

**Section 1. Product information and supplier details.**

<b>Product name:</b>	Anhydrous Ammonia	
<b>Trade name / Other names:</b>	Refrigerant 717, Ammonia, NH <sub>3</sub> , AZANE	
<b>HSNO Approval number(s):</b>	HSR001035	
<b>Cylinder colour coding:</b>	Silver body – grey band.	
<b>Cylinder valve thread</b>	Right hand ½ M/BSP-Parallel (Requires gasket)	
<b>Global warming potential:</b>	GWP 0	
<b>Ozone depletion potential:</b>	ODP 0	
<b>ASHRAE Safety Group</b>	B2L	
<b>Use:</b>	Professional use only; Refrigerant, Fertilizer, Industrial process; Nitriding, Explosives, Rocket fuels, Metal refining.	
<b>New Zealand suppliers:</b>	IXOM	BOC
<b>Websites:</b>	<a href="https://www.ixom.com">https://www.ixom.com</a>	<a href="https://www.boc.co.nz">https://www.boc.co.nz</a>
<b>Address':</b>	Level 5, Office Tower 277 Broadway Newmarket Auckland 1023 New Zealand	970 - 992 Great South Road Penrose Auckland 1061
<b>Phone:</b>	+64 9 368 2700	0800 111 333

**EMERGENCY CONTACT: 111 (FENZ)**

**Section 2. Hazard Identification.**

<b>Hazard Classification:</b>	Flammable Gases 2.1.1B, Gases under pressure - Liquefied Gas Acute Inhalation Toxicity – 6.C, Skin Corrosion 8.2, Eye Damage 8.2B, 8.3A Aquatic Toxicity 9.1A (Managed by the Environmental Protection Agency)
<b>Signal word:</b>	<b>DANGER</b>
<b>Hazard statements:</b>	<b>H221</b> Flammable gas. <b>H280</b> Contains gas under pressure; may explode if heated. <b>H314</b> Causes severe skin burns and eye damage. <b>H318</b> Serious eye damage/eye irritation, Category 1 <b>H331</b> Toxic if inhaled. <b>H335</b> May cause respiratory irritation. <b>H400</b> Hazardous to the aquatic environment — Acute Hazard, Category 1

**Pictograms (GHS):**



<b>Precautionary statements - Prevention:</b>	<b>P103</b> Read label before use. <b>P210</b> Keep away from heat, sparks, open flames, hot surfaces. No smoking. <b>P262</b> Do not get in eyes, on skin, or on clothing. <b>P260</b> Do not breathe fume / gas / mist / vapours / spray. <b>P264</b> Wash hands thoroughly after handling. <b>P271</b> Use only outdoors or in a well-ventilated area. <b>P280</b> Wear protective gloves / protective clothing / eye protection / face protection. <b>P273</b> Avoid release to the environment. <b>P280</b> Wear protective gloves / protective clothing / eye protection / face protection.
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**Section 2. Hazard Identification – Continued.**

<b>Response:</b>	<p><b>P301+P330+P331</b> IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.  <b>P303+P361+P353</b> IF ON SKIN (or hair): Thaw frozen clothing, Take off immediately all contaminated clothing. Rinse skin with water/shower.  <b>P321 Specific treatment</b> (see First Aid Measures on Safety Data Sheet).  <b>P363</b> Wash contaminated clothing before re-use.  <b>P304+P340</b> IF INHALED: Remove person to fresh air and keep comfortable for breathing. <b>P311</b> Call a POISON CENTER or doctor/physician.  <b>P305+P351+P338</b> IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. <b>P310</b> Immediately call a POISON CENTER or doctor/physician.  <b>P377</b> Leaking gas fire: Do not extinguish, unless leak can be stopped safely.  <b>P381</b> Eliminate all ignition sources if safe to do so.  <b>P391</b> Collect spillage. <b>P501</b> - Dispose of contents/container in accordance with container Supplier/owner instructions - Use a back flow preventive device in the piping</p>
<b>Storage:</b>	<p><b>P403+P233</b> Store in a well-ventilated place. Keep container tightly closed.  <b>P405</b> Store locked up. <b>P410</b> Protect from sunlight.</p>
<b>Disposal:</b>	<p><b>P501</b> Dispose of contents and container in accordance with local, regional, national, international regulations.</p>
<b>Emergency overview:</b>	<p>Contact 111 and Ammonia Engineering Specialist / Technical Advisory</p>
<b>Experiences of exposure:</b>	<p>Awareness of Ammonia presence, Inconvenience (repulsive odour)          Alarm (no injury but fear of harm / panic). Minor Injury resulting in first aid or observation. Acute injury (Serious burns and or Inhalation) Disability. Fatality.</p>
<b>Skin:</b>	<p>Mild exposure may form highly corrosive Ammonium solutions on moist tissue such as the following but not limited to; Skin, Eyes, Mucus membranes Including Respiratory system, Throat, Sinuses, Urethra, anus. Patients exposed to only mild ammonia gas and have no skin or eye irritation do not necessarily require decontamination unless advised by lead agency or medical professional. Acute exposure can cause Cryogenic (Low temperature) skin dehydration &amp; Corrosive burns.</p>
<b>Potential health hazards:</b>	<p><b>Eyes:</b> Ammonia can be very irritating to the eyes. Can cause corneal burns &amp; blindness.  <b>Inhalation:</b> Mild to moderate inhalation exposures produce headache, cough, bronchospasm, nausea, vomiting, pharyngeal and retrosternal pain and conjunctivitis. Because of a child's narrow airway, they are especially susceptible to breathing difficulties if exposed. Pulmonary Edema and Organ malfunction.  <b>Ingestion:</b> Ingestion is not considered a potential route of exposure.  <b>Delayed effects:</b> Pulmonary oedema may result following severe exposure.</p>

