

Product Safety Summary for Ammonia

SUBSTANCE NAME

Anhydrous Ammonia
Ammonia, anhydrous
Ammonia
Azane

GENERAL STATEMENT

Ammonia in the anhydrous (gas) form is a colorless gas with a very distinct odor, and it is one of the most highly produced inorganic chemicals. Anhydrous and aqueous (liquid) ammonia are extensively used across a broad range of industrial, professional and domestic applications. Anhydrous Ammonia is used in fertilizer, cleaning agents, refrigerants, and as a chemical intermediate. Anhydrous ammonia is a gaseous substance at room temperature. The general public and consumers should not come in direct contact with Anhydrous Ammonia. Workers should have specific training to handle this substance.

CHEMICAL IDENTITY

EC Name: Ammonia, anhydrous

EC-No. : 231-635-3

CAS-No. : 7664-41-7

Molecular formula: H₃N

Structural formula:



USES AND APPLICATIONS

Ammonia Anhydrous is used in industrial applications for the formulation of mixtures, as an intermediate, as reactive agent or processing aid for water treatment, as heat transfer fluid for cooling/heating systems, as process nutrient for pharmaceuticals, food and biofuel and for treatment of several surfaces/articles such as leather, plastic, wood and semiconductors. Professional uses in the public domain are found in the education, entertainment, laboratories and craftsmen services, as well as in the agriculture as fertilizer. Consumers may be exposed to aqueous ammonia when using a variety of common household products including Do-It-Yourself (DIY) products such as coatings, paints, thinners and removers, washing and cleaning products (e.g. all-purpose liquid), and cosmetic, personal care products such as hair dyes.

PHYSICAL CHEMICAL PROPERTIES

Anhydrous ammonia is a colorless gas at room temperature and pressure and has very sharp odor. Anhydrous ammonia is a flammable gas.

Melting point/range: -77.7 °C

Boiling point/boiling range: -33 °C

Flammability (solid, gaseous): Flammable

Ignition temperature: 651 °C (1013 hPa)

Explosion limits:

Lower: 16 Vol %

Upper: 25 Vol %

Molecular weight: 17.03056

log Pow: 0.23 (at 20 °C)

Vapor pressure: 8611 hPa (at 20 °C)

Vapor density: 0.59 g/cm³

Dissociation constant: 9.25 (at 25 °C)

Relative density: 1.77 g/cm³ at 25 °C

Solubility in/Miscibility with water: 482 g/l (at 25 °C)

HEALTH EFFECTS

Anhydrous ammonia is gaseous therefore inhalation is the most common route of exposure. Based on the classification of the substance (REGULATION (EC) No 1272/2008) anhydrous ammonia is toxic by acute inhalation (Category 3). Acute, short-term and chronic, long-term inhalation or dermal exposures to ammonia can induce local and systemic effects. The critical local effect after acute or long-term inhalation exposures to ammonia is irritation of the respiratory tract. Anhydrous ammonia causes severe skin and eye damage (Category 1B). Shortness of breath, convulsions and discoloration of the limbs has also been observed. Following prolonged exposure to anhydrous ammonia, irritation to eyes, nose and throat was observed 2-3 weeks after inhalation exposure. The critical local effects after dermal exposures to ammonia are irritation and corrosivity to the eyes and the skin.

EFFECT ASSESSMENT	RESULT
Acute Toxicity (oral/dermal/inhalation)	Anhydrous ammonia is toxic by acute inhalation. The substance is a gas therefore; the oral route is not a relevant route of exposure.
Irritation/Corrosivity (skin/eye/respiratory tract)	Anhydrous ammonia Causes burns and is classified as corrosive to the skin and eyes.
Sensitization (skin/respiratory tract)	The local dermal effects of Anhydrous ammonia will be dominated by irritation/corrosion and sensitization to the skin or respiratory track is considered to be unlikely. The local respiratory tract effects of the substance will be irritation.
Mutagenicity	Available data indicate that Anhydrous ammonia does not

	cause mutagenicity.
Carcinogenicity	Ammonia is produced in significant quantities by the body during normal metabolism and therefore the substance is considered unlikely to be carcinogenic.
Reproductive Toxicity	There is no evidence that exposure to Anhydrous ammonia will cause reproductive toxicity.
Repeated Dose Exposure	There is no evidence of marked repeated dose toxicity.

