

AB ACHEMA
Safety Data Sheet



In accordance with Regulation (EC) No. 1907/2006 (REACH), Annex II with all subsequent amendments and supplements and EC Regulation No. 830/2015

Ammonia solution „AZO NOX AV2“

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

1.1 Product identifier

Trade name: Ammonia solution „AZO NOX AV2“

Composition: Ammonia and water

Chemical name: Ammonia, anhydrous

Identification number in accordance with Regulation (EC) No. 1272/2008: 007-001-00-5

EC Number: 231-635-3

CAS Number: 7664-41-7

REACH Registration No.: 01-2119488876-14-xxxx

1.2. Relevant identified uses of the mixture and uses advised against

1.2.1. Uses:

Industrial use:

Industrial use [SU0, SU5, SU9, SU10, SU11, SU12, SU16]: use of ammonia solution for production and industrial use – concentration 25 % (PC0, PC7, PC9a, PC12, PC14, PC15, PC19, PC20, PC23, PC30, PC33, PC34, PC35, PC39).

1.2.2 Uses advised against: ammonia registration is not specified under the REACH dossier.

1.3. Details of the supplier of the safety data sheet

Manufacturer/Company name: AB Achema

Address: Jonalaukio k., Ruklos sen., LT55550

Country: Lithuania

Tel. Nr.: + 370 349 56465

URL website: www.achema.lt

Person responsible for the Safety Data Sheet (with e-mail address): A. Vaicekauskaitė, e-mail: a.vaicekauskaite@achema.com

1.4. Emergency telephone number

Please contact: Poison Information and Control Office in the Republic of Lithuania by phone +370 52362052 or by the Common emergency Center by 112.

Helpdesk services work 24 hours a day, 365 days a year.

Other remarks (language in which assistance is provided): assistance is provided in Lithuanian.

SECTION 2. HAZARDS IDENTIFICATION

2.1 Classification of the substance

Classification under Regulation (EC) No. 1272/2008 [CLP]:

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Skin Corr. 1B, H314;
STOT SE 3, H335;
Aquatic Acute 1, H400;
Aquatic Chronic 2, H411.

2.2 Label elements

Labelling in accordance with Regulation (EC) No 1272/2008 [CLP]:

Hazard pictogram(s):



Signal word: DANGER

Hazard Statements:

- H314 – Causes severe skin burns and eye damage.
- H335 – May cause respiratory irritation.
- H400 – Very toxic to aquatic life.
- H411 – Toxic to aquatic life with long lasting effects.

Precautionary statements:

- P260 – Do not breathe dust/fumes/gas/mist/vapours/sprays.
- P264 – Wash hands thoroughly after handling.
- P280 – Wear protective gloves / protective clothing / eye protection / face protection.
- P301+P330+P331 – IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
- P303+P361+P353 – IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
- P363 – Wash contaminated clothing before reuse.
- P304+P340 – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P310 – Immediately call a POISON CENTER or doctor/physician.
- P321 – Specific treatment: If on skin wash with 0,5 % boric acid solution.
- P305+P351+P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P405 – Store locked up.

2.3 Other hazards

Risk of soot, severe odor on the receptors, danger to soil organisms.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

According to the REACH Regulation (EU) No. 1907/2006 the product is treated as a mixture.

3.2. Mixtures

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Hazardous components						
CAS number	EC number	Identification Numbers according to Regulation (EC) No. 1272/2008	REACH registration No.	The mass (volume) of %	Name	Classification according to Regulation (EC) 1272/2008
7664-41-7	231-635-3	007-001-00-5	01-2119488876-14-xxxx	Not less than 25	Ammonia	Flam.Gas 2, H221, Acute Tox 3, H331 Skin Corr. 1B, H314 Aquatic Acute 1, H400 Aquatic Acute 2, H411 Specific concentration limits: 1) C ≥ 25 % : Skin Corr. 1B; STOT SE 3, H335; Aquatic Acute 1, H400; Aquatic Acute 2, H411. 2) C > 5 % C < 25 % : Skin Corr.1B; STOT SE 3, H335; Aquatic Acute 2, H411

Additional references: hazard statements and abbreviations are listed in section 16 of this SDS.

SECTION 4. FIRST-AID MEASURES

4.1 Description of first aid measures

4.1.1 General information:

If the clothes are contaminated with the product, immediately remove them. Remove the victim from exposure into fresh air and seek medical advice immediately and provide this material safety data sheet.

The material can get through: inhalation, contact with skin, contact with eyes, ingestion.

4.1.2 Inhalation: remove victim to fresh air and keep at rest. Victim to lie down in the recovery position, cover and keep him warm. Give artificial respiration if necessary. If breathing difficult, assess the extent of the damage to the affected respiratory tract, indications that the patient could have started bronchitis and / or pneumonia.

4.1.3 Skin contact: take off contaminated clothing and shoes immediately. Wash off with plenty of water, at least 15 minutes. After contact with skin, can be washed with 0.5% boric acid solution. If skin irritation and pain persist, seek medical advice. When clothes clinging to the skin, it must be well-drained and stooped before removing them.

4.1.4 Accidental eye contact: rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses if present and easy to do. If eye irritation, pain, swelling, excessive tearing are felt, seek medical advice.

4.1.5 Ingestion: Immediately call a POISON CENTER or seek medical advice. If victim is conscious: – If swallowed, rinse mouth with milk or water (only if the person is conscious). Do NOT INDUCE VOMITING. If victim is unconscious but breathing: oxygen or artificial respiration if needed.

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4.2 Most important symptoms and effects (acute and delayed)

If inhaled – ammonia fumes may cause immediate irritation of the respiratory tract, pain, and dyspnea which are followed by a period of recovery that may last several weeks. After this time, a relapse may occur with death \ caused by bronchopneumonia and/or pulmonary fibrosis.

If on skin: ammonia causes skin and eye burns.

If swallowed: may cause burns or irritation of the gastrointestinal tract.

4.3 Indication of any immediate medical attention and special treatment needed

Keep under medical surveillance if inhaled: pulmonary oedema may occur within 48 hours.

Keep under medical surveillance in case of eye contact: eye damage effects may occur within a few days.

SECTION 5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media:

- If the fire is small – dry chemical, carbon dioxide.
- If the fire is large – water spray/mist, foam.

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media: water. Only to be used in a closed container with ammonia for cooling and fogging, in order to precipitate ammonia vapors.

5.2 Special material or mixture of hazards

The release of ammonia vapor in enclosed spaces can lead to a burst of explosive mixtures. Closed liquid ammonia can explode from warming. Ammonia vapor clouds can limit visibility. Do not spray water into liquid ammonia and inside its containers, this can cause heat dissipation, increase evaporation and spray hazards. Contaminated water is very dangerous to the environment.

