

# Safety Data Sheet

In accordance with Commission Regulation (EU) No 2020/878



Publication date: 15.12.2023

Edition: 3


Revision date: 18.08.2023

Revision: 1

## Anhydrous ammonia

SECTION 1		Identification of the substance/mixture and of the company/undertaking	
1.1		Product identifier	
	Trade name	Anhydrous Ammonia 82%; Metallurgical grade ammonia, Green Ammonia	
	Synonyms	Liquid Ammonia, Liquefied Ammonia, Anhydrous Ammonia	
	Code	DS-017	
	Chemical name	anhydrous ammonia, ammonia	
	Chemical formula	NH <sub>3</sub>	
	Index Number	007-001-00-5	
	EINECS Number	231-635-3	
	CAS Number	7664-41-7	
	Registration Number	01-2119488876-14-0038	
	UFI	HJ40-Q0V3-A00Y-VX8J	
1.2		Relevant identified uses of the substance or mixture and uses advised against	
	Application of the substance / the mixture	<p><b>Industrial Uses:</b> Distribution and formulation as chemical intermediate; flue gas NO<sub>x</sub> and SO<sub>x</sub> reduction; reactive agent/processing aid and for general chemical applications (e.g. extraction, water treatment/septicity control, pH/neutralising agent); heat transfer fluid (e.g refrigeration, cooling/heating systems); chemical/process nutrient (e.g. pharmaceuticals, food, biofuel); surface/article treatment (e.g. metal, leather/textiles, plastics, wood, electronics/semiconductors, insulation, hardening, etchant); Industrial USE to manufacture specialist chemical/other products (e.g. adhesives, biocides, catalysts, cleaning products, cosmetics, coatings/paints, construction chemicals, corrosion; specialist chemicals/other products (e.g. photochemical)</p> <p><b>Professional uses:</b> chemical/process nutrient (e.g. fertiliser, pharmaceuticals, food); reactive agent/processing aid and for general chemical applications (e.g. pH/neutralising agent, water treatment); laboratory/research chemical; heat transfer fluid (e.g refrigeration, cooling/heating systems); surface/article treatment (e.g. metal, textiles/leather, plastics, wood, etching concrete); specialist chemicals/other products (e.g. biocides, cleaning products, coatings/paints).</p> <p><b>Consumer uses:</b> Cosmetic products (e.g. hair); heat transfer fluid (e.g refrigeration, cooling systems); component in cleaning products; part of specialist product s/articles (e.g. coatings/paints/thinners/paint removers).</p>	

## Anhydrous ammonia

	<b>Uses advised against</b>	Others than those indicated.
<b>1.3</b>	<b>Details of the supplier of the safety data sheet</b>	Fertiberia, S.A. 27, Agustín de Foxa Street pta. 11 28036 Madrid Madrid (Spain) +34 91.586.62.00; fdsinfo@grupofertiberia.com
<b>1.4</b>	<b>Emergency telephone number</b>	Aviles factory: +34 985.57.78.50 Huelva factory: +34 959.28.12.11 Palos factory: +34 959.49.24.00 Puertollano factory: +34 926.44.93.00 Sagunto Factory: +34 962.69.90.04 (Only available during office hours; Monday-Friday; 09:00-18:00)
<b>SECTION 2</b>	<b>Hazards identification</b>	
<b>2.1</b>	<b>Classification of the substance or mixture according Regulation (EC) n° 1272/2008 (CLP)</b>	Acute Tox. 3 H331 Toxic if inhaled. Skin Corr. 1B H314 Causes severe skin burns and eye damage. Aquatic Acute 1 H400 Very toxic to aquatic life. Aquatic Chronic 2 H411 Toxic to aquatic life with long lasting effects. Flam. Gas 2 H221 Flammable gas. Press. Gas (Comp.) H280 Contains gas under pressure; may explode if heated.
<b>2.2</b>	<b>Label elements</b>	
	<b>Hazard pictograms</b>	
	<b>Signal word</b>	Danger
	<b>Hazard-determining components of labelling</b>	ammonia, anhydrous
	<b>Hazard statements</b>	H221 Flammable gas. H280 Contains gas under pressure; may explode if heated. H331 Toxic if inhaled. H314 Causes severe skin burns and eye damage. H410 Very toxic to aquatic life with long lasting effects.
	<b>Precautionary statements</b>	P102 Keep out of reach of children. P270 Do not eat, drink or smoke when using this product. P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower]. P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P310 Immediately call a POISON CENTER/doctor. P321 Specific treatment (see on this label). P410+P403 Protect from sunlight. Store in a well-ventilated place. P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

## Anhydrous ammonia

	<b>Additional information</b>	EUH071 Corrosive to the respiratory tract.		
	<b>Supplemental information on the label</b>	Not applicable.		
	<b>Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles</b>	Not applicable.		
	<b>Special packaging requirements</b>	Not applicable.		
	<b>Containers to be fitted with child-resistant fastenings</b>	Not applicable.		
	<b>Tactile hazard warning</b>	Not applicable.		
<b>2.3</b>	<b>Other hazards</b>			
	<b>Other hazards which do not result in classification</b>	None known.		
	<b>Results of the PBT and vPvB assessment</b>	Not applicable.		
	<b>Determination of endocrine disrupting properties</b>	None substance listed.		
<b>SECTION 3</b>	<b>Composition/information on ingredients</b>			
<b>3.1</b>	<b>Substances</b>			
	<b>Name</b>	<b>N° Index</b>	<b>EC Number</b>	<b>CAS Number</b>
	Anhydrous ammonia	007-001-00-5	231-635-3	7664-41-7
<b>3.2</b>	<b>Mixtures</b>			
	Not applicable.			
	<b>Additional indications</b>	For the wording of the listed hazard phrases refer to section 16.		

## Anhydrous ammonia

<b>SECTION 4</b>	<b>First aid measures</b>	
<b>4.1</b>	<b>Description of first aid measures</b>	
	<b>General information</b>	Provide medical assistance to those affected. People who dispense first aid are advised to wear personal protective equipment. There may be delayed effects on exposure.
	<b>Inhalation</b>	Move patient to fresh air and keep at rest in a position comfortable for breathing. Monitor for respiratory distress. If coughing or difficulty breathing, assess for airway irritation, bronchitis or pneumonitis. If able, administer supplemental oxygen with assisted ventilation as needed. Administer artificial respiration if the patient is not breathing.
	<b>Ingestion</b>	Call a doctor. If conscious, rinse mouth and immediately give patient milk or water to drink. Do not induce vomiting.
	<b>Skin contact</b>	Immediately remove all contaminated clothing and wash the exposed area with plenty of warm water for at least 15 minutes, followed by thorough washing with soap and water. The patient should be seen at a health care facility if irritation or pain persists. Caution: Clothing frozen to the skin should be thawed before removal.
	<b>Eye contact</b>	Immediately remove contact lenses and flush eyes with plenty of lukewarm water for at least 15 minutes. If irritation, pain, swelling, excessive tearing or sensitivity to light persists, the patient should be seen at a health centre and referral to an ophthalmologist should be considered.
<b>4.2</b>	<b>Most important symptoms and effects, both acute and delayed</b>	
	<b>Eye contact</b>	Redness. Pain. Severe deep burns.
	<b>Inhalation</b>	Burning sensation. Coughing. labored breathing Difficulty in breathing. sore throat Symptoms may be delayed. Symptoms of pulmonary oedema often do not become apparent for several hours and are aggravated by physical exertion. Therefore, rest and medical observation are essential.
	<b>Skin contact</b>	Redness. Skin burns. Pain. Blistering. IN CONTACT WITH LIQUID: FROSTBITE.
	<b>Ingestion</b>	Cough, gastric pain, bloody vomiting, nausea.
<b>4.3</b>	<b>Indication of any immediate medical attention and special treatment needed</b>	
	No action involving personal risk or without adequate training should be taken. Avoid direct mouth-to-mouth resuscitation, as it can be dangerous for the person providing the help. Use other methods for resuscitation, preferably oxygen or compressed air equipment. Treat according to the following indications:	
	<b>Notes to physician</b>	Treat symptomatically.
	<b>Specific treatments</b>	There is not an specific treatment.

## Anhydrous ammonia

<b>SECTION 5</b>	<b>Firefighting measures</b>	
<b>5.1</b>	<b>Extinguishing media</b>	
	Ammonia is classified as a Cat. 2 Flammable Gas and pressurised gases, which can explode if heated. Stopping the flow of gas rather than extinguishing the fire is usually the best procedure to follow when the leaking gas is burning.	
	<b>Suitable extinguishing agents</b>	Small fire: Dry chemical or CO2 Large fire: Water spray, fog or foam
	<b>Unsuitable extinguishing agents for safety reasons</b>	High volume water jet.
<b>5.2</b>	<b>Special hazards arising from the substance or mixture</b>	
	The substance is a flammable gas. Gas under pressure may explode if heated. The substance is toxic if inhaled and causes severe skin burns and eye damage as well as corrosion of the respiratory tract. It is also very toxic to aquatic life.	
	<b>Hazardous thermal decomposition products</b>	Ammonia decomposes into nitrogen and hydrogen gases, which can form a flammable mixture in air.
<b>5.3</b>	<b>Advice for firefighters</b>	
	<p>Open warehouse doors and windows for maximum ventilation.</p> <p>Fire-fighting personnel should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face mask operating in positive pressure mode. Clothing for fire-fighting personnel (including helmets, protective boots) should conform to European standard EN 469 and gloves to EN 659. It should provide a basic level of protection for chemical incidents and should be fire resistant. The facility shall have sufficient protective equipment available to deal with fires.</p>	
<b>SECTION 6</b>	<b>Accidental release measures</b>	
<b>6.1</b>	<b>Personal precautions, protective equipment and emergency procedures</b>	
	<p>Protection against spillage:</p> <ul style="list-style-type: none"> <li>- A water network with hydrants shall be installed around the storage, so that it can be used irrespective of wind direction. The pressure, flow and equipment available shall be sufficient to control any emergencies that may occur. The water network must not be susceptible to freezing during the winter season and the necessary measures must be taken for this purpose.</li> <li>- The surface area of the tank shall be reduced as far as possible in order to reduce the vaporisation of liquid ammonia in the event of a spillage.</li> </ul>	
	<b>For non-emergency personnel</b>	
	<p>Do not breathe vapors or spray mist. Avoid contact with skin, eyes and clothing. In case of non-flammable spills and leaks, wear vapor protective clothing. Stop leak if you can do so without risk. Keep unnecessary persons away, isolate the danger area and prevent entry. Eliminate sources of combustion. Keep upwind, out of low areas and ventilate confined spaces before entering. Assess the affected area to determine if evacuation is necessary. If it is necessary to evacuate the danger zone, you should follow the advice of an expert. If sheltering in place, tape windows and doors, close outside air intakes (attic fans, etc.) and place a damp towel or cloth over your face (if necessary).</p>	