**Section 3. Composition Information on Ingredients.**

<b>Chemical name:</b>	Anhydrous Ammonia		
<b>Chemical family:</b>	Vapor Producing Liquid, Corrosive, caustic, reactive gas, liquefiable gas		
<b>Ingredient:</b>	<b>Weight (%w/w)</b>	<b>CAS number:</b>	<b>Hazard Codes:</b>
Anhydrous Ammonia	99.95	7664-41-7	H221, H280, H314, H318, H331, H335, H400



**Section 4.**

**First aid measures.**

- General advice:** Contact Poisons Information Centre New Zealand 0800 764 766 Urgent hospital treatment is likely to be needed.
- First responders:** Approach upwind with caution – Respiratory protection may be required. – avoid becoming a casualty.
- Skin:** Relocate to fresh air, upwind of the source. Flush exposed areas thoroughly and preferably with luke-warm water for 15-20 minutes. If only cold water is available, irrigate in short intervals and provide blankets, quickly shelter them in a warm and dry environment to maintain safe body temperature. If clothing is frozen to skin, thaw out area first with water before removing, double-bag contaminated clothing and personal belongings. Clothing that is contaminated with ammonia can cause secondary exposure to responders so use extreme caution. Seek immediate medical attention.
- Eyes:** Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly, get the patient to look left right up and down. Contact an ophthalmologist immediately.
- Inhalation:** Relocate the person to fresh air up wind using self-contained breathing apparatus. If breathing has stopped, perform artificial resuscitation with caution as lungs maybe highly contaminated, administer medical oxygen if available and trained. Seek immediate medical attention.
- Ingestion:** Ingestion is unlikely because of the physical properties and is not expected to be hazardous. (See Ammonia Solutions SDS)
- Advanced treatment:** In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, perform cricothyroidotomy if equipped and trained to do so. Patients who are hypotensive or have seizures should be treated according to advanced life support (ALS) protocols.

Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Also consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Ammonia poisoning is not known to pose additional risk during the use of bronchial or cardiac sensitizing agents. Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25-0.75 mL of 2.25% racemic epinephrine solution in water, repeat every 20 minutes as needed cautioning for myocardial variability.

Patients who are comatose, hypotensive, or are having seizures or have cardiac arrhythmias should be treated according to ALS protocols. Monitor fluid and electrolyte balance and restore if abnormal. Fluids should be administered cautiously to patients with pulmonary edema.



**Section 4.**

**First aid measures – continued.**

**Emergency department & Intensive Care Unit:**

Previously decontaminated patients and patients exposed only to ammonia gas who have no skin or eye irritation may be transferred immediately to the Intensive Care Unit. Other patients will require rapid decontamination. Patients who are able, may assist with their own decontamination. Remove and double bag contaminated clothing and personal belongings. Because ammonia in solution can cause burns, ED staff should don chemical-resistant jumpsuits or butyl rubber aprons, rubber gloves, and eye protection if the patient's clothing or skin is wet. After the patient has been decontaminated, no special protective clothing or equipment is required for ED personnel. Flush liquid-exposed skin and hair with water for at least 5 minutes. If feasible, wash exposed skin extremely thoroughly with soap and water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Irrigate exposed or irritated eyes with plain water or saline for at least 15 minutes. Remove contact lenses, if easily removable without additional trauma to the eye. Continue irrigation while transferring the victim to Intensive Care Unit. An ophthalmic anesthetic, such as 0.5% tetracaine, may be necessary to alleviate blepharospasm, and lid retractors may be required to allow adequate irrigation under the eyelid.

Administer supplemental oxygen by mask to patients who have respiratory symptoms. Treat patients who have bronchospasm with aerosolized bronchodilators. The use of bronchial sensitizing agents in situations of multiple chemical exposures may pose additional risks. Also consider the health of the myocardium before choosing which type of bronchodilator should be administered. Cardiac sensitizing agents may be appropriate; however, the use of cardiac sensitizing agents after exposure to certain chemicals may pose enhanced risk of cardiac arrhythmias (especially in the elderly). Ammonia poisoning is not known to pose additional risk during the use of bronchial or cardiac sensitizing agents. Consider racemic epinephrine aerosol for children who develop stridor. Dose 0.25-0.75 mL of 2.25% racemic epinephrine solution in water, repeat every 20 minutes as needed cautioning for myocardial variability. Observe patients carefully for 6 to 12 hours for signs of upper-airway obstruction. Patients who have had a severe exposure may develop noncardiogenic pulmonary edema. Observe patients carefully for 6 to 12 hours for signs of upper-airway obstruction. Patients who have had a severe exposure may develop noncardiogenic pulmonary edema.