5.3 Advice for fire-fighters

When burning ammonia gas, the best way to quench ammonia is by stopping the ammonia gas leakage and only then starting to quench it.

Wear self-contained breathing apparatus and protective suit. Fire fighters must wear fire resistant personnel protective equipment. Wear chemical resistant oversuit (EN 14605), chemical resistant rubber boots. If it is possible and safe to do this, remove ammonia containers from the fire. The outer walls of containers with ammonia, which went into the fire, cool down by a water jet until the flame disappears. If the ammonia tank is exposed to open fire, people have to keep a long distance from them because of the risk of an explosion of ammonia containers. Avoid contact with contaminated water. Reach from the front side. Sweep gaseous ammonia, steam, fog by water spraying. Cover the surface with foam to reduce evaporation. Insulate the area until gas is scattered. Prevent the entry of ammonia or contaminated water into water bodies. After the fire, rinse the equipment exposed to smoke to prevent damage.

SECTION 6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

6.1.1 For personnel not involved in emergency situations: use recommended type K respiratory protection (EN 402). Approach from upwind if it's safe. If unsafe to evacuate, stay indoors, close windows, turn off ventilation and electrical equipment, remove potential sources of ignition. If necessary, wear wet towels or

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other clothes on the face. If available, use self-contained breathing apparatus.

6.1.2 For the personnel involved in emergency situations:

Use self-contained breathing apparatus and full body protective suit (EN 14605), chemical resistant rubber boots. If possible, stop the flow of ammonia. According to the size and nature of the contaminated site, it is important to assess whether extraneous people have to evacuate or evacuate unsafe ones and they must remain in the rooms to close windows, turn off ventilation and electrical equipment, and remove potential sources of ignition. Isolate the accident area. Be on the side of the accident area so that the wind will carry harmful vapors away from you. Do not be in the dumps. Locate poured ammonia, ventilate the area. Closed rooms are avoided before they enter. Ammonia vapor may be precipitated by water spraying. Avoid contact with contaminated water. Remove ammonia-free materials (see section 10).

6.2 Environmental precautions

Do not allow product to spread into the environment. Do not discharge into drains and / or rivers. In case of accidental plumbing or sewage system pollution, inform the systems supervising institutions.

6.3 Methods and material for containment and cleaning up

6.3.1 Containment: stop the leakage by covering drainage systems, installing protective barriers.

6.3.2 Cleaning: dissolve the spilled material with water, neutralize with 5% acetic acid solution, into a closed container. Store in properly sealed containers. Collect contaminated soil in a closed container and handle in accordance with applicable legislation.

6.3.3 Other information: never use open containers for collecting spillage.

6.4 Reference to other sections

Refer to section 8 of SDS for personal protection details.

SECTION 7. HANDLING AND STORAGE

7.1 Precaution for safe handling. Protective measures

Protective measures: use appropriate personal protective equipment. Skin protection measures must be worn when there is exposure of ammonia through liquid, fog, vapors.

Fire prevention measures: while indoors use only explosion-proof electrical equipment and measures to protect against discharge of electric charge.

Environmental precautions: supply and exhaust ventilation must be provided to prevent the accumulation of harmful substances in industrial premises and laboratories that work with ammonia solution. Constantly monitor the concentration of ammonia in indoors air.

Recommendations concerning good general hygiene practices at the work place: do not eat, drink, smoke at workplace. Wash hands after work and before eating. Remove contaminated clothing and remove contaminated protective equipment before entering eating.

7.2 Condition for safe storage, including any incompatibilities

Technical measures and storage conditions: store in tightly closed containers in cool and well ventilated areas. Protect from heat, exposure to sunlight, sources of ignition, contacts with incompatible materials (see section 10).

Packing materials. User packaging (barrels, containers, tanks made of stainless steel, vanadium steel, polyethylene, polypropylene) must be clean, technically clean and suitable for ammonia solution transportation.

Requirements for storage places and containers. At the entrance to the production and storage premises there must be specified categories for explosion and fire hazards. The enclosure must contain the hazardous materials

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specified by the manufacturer's technical documentation. The permanent maintenance of the container is carried out by its owner in accordance with the technical documentation of the container provided by the manufacturer, as well as other legislation in force in the Republic of Lithuania governing the safety and health of workers, protection of the environment, storage of dangerous substances and maintenance of structures.

It is allowed to store up to 100 tons of ammonia solution „AZO NOX AV2“. Larger amounts of ammonia solution can be stored in facilities according to the Resolution of the Government of the Republic of Lithuania No.16.08.2004. 966 „On the Approval of the Description and Listing of Criteria for the Listing and Classification of Substances, Mixtures or Preparations of Hazardous Substances in Hazardous Substances“ (Official Gazette, 2004, No. 130-4649 as well as subsequent amendments and supplements) and Regulation 2012/18/ES with requirements for hazardous objects.

Additional information on storage conditions. None.

7.3 Relevant identified uses

Industrial use

Used in the manufacture of dyes, detergents, cosmetics, synthetic fibers, as fertilizers, in the chemical industry, paper / leather processing, wood and metal surface treatment, rubber / latex and semiconductor / electronics manufacturing.

Professional use

Used as photochemical processes, insulation products. As a laboratory reagent, cleansing product, pH adjuster, leather product or other surface treatment agent.

Distant consumers usage

Used in coating, paint diluent and device for cleaning, fillings, putty and plasters, washing and cleaning products, as well as cosmetics and body care products.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Chemical, worker exposure limit value in air:

Long-term exposure limit (IPRD): 14 mg / m³ or 20 ppm (applicable in Lithuania according to hygiene norm HN 23).

Short-term exposure limit (TPRD): 36 mg / m³ or 50 ppm (applicable in Lithuania according to hygiene norm HN 23).

United Kingdom (IPRD): 18 mg/m³;

United Kingdom (TPRD): 25 mg/m³;

France (IPRD): 7 mg/m³;

France (TPRD): 14 mg/m³.

Non-limiting value (s) (DNEL)

Ammonia was subjected to a quantitative effect assessment. The DNEL values for SDS sub-section 1.2.1, are given for the product use methods in which exposure scenarios are included in SDS.

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Exposure scenario (5): Use of ammonia solution for production and industrial use – concentration 25%.

Dermal exposure for professional workers: Acute / long-term systemic effects DNEL = 6.8 mg / kg.

Inhalation exposure for professional workers: Short-term / long-term systemic effect DNEL = 47.6 mg / m³; Short-term

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local effects DNEL = 36 mg / m³; Long-term / local effects DNEL = 14 mg / m³.