## Anhydrous ammonia

	<b>For emergency responders</b>	
	With proper training, self-contained breathing apparatus (SCBA) and protective clothing for structural firefighters used in conjunction with water spray will provide limited protection in outdoor emissions for short-term exposure.	
<b>6.2</b>	<b>Environmental precautions</b>	
	In case of accidental spills and leaks avoid dispersal of spilled material, runoff and contact with soil, watercourses (surface and groundwater), drains and sewers. Inform the competent authorities if the product has caused adverse impacts (sewers, watercourses, soil or air).	
<b>6.3</b>	<b>Methods and material for containment and cleaning up</b>	
	In case of accidental spills and leaks, avoid dispersal of spilled material. Use water spray or foam to control vapors. Make a protective barrier and ensure closure of drains with suitable containment material. Absorb with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Sweep and shovel into suitable containers for disposal.	
<b>6.4</b>	<b>Reference to other sections</b>	
	See Section 1 for emergency contact information. See Section 8 for information on personal protection equipment. See Section 13 for disposal information.	
<b>SECTION 7</b>	<b>Handling and storage</b>	
<b>7.1</b>	<b>Precautions for safe handling</b>	
	<b>Technical precautionary measures</b>	Wear appropriate personal protective equipment. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering food areas. Avoid contact with eyes, skin or clothing. Do not breathe vapours or mist. Do not ingest. Avoid release to the environment. Keep in original container or approved alternative made of compatible material, kept tightly closed when not in use. Keep away from acids. Empty containers retain product residues and may be hazardous. Do not reuse container.
	<b>Advice on general occupational hygiene</b>	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
<b>7.2</b>	<b>Conditions for safe storage, including any incompatibilities</b>	
	Avoid contact and packaging with incompatible substances or mixtures. See section 10; Avoid proximity to potential sources of ignition (including electrical equipment); Store in a place that avoids adverse weather conditions (high temperatures); Avoid direct sunlight; Ensure good ventilation of the storage area. Ensure that the quantities that can be stored are not exceeded. See section 15.	

## Anhydrous ammonia

<b>7.3</b>	<b>Specific end use(s)</b>			
	Use only as described in section 1.2.			
<b>SECTION 8</b>	<b>Exposure controls/personal protection</b>			
<b>8.1</b>	<b>Control parameters</b>			
	<b>Occupational exposure limits</b>	CAS: 7664-41-7 ammonia, anhydrous IOELV (EU): Short-term value: 36 mg/m <sup>3</sup> , 50 ppm Long-term value: 14 mg/m <sup>3</sup> , 20 ppm		
	<b>Recommended monitoring procedures</b>	If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of ventilation or other control measures and/or the need to use respiratory protective equipment. Monitoring standards such as the following may be used as reference: European Standard EN 689 (Atmospheres in the workplace. Guidelines for the evaluation of inhalation exposure of chemical agents for comparison with limit values and measurement strategy), European Standard EN 14042 (atmospheres in the workplace. Guidelines for the application and use of procedures to assess exposure to chemical and biological agents) European Standard EN 482 (atmospheres in the workplace. General requirements for the performance of procedures for measuring chemical agents). National guidance documents on methods for the determination of hazardous substances should also be used as a reference.		
	<b>Derived effect levels</b>	No DELs available.		
	<b>Predicted effect concentrations</b>	No PECs available.		
	<b>Ingredients with limit values that require monitoring at the workplace</b>	Not applicable.		
<b>DNEL</b>				
<b>Substance</b>				7664-41-7
				Anhydrous ammonia
<b>Industrial/Professional worker</b>	<b>Inhalation (mg/m<sup>3</sup>)</b>	<b>Long-term</b>	<b>Systemic</b>	47,6 mg/m <sup>3</sup>
			<b>Local</b>	14 mg/m <sup>3</sup>
		<b>Short-term</b>	<b>Systemic</b>	47,6 mg/m <sup>3</sup>
			<b>Local</b>	36 mg/m <sup>3</sup>
	<b>Dermal (mg/kg pc/día)</b>	<b>Long-term</b>	<b>Systemic</b>	6,8 mg/kg pc /d
			<b>Local</b>	Medium hazard (no threshold derived)
		<b>Short-term</b>	<b>Systemic</b>	6,8 mg/kg pc /d
			<b>Local</b>	Medium hazard (no threshold derived)
	<b>Ocular (mg/kg pc/día)</b>	<b>Long-term</b>	<b>Systemic</b>	Not available
			<b>Local</b>	Medium hazard (no threshold derived)
		<b>Short-term</b>	<b>Systemic</b>	Not available
			<b>Local</b>	Medium hazard (no threshold derived)

## Anhydrous ammonia

<b>Consumer</b>	<b>Inhalation (mg/m3)</b>	<b>Long-term</b>	<b>Systemic</b>	23,8 mg/m3	
			<b>Local</b>	2,8 mg/m3	
		<b>Short-term</b>	<b>Systemic</b>	23,8 mg/m3	
			<b>Local</b>	7,2 mg/m3	
		<b>Dermal (mg/kg pc/day)</b>	<b>Long-term</b>	<b>Systemic</b>	6,8 mg/kg pc/d
				<b>Local</b>	Medium hazard (no threshold derived)
			<b>Short-term</b>	<b>Systemic</b>	6,8 mg/kg pc/d
				<b>Local</b>	Medium hazard (no threshold derived)
	<b>Oral (mg/kg pc/day)</b>	<b>Long-term</b>	<b>Systemic</b>	6,8 mg/kg pc /d	
			<b>Local</b>	Not available	
		<b>Short-term</b>	<b>Systemic</b>	6,8 mg/kg pc /d	
			<b>Local</b>	Not available	
	<b>Ocular (mg/kg pc/day)</b>	<b>Long-term</b>	<b>Systemic</b>	Not available	
			<b>Local</b>	Medium hazard (no threshold derived)	
		<b>Short-term</b>	<b>Systemic</b>	Not available	
			<b>Local</b>	Medium hazard (no threshold derived)	
	<b>PNEC</b>				
	<b>Substance</b>				7664-41-7
					Anhydrous ammonia
	<b>Fresh water (mg/L)</b>				0,001 mg/L
<b>Salt water (mg/L)</b>				0,001 mg/L	
<b>STP (mg/L)</b>				Not available	
<b>Fresh water sediment (mg/L)</b>				Not available	
<b>Salt water sediment (mg/L)</b>				Not available	
<b>Air (mg/L)</b>				Not available	
<b>Soil (mg/L)</b>				0,022 mg/L	
<b>Predators (secondary poisoning) (mg/L)</b>				Not available	
<b>Components with biological limit values</b>		Non-existent.			
<b>Additional indications</b>		The Occupational exposure limits lists valid during the making were used as basis.			



## Anhydrous ammonia

<b>8.2</b>	<b>Exposure controls</b>	
	<b>Appropriate engineering controls</b>	<p>Storage and loading and unloading or transfer facilities shall necessarily be designed with natural or forced ventilation so that the risk of exposure of workers is adequately controlled. For this purpose, the design shall take particular account of the characteristics of the vapours to which they may be exposed and of the source of emission, their collection at source and their possible transmission to the environment of the storage or installation.</p> <p>Where they are located inside buildings, ventilation shall be channelled to a safe place outside through dedicated ducts, taking into account the permissible levels of emissions to air. Where forced ventilation is used, it shall be provided with an alarm system in case of failure.</p> <p>Premises with pits or basements in which vapours may accumulate shall have adequate forced ventilation in such pits or basements to prevent such accumulation.</p>
	<b>Personal protective measures, such as personal protective equipment</b>	<b>General protection and hygiene measures</b> Wash completely the hands, forearms and face after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Use the appropriate techniques to remove the contaminated clothes. Wash the contaminated clothes before reusing. Verify that the eyes washing stations and safety showers were near to working stations.
		<b>Eye/face protection</b> Wear sealed goggles when there is a possibility of contact with liquid or mist. The use of a full face shield in addition to goggles is recommended for additional protection. See standard EN 166 for eye and face protection for more information. A safety shower and eye wash fountain should be provided in the ammonia handling area.
		<b>Respiratory protection</b> In case of hazardous fumes, wear self-contained breathing apparatus. See respiratory protection standard EN 137 for further information.
		<b>Hand protection</b> Wear leather gloves to avoid frostbite injuries due to the rapid expansion of the gas when handling pressurised gas cylinders. Skin protection creams do not sufficiently protect against the substance. Where there is a risk of direct contact with the substance, chemical resistant gloves are required.
		<b>Glove material</b> Leather gloves
		<b>Other</b> Use personal protective equipment during use and handling of the product.
		<b>Thermal hazards</b> Not applicable due to the physico-chemical characteristics of the product.
	<b>Environmental exposure controls</b>	General ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.
<b>SECTION 9</b>	<b>Physical and chemical properties</b>	
<b>9.1</b>	<b>Information on basic physical and chemical properties</b>	
	<b>Physical state</b>	Aerosol