If ammonia gas or solution was in contact with the skin, chemical burns may result; treat as thermal burns.



**Section 4.**

**First aid measures – continued.**

**Emergency department & Intensive Care Unit:**

If ocular exposure - continue irrigation for at least 15 minutes or until the pH of the conjunctival fluid has returned to normal. Test visual acuity. Examine the eyes for corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients who have severe corneal injuries.

In cases of ingestion, not induce emesis because this may re-expose the esophagus and mouth to the caustic substance. Do not administer activated charcoal. Do not perform gastric lavage or attempt neutralization after ingestion. If not given during decontamination, give 4 to 8 ounces (100 -200 ml) of water by mouth to dilute stomach contents. Consider endoscopy to evaluate the extent of gastrointestinal-tract injury. Extreme throat swelling may require endotracheal intubation or cricothyroidotomy. There is no specific antidote for ammonia poisoning. Although administration of corticosteroids to limit esophageal scarring is recommended by some toxicologists, this treatment is unproven and may be harmful in patients who have perforation or serious infection. Hemodialysis is not effective.

Routine laboratory studies for all exposed patients include CBC, glucose, and electrolyte determinations. Chest radiography and pulse oximetry (or arterial blood gases measurements) are recommended for severe inhalation exposure or if pulmonary aspiration is suspected. No specific biologic test for ammonia exposure exists. Consider hospitalizing patients who have evidence of respiratory distress or significant skin burns or who have ingested an ammonia solution.

Pulmonary injury may continue to evolve over 18 to 24 hours. Residual bronchoconstriction, bronchiectasis and small airway disease may occur, and chronic obstructive pulmonary disease can develop. Patients exposed by inhalation who are initially symptomatic should be observed carefully and reexamined periodically. Pulmonary function tests should be repeated on an annual basis. Patients who develop pulmonary edema should be admitted to an intensive care unit.

Patients who are asymptomatic following exposure or who experienced mild symptoms that have been treated may be released and advised to seek medical care promptly if symptoms recur or develop. Cigarette smoking may exacerbate pulmonary injury and should be discouraged for 72 hours after exposure.

Patients with mild to moderate skin burns should be reexamined within 24 hours. Patients who have eye injuries should be reexamined by an ophthalmologist in 24 hours.



**Section 5. Firefighting measures.**

<b>Hazard type:</b>	Compressed gas non-flammable		
<b>HAZCHEM code:</b>	2PE		
<b>2</b>	Fine Water Spray.		
<b>p</b>	Can be violently (V) reactive. Gas tight suit with breathing apparatus is necessary.		
<b>E</b>	The substance may be diluted and washed to drain, prevent by any means available, spillage from entering drains and watercourses.		
<b>Extinguishing media:</b>	<b>Fine water spray or fog for containment curtains.</b>	<b>Normal foam or dry agent.</b>	<b>Carbon dioxide can be utilised for neutralisation,</b> forming Ammonium Carbonate. 2.5kg of Carbon dioxide are required for every 1kg of Anhydrous Ammonia.
	100L of water are required for every 1kg of Anhydrous Ammonia.		
<b>Decomposition products:</b>	Nitrogen, Water, Nitrogen dioxide and ammonium nitrate. Ammonia decomposes into hydrogen at approximately 450 °C. The presence of oil mist may lower the LEL and increase the risk of deflagration.		
<b>Precautions for firefighters and special protective clothing:</b>	<b>DO NOT SPRAY WATER DIRECTLY ON POOLING LIQUID. FLAMMABLE GAS – AVOID IGNITION SOURCES.</b>		
	Level 4 Gas encapsulated suits, Positive Pressure Respirators >300ppm		
<b>Auto ignition temperature:</b>	651°C		
<b>Flash point:</b>	Not available.		
<b>Further advice:</b>	May form flammable vapour mixtures with air. Avoid all ignition sources are to be eliminated. Cool containers/tanks with water spray. Ammonium solutions can be neutralised with mild acidic mixtures. (Acetic/Citric)		
<b>Evaporation rate:</b>	Very fast		
<b>Estimating concentration:</b>	$1.43\text{m}^3/\text{kg}$ (Full expansion @ 25°C) x Kg / Room Volume x 100% x 10,000 = ppm		
<b>Estimating Ammonia loss:</b>	ppm / 10,000 / 100% x room volume / 1.43 = kg Ammonia lost.		

**Section 6. Accidental release.**

<b>Personal precautions:</b>	Clear area of all unprotected personnel upwind. Do not breathe vapours. Increase ventilation. Avoid contact with skin and eyes- wear suitable full-face respiratory and skin protection.
<b>Environmental:</b>	Contain the spilled material, prevent the product from spreading into the environment. Uncontrolled releases must be reported to Worksafe New Zealand as well as appropriate regional council where water courses may have been contaminated. Ammonia dissolves in water forming Ammonium solutions CAS 1336-21-6 effecting water pH and Toxicity.
<b>Further advice:</b>	Avoid open flames and high temperatures. Self-contained breathing apparatus (SCBA) is required if a large release occurs. (>300pm) Do not enter Ammonia plume. >5000ppm (Half the mild skin irritation threshold) Level four protective clothing recommended.