Oral exposure for professional workers: in the case of all hygiene conditions, oral exposure is unavailable.

The physico-chemical properties of DNEL anhydrous ammonia which could have the greatest negative effect are presented.

Workers exposure

Exposure method	Exposure type	Hazardousness	Physicochemical property that could have the greatest negative effect
Dermal	Systemic effect - acute	DNEL: 6,8 mg/kg bw/d	Specific toxicity for a specific organ, repeated effect
Inhalation	Systemic effect - acute	DNEL: 47,6 mg/m ³	Specific toxicity for a specific organ, repeated effect
Dermal	Local effect - acute	Ammonia is a corrosive material. DNEL values are not available.	Corrosion / irritation (eye and skin)
Inhalation	Local effect - acute	DNEL: 36 mg/m ³	Respiratory tract irritation
Dermal	Systemic effect - long lasting	6,8 mg/kg bw/d	Specific toxicity for a specific organ, repeated effect
Inhalation	Systemic effect - long lasting	DNEL: 47,6 mg/m ³	Specific toxicity for a specific organ, repeated effect
Dermal	Local effect – long lasting	Ammonia is a corrosive material. DNEL values are not available.	Corrosion / irritation (eye and skin)
Inhalation	Local effect – long lasting	DNEL: 14 mg/m ³	Respiratory tract irritation

Predicted inactive concentration(s) PNEC.

The anhydrous ammonia PNEC value is given.

Task in the field of environmental protection	PNEC value, mg/l
Fresh water	0,0011 mg/l
Fresh water sediment	Ammonia is highly soluble in water and does not accumulate in sediments therefore it is not demanded to determine a PNEC of sediment.
Sea water	0,0011 mg/l
Sea water sediment	Ammonia is highly soluble in water and does not accumulate in sediments therefore it is not demanded to obtain a sediment PNEC.
Food chain	There is no data that ammonia has bioaccumulation properties. Because its log Kow value is 0.23 which is less than 3, it is not demanded to determine a PNEC of food chain.
Microorganisms in sewage treatment system	Ammonia is fragmented by bacteria as a nutrient. It is also an intermediate product for bacteria decomposing other nitrogen compounds. Accordingly it is not demanded to determine a PNEC for it.
Soil (agricultural)	Ammonia, directly inserted in the soil, rapidly converts into other compounds in the nitrate cycle, and therefore its effects on the macro-organisms of soil are not noticeable.
Air	Not specified.

8.2 Exposure controls

8.2.1. Appropriate engineering controls: Sealed equipment, apparatus and pipelines, automated and sealed loading and dump equipment. Enclosed rooms must have a local exhaust ventilation system. Engineering controls must be used to ensure that the amount of ammonia in the environment does not exceed the limit values.

Organizational measures to avoid exposure of the product:

8.2.2. Individual protection measures, such as personal protective equipment: personal protective

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equipment must be used in accordance with good work-hygiene practices and must be used together with other control measures, including technical controls, ventilation and isolation.

8.2.2.1 Eye and (or) face protection: chemical protective safety goggles (EN 166), face shield (EN 402). Face shielding remedies are recommended.

8.2.2.2 Skin protection:

Hand protection: protective gloves (EN 374, EN 388).

The suitability and durability of gloves depend on the frequency and duration of contact with the product, the material used to manufacture gloves, chemical resistance, gloves, functional use.

The material used to make gloves must be impermeable and resistant to the product. Glove material to be selected according to the time of penetration, rubbing and decomposition.

The chemical penetration time varies depending on the chemical resistance of the glove, the thickness of the glove, the frequency and duration of contact with the substance.

The exact time of expiry of the protective gloves must be indicated by the manufacturer and must be observed.

Protective gloves must be made of one of the following materials, to be of appropriate thickness.

The gloves are characterized by the penetration time indicated in brackets:

- Butyl rubber, thickness at least 0.7 mm (penetration time 8 hours);
- Fluorocarbon rubber, thickness of at least 0.4 mm (penetration time of 2 hours);
- Polychloroprene CR, thickness of at least 0.5 mm (penetration time 1 hour).

Due to the lack of resistance to ammonia and its aqueous solutions, during the short penetration time it is not allowed to use gloves from the following materials: natural rubber / natural latex NR, nitrile gloves / nitrile latex NBR, polyvinyl chloride PVC.

When choosing gloves, other requirements for use such as work intensity, heat resistance and other materials that are being used are also to be considered.

Other protection: chemical resistant apron (EN14605), work clothes (jacket, trousers, jacket or warm semi-jumper), chemicals and ammonia resistant work boots (EN 20345).

8.2.2.3 Respiratory protection: It is recommended to use: a filtration gas masks with an A2B2E2K2 brand filter (EN 14387) or air filtration unit 3M JUPITER 453-09-25P with A2B1E1K1P3 filter, insulating gas masks.

8.2.2.4 Thermal protection: Chemically resistant gloves (EN 374), winter footwear protection – felt with rubber calio, felt shoes with rubber padding or rubberized shoes.

8.2.3 Environmental exposure controls: conduct regular / constant control of the pH of discharged sewage water, do not allow to enter drains and the environment.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

(a) **Appearance:** colourless liquid with very pungent odor.

(b) **Odour:** very pungent.

(c) **Odour threshold:** 0.6 – 53 ppm threshold, with geometric mean of 17 ppm.

(d) **pH:** 11.7 (1% concentration aqueous solution).

(e) **Melting point/freezing point °C:** about –56 °C (25% ammonia solution). Melting point/freezing point of ammonia anhydrous –77.7°C. Validation: Ammonia solution exists only in solution type. The freezing temperature depends on the concentration of ammonia in the solution. The freezing temperature of the 4% ammonia solution is -2.9 °C. As the concentration of ammonia increases, the freezing point is lowered. A 28% ammonia solution has a freezing temperature of -69.2 °C. The freezing point of the 29.4% ammonia solution is about -79.4 °C.

(f) **Initial boiling point and boiling range °C:** 38 °C at 1013 hPa (25% ammonia solution).

(g) **Flash point:** according to REACH Regulation Annex VII column 2 it is not clarified, using an explanation: it was not identified because the product is an inorganic material.