## Anhydrous ammonia

	<b>Colour</b>	Colourless
	<b>Odour</b>	Characteristic
	<b>Melting point/freezing point</b>	-78 ° C
	<b>Initial boiling point and boiling range</b>	-33 ° C
	<b>Flammability</b>	Non flammable
	<b>Upper/lower flammability or explosive limits</b>	
	<b>Lower</b>	15 Vol %
	<b>Upper</b>	30.2 Vol %
	<b>Flash point</b>	132 ° C
	<b>Auto-ignition temperature</b>	651 ° C
	<b>Decomposition temperature</b>	450 ° C
	<b>pH</b>	Not applicable due to physico-chemical characteristics
	<b>Viscosity</b>	
	<b>Kinematic</b>	Not applicable due to physico-chemical characteristics
	<b>Dynamic</b>	Not applicable due to physico-chemical characteristics
	<b>Solubility</b>	
	<b>In water</b>	at 20 ° C                      520 g/l
	<b>Partition coefficient: n-octanol/water</b>	Not applicable due to physico-chemical characteristics
	<b>Vapour pressure</b>	at 20 ° C                      8 hPa
	<b>Density and/or relative density</b>	0,6
	<b>Relative vapour density</b>	at 0 ° C                      0.7714 g/cm <sup>3</sup>
	<b>Particle characteristics</b>	Not applicable due to physico-chemical characteristics
<b>9.2</b>	<b>Other information</b>	
	<b>Appearance</b>	Gaseous
	<b>Explosives properties</b>	Not applicable due to physico-chemical characteristics.
	<b>Oxidizing properties</b>	Not applicable due to physico-chemical characteristics.
	<b>Information with regard to physical hazard classes</b>	
	<b>Explosives</b>	Not applicable due to physico-chemical characteristics.
	<b>Flammable gases</b>	Flammable gas

## Anhydrous ammonia

<b>Aerosols</b>	Not applicable due to physico-chemical characteristics.
<b>Oxidising gases</b>	Not applicable due to physico-chemical characteristics.

## Anhydrous ammonia

	<b>Gases under pressure</b>	Contains gas under pressure; danger of explosion if heated.
	<b>Flammable liquids</b>	Not applicable due to physico-chemical characteristics.
	<b>Flammable solids</b>	Not applicable due to physico-chemical characteristics.
	<b>Pyrophobic liquids</b>	Not applicable due to physico-chemical characteristics.
	<b>Pyrophobic solids</b>	Not applicable due to physico-chemical characteristics.
	<b>Self-reactive substances and mixtures</b>	Not applicable due to physico-chemical characteristics.
	<b>Substances and mixtures, which emit flammable gases</b>	Not applicable due to physico-chemical characteristics.
	<b>Oxidising liquids</b>	Not applicable due to physico-chemical characteristics.
	<b>Oxidizing solids</b>	Not applicable due to physico-chemical characteristics.
	<b>Organic peroxides</b>	Not applicable due to physico-chemical characteristics.
	<b>Corrosive to metals</b>	Not applicable due to physico-chemical characteristics.
	<b>Desensitised explosives</b>	Not applicable due to physico-chemical characteristics.
	<b>Other safety characteristics</b>	
	<b>Mechanical sensitivity</b>	Not applicable due to physico-chemical characteristics.
	<b>Self-accelerating polymerisation temperature</b>	Not applicable due to physico-chemical characteristics.
	<b>Formation of explosible dust/air mixtures</b>	Not applicable due to physico-chemical characteristics.
	<b>Acid/alkaline reserve</b>	Not applicable due to physico-chemical characteristics.
	<b>Evaporation rate</b>	Not applicable due to physico-chemical characteristics.
	<b>Miscibility</b>	Not applicable due to physico-chemical characteristics.
	<b>Conductivity</b>	Not applicable due to physico-chemical characteristics.
	<b>Corrosiveness</b>	Not applicable due to physico-chemical characteristics.
	<b>Gas group</b>	Not applicable due to physico-chemical characteristics.
	<b>Redox potential</b>	Not applicable due to physico-chemical characteristics.
	<b>Radical formation potential</b>	Not applicable due to physico-chemical characteristics.
	<b>Photocatalytic properties</b>	Not applicable due to physico-chemical characteristics.
<b>SECTION 10</b>	<b>Stability and reactivity</b>	
<b>10.1</b>	<b>Reactivity</b>	Stable under recommended storage conditions.
<b>10.2</b>	<b>Chemical stability</b>	Chemically stable under the indicated storage, handling and use conditions.

## Anhydrous ammonia

<b>10.3</b>	<b>Possibility of hazardous reactions</b>	Hydrogen is released on heating above 454°C. The decomposition temperature can be reduced to 300°C by contact with certain metals, such as nickel. At 690°C or in the presence of an electric spark, ammonia decomposes into nitrogen and hydrogen gases, which can form a flammable mixture in air.
<b>10.4</b>	<b>Conditions to avoid</b>	Avoid heat sources, direct sunlight and physical damage to tanks. Avoid direct contact with hydrocarbons, ethanol, and silver nitrate and chlorine as a violent reaction may occur.
<b>10.5</b>	<b>Incompatible materials</b>	Ammonia is incompatible or has potentially hazardous reactions with silver, acetaldehyde, acrolein, boron, halogens, perchlorate, chloric acid, chlorine monoxide, chlorites, nitrogen tetroxide, tin and sulphur.
<b>10.6</b>	<b>Hazardous decomposition products</b>	Hydrogen is released on heating above 454°C. The decomposition temperature can be reduced to 300°C by contact with certain metals, such as nickel. At 690°C or in the presence of an electric spark, ammonia decomposes into nitrogen and hydrogen gases, which can form a flammable mixture in air.

### SECTION 11 Toxicological information

#### 11.1 Information on toxicological effects

##### Acute toxicity

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	OECD 401 Not specified	Rat Rat	Oral Inhalation	DL50: 3500 mg/kg bw. CL50: 28130 mg/m <sup>3</sup> air. Toxic if inhaled.

Toxic if inhaled.

##### Skin corrosion/irritation

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	-	-	-	Ammonium anhydride is listed in Annex I to Directive 67/548/EEC with a classification (R34) "Causes burns". So that it is classified as Category 1, causes severe skin burns.

Causes severe skin burns and eye damage.

##### Serious eye damage/irritation

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	-	-	-	Non irritant

Causes severe skin burns and eye damage.

##### Respiratory or skin sensitisation

## Anhydrous ammonia

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	-	-	-	No data available. Ammonium anhydride is listed in Annex I to Directive 67/548/EEC with a classification (R34) "Causes burns". So from a scientific point of view it is not justified to carry out an awareness test. Sensitization is considered unlikely for this substance.

Based on available data, the classification criteria are not met.

### Germ cell mutagenicity

Component	CAS number	Method	Species	Result
Anhydrous ammonia	7664-41-7	OECD 473 OECD 474	Bacteria Mutation of mammal cells	Non mutagenic

Based on available data, the classification criteria are not met.

### Carcinogenicity

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	-	-	-	NOAEL: 67 mg/kg bw/d. No signs of carcinogenicity in a study with ammonium sulfate.

Based on available data, the classification criteria are not met.

### Reproductive toxicity

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	OECD 422 OECD 414	Rat Rabbit	Oral Inhalation	Effects on fertility: NOAEL: 408 mg/kg bw/d. Toxicity for the development: NOAEL: 100 mg/kg bw/d NOAEC: 25 mg/m3

Based on available data, the classification criteria are not met.

### STOT- single exposure

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	Not available	Not available	Not available	Not available

Based on available data, the classification criteria are not met.

### STOT-repeated exposure

Component	CAS number	Method	Species	Route	Result
Anhydrous ammonia	7664-41-7	OECD 422	Rat Cerdo	Oral Inhalation	NOAEL: 250 mg/kg bw/d NOAEC: 35 mg/m3

Based on available data, the classification criteria are not met.

### Aspiration hazard

Component	CAS number	Result
Anhydrous ammonia	7664-41-7	No significant effects or critical hazards are known.

Based on available data, the classification criteria are not met.

## 11.2 Information on other hazards

### Endocrine disruptive properties

Not available

### Other information

## Anhydrous ammonia

Not available

### SECTION 12 Ecological information

#### 12.1 Toxicity

##### Aquatic toxicity

Component	N° CAS		Fish	Crustacea	Algae
Anhydrous ammonia	7664-41-7	Short term	CL50: 0,068 mg/l	The lowest concentration of deionized ammonia with which long term effects are	CL50(48h): 110 mg/l.
		Long term	NOEC: 0,79 mg/l.	CE50: 2700 mg/l.	Not available

##### Terrestrial toxicity

Component	N° CAS	Macro-organism	Micro-organism	Terrestrial plants	Other organisms
Anhydrous ammonia	7664-41-7	Ammonia that is applied directly to the soil is	Ammonia is unlikely to be toxic to soil	Ammonia is used as a component of fertilizers so it is not expected to be	-

##### Microbiological activity in wastewater treatment plants

Component	N° CAS	Toxicity to aquatic micro-organisms
Anhydrous ammonia	7664-41-7	Ammonia is used as a nitrogen strain by microorganisms and is also produced by the bacteria of other nitrogenous compounds.

#### 12.2 Persistence and degradability

Component	N° CAS	Degradation	
Anhydrous ammonia	7664-41-7	<b>Hydrolysis</b>	Ammonia is not hydrolyzed. The substance is highly soluble in water and will be in an equilibrium as ammonia and as an ammonium ion. The balance of equilibrium will be influenced by concentration and pH, however the ammonium ion will predominate at relevant pH and at low concentrations.
		<b>Photolysis</b>	Photolytic degradation and reaction with OH <sup>-</sup> radicals in the troposphere are the main mechanisms for removing ammonia in the atmosphere.
		<b>Biodegradation</b>	Ammonia degrades rapidly in aquatic systems.

#### 12.3 Bioaccumulative potential

Component	N° CAS	Octanol-water partition coefficient (Kow)	Bioaccumulation factor (BFC)	Observations
Anhydrous ammonia	7664-41-7	-	-	The bioaccumulation of ammonia is not considered important in the environment as it does not accumulate in fat-rich tissues in the same way as organic chemicals.