**Section 6.**
**Accidental release – continued.**
**Minor emergencies –**

Avoid contact with liquid and vapour, Protective equipment necessary. Initial actions may include:

Do not affect areas outside its immediate location,

- a. Clear area of personnel.
- b. Sitewide Shelter in Place (SIP) / Evacuation.
- c. Contact 111
- d. Contact specialist engineer
- e. Prepare site plans & drawings to establish status & initial Action Plan (IAP)
- f. Increase ventilation.
- g. Water spray or fog may be used to disperse vapour.
- h. Cover with heavy duty tarpaulin.

SMALL SPILLS involve leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills".

Only if competent and safe to do so; Approach source upwind, stand small cylinder vertically or rotate so that the leak is limited to gas. Relocate leaking cylinders to a secure outdoor area. Transfer cylinder contents or purge through water, shut valves upstream of leak and evacuate contents using compressor suction, when all liquid removed downstream isolate section. Shutdown plant if leaking on a non-isolatable Condensor or ignition potential exists within an enclosed space. Keep area clear of personnel until gas has dispersed and official all clear provided by Fire and Emergency New Zealand or Plant Incident controller.

**Major emergencies –**

Affect areas outside the immediate location. LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder

Step	Action
1	Shelter in place (SIP) should be considered to establish source of leak & wind direction, evacuate personnel and move laterally upwind. If evacuation not safe – shut all windows and supply air ventilation and move to the upper floor as far from the source of leak as possible.
2	Alert Fire and Emergency and calmly advise <b>who</b> you are, <b>where</b> you are and <b>what</b> has happened.
3	Notify Ammonia specialist engineer and calmly advise <b>who</b> you are, <b>where</b> you are and <b>what</b> has happened.
4	Only if competent and safe to do so; shut valves upstream of leak and evacuate contents using compressor suction. Remove product load. Shutdown plant if leaking on a non-isolatable Condensor or ignition potential exists.
5	Increase ventilation if possible, water spray or fog may be used to disperse and contain vapour. Only if competent and safe to do so; cover leak with heavy duty tarpaulin.
6	Keep area clear of personnel until gas has dispersed and official all clear provided by Fire and Emergency New Zealand or Plant Incident controller. Once leak ceased - CO <sub>2</sub> Can be introduced to enclosed spaces with no supply ventilation to reduce Ammonia concentration (Section 5)

**Section 6. Accidental release – continued.**

TARP™ Triggers:	Level One (1)	Level Two (2)	Level Three (3)
	35ppm	300ppm	External or unknown
	Minor consequence emergency managed by site resources without external assistance.	Moderate consequence emergency may require assistance of external services (FENZ), IMT/ERT formed.	Major consequence emergency requiring multi agency response, IMT/ERT & CMT formed.

**Initial Isolation distance:** Determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

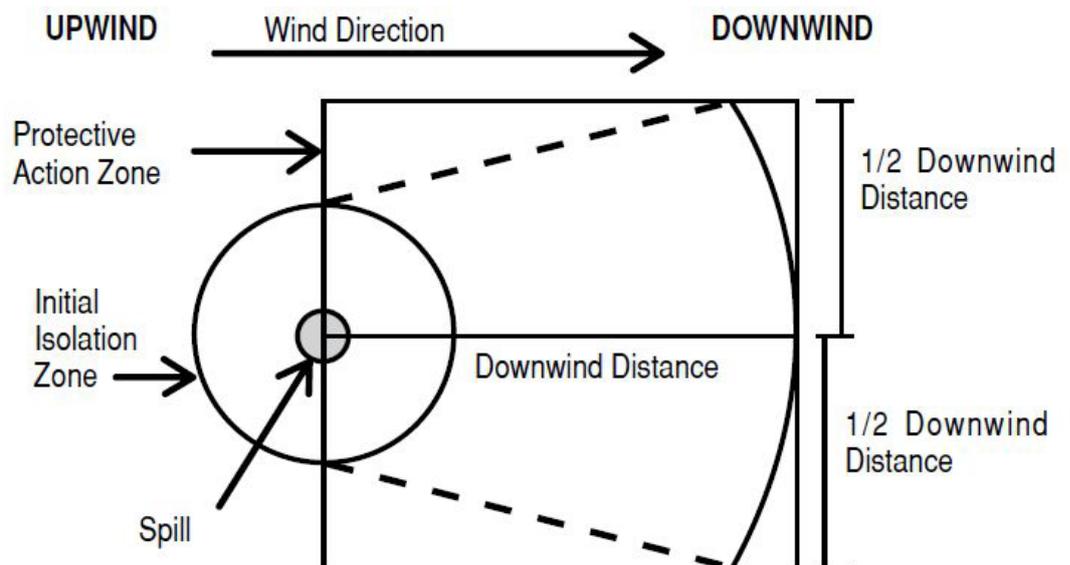
Minor Emergencies	Major Emergencies
<b>0-30m</b>	<b>200-500m</b>