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- (h) **Speed of vaporization:** data not available.
- (i) **Flammability:** ammonia solution is water based. Anhydrous ammonia is flammable gas. Ammonia-air mixtures are explosive. The lowest explosion limit of ammonia is 16% vol., the upper limit is 25%.
- (j) **Limit values of flammability or explosion:** ammonia solution is water based. Ammonia-air mixture in the range of 16 – 28% is explosive.
- (k) **Vapour pressure:** 48 kPa at 20 °C (25% ammonia solution).
- (l) **Vapour density:** 0.7714 g/l, at 0 °C and pressure 101,3 kPa (Anhydrous ammonia).
- (m) **Relative density:** 0.907 g / cm³ at 20 °C (25% ammonia solution).
- (n) **Solubility:** highly soluble in water, approximately 482 000 mg / l at 25 °C. Validation: according to REACH documentation for ammonia, the solubility of water in various literature sources is 48200 – 53100 mg / l.
- (o) **Partition coefficient n-octanol/water:** Log Kow (Pow) is equal to 0.23 at 20 °C. Validation: according to REACH regulation annex VII column 2, could be unexplained because the material is inorganic. The value is based on the literature source – UK Environment Agency report.
- (p) **Auto-ignition temperature:** 650 °C.
- (q) **Decomposition temperature:** ammonia solution is water based. Anhydrous ammonia decomposition temperature is 450 °C.
- (r) **Viscosity:** 0.00982 cP at 20 °C (NH₃).
- (s) **Explosive properties:** Anhydrous ammonia is not explosive. Validation: The conclusion of the ammonia registration in REACH is based on a theoretical assessment of the structure of ammonia. Ammonia mixtures are explosive with air in the range of 16 – 28% vol.
- (t) **Oxidising properties:** In accordance with REACH regulation Annex VII column 2 it is not determined using an explanation: non-oxidising based on the theoretical assessment of the chemical structure.

9.2 Other information

Mix well with water.

SECTION 10. STABILITY AND REACTIVITY

10.1 Reactivity

Ammonia reacts with hypochlorites, mercury and halogens, producing unstable explosive compounds. Destroys copper, zinc, aluminum, cadmium and their compounds. Reacts with mercury and silver oxides to form compounds that are explosive from mechanical shock. Ammonia vapors can react violently with nitrogen oxides and strong acids.

10.2 Chemical stability

Stable under appropriate conditions. Not polymerize. See section 10.3 for more details.

10.3 Possibility of hazardous reactions

Can form unstable or explosive compounds with halogens, strong oxides, nitric acid, fluorine, nitrogen oxides, hypochlorites, silver, mercury, lead. Tightly reacts with strong acids, nitrogen oxides. Ammonia forms explosive mixtures with air and hydrocarbons, ethanol, silver nitrate, chlorine. Contains explosive products in response to silver chloride, silver oxide, bromine, iodine, gold, mercury, and telomerur halite. Ammonia is incompatible, which may lead to dangerous reactions, with silver, acetylaldehyde, halogens, perchlorates, hydrochloric acid, chlorine monoxide, chlorite, nitrogen tetroxide, tin and sulfur. When heated above 454 °C, it decomposes in the presence of hydrogen. In the case of certain metals, such as nickel, the dehumidification temperature may drop to 300 °C. At 690 °C and in the case of electrical sparking, ammonia decomposes into nitrogen and hydrogen, which can form combustible mixtures with air.

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10.4 Conditions to avoid

Heating, mechanical damage to the container. Keep away from direct sunlight. Protect from heat and ignition sources.

10.5 Incompatible materials

Halogens, nitric acid, hypochlorites and other acids, silver, mercury, lead, strong acids and nitrogen oxides, oxidants, acrolein, acrylic acid, dimethyl sulphate, silver nitrate, silver oxide, copper, gold, zinc, tin, aluminum, cadmium and their compounds, sulfur, fluorine, chlorine, chlorine monoxide, chlorites, bromine, iodine, gold, silicon aluminides, hydrocarbons, ethanol, acetylaldehyde, perchlorates. For the possibility of hazardous reactions see section 10.3.

10.6 Hazardous decomposition products

Hydrogen, nitrogen oxides. The ammonia vapor is released by heating the solution. See section 5 for fire extinguishing media.

SECTION 11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Acute toxicity: the product (25 % ammonia solution) does not match the classification criteria according to EC Regulation no. 1272/2008.

Anhydrous ammonia data

	Effect dose	Species	Method	Remark
Acute oral toxicity	LD50 350 mg/kg bw	Wistar male rats	Acute Oral Toxicity	Probit Analysis
Acute dermal toxicity	Not determined due to ammonia is corrosive to the skin			
Acute inhalative toxicity	LC50 28130 – 9850 mg/m ³	Wistar male and female rats	Assessment of acute inhalation toxicity in the rat following various exposure periods.	Results are the range from 10 minutes exposure to 60 minutes exposure.

Long term toxicity: Anhydrous ammonia data

	Effect dose	Value	Exposure time period	Species	Method	Evaluation	Remark
Sub-acute oral	68 mg/kg	NOAEL	35 days	CD male and female rats	Combined Repeated dose Toxicity Study with the Reproduction/Developmental Toxicity Study	No marked toxicity	
Sub-chronic inhalative	35 or 63 mg/m ³	NOAEC	50 days	Wistar rats, male	Subchronic inhalative toxicity of ammonia in the rat.	No systemic toxicity, however, the primary effect is local irritation of the respiratory tract.	

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Skin irritation or/and sensitization: product (25 % ammonia solution) in accordance with Regulation (EC) No. 1272/2008 it is classified as skin corrosion / irritation Cat. 1B.

	Exposure time	Species	Evaluation	Method	Remark
Primary irritation to the skin	n/a	Human	Corrosive	–	Skin pH was determined to be 10
Irritation to eyes	n/a	n/a	Highly irritating	n/a	No study conducted, however, based on the results of the skin irritation, it can be assumed that eye irritation will occur.

Sensitizing of the airways or skin: product (25 % ammonia solution) in accordance with Regulation (EC) No. 1272/2008 it is classified as skin corrosion / irritation Cat. 1B.

The effect of the product on respiratory and skin sensitization has not been established since the product already meets classification as skin corrosion / irritation Cat. 1B.

Mutagenicity: product (25% ammonia solution) does not meet the criteria for classification in accordance with Regulation (EC) No. 1272/2008. Validation: There is no indication of mutagenicity while testing *in vitro* for bacterial inverse mutation and *in vivo* micronucleus test. The Ames test, performed with ammonia, is negative (with and without the metabolic activation). Referred to registration of ammonia in accordance with REACH dossier data.

Carcinogenicity: product (25% ammonia solution) does not meet with the classification criteria in accordance with Regulation (EC) No. 1272/2008. Validation: Studies conducted with ammonium sulphate showed no signs of carcinogenicity. An ammonia exposure study has shown that long-term exposure via drinking water which has ammonia in it can lead to gastritis that stimulates stomach carcinogenesis. However, there is no evidence that ammonia is carcinogenic. Referred to registration of ammonia in accordance with REACH dossier data.