#### 12.4 Mobility in soil

Component	N° CAS	Result
Anhydrous ammonia	7664-41-7	Ammonia in water can be transferred to the atmosphere by volatilization of the air-water interface; this process has a quantifiable effect on ammonia levels in water. The volatilization rate of ammonia in water will increase as the pH and temperature increase.

#### 12.5 Results of PBT and vPvB assessment

Not applicable.

## Anhydrous ammonia

<b>12.6</b>	<b>Endocrine disrupting properties</b>				
	The product does not contain substances with endocrine disrupting properties.				
<b>12.7</b>	<b>Other adverse effects</b>				
	Significative effects or critcs risks are not known.				
<b>SECTION 13</b>	<b>Disposal considerations</b>				
<b>13.1</b>	<b>Waste treatment methods</b>				
	Methods of disposal	<p>Waste management (disposal and recovery): Consult the authorised waste manager for recovery and disposal operations, in accordance with Annex 1 and Annex 2 (Directive 2018/851/EC).</p> <p>Packaging: According to codes 15 01 (Commission Decision 2014/955/EU), if the packaging has been in direct contact with the product, it should be treated in the same way as the product itself, otherwise it should be treated as non-hazardous waste. Discharge into waste water is not recommended. See section 6.2.</p> <p>Waste management provisions: In accordance with Annex II of Regulation (EC) No 1907/2006 (REACH), the Community or national provisions on waste management are presented. Community legislation: Directive 2018/851/EC, Commission Decision 2014/955/EU, Regulation (EU) no. 1357/2014 and the national legislation.</p>			
	Hazardous waste code	HP3: Flammable HP8: Corrosive HP14: Ecotoxic			
<b>SECTION 14</b>	<b>Transport information</b>				
	<b>Regulatory information</b>	<b>ADR/RID</b>	<b>ADNR</b>	<b>IMDG</b>	<b>IATA</b>
<b>14.1</b>	<b>UN number</b>	UN1005			
<b>14.2</b>	<b>UN proper shipping name</b>	UN1005 AMMONIA, ANHYDROUS, ENVIRONMENTALLY HAZARDOUS		AMMONIA, ANHYDROUS, MARINE POLLUTANT	
<b>14.3</b>	<b>Transport hazard class(es)</b>				
	<b>Class</b>	2 2TC Gases.		2.3 Gases.	
	<b>Label</b>	2.3+8		2.3/8	
<b>14.4</b>	<b>Packing group</b>	Not regulated			
<b>14.5</b>	<b>Environmental hazards</b>	Symbol (fish and tree)			
	<b>Special precautions for user</b>	Not applicable.			
<b>14.6</b>		Hazard identification number (Kemler code):268 EMS Number: 2-08 Segregation groups: (SGG18) Alkalis Stowage Category: D			
	<b>Segregation Code:</b>	G35 Stow "separated from" SGG1-acids SG46 Stow "separated from" chlorine.			



## Anhydrous ammonia

<b>14.7</b>	<b>Maritime transport in bulk according to IMO instruments</b>	Not applicable.		
<b>Additional information</b>		Limited quantities (LQ) 0 Excepted quantities (EQ) Code: E0 Not permitted as Excepted Quantity Transport category 1 Tunnel restriction code C/D	Limited quantities (LQ): 0 Excepted quantities (EQ) Code: E0 Not permitted as Excepted Quantity	-
<b>UN "Model Regulation":</b>		UN 1005 AMMONIA, ANHYDROUS, 2.3 (8), DANGEROUS FOR THE ENVIRONMENT		
<b>SECTION 15 Regulatory information</b>				
<b>15.1</b>	<b>Safety, health and environmental regulations/legislation specific for the substance or mixture</b>			
	<b>Regulation (EC) No 1907/2006 (REACH)</b>	This product complies with the REACH Regulation.		
	<b>SEVESO Category</b>	Not applicable. Named substance.		
	<b>Qualifying quantity (tonnes) for the application of lower-tier requirements</b>	50 t		
	<b>Qualifying quantity (tonnes) for the application of upper-tier requirements</b>	200 t		
	<b>Named dangerous substances - ANNEX VI (CLP)</b>	Contains ammonia according to Index No. 007-001-01-2.		
	<b>Regulation (EC) No 1907/2006 - ANNEX XVII</b>	Not applicable.		
	<b>REGULATION (EU) 2019/1148</b>			
	<b>Annex I - Restricted Explosives Precursors (Upper limit value for licensing purposes under Article 5(3))</b>	None substance listed.		
	<b>Annex II - Reportable Explosives Precursors</b>	None substance listed.		
	<b>Regulation (EC) No 273/2004 on Drug Precursors</b>	None substance listed.		

## Anhydrous ammonia

	Regulation (EC) No 111/2005 laying down rules for the monitoring and trade in drug precursors between the Community and third countries.	None substance listed.
	Regulation (UE) 2019/1009	This product complies with the Fertilizer Regulation.
	Regulation (EC) No. 1272/2008 (CLP)	This product complies with the CLP Regulation.
	Regulation (EC) No 1005/2009 on substances that deplete the ozone layer.	Not applicable.
	Regulation (EC) No. 850/2004 on persistent organic pollutants and amending Directive 79/117/EEC	Not applicable.
	Regulation (EC) No 649/2012 concerning the export and import of dangerous chemicals.	Not applicable.
	PBT/mPmB Evaluation	Not applicable.
<b>15.2</b>	<b>Chemical safety assessment</b>	
	A chemical safety assessment has been carried out and exposure scenarios are annexed to this sheet.	
<b>SECTION 16</b>	<b>Other information</b>	
	<b>Relevant phrases</b>	H221 Flammable gas. H280 Contains gas under pressure; danger of explosion if heated. H331 Toxic if inhaled. H314 Causes severe skin burns and eye damage. H400 Very toxic to aquatic life. H410 Very toxic to aquatic life with long lasting effects. H411 Toxic to aquatic life with long lasting effects. EUH071 Corrosive to the respiratory tract.
	<b>Abbreviations and acronyms</b>	ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road). STP: Sewage treatment plant. OECD: Organisation for Economic Co-operation and Development. NOAEL: No observed adverse effect level. IMDG: International Maritime Code for Dangerous Goods. IATA: International Air Transport Association. DNEL: Derived No-Effect Level (REACH). PNEC: Predicted No-Effect Concentration (REACH).

## Anhydrous ammonia

	<b>Data compared to the previous version altered</b>	Inclusion of new trade names. Addition of uses according to the registration dossier.
	<b>References</b>	This safety data sheet has been prepared in accordance with: - ANNEX II: Guidance for the preparation of Safety Data Sheets of Regulation (EC) No 1907/2006 (Regulation (EU) 2015/830) based on the data included in the chemical safety report of registered substances. - Guidance available on the European Chemicals Agency (ECHA) website: ( <a href="http://echa.europa.eu/">http://echa.europa.eu/</a> ). - Guidance for the compilation of safety data sheets for fertilizer materials ( <a href="http://www.fertilizerseurope.com">www.fertilizerseurope.com</a> ).
	<b>Methods used for the classification of the mixture (Article 9 of Regulation (EC) No 1272/2008)</b>	Classification and Labeling in accordance with the principle of extrapolation of Regulation No. 1272/2008 (CLP).
	<b>Advice on any training appropriate for workers to ensure protection of human health and the environment</b>	Minimum training in the prevention of occupational hazards is recommended for personnel who will handle this product, in order to facilitate the understanding and interpretation of this safety data sheet, as well as the product label.

The information contained in this safety data sheet is provided in good faith and its accuracy is based on knowledge of the product at the time of publication. The information presented is only intended to describe the product from the point of view of human and environmental protection and safety, and therefore cannot be regarded as product specifications. It does not imply acceptance of any commitment or legal responsibility on the part of the Company, for the consequences of its use or misuse in any circumstances. The information provided is considered accurate and current at the time of this edition, referring only to the product and may not be valid in compositions or formulations with other products. The responsibility for its use belongs to the users.

## Anhydrous ammonia

### Exposure Scenarios



## Anhydrous ammonia

### Summary of uses included

Uses	No. Use	Descriptors		
		Environment (ERCs)	Workers (PROCs)	Consumers (PCs)
Distribution and formulation of anhydrous ammonia	1	2	1, 2, 3, 8b, 9, 15	-
Industrial use of anhydrous ammonia as an intermediate	2	6a	1, 2, 3, 8b, 9, 15	-
Industrial end-use of anhydrous ammonia in industrial cooling systems	3	7	1, 3, 8b, 9	-
Industrial end-use of anhydrous ammonia (heat transfer fluid, e.g., refrigerating, cooling/heating systems)	4	7	1, 3, 8b, 9	-
Industrial end-use of anhydrous and aqueous ammonia (chemical/process nutrient, e.g., pharmaceuticals, food, biofuel)	5	6b	1, 2, 3, 8b	-
Industrial end-use of anhydrous and aqueous ammonia (flue gas NOx and SOx reduction)	6	6b	1, 2, 3, 8b	-
Industrial end-use of anhydrous and aqueous ammonia (part of specialist chemicals/other products, (e.g., photochemical)	7	6b	1, 2, 3, 8b	-
Industrial end-use of anhydrous and aqueous ammonia (processing, non-processing aids, auxiliary agent)	8	6b	1, 2, 3, 4, 8b	-
Industrial end-use of anhydrous and aqueous ammonia (reactive agent/processing aid and for general chemical applications, e.g., extraction, water treatment/septicity control, pH/neutralising agent)	9	6b	1, 2, 3, 8b	-

## Anhydrous ammonia

Industrial end-use of anhydrous and aqueous ammonia (surface/article treatment, e.g., metal, leather/textiles, plastics, wood, electronics/semiconductors, insulation, hardening, etchant)	10	6b	1, 2, 3, 8b	-
Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (formulation o mixtures)	11	8b	1, 2, 3, 5, 8b, 9, 15, 19	-
Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (heat transfer fluid, e.g., refrigeration, cooling/heating systems)	12	9a, 9b	1, 2, 8b, 9, 15, 19, 20	-
Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)	13	8b, 8e	2, 3, 4, 9, 15	-
Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (reactive agent/processing aid, general chemical applications, e.g., pH/neutralising agent, water treatment)	14	8b, 8e	1, 2, 3, 4, 8a, 8b, 9, 10, 19	-
Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)	15	8b, 8e	1, 2, 4, 8b, 9	-