**Downwind protective action zone:** Defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance. Protective actions should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

Minor Emergencies	Major Emergencies
<b>60-100m</b>	<b>800m – 2300m</b>

From The emergency response guide book 2017

ERG 125

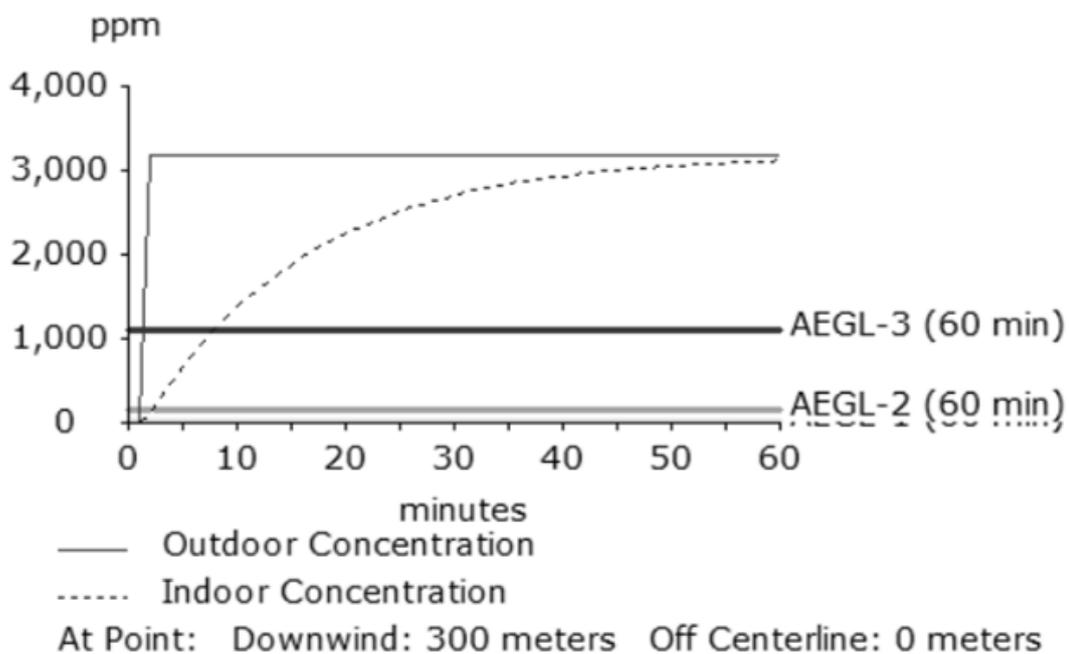


**Section 6. Accidental release – continued.**

<b>Emergency Planning Guidelines:</b>	The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing;	
<b>EPRG 1 Non-disabling:</b>	25 ppm	The maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odour.
<b>EPRG 2 Disabling, Discomfort:</b>	200 ppm	Is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.
<b>EPRG 3 Serious, Life threatening:</b>	1000 ppm	is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

<b>Pipe flow rates (1200kPa):</b>	<b>25mm</b>	<b>50mm</b>	<b>80mm</b>	<b>100mm</b>
	16 kg/s	65kg/s	190kg/s	300/kg/s
<b>Concentration vs distance (16kg/s):</b>	<b>50m</b>	<b>100m</b>	<b>300m</b>	<b>500m</b>
	110,000ppm	27,700ppm	3,160ppm	1,170ppm
	<b>1000m</b>	<b>1500m</b>	<b>2000m</b>	<b>2500m</b>
	313ppm	148ppm	88ppm	59ppm

*(20°C ambient 3m/s wind speed 50% relative humidity - 60min duration)*





**Section 7.**

**Handling and Storage.**

**Normal handling:** Refer to ASNZS 2002:2003, Only qualified, experienced and properly instructed persons should handle Anhydrous Ammonia. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Do not remove or deface labels provided by the supplier for the identification of the container contents. Observe all regulations and local requirements regarding storage of containers. Leave valve protection caps in place until the container is ready for use. Damaged valves should be reported immediately to the supplier. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Always wear recommended personal protective equipment. Do not breathe vapours. Provide sufficient air exchange and/or exhaust in work rooms. Test for leakage with phenolphthalein or detergent - NEVER use a naked flame. Obtain a work permit before attempting any repairs – conduct risk assessment and ensure emergency response contingencies in place.

**Storage recommendations:** Refer to ASNZS 2002:2003, For Hazard Class 2.1.1B, Quantities greater than 100kg that are stored for more than 24 hours require a Compliance Certificate for a Hazardous Substance Location (HSL) including Hazardous area meeting AS/NZS 60079.10.1:2009. Cylinders should be stored in a purpose-built compound with Fixed Gas Detection and good ventilation, preferably in the open. Such compounds should be sited and built in accordance with statutory requirements. The storage compound should be kept clear and access restricted to authorised personnel only. Cylinders stored in the open should be protected against, vehicular impact, rust and extremes of weather. Cylinders in storage should be properly secured to prevent toppling or rolling. Where cylinders are fitted with valve protection this should be in place and properly secured. Cylinders should be segregated from all reactive substances, storage incompatible with a class 1, 2, 3, 4, 5, 6, or 8 substances – requires appropriate separation distances.