Reproductive toxicity: product (25% ammonia solution) does not meet the classification criteria in accordance with Regulation (EC) No. 1272/2008. Validation: Ammonia registration in the REACH dossier states that no evidence of reproductive toxicity has been identified in ammonium salts studies. Based on the physiological role of ammonia, it was concluded that ammonia is not able to cause reproductive toxicity.

Specific target organ toxicity (STOT) (single exposure): product (25% ammonia solution) in accordance with Regulation (EC) No. 1272/2008 is classified as specific to the specific organ toxicity-single exposure category 3.

Specific target organ toxicity (STOT) (repeated effects): product (25% ammonia solution) does not meet the classification criteria in accordance with Regulation (EC) No. 1272/2008.

Aspiration hazard: does not meet the classification criteria in accordance with Regulation (EC) No. 1272/2008.

SECTION 12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxic to aquatic organisms. In accordance with Regulation (EC) No. 1272/2008 is classified as hazardous to the aquatic environment 1 „acute hazard category”, hazardous to the aquatic environment 2 „chronic hazard category”.

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Ammonia anhydrous data from ammonia registration in REACH dossier

Aquatic toxicity	Effect dose	Exposure time	Species	Method	Evaluation	Remark
Acute fish toxicity	LC50	96 h	Onchorynchus mykiss		0.89 mg/L unionised ammonia.	Result is pH and temperature adjusted.
Acute daphnia toxicity	EC50	48 h	Daphnia magna	Freshwater static, equivalent to ASTM E729-80.	101 mg/L	Results based on mortality
Acute algae toxicity	EC50	18 days	Chlorella vulgaris	Freshwater, static	7200 mg/L	Result based on cell number
Chronic fish toxicity	LOEC	73 days	Onchorynchus mykiss		0.022 mg/L	Result based on mortality
Chronic daphnia toxicity	NOEC	96 h	Daphnia magna	Freshwater flow-through equivalent or similar to EPA OPPTS 850.1300 (Daphnid Chronic Toxicity Test)	0.79 mg/L unionised ammonia	Result based on mortality

12.2 Persistence and degradability

Not considered to be persistent and is rapidly biodegradable in aquatic systems. In abiotic environments, ammonia is assimilated by aquatic algae and macrophytes for use as a nitrogen source.

The registration of ammonia in the REACH documentation states that ammonia dissipates relatively quickly in ambient air and rapidly returns to the soil via combination with sulfate ions or washout by rainfall. Ammonia strongly adsorbs to soil, sediment particles and colloids in water under aerobic conditions. Biodegradation of ammonia to nitrate occurs in water under aerobic conditions resulting in a biological oxygen demand (BOD).

12.3 Bioaccumulative potential

The accumulation of ammonia in biota is not considered of importance in the environment as it does not accumulate in lipid-rich tissues in the same manner as organic chemicals. Ammonia is ubiquitous in the aquatic environment due to the breakdown of plant and animal material and due to animal excretory processes. Based on the chemical nature of ammonia and the fact that it is a product of animal metabolism, ammonia registration in the REACH documentation states that bioaccumulation of ammonia is unlikely.

12.4 Mobility in soil

There is limited mobility in soil expected due to the strong adsorption of ammonium ions to clay minerals and the bacterial oxidation to nitrate. Ammonia in soil is in dynamic equilibrium with nitrate and other substrates in the nitrate cycle.

12.5 Results of PBT and vPvB assessment

This substance is not identified as a PBT substance.

12.6 Other adverse effects

No further details.

SECTION 13. DISPOSAL CONSIDERATIONS

13.1 Waste from residues

13.1.1 Waste treatment methods:

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Waste from residues. Ammonia solution waste in accordance with Regulation (EU) 1357/2014 is classified as hazardous waste by **HP 8** „Corrosive“ hazard statement H314 „Causes severe skin burns and eye damage“; **HP 5** „ Specific target organ toxicity and aspiration hazard“ hazard statement H335 „May cause respiratory irritation“, **HP 14** „Ecotoxicity“ hazard statement H412 „Harmful to aquatic life with long lasting effects“.

Packaging waste. Ammonia solution packaging waste in accordance with Regulation (EU) 1357/2014 is classified as hazardous waste. The codes assigned to these wastes depend on the amount of ammonia solution remaining in the packaging waste. Packages containing up to 5 % ammonia solution are classified as hazardous waste by **HP 14** „Ecotoxicity“ hazard statement H412 „Harmful to aquatic life with long lasting effects“.

Packages containing up to 20 % ammonia solution are classified as hazardous waste by **HP 8** „Corrosive“ hazard statement H314 „Causes severe skin burns and eye damage“ and **HP 14** „Ecotoxicity“ hazard statement H412 „Harmful to aquatic life with long lasting effects“.

Packages containing more than 20 % ammonia solution are classified as hazardous waste by **HP 8** „Corrosive“ hazard statement H314 „Causes severe skin burns and eye damage“, **HP 5** „ Specific target organ toxicity and aspiration hazard“ hazard statement H335 „May cause respiratory irritation“ and **HP 14** „Ecotoxicity“ hazard statement H412 „Harmful to aquatic life with long lasting effects“.

13.1.2 Information related to waste disposal. Waste of ammonia solution must be diluted with water and accumulate in closed containers. Keep locked. Dispose of contents / container in stainless steel / plastic containers, labeled with packs / containers. Ammonia solution waste must be handled in accordance with the Law on Waste Management and regional and local laws of the Republic of Lithuania.

Empty containers, respectively neutralized and washed, can be recycled as non-hazardous waste. Empty containers can contain ammonia vapours, that when mixed with air may form explosive mixtures, therefore do not drill cut, grind or weld empty containers. The used packaging is dangerous and must be handled in accordance with the Republic of Lithuania „Packaging and packaging waste management law“ as well as regional and local laws. The used packaging may be temporarily stored, properly marked, until the transfer to the company registered in the „Waste Management Act“ to manage the waste.

13.1.3 Related information about the disposal of sewage: ammonia is toxic to aquatic life. It is forbidden to release water contaminated by the product into the environment or into the water drain. Wastes of ammonia and its mixtures may be temporarily stored in appropriate, closed, properly labeled containers until the transfer to the company registered in the „Waste Management Act“ to manage the waste.

13.1.4. Other disposal recommendations: none.

SECTION 14. TRANSPORT INFORMATION

14.1 UN number

2672.

14.2 UN proper shipping name

Ammonia solution.

14.3 Transport hazard class(es)

8.

14.4 Packing group

III.