## Anhydrous ammonia

**ES 1: Distribution and formulation of anhydrous ammonia**

### 1. Title section

ES name: *Distribution and formulation of anhydrous ammonia*

#### Environment

Distribution and formulation of anhydrous ammonia	ERC 2
---------------------------------------------------	-------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9
Use as laboratory reagent	PROC 15

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental exposure

##### Operational conditions

Annual tonnage	3,83E6 to/year
Daily amount used at site	7.27E3 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,003%
Release fraction to wastewater from process	0.002%
Release fraction to soil from process	0%
Fraction tonnage to region	3,80%
Fraction used at main source	0.49998 % (justification: Maximum tonnage biggest customer: 3'829'950 tpa / 200 = 19'149)

## Anhydrous ammonia

STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -2

### 2.2. Control of worker exposure (worst case)

PROCs	1	2	3	8b	9	15
<b>Product characteristics</b>						
Physical state	Liquid					
Concentration in substance	100%					
Fugacity / Dustiness	High					
<b>Frequency and duration of use</b>						
Duration of activity:	>4 hours					
Frequency of use	5 days / week					
<b>Human factors not influenced by risk management</b>						
Exposed skin surface	240 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>		
<b>Other given operational conditions affecting workers exposure</b>						
Location	Indoors					
Domain	industrial					
<b>Technical conditions and measures to control dispersion and exposure</b>						
Local exhaust ventilation:	yes (dermal 100 %)					
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>						
Protective gloves	No	Gloves APF5 80%			No	
Respiratory Protection:	No	0,9			No	

## Anhydrous ammonia

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	1,78x10 <sup>-4</sup> mg/L	0,1317
Marine water	1,8x10 <sup>-5</sup> mg/L	0,013
Agricultural soil	0,000313 mg/kg dw	0,014

#### 3.2. Worker exposure (worst case)

PROCs	1	2	3	8b	9	15
<b>Route of exposure and type of effects</b>						
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	1,371	0,6857	2,743	1,37	0,3428
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	17,741	35,481	10,644	14,2	35,481
Combined routes, systemic, long-term	0,035299	3,906	5,754	4,263	3,4	5,412
<b>RCR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>8b</b>	<b>9</b>	<b>15</b>
Dermal, long-term systemic	0,005042	0,2016	0,1008	0,4033	0,2	0,05042
Inhalation, long-term systemic	0,000149	0,3727	0,7454	0,2236	0,3	0,7454
Combined routes, systemic, long-term	0,005191	0,5743	0,8462	0,6269	0,5	0,7958

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.



## Anhydrous ammonia

**ES 2:**

**Industrial use of anhydrous ammonia as an intermediate**

### 1. Title section

ES name: *Industrial use of anhydrous ammonia as an intermediate*

#### Environment

Industrial use of anhydrous ammonia as an intermediate	ERC 6a
--------------------------------------------------------	--------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9
Use as laboratory reagent	PROC 15

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

##### Operational conditions

Annual tonnage	3,83E6 to/year
Daily amount used at site	9E5 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,005%
Release fraction to wastewater from process	0.02%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.500039 % (justification: Maximum tonnage biggest customer: 3'829'950 tpa / 200 = 19'149)

## Anhydrous ammonia

STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6a

### 2.2. Control of worker exposure (worst case)

PROCs	1	2	3	8b	9	15
<b>Product characteristics</b>						
Physical state	Liquid					
Concentration in substance	100%					
Fugacity / Dustiness	High					
<b>Frequency and duration of use</b>						
Duration of activity:	>4 hours					
Frequency of use	5 days / week					
<b>Human factors not influenced by risk management</b>						
Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>
<b>Other given operational conditions affecting workers exposure</b>						
Location	Indoors					
Domain	industrial					
<b>Technical conditions and measures to control dispersion and exposure</b>						
Local exhaust ventilation:	yes (dermal 100 %)					
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>						
Protective gloves	No		Gloves APF5 80%		No	
Respiratory Protection:	No		0,9		No	

## Anhydrous ammonia

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	2,19x10 <sup>-4</sup> mg/L	0,1619
Marine water	2,2x10 <sup>-5</sup> mg/L	0,01616
Agricultural soil	0,000204 mg/kg dw	0,0092

#### 3.2. Worker exposure (worst case)

PROCs	1	2	3	8b	9	15
<b>Route of exposure and type of effects</b>						
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	1,371	0,6857	2,743	1,37	0,3428
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	17,741	35,481	10,644	14,2	35,481
Combined routes, systemic, long-term	0,035299	3,906	5,754	4,263	3,4	5,412
<b>RCR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>8b</b>	<b>9</b>	<b>15</b>
Dermal, long-term systemic	0,005042	0,2016	0,1008	0,4033	0,2	0,05042
Inhalation, long-term systemic	0,000149	0,3727	0,7454	0,2236	0,3	0,7454
Combined routes, systemic, long-term	0,005191	0,5743	0,8462	0,6269	0,5	0,7958

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 3: Industrial end-use of anhydrous ammonia in industrial cooling systems**

### 1. Title section

ES name: *Industrial end-use of anhydrous ammonia in industrial cooling systems*

#### Environment

Industrial end-use of anhydrous ammonia in industrial cooling systems	ERC 7
-----------------------------------------------------------------------	-------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

##### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41.642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,005%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day

## Anhydrous ammonia

Municipal sewage treatment plant discharge	2000000 L/day
--------------------------------------------	---------------

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -7

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	8b	9
-------	---	---	----	---

#### Product characteristics

Physical state	Liquid			
Concentration in substance	100%			
Fugacity / Dustiness	High			

#### Frequency and duration of use

Duration of activity:	>4 hours	8b	>4 hours
Frequency of use	5 days / week		

#### Human factors not influenced by risk management

Exposed skin surface	240 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>
----------------------	---------------------	---------------------	---------------------

#### Other given operational conditions affecting workers exposure

Location	Indoors		
Domain	industrial		

#### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 0 %)	yes (dermal 100 %)
----------------------------	------------------	--------------------

#### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF5 80%
Respiratory Protection:	No	90%

### 3. Exposure estimation and reference to its source

## Anhydrous ammonia

### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000169 mg/kg dw	0,0076

### 3.2. Worker exposure (worst case)

PROCs	1	3	8b	9
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	2,743	1,371
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	10,644	14,193
Combined routes, systemic, long-term	0,035299	5,754	4,263	3,399
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>8b</b>	<b>9</b>
Dermal, long-term systemic	0,005042	0,1008	0,4033	0,2016
Inhalation, long-term systemic	0,000149	0,7454	0,2236	0,2981
Combined routes, systemic, long-term	0,005191	0,8462	0,6269	0,4998

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 4:**

**Industrial end-use of anhydrous ammonia (heat transfer fluid, e.g., refrigerating, cooling/heating systems)**

### 1. Title section

ES name: *Industrial end-use of anhydrous ammonia (heat transfer fluid, e.g., refrigerating, cooling/heating systems)*

#### Environment

Industrial end-use of anhydrous ammonia (heat transfer fluid, e.g., refrigerating, cooling/heating systems)	ERC 7
-------------------------------------------------------------------------------------------------------------	-------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

#### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41.642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,005%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day

## Anhydrous ammonia

Municipal sewage treatment plant discharge	2000000 L/day
--------------------------------------------	---------------

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -7

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	8b	9
-------	---	---	----	---

#### Product characteristics

Physical state	Liquid			
Concentration in substance	100%			
Fugacity / Dustiness	High			

#### Frequency and duration of use

Duration of activity:	>4 hours	8b	>4 hours
Frequency of use	5 days / week		

#### Human factors not influenced by risk management

Exposed skin surface	240 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>
----------------------	---------------------	---------------------	---------------------

#### Other given operational conditions affecting workers exposure

Location	Indoors		
Domain	industrial		

#### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 0 %)	yes (dermal 100 %)
----------------------------	------------------	--------------------

#### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF5 80%
Respiratory Protection:	No	90%

### 3. Exposure estimation and reference to its source



## Anhydrous ammonia

### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000169 mg/kg dw	0,0076

### 3.2. Worker exposure (worst case)

PROCs	1	3	8b	9
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	2,743	1,371
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	10,644	14,193
Combined routes, systemic, long-term	0,035299	5,754	4,263	3,399
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>8b</b>	<b>9</b>
Dermal, long-term systemic	0,005042	0,1008	0,4033	0,2016
Inhalation, long-term systemic	0,000149	0,7454	0,2236	0,2981
Combined routes, systemic, long-term	0,005191	0,8462	0,6269	0,4998

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 5:**

**Industrial end-use of anhydrous and aqueous ammonia (chemical/process nutrient, e.g., pharmaceuticals, food, biofuel)**

### 1. Title section

ES name: *Industrial end-use of anhydrous and aqueous ammonia (chemical/process nutrient, e.g., pharmaceuticals, food, biofuel)*

#### Environment

Industrial end-use of anhydrous and aqueous ammonia (chemical/process nutrient, e.g., pharmaceuticals, food, biofuel)	ERC 6b
-----------------------------------------------------------------------------------------------------------------------	--------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

#### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,000%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day

## Anhydrous ammonia

Municipal sewage treatment plant discharge	2000000 L/day
--------------------------------------------	---------------

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6b

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	2	8b
-------	---	---	---	----

#### Product characteristics

Physical state	Liquid
Concentration in substance	100%
Fugacity / Dustiness	High

#### Frequency and duration of use

Duration of activity:	>4 hours
Frequency of use	5 days / week

#### Human factors not influenced by risk management

Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>
----------------------	---------------------	---------------------	---------------------

#### Other given operational conditions affecting workers exposure

Location	Indoors
Domain	industrial

#### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 100 %)
----------------------------	--------------------

#### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF5 80%
Respiratory Protection:	No	90%