**Incompatibilities:** See section ten (10)

**Section 8.**

**Exposure controls & personal protection**

Detail	Concentration (ppm)	Exposure (Hours/min):
TWA	25 ppm	8 hours, Time Weighted Average (WES-TWA).
STEL	35 ppm	15 min. Short term Exposure Level (WES- STEL)
IDLH	300 ppm	Immediately dangerous to life and health (OSHA)
AEGL 1	30 ppm	8-hour Non-threatening (Acute Exposure Guideline)
AEGL 2	110 ppm	8 hours Disabling, Discomfort (Acute Exposure Guideline)
AEGL 2	160 ppm	60 min Disabling, Discomfort (Acute Exposure Guideline)
AEGL 2	220 ppm	10min Disabling, Discomfort (Acute Exposure Guideline)
AEGL 3	550 ppm	4 hours Serious, life threatening (Acute Exposure Guideline)
AEGL 3	1,600 ppm	30 min Serious, life threatening (Acute Exposure Guideline)
AEGL 3	2,700 ppm	10 min Serious, life threatening (Acute Exposure Guideline)

**Section 8.**
**Exposure controls & personal protection – Continued.**
**Other exposure guidelines:**

Use work permit and line breaking procedure for all intrusive maintenance work. Where open flame used during repairs, ensure system is purged with oxygen free nitrogen before commencing any work. Gas detection should be used when asphyxiating and potentially toxic or flammable gases may be released. Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded. Systems under pressure should be regularly checked for leakages. Preferably use permanent leak tight connections. Do not eat, drink or smoke when using the product.

**Engineering controls:**

Fixed gas detection should be used in all areas to obtain remote concentration readings as well as initiate automated control strategies. Mechanical ventilation that is EX rated and can provide sufficient air volumes to minimise toxic levels (>30 air changes per hour,  $30/3600 \times \text{Room volume} = \text{m}^3/\text{s}$ )

**Personal protective equipment:**
**Respiratory protection:**


Wear negative pressure respirator with K type air purifying filter above TWA meeting joint standards AS/NZS 1715 & AS/NZS 1716.



Wear positive pressure self-contained breathing apparatus above 300ppm (IDLH) meeting joint standards AS/NZS 1715 & AS/NZS 1716.

**Eye protection:**


Wear safety protective glasses meeting joint standards AS/NZS 1336:2014 when operating valves. When transferring, line breaking or working on elevated platforms - wear negative pressure respirator with K type filter.



Wear BUTYL/NEOPRENE gloves meeting joint standards AS/NZS 2161.1:2016



Always wear protective footwear; where liquid potential exists utilise impervious boots meeting joint standards AS/NZS 2210.3:2009

**Skin protection:**


Full length overalls are required at all times when handling meeting joint standards AS/NZS 4501.1:2008



When concentrations unknown or above IDLH, Level 4 is fully encapsulated suit required (Type 1, EN 943) meeting joint standards meeting joint standards AS/NZS ISO 6529:2006. Level 3 suitable for up to 5000ppm

**Additional controls:**

Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for areas of principle exposure. Provide eyewash stations and quick drench shower facilities at convenient locations. Always utilise personal gas detection when wearing respiratory protection equipment.



Section 9.	Physical & Chemical Properties
<b>Appearance:</b>	Physical state at 20°C / 101.3kPa Gas, Clear, colourless liquid and vapor
<b>Odour:</b>	Strong, Pungent, Repulsive odour.
<b>Odour threshold:</b>	Odour threshold is subjective and inadequate to warn of overexposure.
<b>Boiling point:</b>	-33°C
<b>Freezing Point:</b>	-77°C
<b>Physical state:</b>	Liquefiable gas, Gas at ambient temperatures
<b>Specific gravity:</b>	1.10 at 25°C (77 °F)
<b>Vapour pressure:</b>	8.6 bar @ 20°C
<b>Critical temperature:</b>	132°C
<b>Relative density (gas)</b>	0.6 (air = 1)
<b>Relative density (liquid)</b>	0.7 (water = 1)
<b>pH:</b>	>11 If dissolved in water pH-value will be affected.
<b>Molar mass:</b>	17 g/mol
<b>Solubility:</b>	Soluble in water. Soluble in alcohol and ether
<b>Oxidising properties:</b>	Non-oxidising material according to EEC criteria
<b>Decomposition temperature:</b>	Not known.
<b>LEL / UEL:</b>	13-28%
<b>Flash point:</b>	Not applicable for gases and gas mixtures.