14.5 Environmental hazards

Environmentally hazardous substance.

14.6 Special precautions for user

Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Bulk transport in accordance with Annex II of MARPOL73 / 78 and IBC Code. Does not apply to packaged goods.

SECTION 15. REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

EU legislation:

- Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC;
- Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH);
- Commission Regulation (EC) No 552/2009 of 22 June 2009 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Annex XVII;
- REGULATION (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006;
- Commission Regulation (EU) No 1357/2014 of 18 December 2014 replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives;
- Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC;
- Regulation (EU) No 98/2013 of the European Parliament and of the Council of 15 January 2013 on the marketing and use of explosives precursors;
- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);
- The International Rule for Transport of Dangerous Substances by Railway (RID);
- The International Maritime Dangerous Goods (IMDG);
- International Convention for the Prevention of Pollution from Ships (MARPOL 73/78);
- The International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code) (the IBC Code).

National legislation (Lithuania):

- Applicable Law on Waste Disposal of the Republic of Lithuania;
- Applicable Law on Package and Package Waste Handling of the Republic of Lithuania;
- HN23 Maximum Allowable Concentrations of Hazardous Chemical Substances and Preparations in Working

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Environment. General Requirements;

- HN36 Banned and Restricted Substances;
- Applicable Regulations for Workers "Protection against the Impact of Chemical Factors" and Regulations for Workers „Protection against Carcinogenous and Mutagenous Impacts“;
- Applicable Procedure of Safety Data Sheet Requirements and Supply thereof to Professional Users;
- Applicable Rules on Labeling of Items (Products) to be Sold in Lithuania and Referring Price thereof;
- Applicable Rules on Waste Disposal;
- 17 of August 2004 Governments of the LR resolution No. 966 „On Prevention, Response and Investigation of dangerous objects and substances, mixtures or preparations classified as hazardous materials, and a list of criteria for designation of the Approval" subsequently amended and supplemented. (Official Gazette, 2004, No. 130-4649; 2005 No. 131-4731, 2008, No. 109-4159; 2009 No. 90-3855; 2010, No. 59-2894; 2012 No. 61-3078), as amended and supplemented.

Additional information on the relevant Community provisions on safety, health and the environment for the product:

The product is a dangerous substance, which is subject to the Government of the Republic Regulation No. 18.08.2004. 966 „On the Approval of the Description and List of Criteria for the List of Substances, Mixtures or Preparations Substances of Hazardous Substances in Hazardous Substances“ (Official Gazette, 2004, No. 130-4649) with all subsequent amendments and supplements And listed in Part 2 of Annex I to Directive 2012/18 / EU.

Restrictions on the product as regards Regulation (EU) No. 98/2013: not applicable.

15.2 Chemical safety assessment

A chemical safety assessment has been conducted. See annex.

SECTION 16. OTHER INFORMATION

Revision date: 2018.02.28

Version: 3.0

Revision No. 0

Issuing date: 2018.02.28

(i) A clear evidence of added, deleted or modified information:

The safety data sheet, as compared to its previous version, has been modified in accordance with Commission Regulation (EU) No. 2015/830 requirements. Other changes were made:

- section 1: product using information was modified, emergency number was modified;
- section 4: revised and supplemented first aid measures;
- section 7: revised product handling and storage conditions;
- section 8: recorded DNEL, PNEC data, new requirements for personal protective equipment;
- section 9: revised physicochemical properties of the product;
- section 11: introduced additional toxicological data under the REACH dossier;
- section 12: revised ecological information;
- section 13: revised information on waste management;
- section 15: introduced Regulation data.

(ii) List of abbreviations and acronyms used throughout the Safety Data Sheet:

Acute Tox.3 – Acute toxicity Category 3;

ADR – European Agreement on Dangerous Goods by Road;

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ATE – Acute toxicity estimates;
Aquatic Acute 1 – Dangerous for the aquatic environment category 1 „acute hazard category”;
Aquatic Chronic 2 – Dangerous for the aquatic environment category 2 „chronic hazard category”;
C&L – Classification and labeling;
CLP – Classification, Labeling and Packaging regulation; Regulation (EC) No. 1272/2008;
CAS – Chemical Abstracts Service;
CSR – Chemical Safety Report;
DNEL – Derived No-Effect Limit;
EC – European Commission;
ECHA – European Chemicals Agency;
EC₅₀ – Effective concentration in 50% of the target population;
EC No. – EINECS and ELINCS numbers;
EFMA – European Fertilizers Manufactures Association.
EINECS – European Inventory of Existing Commercial Chemical Substances.
ELINCS – European List of New Chemicals.
EN – European norm;
EU – European Union;
Flam Gas 2 – Flammable gas category 2;
GHS – Generally Harmonized System;
HN – Hygiene norm;
IBC Code – The International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk;
IMDG – International Maritime Dangerous Goods Code;
IMSBC – International Bulk Cargo Code;
IPRD – Long-term Exposure Limit;
IUCLID – International Database of General Information on Chemicals;
IUPAC – International Union of Pure and Applied Chemistry;
UN – United Nations;
Kow – octanol-water partition coefficient;
LC₅₀ – Median lethal concentration in 50% of the population under study;
LD₅₀ – Median lethal doze in 50% of the population under study;
LOEC – Minimum observed effect concentration;
LT – Lithuanian;
MARPOL 73/78 – International Convention for the Prevention of Pollution from Ships;
NOAEC – Concentration of non-observation negative effect;
NOEC – Concentration of non-observation effect;
OJ – Official Journal;
PBT – Persistent bioaccumulative toxicity;
PEC – Predicted environmental concentration;
PNEC – Predicted no effect concentration;
PPE – Personal protective equipment;
Press Gas – Pressurized gas;
REACH – Registration, Evaluation, Authorization and Restrictions;
RID – Regulations Concerning the International Carriage of Dangerous Goods by Rail;
RV – Limit value in working environment;
RMP – Risk Management Tools;
SCBA – Self-contained breathing apparatus;
Skin Corr 1B – Skin corrosion / irritation Category 1B;
SDS – Safety Data Sheet;

SIEF – Chemical Substance Information Exchange Forum;
STOT – Specific target organ toxicity;
(STOT) RE – Repeated exposure;
(STOT) SE – One-time effects;
SVHC – Severely critical substance;
TPRD – Short-term exposure limit;
UN – United Nations;
(Q) SAR – (Quantitative) structure and property relationship;
vPvB – Very persistent, very bioaccumulative.