### 3. Exposure estimation and reference to its source

## Anhydrous ammonia

### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000168 mg/kg dw	0,0075

### 3.2. Worker exposure (worst case)

PROCs	1	3	2	8b
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	1,371	2,743
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	17,741	10,644
Combined routes, systemic, long-term	0,035299	5,754	3,906	4,263
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>8b</b>
Dermal, long-term systemic	0,005042	0,1008	0,2016	0,4033
Inhalation, long-term systemic	0,000149	0,7454	0,3727	0,2236
Combined routes, systemic, long-term	0,005191	0,8462	0,5743	0,6269

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 6:**

**Industrial end-use of anhydrous and aqueous ammonia (flue gas NO<sub>x</sub> and SO<sub>x</sub> reduction)**

### 1. Title section

ES name: *Industrial end-use of anhydrous and aqueous ammonia (flue gas NO<sub>x</sub> and SO<sub>x</sub> reduction)*

### Environment

Industrial end-use of anhydrous and aqueous ammonia (flue gas NO <sub>x</sub> and SO <sub>x</sub> reduction)	ERC 6b
--------------------------------------------------------------------------------------------------------------	--------

### Worker

Use in closed process, no likelihood of exposure	PROC 1
--------------------------------------------------	--------

Use in closed, continuous process with occasional controlled exposure	PROC 2
-----------------------------------------------------------------------	--------

Use in closed batch process (synthesis or formulation)	PROC 3
--------------------------------------------------------	--------

Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
----------------------------------------------------------------------------------------------------------------------	---------

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,000%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day

## Anhydrous ammonia

Municipal sewage treatment plant discharge	2000000 L/day
--------------------------------------------	---------------

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6b

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	2	8b
-------	---	---	---	----

#### Product characteristics

Physical state	Liquid
Concentration in substance	100%
Fugacity / Dustiness	High

#### Frequency and duration of use

Duration of activity:	>4 hours
Frequency of use	5 days / week

#### Human factors not influenced by risk management

Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>
----------------------	---------------------	---------------------	---------------------

#### Other given operational conditions affecting workers exposure

Location	Indoors
Domain	industrial

#### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 100 %)
----------------------------	--------------------

#### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF5 80%
Respiratory Protection:	No	90%

### 3. Exposure estimation and reference to its source

## Anhydrous ammonia

### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000168 mg/kg dw	0,0075

### 3.2. Worker exposure (worst case)

PROCs	1	3	2	8b
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	1,371	2,743
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	17,741	10,644
Combined routes, systemic, long-term	0,035299	5,754	3,906	4,263
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>8b</b>
Dermal, long-term systemic	0,005042	0,1008	0,2016	0,4033
Inhalation, long-term systemic	0,000149	0,7454	0,3727	0,2236
Combined routes, systemic, long-term	0,005191	0,8462	0,5743	0,6269

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 7:**

**Industrial end-use of anhydrous and aqueous ammonia (part of specialist chemicals/other products, (e.g., photochemical))**

### 1. Title section

ES name: *Industrial end-use of anhydrous and aqueous ammonia (part of specialist chemicals/other products, (e.g., photochemical))*

#### Environment

Industrial end-use of anhydrous and aqueous ammonia (part of specialist chemicals/other products, (e.g., photochemical))	ERC 6b
--------------------------------------------------------------------------------------------------------------------------	--------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

#### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,000%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day



## Anhydrous ammonia

Municipal sewage treatment plant discharge	2000000 L/day
--------------------------------------------	---------------

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6b

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	2	8b
-------	---	---	---	----

#### Product characteristics

Physical state	Liquid
Concentration in substance	100%
Fugacity / Dustiness	High

#### Frequency and duration of use

Duration of activity:	>4 hours
Frequency of use	5 days / week

#### Human factors not influenced by risk management

Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>
----------------------	---------------------	---------------------	---------------------

#### Other given operational conditions affecting workers exposure

Location	Indoors
Domain	industrial

#### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 100 %)
----------------------------	--------------------

#### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF5 80%
Respiratory Protection:	No	90%

### 3. Exposure estimation and reference to its source

## Anhydrous ammonia

### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000168 mg/kg dw	0,0075

### 3.2. Worker exposure (worst case)

PROCs	1	3	2	8b
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	1,371	2,743
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	17,741	10,644
Combined routes, systemic, long-term	0,035299	5,754	3,906	4,263
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>8b</b>
Dermal, long-term systemic	0,005042	0,1008	0,2016	0,4033
Inhalation, long-term systemic	0,000149	0,7454	0,3727	0,2236
Combined routes, systemic, long-term	0,005191	0,8462	0,5743	0,6269

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 8:**

**Industrial end-use of anhydrous and aqueous ammonia (processing, non-processing aids, auxiliary agent)**

### 1. Title section

ES name: *Industrial end-use of anhydrous and aqueous ammonia (processing, non-processing aids, auxiliary agent)*

#### Environment

Industrial end-use of anhydrous and aqueous ammonia (processing, non-processing aids, auxiliary agent)	ERC 6b
--------------------------------------------------------------------------------------------------------	--------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental and worker exposure

#### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,000%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)
STP	yes (municipal)

## Anhydrous ammonia

River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6b

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	2	4	8b
<b>Product characteristics</b>					
Physical state	Liquid				
Concentration in substance	100%				
Fugacity / Dustiness	High				
<b>Frequency and duration of use</b>					
Duration of activity:	>4 hours				
Frequency of use	5 days / week				
<b>Human factors not influenced by risk management</b>					
Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>		
<b>Other given operational conditions affecting workers exposure</b>					
Location	Indoors				
Domain	industrial				
<b>Technical conditions and measures to control dispersion and exposure</b>					
Local exhaust ventilation:	yes (dermal 100 %)				
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>					
Protective gloves	No			Gloves APF5 80%	
Respiratory Protection:	No				

## Anhydrous ammonia

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000168 mg/kg dw	0,0075

#### 3.2. Worker exposure (worst case)

PROCs	1	3	2	4	8b
<b>Route of exposure and type of effects</b>					
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	1,371	1,37	2,743
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	17,741	7,1	10,644
Combined routes, systemic, long-term	0,035299	5,754	3,906	2,39	4,263
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>4</b>	<b>8b</b>
Dermal, long-term systemic	0,005042	0,1008	0,2016	0,2	0,4033
Inhalation, long-term systemic	0,000149	0,7454	0,3727	0,15	0,2236
Combined routes, systemic, long-term	0,005191	0,8462	0,5743	0,35	0,6269

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 9:**

**Industrial end-use of anhydrous and aqueous ammonia (reactive agent/processing aid and for general chemical applications, e.g., extraction, water treatment/septicity control, pH/neutralising agent)**

### 1. Title section

ES name: *Industrial end-use of anhydrous and aqueous ammonia (reactive agent/processing aid and for general chemical applications, e.g., extraction, water treatment/septicity control, pH/neutralising agent)*

### Environment

Industrial end-use of anhydrous and aqueous ammonia (reactive agent/processing aid and for general chemical applications, e.g., extraction, water treatment/septicity control, pH/neutralising agent)	ERC 6b
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------

### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

## 2. Conditions of use affecting exposure

### 2.1. Control of environmental and worker exposure

#### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,000%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)

## Anhydrous ammonia

STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6b

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	2	8b
<b>Product characteristics</b>				
Physical state	Liquid			
Concentration in substance	100%			
Fugacity / Dustiness	High			
<b>Frequency and duration of use</b>				
Duration of activity:	>4 hours			
Frequency of use	5 days / week			
<b>Human factors not influenced by risk management</b>				
Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	
<b>Other given operational conditions affecting workers exposure</b>				
Location	Indoors			
Domain	industrial			
<b>Technical conditions and measures to control dispersion and exposure</b>				
Local exhaust ventilation:	yes (dermal 100 %)			
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>				
Protective gloves	No			Gloves APF5 80%
Respiratory Protection:	No			90%

## Anhydrous ammonia

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000168 mg/kg dw	0,0075

#### 3.2. Worker exposure (worst case)

PROCs	1	3	2	8b
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	1,371	2,743
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	17,741	10,644
Combined routes, systemic, long-term	0,035299	5,754	3,906	4,263
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>8b</b>
Dermal, long-term systemic	0,005042	0,1008	0,2016	0,4033
Inhalation, long-term systemic	0,000149	0,7454	0,3727	0,2236
Combined routes, systemic, long-term	0,005191	0,8462	0,5743	0,6269

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.



## Anhydrous ammonia

**ES 10:**

**Industrial end-use of anhydrous and aqueous ammonia (surface/article treatment, e.g., metal, leather/textiles, plastics, wood, electronics/semiconductors, insulation, hardening, etchant)**

### 1. Title section

ES name: *Industrial end-use of anhydrous and aqueous ammonia (surface/article treatment, e.g., metal, leather/textiles, plastics, wood, electronics/semiconductors, insulation, hardening, etchant)*

### Environment

Industrial end-use of anhydrous and aqueous ammonia (surface/article treatment, e.g., metal, leather/textiles, plastics, wood, electronics/semiconductors, insulation, hardening, etchant)	ERC 6b
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------

### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b

## 2. Conditions of use affecting exposure

### 2.1. Control of environmental and worker exposure

#### Operational conditions

Annual tonnage	3,55E5 to/year
Daily amount used at site	41642 kg/day
Release times per year	100 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,000%
Release fraction to wastewater from process	0.05%
Release fraction to soil from process	0%
Fraction tonnage to region	0,47%
Fraction used at main source	0.249837 % (justification: Maximum tonnage biggest customer: 354631 tpa / 400 = 886 tpa)

## Anhydrous ammonia

STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: 100 % reduction of emission from sludge to soil. Rationale: Sludges of industrial firms will be incinerated or discharged according to national safety regulations.)
SpERC	spERC -6b