Section 10.	Stability and reactivity.
<b>Stability:</b>	Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Ammonia dissolves exothermically in water. Can react explosively with chlorine and hypochlorite's or other strong oxidising agents. Critical pressure = 114 Bar
<b>Conditions to avoid:</b>	Never heat cylinder to raise pressure, eliminate sources of ignition. Do not over fill cylinder above 80% volume, never "lock in" liquid Ammonia in pipework or vessels as hydraulic rupture will occur rapidly.
<b>Incompatibilities:</b>	Anhydrous Ammonia forms explosive mixtures with oxygen (13-28%), chlorine, bromine, fluorine, iodine, mercury, platinum and silver. Oxidizing agents, Halogens, Halogenated compounds, Acids, Copper, Zinc, Copper/Zinc alloys (Brass), Chlorates.
<b>Hazardous decomposition products:</b>	Hydrogen, oxides of nitrogen, Chloramines, Nitrogen trichloride, Hydrazine. (DO NOT MIX WITH BLEACH)



**Section 11.**

**Toxicological information.**

<b>Systemic Effects:</b>	Effects on various organs, including liver, kidney, spleen, and heart, were observed in several studies that examined ammonia exposure in a number of laboratory animal species however the available information is inadequate to draw conclusions. No information was located regarding dermal or ocular effects of ammonia or ammonium compounds in humans or animals.
<b>Inhalation toxicity:</b>	Human NOAEL (No-observed-adverse-effect level) * <sub>ADJ</sub> : 4.9 mg/m <sup>3</sup> (6.18ppm) Human LC <sub>Lo</sub> (lowest concentration of a substance in air which has been reported to cause death in humans or animals): >5000ppm/5min <i>*<sub>ADJ</sub> - Calculated for continuous exposure.</i>
<b>Acute symptoms:</b>	Inhalation of gas causes: coughing, belching, shortness of breath, wheezing, irregular breathing, inflammation of lips, mouth, nose, throat and eyes, headache, confusion, dizziness, coma, seizures & burns, over exposure may result in fatality.
<b>Skin irritation:</b>	Skin contact with may produce severe pain and burns; brownish stains may develop. The corroded area may be soft, gelatinous and necrotic; tissue destruction may be deep.
<b>Eye irritation:</b>	Exposure to Ammonia gas can be extremely irritating due to the hydroscopic nature of the gas forming Ammonia solutions (CAS number 1336-21-6) on the surface of the eye. Direct liquid contact will cause chemical burns to the eye. Contamination of eyes can result in permanent injury.
<b>Ingestion:</b>	Not normally a hazard due to the physical state, will produce chemical and freeze burns within the oral cavity and gastrointestinal tract.
<b>Chronic exposure:</b>	At lower concentrations, approximately 50 mg/m <sup>3</sup> and below, do not identify respiratory effects in laboratory animals exposed to ammonia. Multiple occupational studies involving chronic exposure to ammonia in industrial settings provide evidence of an increased prevalence of respiratory symptoms and decreased lung function Asthma like symptoms may persist for years after high level exposure.
<b>Mutagenicity:</b>	Genetic mutations observed in bacterial and mammalian test systems.
<b>Carcinogenicity assessment:</b>	Not classifiable as a human carcinogen. Overall weight of evidence indicates that the substance is not carcinogenic.
<b>Reproductive toxicity:</b>	Ammonia is produced in human and animal tissues during all life stages, including prenatal. Although the potential for effects on reproduction and the developing foetus cannot be ruled out at external concentrations that do not alter normal blood or tissue ammonia levels, there is no evidence that raises concerns for the developing foetus or reproduction or to other distal tissues/organs. No evidence was identified that inhaled ammonia would influence the ammonia nitrogen content of breast milk.
<b>Susceptible Populations:</b>	Controlled human exposure studies that examined both healthy adult volunteers and volunteers with asthma did not demonstrate greater respiratory sensitivity in asthmatics than healthy volunteers after acute exposure to ammonia. Individuals with disease conditions that lead to hyperammonemia may be more susceptible to the effects of ammonia from external sources.

Section 12.	Ecotoxicological Information.
<b>Assessment:</b>	Very toxic to aquatic organisms but does not concentrate in the food chain.
<b>Persistence / Degradability:</b>	The substance is biodegradable. Unlikely to persist.
<b>Mobility in soil:</b>	Ammonia is strongly adsorbed to soil and sediment particles.
<b>Results of PBT and vPvB assessment:</b>	This substance contains no materials considered to be very persistent and very bioaccumulating (vPvB).
<b>Acute toxicity - Fish Component information</b>	Very toxic to aquatic organisms. Ammonia is readily oxidised to nitrite which is also very toxic to fish. 24hr LC <sub>50</sub> (Common Bully - adult): >1.31mg/L 24hr LC <sub>50</sub> (rainbow trout - adult): 0.097 mg/L 24hr LC <sub>50</sub> (Longfin Elver): 1.80mg/L 24hr LC <sub>50</sub> (Shortfin Elver): >5.10mg/L
<b>Acute toxicity - Aquatic Invertebrates Component information</b>	96hr LC <sub>50</sub> (Mayfly): 0.45 gNH <sub>3</sub> m <sup>-3</sup> 96hr LC <sub>50</sub> (Snail): 0.41 gNH <sub>3</sub> m <sup>-3</sup> 24hr LC <sub>50</sub> (Shrimp – adult): >1.68 mg/L
<b>Other adverse effects: GWP, Component information:</b>	May cause pH changes in aqueous ecological systems. No known effects from this product.
<b>Drinking Water Standards:</b>	0.5 mg/l (UK max.) 1.5 mg/l (WHO Levels) 1.5 mg/l (NZ Levels)

Section 13.	Disposal Information.
<b>Waste treatment methods:</b>	Must not be discharged to atmosphere. Gas may be scrubbed in water or compatible acidic solutions. Ensure that the local concentrations not exceeded in accordance with workplace exposure standards. Do not allow the product to be released into the environment.
<b>Disposal:</b>	Consult manufacture, must comply with local disposal or discharge laws – send Ammonia solutions for neutralisation.
<b>Empty cylinders:</b>	Return empty cylinders to supplier – use same precautions as if full.

