 hours, 96 hours

LC<sub>50</sub> (*Salvelinus fontinalis*) = 0.96-1.05 mg/L, 96 hours

LC<sub>50</sub> (*Catostomus platyrhynchos*) = 0.67-0.82 mg/L, 96 hours

LC<sub>50</sub> (*Oimephales promelas*) = 0.73-3.4 mg/L, 96 hours

LC<sub>50</sub> (*Catostmus commersoni*) = 0.79-1.4 mg/L, 96 hours

LC<sub>50</sub> (*Lepomis macrochirus*) = 0.26-4.6 mg/L, 96 hours

LC<sub>50</sub> (*Lepomis macrochirus*) = 0.024-2.3 mg/L, 48 hours

LC<sub>50</sub> (*Micropterus salmoides*) = >0.21-1.7 mg/L, 96 hours

LC<sub>50</sub> (*Notropis lutrensis*) = 0.9-1.1 mg/L, 96 hours

LC<sub>50</sub> (*Mugil cephalus*) = 1.2-2.4 mg/L, 96 hours

LC<sub>50</sub> (*Morone americana*) = 0.52-2.13 mg/L, 96 hours

LC<sub>50</sub> (*Notropis spilopterus*) = 1.2-1.35 mg/L, 96 hours

LC<sub>50</sub> (*Lepomis cyanellus*) = 0.6-2.1 mg/L, 96 hours

LC<sub>50</sub> (*Lepomis gibbosus*) = 0.14-0.86 mg/L, 96 hours

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## 13. DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL:** Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product MESA Specialty Gases & Equipment. Do not dispose of locally.

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## 14. TRANSPORTATION INFORMATION

**THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**

For U.S. Domestic Shipments:

**PROPER SHIPPING NAME:**

Ammonia, anhydrous

**HAZARD CLASS NUMBER and DESCRIPTION:**

2.2 (Non-Flammable Gas)

**UN IDENTIFICATION NUMBER:**

UN 1005

**PACKING GROUP:**

Not Applicable

**DOT LABEL(S) REQUIRED:**

Non-Flammable Gas

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):** 125

**MARINE POLLUTANT:** Ammonia is not designated by the Department of Transportation to be a Marine Pollutant (49 CFR 172.101, Appendix B).

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above following for the preparation of Canadian Shipments.

**PROPER SHIPPING NAME:**

Ammonia, anhydrous

**HAZARD CLASS NUMBER and DESCRIPTION:**

2.4 (Corrosive Gas); 9.2 (Substance hazardous to the environment)

**UN IDENTIFICATION NUMBER:**

UN 1005

**PACKING GROUP:**

Not Applicable

**DOT LABEL(S) REQUIRED:**

Poison Gas, Corrosive



## 14. TRANSPORTATION INFORMATION (Continued)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 125

**SPECIAL PROVISION:** 102 (Poison-Inhalation Hazard) 109 Emergency Response Assistance Planning requirements must be met for shipments in excess of 5 kg or liters. Placards on trucks must be changed at the border.

## 15. REGULATORY INFORMATION

**U.S. SARA REPORTING REQUIREMENTS:** Ammonia is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Ammonia	YES	YES	YES

**U.S. SARA THRESHOLD PLANNING QUANTITY:** 500 lb.

**U.S. CERCLA REPORTABLE QUANTITY (RQ):** Ammonia CERCLA RQ = 100 lb; Ammonia EHS (Extremely Hazardous Substance) RQ = 100 lb.

**CANADIAN DSL/NDSL INVENTORY STATUS:** Ammonia is on the DSL Inventory.

**U.S. TSCA INVENTORY STATUS:** Ammonia is listed on the TSCA Inventory.

**OTHER U.S. FEDERAL REGULATIONS:** Ammonia is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity of Ammonia is 10,000 lb. Compliance with the OSHA Process Safety Standard, 29 CFR 1910.119 may be applicable to operations involving the use of Ammonia. Under this regulation Ammonia is listed in Appendix A. The Threshold Quantity of Ammonia under this regulation is 10,000 lb.

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** Ammonia is not on the California Proposition 65 lists.

**U.S. STATE REGULATORY INFORMATION:** Ammonia is covered under the following specific State regulations:

**Alaska - Designated Toxic and Hazardous Substances:** Ammonia.

**California - Permissible Exposure Limits for Chemical Contaminants:** Ammonia.

**Florida - Substance List:** Ammonia.

**Illinois - Toxic Substance List:** Ammonia.

**Kansas - Section 302/313 List:** Ammonia.

**Massachusetts - Substance List:** Ammonia.

**Michigan - Critical Materials Register:** No.

**Minnesota - List of Hazardous Substances:** Ammonia.

**Missouri - Employer Information/Toxic Substance List:** Ammonia.

**New Jersey - Right to Know Hazardous Substance List:** Ammonia.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** Ammonia.

**Pennsylvania - Hazardous Substance List:** Ammonia.

**Rhode Island - Hazardous Substance List:** Ammonia.

**Texas - Hazardous Substance List:** Ammonia.

**West Virginia - Hazardous Substance List:** Ammonia.

**Wisconsin - Toxic and Hazardous Substances:** Ammonia.

### LABELING:

#### **DANGER:**

CORROSIVE LIQUID AND GAS UNDER PRESSURE.  
CAN CAUSE EYE, SKIN, AND RESPIRATORY TRACT BURNS.

Avoid breathing gas.

Store and use with adequate ventilation.

Keep away from heat, flames, and sparks.

Do not get in eyes, on skin or clothing.

Use only with equipment of compatible material and construction.

Cylinder temperature should not exceed 52°C (125°F).

Close valve after each use and when empty.

Use in accordance with the Material Safety Data Sheet.

#### **NOTE:**

Suck-back into cylinder may cause rupture.

Always use a back flow preventative device in piping.

#### **FIRST-AID:**

**IF INHALED,** remove to fresh air. If not breathing, give artificial respiration. (Rescuer may receive chemical burns as a result of giving mouth to mouth). If breathing is difficult, give oxygen. Call a physician. Keep under medical observation.

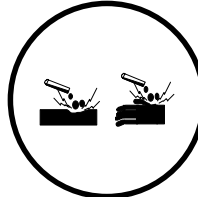
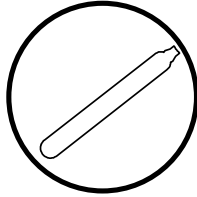
## 15. REGULATORY INFORMATION (Continued)

LABELING (continued):

**IN CASE OF CONTACT**, immediately flush eyes or skin with water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse. (Discard contaminated shoes).

DO NOT REMOVE THIS PRODUCT LABEL.

CANADIAN WHMIS SYMBOLS:    **Class A:** Compressed Gas  
   **Class E:** Corrosive Material



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## 16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA Specialty Gases & Equipment assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA Specialty Gases & Equipment assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

**CAS #:** This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

### EXPOSURE LIMITS IN AIR:

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

**IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called Recommended Exposure Levels (**RELs**). When no exposure guidelines are established, an entry of **NE** is made for reference.

### HAZARD RATINGS:

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

**NATIONAL FIRE PROTECTION ASSOCIATION:** Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m<sup>3</sup>** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

### REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.