Explanation of Utilization Sector (S):

SU5 – Manufacture of textiles, leather, fur;
SU9 – Manufacture of purified chemicals;
SU10 – Preparation or repackaging;
SU11 – Manufacture of rubber products;
SU12 – Manufacture of plastics, including blending and recycling;
SU16 – Manufacture of computer, electronic and optical products, electrical equipment;
SU0 – Other.

Product category (PC) explanation:

PC0 – Other.
PC7 – Untreated Crude metals and alloy.
PC9a – Coatings, paints, fillers, diluents.
PC12 – Fertilizer.
PC14 – Metal surface processing products, including galvanic and galvanic products.
PC15 – Non-surface metal processing products.
PC19 – Intermediate.
PC20 – Products such as p-regulators, flocculants, sedimentation tanks, neutralizing agents.
PC23 – Tanning, dyeing, finishing, impregnating and maintaining the leather.
PC30 – Photochemicals.
PC33 – Semiconductors.
PC34 – Textile paints, finishing and impregnation products.
PC35 – Washing and cleaning equipment (including solvents).
PC39 – Cosmetics.

(iii) Bibliography:

- 1) Registration of ammonia in accordance with REACH dossier, published on the website of the European Chemicals Agency.
- 2) Company standard IST 156667399-05 Ammonia solution.
- 3) <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>.
- 4) <http://echa.europa.eu/information-on-chemicals/registered-substances>.
- 5) EN 166 „Personal eye protection - Specifications; English version of DIN EN 166“.
- 6) DIN EN ISO 374-1 „Protective gloves against dangerous chemicals and micro-organisms - Part 1: Terminology and performance requirements for chemical risks (ISO 374-1:2016)“.
- 7) DIN EN 374-2 „Protective gloves against dangerous chemicals and micro-organisms - Part 2: Determination of resistance to penetration“.
- 8) DIN EN 374-4 „Protective gloves against chemicals and micro-organisms - Part 4: Determination of resistance to degradation by chemicals“.
- 9) CSN EN 402 „Respiratory protective devices - Lung governed demand self-contained open-circuit

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compressed air breathing apparatus with full face mask or mouthpiece assembly for escape - Requirements, testing, marking“.

10) EN 14605 „Protective clothing against liquid chemicals - Performance requirements for clothing with liquid-tight (Type 3) or spray-tight (Type 4) connections, including items providing protection to parts of the body only (Types PB [3] and PB [4])“.

11) DIN EN 388 „Protective gloves against mechanical risks“.

12) DIN EN ISO 20345 „Personal protective equipment - Safety footwear (ISO 20345)“.

13) DIN EN 14387 „Respiratory protective devices - Gas filter(s) and combined filter(s) - Requirements, testing, marking“.

(iv) Applicable classification and procedures used to determine the classification of mixtures in accordance with Regulation (EC) No. 1272/2008 [CLP Regulation]

Classification in accordance to regulation (EC) No. 1272/2008	Classification procedure
Skin Corr. 1A, H314	Based on the specific concentration limits that were determined by the nitric acid leading registrant with a calculating method and included in the nitric acid registration REACH dossier.
Specific target organ toxicity and aspiration hazard 3, H335	
Harmful to aquatic life with long lasting effects 1, H400	
Harmful to aquatic life with long lasting effects 2, H411	

(v) Hazard and precautionary statements:

H314 – Causes severe skin burns and eye damage.

H335 – May cause respiratory irritation.

H400 – Very toxic to aquatic life.

H411 – Toxic to aquatic life with long lasting effects.

P260 – Do not breathe dust/fumes/gas/mist/vapours/sprays.

P264 – Wash hands thoroughly after handling.

P280 – Wear protective gloves / protective clothing / eye protection / face protection.

P301+P330+P331 – IF SWALLOWED: rinse mouth. Do NOT induce vomiting.

P303+P361+P353 – IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

P363 – Wash contaminated clothing before reuse.

P304+P340 – IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P310 – Immediately call a POISON CENTER or doctor/physician.

P321 – Specific treatment: If on skin wash with 0,5 % boric acid solution.

P305+P351+P338 – IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P405 – Store locked up.

(vi) Training Advice:

Workers must be trained in the proper use and handling of this product as required under applicable regulations. The user's attention is drawn to possible other provisions that complement these requirements. Adhere to all applicable national, international and local requirements or regulations. People handling this product must be trained to work with hazardous substances, ammonia, hygiene skills, working with hazardous substances, ammonia properties and risks.

NOTE. The information provided in this safety data sheet is correct to the best of our knowledge, information, and belief at the date of its publication. The information given is designed only as guidance for safe handling,

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use, processing, storage, transportation, disposal, and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any proceed, unless specified in the text.

Release info: This version replaces all previous documents.

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ANNEX

Exposure scenarios:

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Exposure scenario (5): Manufacturing and industrial use of ammonia solution concentration 5 – 25 %.

1. Exposure scenario (5)	
Manufacturing and industrial use of ammonia solution concentration 5 – 25 %.	
2. Description of activity and process exposure scenarios	
Sector of use (SU) and product category (PC)	SU0, SU5, SU9, SU10, SU11, SU12, SU16, PC0, PC7, PC9a, PC12, PC14, PC15, PC19, PC20, P23, PC30, PC33, PC34, PC35, PC39
Process category (PROC)	<p>1. PROC 1: Use in closed process, no likelihood of exposure.</p> <p>2. PROC 2: Use in closed, continuous process with occasional controlled exposure.</p> <p>3. PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.</p> <p>4. PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.</p>
Article category (AC)	Not applicable
Environmental release category (ERC)	<p>ERC 8a Wide dispersive indoors use of processing aids in open systems;</p> <p>ERC 8b Wide dispersive indoors use of reactive substances in open systems;</p> <p>ERC 8d Wide dispersive outdoor use of processing aids in open systems;</p> <p>ERC 8e Wide dispersive outdoors use of reactive substances in open systems;</p> <p>ERC 9a Wide dispersive indoors use of chemicals in indoors systems;</p> <p>ERC 9b Wide dispersive outdoors use of chemicals in indoors systems;</p> <p>ERC 11a Wide dispersive indoors use of durable goods and materials.</p>
3. Operational conditions	
3.1 Operational conditions related with frequency and quantities of use	
Duration of exposure at workplace:	8 hours/day
Frequency of exposure at workplace:	220 days/year for each worker
Annual amount used per site:	Not applicable
3.2 Operational conditions related with substance/ product	