**Section 14. Transport Information.**
**Shipping name:** ANHYDROUS AMMONIA

**HAZCHEM code:** 2PE

**Label:**

**Primary classification:** 2.3

**Packing group:** None

**EMS Number:** F-C, S-U

	Land	Sea	Air
<b>United Nations Model number: (UN)</b>	UN 1005	UN 1005	UN 1005
<b>Transport Hazard class:</b>	Class 2.3 Toxic	Class 2.3 Toxic	Class 2.3 Toxic
<b>Sub risk:</b>	8 Corrosive	8 Corrosive	8 Corrosive
<b>Special precautions for User:</b>	Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.	Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; DANGEROUS GOODS.	Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; DANGEROUS GOODS TRANSPORT PROHIBITED under the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air in Passenger and Cargo Aircraft, and Cargo Aircraft Only.

<b>Section 15.</b>	<b>Regulatory Information.</b>
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<b>HSNO Approval number(s):</b>	HSR001035
<b>Training &amp; supervision:</b>	Refrigeration & Air Conditioning Level 4, NZQA US30127v1, Demonstrate knowledge of anhydrous ammonia and safe practices for its use as a refrigerant. Applied training in safe handling essential. Minimum guidelines available through Joint Australian and New Zealand standards <a href="#">AS/NZS 2022.2003 Anhydrous Ammonia Storage and handling</a>
<b>Certified Handler:</b>	Not applicable under current statute.
<b>Certified Filler:</b>	Required.
<b>Controlled substance licence required:</b>	Not applicable under current statute.
<b>Tracking required:</b>	Not applicable under current statute.

<b>Hazard Controls:</b>	<b>Regulation.</b>	<b>Detail.</b>
	<a href="#">HSWA Hazardous Substance Regulation 3.1</a>	Maintain inventory
	<a href="#">HSWA General Risk Workplace Management Regulation 15</a>	Personal Protection
	<a href="#">HSWA Hazardous Substance Regulation 2.11</a>	Provide access to Safety data sheets
	<a href="#">HSWA Hazardous Substance Regulations, Regulation 4.5</a>	Provide training & instruction
	<a href="#">HSWA Hazardous Substance Regulations, Regulation 2.1</a>	Labelling of containers
	<a href="#">HSWA Hazardous Substance Regulations, Regulation 2.12</a>	Appropriate packaging
	<a href="#">HSWA Hazardous Substance Regulations, Regulation 5</a>	Emergency Response Plan
	<a href="#">HSWA Hazardous Substance Regulations, Regulation 10.26</a>	Hazardous substance location
	<a href="#">HSWA Hazardous Substance Regulations, Regulation 10.34</a>	Location compliance certificate
	<a href="#">HSWA (Hazardous Substance) Regulations, Part 15.66</a>	Approved Filling licence.

*Note: Some controls do not apply if anhydrous ammonia is contained in any equipment that forms part of any other equipment in which anhydrous ammonia is used as a refrigerant.*

**Section 16.**
**Other Information.**

<b>Current date of issue:</b>	21 June 2019
<b>Management of this product:</b>	Management of this product must comply with Health & Safety at Work (Hazardous Substance) Regulations 2017.
<b>References:</b>	Various sources of data have been used in the compilation of this SDS, they include but are not exclusive to: Guidance on the Compilation of Safety Data Sheets. (Environmental Protection Authority , 2017) ASNZS2002:2003, ASNZS5149.1-4:20016, (Holness, Purdham, & Nethercott, 1989) (C.W Hickey, ML Vickers. 1992) (Jody Richardson. 1997) Drinking-water Standards for New Zealand (Revised 2008) (Holness, Purdham, & Nethercott, 1989) (Atkinson et al., 1980) (Petrova et al., 2008; Sigurdarson et al., 2004) (Toxicological Review of Ammonia Noncancer Inhalation., 2016) (Rahman et al., 2007; Ali et al., 2001; Bhat and Ramaswamy, 1993) (Rahman et al., 2007; Ballal et al., 1998) (Tab Biol Per 1933) (Coon et al., 1970; Anderson et al., 1964; Weatherby, 1952) (Agency for toxic substances and disease registry 2019) (ALOHA)

This document has been issued by Gauge Refrigeration Management Ltd and serves as their Safety Data Sheet (SDS). It is based on information concerning the product which has been obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the manufacturer.

Whilst Gauge Refrigeration Management Ltd have taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, Gauge Refrigeration Management Ltd. accept no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

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