### 2.2. Control of worker exposure (worst case)

PROCs	1	3	2	8b
<b>Product characteristics</b>				
Physical state	Liquid			
Concentration in substance	100%			
Fugacity / Dustiness	High			
<b>Frequency and duration of use</b>				
Duration of activity:	>4 hours			
Frequency of use	5 days / week			
<b>Human factors not influenced by risk management</b>				
Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	
<b>Other given operational conditions affecting workers exposure</b>				
Location	Indoors			
Domain	industrial			
<b>Technical conditions and measures to control dispersion and exposure</b>				
Local exhaust ventilation:	yes (dermal 100 %)			
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>				
Protective gloves	No			Gloves APF5 80%
Respiratory Protection:	No			90%

## Anhydrous ammonia

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$3 \times 10^{-5}$ mg/L	0,0224
Marine water	$2,99 \times 10^{-6}$ mg/L	0,0022
Agricultural soil	0,000168 mg/kg dw	0,0075

#### 3.2. Worker exposure (worst case)

PROCs	1	3	2	8b
<b>Route of exposure and type of effects</b>				
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034286	0,6857	1,371	2,743
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,007096	35,481	17,741	10,644
Combined routes, systemic, long-term	0,035299	5,754	3,906	4,263
<b>RCR</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>8b</b>
Dermal, long-term systemic	0,005042	0,1008	0,2016	0,4033
Inhalation, long-term systemic	0,000149	0,7454	0,3727	0,2236
Combined routes, systemic, long-term	0,005191	0,8462	0,5743	0,6269

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 11:**

**Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (formulation o mixtures)**

### 1. Title section

ES name: *Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (formulation o mixtures)*

#### Environment

Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (formulation o mixtures)	ERC 8b
------------------------------------------------------------------------------------------------------	--------

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Mixing or blending in batch processes (multistage and/or significant contact)	PROC 5
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9
Use as laboratory reagent	PROC 15
Hand-mixing with intimate contact (only PPE available)	PROC 19

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental exposure

#### Operational conditions

Annual tonnage	2.50E4 to/year
Daily amount used at site	242.74 kg/day
Release times per year	365 days/year
Local freshwater dilution factor	10
Local marine water dilution factor	100
Release fraction to air from process	0,100%
Release fraction to wastewater from process	2%
Release fraction to soil from process	0%
Fraction tonnage to region	10,00%

## Anhydrous ammonia

Fraction used at main source	3.544 % (justification: The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter. Wide dispersive professional uses of ammonia are diverse and widespread. The resulting environmental exposure is not expected to add significantly to already present background levels of ammonia in the environment. An additional assessment for environmental exposure for wide dispersive uses has therefore not been performed.)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: Sludges will be oxidized or discharged according to national safety regulations. Hence there will be no released to soil (0%).)
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------

### 2.2. Control of worker exposure (worst case)

PROCs	1	2	3	5	8b	9	15	19
<b>Product characteristics</b>								
Physical state	Liquid							
Concentration in substance	100%							
Fugacity / Dustiness	High							
<b>Frequency and duration of use</b>								
Duration of activity:	>4 hours	1 - 4 hours	>4 hours	1 - 4 hours	1 - 4 hours	1 - 4 hours	>4 hours	>4 hours
Frequency of use	5 days / week							
<b>Human factors not influenced by risk management</b>								
Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>	1,980 cm <sup>2</sup>
<b>Other given operational conditions affecting workers exposure</b>								
Location	Indoors						outdoors (30%)	Indoors
Domain	professional							

## Anhydrous ammonia

### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:

yes (dermal 100 %)

### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF10 90%	Gloves APF5 80%	No	99 %, burst-time: >4 hours
Respiratory Protection:	No	90%	No		90%

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$5,62 \times 10^{-6}$ mg/L	0,0041
Marine water	$5,75 \times 10^{-4}$ mg/L	0,4259
Agricultural soil	0,000268 mg/kg dw	0,012

#### 3.2. Worker exposure (worst case)

PROCs	1	2	3	5	8b	9	15	19
<b>Route of exposure and type of effects</b>								
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034	1,371	0,4	1,37	1,646	0,82	0,3428	1,414
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,071	35,481	43	35,5	31,933	31,9	24,837	35,481
Combined routes, systemic, long-term	0,044	6,44	6,5	6,44	6,208	5,39	3,891	6,483
<b>RCR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>5</b>	<b>8b</b>	<b>9</b>	<b>15</b>	<b>19</b>
Dermal, long-term systemic	0,005042	0,2016	0,1	0,2	0,242	0,12	0,05042	0,2079
Inhalation, long-term systemic	0,00149	0,7454	0,9	0,75	0,6708	0,67	0,5217	0,7454
Combined routes, systemic, long-term	0,0065	0,947	1	0,95	0,9128	0,79	0,5722	0,9533

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

## Anhydrous ammonia

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 12:**

**Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (heat transfer fluid, e.g., refrigeration, cooling/heating systems)**

### 1. Title section

ES name: *Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (heat transfer fluid, e.g., refrigeration, cooling/heating systems)*

### Environment

Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (heat transfer fluid, e.g., refrigeration, cooling/heating systems)	ERC 9a
	ERC 9b

### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9
Use as laboratory reagent	PROC 15
Hand-mixing with intimate contact (only PPE available)	PROC 19
Heat and pressure transfer fluids (closed systems) in dispersive use	PROC 20

## 2. Conditions of use affecting exposure

### 2.1. Control of environmental exposure

Operational conditions	ERC 9a	ERC 9b
Annual tonnage	2.50E4 to/year	
Daily amount used at site	242.74 kg/day	
Release times per year	365 days/year	
Local freshwater dilution factor	10	
Local marine water dilution factor	100	
Release fraction to air from process	5%	
Release fraction to wastewater from process	0%	5%
Release fraction to soil from process	0%	
Fraction tonnage to region	10%	



## Anhydrous ammonia

Fraction used at main source	3.544 % (justification: The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter. Wide dispersive professional uses of ammonia are diverse and widespread. The resulting environmental exposure is not expected to add significantly to already present background levels of ammonia in the environment. An additional assessment for environmental exposure for wide dispersive uses has therefore not been performed.)						
STP	yes (municipal)						
River flow rate	18000 m <sup>3</sup> /day						
Municipal sewage treatment plant discharge	2000000 L/day						
<b>Risk management measures</b>							
Reduction of sludge to soil	100 % (justification: Sludges will be oxidized or discharged according to national safety regulations. Hence there will be no released to soil (0%).)						
<b>2.2. Control of worker exposure (worst case)</b>							
<b>PROCs</b>	<b>1</b>	<b>2</b>	<b>20</b>	<b>8b</b>	<b>9</b>	<b>15</b>	<b>19</b>
<b>Product characteristics</b>							
Physical state	Liquid						
Concentration in substance	100%						
Fugacity / Dustiness	High						
<b>Frequency and duration of use</b>							
Duration of activity:	>4 hours	>4 hours	1 - 4 hours			>4 hours	
Frequency of use	5 days / week						
<b>Human factors not influenced by risk management</b>							
Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>	1,980 cm <sup>2</sup>
<b>Other given operational conditions affecting workers exposure</b>							
Location	Indoors					outdoors (30%)	Indoors

## Anhydrous ammonia

Domain	professional			
<b>Technical conditions and measures to control dispersion and exposure</b>				
Local exhaust ventilation:	yes (dermal 100 %)			
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>				
Protective gloves	No	Gloves APF5 80%	No	99 %, burst-time: >4 hours
Respiratory Protection:	No	No		90%

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate				RCR	
	ERC9a		ERC9b		ERC9a	ERC9b
<b>Fresh water</b>	5,62x10 <sup>-6</sup>	mg/L	<10 <sup>-6</sup>	mg/L	0,0041	0,0041
<b>Marine water</b>	5,285x10 <sup>-7</sup>	mg/L	0	mg/L	0,000391	1,064
<b>Agricultural soil</b>	0,000168	mg/kg dw	0	mg/kg dw	0,007584	0,018

#### 3.2. Worker exposure (worst case)

PROCs	1	2	20	8b	9	15	19
<b>Route of exposure and type of effects</b>							
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034	1,371	1,714	1,646	0,82	0,3428	1,414
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,071	35,481	35,481	31,933	31,9	24,837	35,481
Combined routes, systemic, long-term	0,044	6,44	6,783	6,208	5,39	3,891	6,483
<b>RCR</b>	<b>1</b>	<b>2</b>	<b>20</b>	<b>8b</b>	<b>9</b>	<b>15</b>	<b>19</b>
Dermal, long-term systemic	0,005042	0,2016	0,2521	0,242	0,12	0,05042	0,2079
Inhalation, long-term systemic	0,00149	0,7454	0,7454	0,6708	0,67	0,5217	0,7454
Combined routes, systemic, long-term	0,0065	0,947	0,9975	0,9128	0,79	0,5722	0,9533

## Anhydrous ammonia

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 13:**

**Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)**

### 1. Title section

ES name: *Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)*

#### Environment

Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)

ERC 8b

ERC 8e

#### Worker

Use in closed, continuous process with occasional controlled exposure

PROC 2

Use in closed batch process (synthesis or formulation)

PROC 3

Use in batch and other process (synthesis) where opportunity for exposure arises

PROC 4

Transfer of chemicals into small containers (dedicated filling line)

PROC 9

Use as laboratory reagent

PROC 15

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental exposure

Operational conditions	ERC 8b	ERC 8e
Annual tonnage	2.50E4 to/year	
Daily amount used at site	242.74 kg/day	
Release times per year	365 days/year	
Local freshwater dilution factor	10	
Local marine water dilution factor	100	
Release fraction to air from process	0,1%	
Release fraction to wastewater from process	2%	
Release fraction to soil from process	0%	
Fraction tonnage to region	10%	

## Anhydrous ammonia

Fraction used at main source	3.544 % (justification: The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter. Wide dispersive professional uses of ammonia are diverse and widespread. The resulting environmental exposure is not expected to add significantly to already present background levels of ammonia in the environment. An additional assessment for environmental exposure for wide dispersive uses has therefore not been performed.)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: Sludges will be oxidized or discharged according to national safety regulations. Hence there will be no released to soil (0%).)
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------