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Physical state	Transparen, colorless to pale yellow liquid
Concentration of substance in mixture	Ammonia solutions containing 5% up to 25%.
3.3 Other relevant operational conditions	
Based on the information retrieved, the maximum duration considered for this exposure scenario is a working shift 1-4 h or > 4h per day, the processes take place outside, indoors without LEV or with LEV.	
4. Risk Management Measures	
4.1 RMMs related to workers	
Organisational measures	Workers in the identified risky process/areas should be trained a) to avoid to work without protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects of nitric acid and c) to follow the safer procedures instructed by the employer The employer has also to ascertain that the required PPE is available and used according to instructions.
Technical measures	Local exhaust / general ventilation is required. Use closed/ automated systems or covering of open containers (e.g. screens) to avoid irritating mists, sprayings and potential splashes. Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.) Use of pliers, grip arms with long handles with manual use “to avoid direct contact and exposure by splashes (no working over one’s head)”. Store in cool, dry, clean, well ventilate areas away from alkaline products and metals. Do not store under direct sun light. Do not pile up the containers. Do not store at temperatures close to freezing point. Protect from heat and ignition sources. Compatible materials: stainless steel; low-carbon steel, polyethylene, polypropylene.
Respiratory protection	Under normal operating conditions, respiratory protection is not required, in case of emergencies or in the case of overflows, filtration A2B2E2K2 or analogue grade gas masks are recommend. Self-contained breathing apparatus and full body protective suit in case of large spill. Use the EU Respiratory Protection (RPE).
Hand protection	Hand protection is required: use impervious chemical resistant protective gloves complying with EN 374, EN 388 material (required): neoprene-latex.
Eye protection	Wearing of eye/face protection is required. Face protection shield EN 1731 or equivalent are required.
Skin and body protection	Wearing protective clothing and boots EN 20345 is required.

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Hygiene measures	Work with clean work clothes, wash hands with soap before breaks and at end of work. Keep work clothes separately.
4.2 RMMs related to the environment	
Organisational measures	Procedural and/or control technologies are required to minimize emissions and the resulting exposure during cleaning and maintenance procedures.
Abatement measures related with wastewater	Ammonia solution wastewater should be reused or discharged to the industrial wastewater and further neutralized if needed
Abatement measures waste air and solid waste	Ammonia solution does not contain solid waste.
4.3 Waste related measures	
Type of waste	Liquid waste. Packaging material.
Disposal technique	The neutralized liquid can be spilled in accordance to regulatory normative. The residue of the containers or the used container itself should be disposed in accordance with local requirements.
Fraction released to environment during waste treatment	The pH of wastewater released from manufacturing sites should be between pH 6-9.

5. Prediction of exposure resulting from the conditions described above and the substance properties

For professional worker on skin (5 – 25% hydrous ammonia)

PROC code	Exposure assumptions		ES 4 – exposure concentration (EC), mg/m ³		Acute/Long term systemic effect DNEL=6.8 mg/kg Risk profile ratio (RCR)	
	Duration	Use of ventilation	No gloves worn	Gloves worn (90% reduction)	No gloves worn	Gloves worn (90% reduction)
PROC1	1-4h or > 4h	Outdoors/indoors without LEV	0.34	0.03	0.05	0.01
PROC2	1-4h or > 4h	Outdoors/indoors without LEV	1.37	0.14	0.20	0.02
		Indoors with LEV	0.14	0.01	0.02	<0.01
PROC8a	1-4h or > 4h	Outdoors/indoors without LEV	13.71	1.37	2.02	0.20
		Indoors with LEV	0.14	0.01	0.02	<0.01
PROC8b	1-4h or > 4h	Outdoors/indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01

For professional worker, inhaled (5 – 25% hydrous ammonia)

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PROC code	Exposure assumptions		ES 4 – exposure concentration (EC), mg/m ³		Short term/Long term systemic effect DNEL=47.6 mg/m ³		Short term/Long term systemic effect DNEL=36 mg/m ³		Short term/Long term systemic effect DNEL=14 mg/m ³	
					RCR		RCR		RCR	
	Durati on	Use of ventilation	No RPE	RPE (95% reduction)	No RPE	RPE (95% reduction)	No RPE	RPE (95% reduction)	No RPE	RPE (95% reduction)
PROC1	1-4h or > 4h	Outdoors	0	NA	<0.01	NA	<0.01	NA	<0.01	NA
		Indoors with LEV	0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA
PROC2	> 4h	Outdoors	30.63	1.53	0.64	0.03	0.85	0.04	2.19	0.11
		Indoors without LEV	43.75	2.19	0.92	0.05	1.22	0.06	3.13	0.16
		Indoors with LEV	4.38	0.22	0.09	0	0.12	0.01	0.31	0.02
PROC2	1-4h	Outdoors	18.38	0.92	0.39	0.02	0.51	0.03	1.31	0.07
		Indoors without LEV	26.25	1.31	0.55	0.03	0.73	0.04	1.88	0.09
		Indoors with LEV	2.63	0.13	0.06	0	0.07	<0.01	0.19	0.01
PROC8a	> 4h	Outdoors	153.1	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.8	10.9	4.60	0.23	6.08	0.30	15.60	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
PROC8a	1-4h	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.2	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
PROC8b	> 4h	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.2	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	3.94	0.20	0.08	0	0.11	0.01	0.28	0.01
PROC8b	1-4h	Outdoors	55.13	2.76	1.16	0.06	1.53	0.08	3.94	0.20
		Indoors without LEV	78.75	3.94	1.65	0.08	2.19	0.11	5.63	0.28
		Indoors with LEV	2.36	0.12	0.05	0	0.07	<0.01	0.17	0.01

For professional worker by mouth:

Under normal hygiene conditions there is no exposure by mouth.

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5.2. Environmental exposure (qualitative assessment)	
PKA values according to EUSES 2.1:	
PKA (PEC)	Value
PKA sewage	0
PKA water (mg/L) Fresh water Sea water	3.48x10 ⁻³ 7.61x10 ⁻⁴
PKA sediment (mg/kg) Fresh water sediments Sea water sediments	3.76x10 ⁻³ 8.24x10 ⁻⁴
PKA soil and groundwater	In soil, ammonia microorganisms oxidize to nitrate ion. Nitrates are reduced to free atmosphere nitrogen – denitrification process. Nitrate ions move with soil water and wash it easily from the soil.
PKA atmospheric compartment (mg/m ³)	36.1

6. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

- Emissions from the waste-water stream should be completely removed.
- Residues may be sent to external waste treatment, on-site effluent treatment or recycled back into the manufacturing process.
- Measured emissions should be ensured to lead to concentrations in the environment which are less than the relevant PNEC.
- LEV should be in place in indoors facilities at times when natural ventilation is not sufficient.
- Health monitoring should be conducted regularly to ascertain the potential levels of exposure.
- Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) should be worn when any potential contact may arise.
- Workers should be fully trained.
- All technological devices should have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.