### 2.2. Control of worker exposure (worst case)

<b>PROCs</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>9</b>	<b>15</b>
<b>Product characteristics</b>					
Physical state	Liquid				
Concentration in substance	100%				
Fugacity / Dustiness	High				
<b>Frequency and duration of use</b>					
Duration of activity:	>4 hours	1 - 4 hours			
Frequency of use	5 days / week				
<b>Human factors not influenced by risk management</b>					
Exposed skin surface	480 cm <sup>2</sup>	240 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>	
<b>Other given operational conditions affecting workers exposure</b>					
Location	Indoors				
Domain	professional				

## Anhydrous ammonia

### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:

yes (dermal 100 %)

### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves

No

Gloves APF5 80%

No

Respiratory Protection:

No

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	$5,62 \times 10^{-6}$ mg/L	0,0041
Marine water	$5,75 \times 10^{-4}$ mg/L	0,4259
Agricultural soil	0,000268 mg/kg dw	0,012

#### 3.2. Worker exposure (worst case)

PROCs	2	3	4	9	15
<b>Route of exposure and type of effects</b>					
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	1,371	0,4114	0,822	0,82	0,3428
Inhalation, long-term systemic (mg/m <sup>3</sup> )	35,481	42,578	31,933	31,9	24,837
Combined routes, systemic, long-term	6,44	6,494	5,385	5,39	3,891
<b>RCR</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>9</b>	<b>15</b>
Dermal, long-term systemic	0,2016	0,06	0,121	0,12	0,05042
Inhalation, long-term systemic	0,7454	0,8944	0,67	0,67	0,5217
Combined routes, systemic, long-term	0,947	0,9549	0,791	0,79	0,5722

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

## Anhydrous ammonia

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 14:**

**Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (reactive agent/processing aid, general chemical applications, e.g., pH/neutralising agent, water treatment)**

### 1. Title section

ES name: *Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (reactive agent/processing aid, general chemical applications, e.g., pH/neutralising agent, water treatment)*

#### Environment

Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (reactive agent/processing aid, general chemical applications, e.g., pH/neutralising agent, water treatment)	ERC 8b
	ERC 8e

#### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Transfer of chemicals from/to vessels/ large containers at non dedicated facilities	PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer into small containers	PROC 9
Roller application or brushing	PROC 10
Hand-mixing with intimate contact (only PPE available)	PROC 19

### 2. Conditions of use affecting exposure

#### 2.1. Control of environmental exposure

Operational conditions	ERC 8b	ERC 8e
Annual tonnage	2.50E4 to/year	
Daily amount used at site	242.74 kg/day	
Release times per year	365 days/year	
Local freshwater dilution factor	10	
Local marine water dilution factor	100	
Release fraction to air from process	0,1%	



## Anhydrous ammonia

Release fraction to wastewater from process	2%
Release fraction to soil from process	0%
Fraction tonnage to region	10%
Fraction used at main source	3.544 % (justification: The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter. Wide dispersive professional uses of ammonia are diverse and widespread. The resulting environmental exposure is not expected to add significantly to already present background levels of ammonia in the environment. An additional assessment for environmental exposure for wide dispersive uses has therefore not been performed.)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: Sludges will be oxidized or discharged according to national safety regulations. Hence there will be no released to soil (0%).)
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------

### 2.2. Control of worker exposure (worst case)

PROCs	1	2	3	8a	8b	9	10	19
<b>Product characteristics</b>								
Physical state	Liquid							
Concentration in substance	100%							
Fugacity / Dustiness	High							
<b>Frequency and duration of use</b>								
Duration of activity:	>4 hours	1 - 4 hours	>4 hours	1 - 4 hours			>4 hours	
Frequency of use	5 days / week							

## Anhydrous ammonia

### Human factors not influenced by risk management

Exposed skin surface	240 cm <sup>2</sup>	480 cm <sup>2</sup>	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	1,980 cm <sup>2</sup>
----------------------	---------------------	---------------------	---------------------	---------------------	---------------------	---------------------	---------------------	-----------------------

### Other given operational conditions affecting workers exposure

Location	Indoors						outdoors (30%)	Indoors
Domain	professional							

### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 100 %)							
----------------------------	--------------------	--	--	--	--	--	--	--

### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF10 90%	Gloves APF5 80%	Gloves APF10 90%	99 %, burst-time: >4 hours
Respiratory Protection:	No	90%	No	90%	

## 3. Exposure estimation and reference to its source

### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
Fresh water	5,62x10 <sup>-6</sup> mg/L	0,0041
Marine water	5,75x10 <sup>-4</sup> mg/L	0,4259
Agricultural soil	0,000268 mg/kg dw	0,012

### 3.2. Worker exposure (worst case)

PROCs	1	2	3	8a	8b	9	10	19
<b>Route of exposure and type of effects</b>								
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	0,034	1,371	0,4	2,74	1,646	0,82	2,743	1,414
Inhalation, long-term systemic (mg/m <sup>3</sup> )	0,071	35,481	43	24,8	31,933	31,9	24,837	35,481
Combined routes, systemic, long-term	0,044	6,44	6,5	6,29	6,208	5,39	6,291	6,483
<b>RCR</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>8a</b>	<b>8b</b>	<b>9</b>	<b>10</b>	<b>19</b>

## Anhydrous ammonia

Dermal, long-term systemic	0,005042	0,2016	0,1	0,4	0,242	0,12	0,403	0,2079
Inhalation, long-term systemic	0,00149	0,7454	0,9	0,52	0,6708	0,67	0,521	0,7454
Combined routes, systemic, long-term	0,0065	0,947	1	0,93	0,9128	0,79	0,925	0,9533

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.

## Anhydrous ammonia

**ES 15:**

**Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)**

### 1. Title section

ES name: *Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)*

### Environment

Wide dispersive end-use: Professional uses of anhydrous and aqueous ammonia (laboratory/research chemical)	ERC 8b
	ERC 8e

### Worker

Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure	PROC 2
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Transfer of chemicals from/to vessels/ large containers at dedicated facilities	PROC 8b
Transfer of chemicals into small containers (dedicated filling line)	PROC 9

## 2. Conditions of use affecting exposure

### 2.1. Control of environmental exposure

Operational conditions	ERC 8b	ERC 8e
Annual tonnage	2.50E4 to/year	
Daily amount used at site	242.74 kg/day	
Release times per year	365 days/year	
Local freshwater dilution factor	10	
Local marine water dilution factor	100	
Release fraction to air from process	0,1%	
Release fraction to wastewater from process	2%	
Release fraction to soil from process	0%	
Fraction tonnage to region	10%	

## Anhydrous ammonia

Fraction used at main source	3.544 % (justification: The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter. Wide dispersive professional uses of ammonia are diverse and widespread. The resulting environmental exposure is not expected to add significantly to already present background levels of ammonia in the environment. An additional assessment for environmental exposure for wide dispersive uses has therefore not been performed.)
STP	yes (municipal)
River flow rate	18000 m <sup>3</sup> /day
Municipal sewage treatment plant discharge	2000000 L/day

### Risk management measures

Reduction of sludge to soil	100 % (justification: Sludges will be oxidized or discharged according to national safety regulations. Hence there will be no released to soil (0%).)
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------

### 2.2. Control of worker exposure (worst case)

<b>PROCs</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>9</b>	<b>8b</b>
<b>Product characteristics</b>					
Physical state	Liquid				
Concentration in substance	100%				
Fugacity / Dustiness	High				
<b>Frequency and duration of use</b>					
Duration of activity:	>4 hours	1 - 4 hours			
Frequency of use	5 days / week				
<b>Human factors not influenced by risk management</b>					
Exposed skin surface	480 cm <sup>2</sup>	240 cm <sup>2</sup>	480 cm <sup>2</sup>	960 cm <sup>2</sup>	
<b>Other given operational conditions affecting workers exposure</b>					
Location	Indoors				
Domain	professional				

## Anhydrous ammonia

### Technical conditions and measures to control dispersion and exposure

Local exhaust ventilation:	yes (dermal 100 %)
----------------------------	--------------------

### Conditions and measures related to personal protection, hygiene and health evaluation

Protective gloves	No	Gloves APF5 80%
Respiratory Protection:	No	No

### 3. Exposure estimation and reference to its source

#### 3.1. Environmental release and exposure

Protection target	Exposure estimate	RCR
<b>Fresh water</b>	$5,62 \times 10^{-6}$ mg/L	0,0041
<b>Marine water</b>	$5,75 \times 10^{-4}$ mg/L	0,4259
<b>Agricultural soil</b>	0,000268 mg/kg dw	0,012

#### 3.2. Worker exposure (worst case)

PROCs	2	1	4	9	8b
<b>Route of exposure and type of effects</b>					
Dermal, long-term systemic (mg/kg <sub>bw</sub> /day)	1,371	0,034	0,822	0,82	1,646
Inhalation, long-term systemic (mg/m <sup>3</sup> )	35,481	0,071	31,933	31,9	31,933
Combined routes, systemic, long-term	6,44	0,044	5,385	5,39	6,208
<b>RCR</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>9</b>	<b>8b</b>
Dermal, long-term systemic	0,2016	0,005042	0,121	0,12	0,242
Inhalation, long-term systemic	0,7454	0,00149	0,67	0,67	0,6708
Combined routes, systemic, long-term	0,947	0,0065	0,791	0,79	0,9128

### 4. Guidance to DU to evaluate whether they work inside the boundaries set by the ES

## Anhydrous ammonia

In any of the exposure scenarios (ES) described above, the downstream user (DU) works within the limits established by ES if the operational conditions (OC) and risk management measures (RMM) described in the same are complied. When the conditions for the DU are not explicitly described in the general conditions of the ES, the DU must ensure that its specific CO and RMM comply with what is established in them. If the concentration of the substance in the mixture is not explicitly indicated in the ES, no restriction should be applied, that is, up to 100% of the substance may be used. Depending on the basis of the exposure assessment conducted for the ES, this can be done in different ways, as described in each of the environmental and occupational EEs.

Any deviation from the described conditions of use implies:

- (i) inform the SDS provider about deviations and request their inclusion in the ES, or
- (ii) develop an CSR (Chemical Safety Report) for DU (in accordance with article 37, paragraph 4), submit it to ECHA and keep it as its own documentation.