ENVIRONMENTAL EFFECTS

The substance is a gas and is highly soluble in water. In water environments the substance rapidly forms ammonium hydroxide / aqueous ammonia, the aquatic toxicity data have therefore been generated using aqueous ammonia and related water-soluble ammonium forms. The toxic effects to the environment are primarily from the acidity changes that may occur. The acute toxicity of ammonia is also influenced to a lesser degree by temperature, carbon dioxide, dissolved oxygen, and salinity. The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter. Environmental exposure is not expected to add significantly to background levels of ammonia already present in the environment. Ammonia is assimilated by aquatic plants for use as a nitrogen source and is therefore predicted to be of low toxicity. Ammonia does not accumulate in sediments.

EFFECT ASSESSMENT	RESULT
Aquatic Toxicity	The substance is classified as very toxic to the environment (Aquatic Acute 1) due to the effects on fish. The toxicity of ammonia decreased as temperature increased from 12-22°C.

FATE AND BEHAVIOR	RESULT
Biodegradation	Readily biodegradable
Bioaccumulation potential	Not bioaccumulative
PBT/vPvB conclusion	This substance does not meet the criteria for classification as PBT or vPvB.

EXPOSURE

Human Health

Anhydrous ammonia is gaseous and the most relevant route of exposure is by inhalation. Industrial workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). Members of the public will not be exposed to anhydrous or aqueous ammonia as a result of industrial uses. Consumers may be exposed to aqueous solutions of ammonia at low concentrations when using a variety of products. Primary routes of exposure for consumers using common household products containing ammonia are the dermal and inhalation routes. Consumers are not expected to ingest ammonia

during the normal use of household products and oral exposures are unlikely. Consumer exposure to ammonia will depend on a number of factors including the frequency and duration of use and the content of anhydrous ammonia present in each product. DIY products are likely to be used intermittently during the year, for several consecutive days. Cleaning products are expected to be used more frequently e.g. several times per week. Consumers are likely to use hair dye products several times per year, possibly up to once/ month. The durations of product use per day are likely to vary across the applications.

Environment

The substance is gaseous in the environment; it will become associated with water or moisture and will therefore predominantly exist as aqueous ammonia. Ammonia is ever-present in the environment with <30% of emissions resulting from fertilizer uses and from non-agricultural sources. In addition, there is no evidence that ammonia bioaccumulates. The risk of indirect exposure of humans via the environment is therefore not considered probable. Removal of ammonia in sewage treatment plants is highly efficient. Upon contact with soil, ammonia will be rapidly converted to nitrate. Nitrate is subsequently taken up and utilized by plants or returned to the atmosphere through normal degradation processes. Therefore accumulation of concentrations of ammonia in soil and groundwater is not expected.

RISK MANAGEMENT RECOMMENDATIONS

The substance is classified as flammable, corrosive, toxic by inhalation and very toxic to aquatic organisms. The dermal and inhalation exposure of workers during and after normal operations should be minimized by the use of good industrial hygiene practice and general measures necessary for safety and health protection of workers. Risk Management Measures (RMMs) include the use of engineering controls such as process enclosure, use of local exhaust ventilation and use of special equipment with high integrity contained systems with little or no potential for worker exposure. All the operations shall be performed in closed systems, with pipelines and vessels properly sealed and insulated, and including extract ventilation in places where emission can occur. In addition, personal protective equipment shall be worn to minimize the potential for dermal and inhalation exposure. Then, workers shall wear protective gloves, safety glasses with side-shields, face protection, boots and protective work clothing. In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure, use self-contained respiratory protective device. Worker exposure should be minimized by the use of RMMs and risk communication through appropriate training. Exposure monitoring programs should be performed to ensure that workplace exposures are below statutory limits and the storage of the substance should be done in tightly sealed containers. Environmental exposure must therefore be minimized. This is achieved in practice by sending the vented gas to absorption and by discharging waste water containing the substance to standard temperature and pressure prior to environmental release to surface water.

STATE AGENCY REVIEW

This substance has been registered under REACH (EC) No. 1907/2006.

Anhydrous ammonia is on the OECD list of High Production Volume (HPV) chemicals.

Anhydrous ammonia is listed in the following Chemical Inventories: TSCA, EINECS, ENCS, AICS, DSL, KECI, PICCS, IESCS, and NZIOC.

REGULATORY INFORMATION/CLASSIFICATION AND LABELING

Classification of the substance according to REGULATION (EC) No 1272/2008:

Flammable gases:	Flammable gas 2; H221 Flammable gas.
Gas under pressure:	Pressurized gas; H280 Contains gas under pressure; may explode if heated.
Acute toxicity:	Category 3; Inhalation; H331 Toxic if inhaled.
Skin (Corrosion/irritation):	Category 1B; H314 Causes severe skin burns and eye damage.
Hazards to the Aquatic environment:	Aquatic Acute 1; H400 Very toxic to aquatic life.

Labeling according to REGULATION (EC) No 1272/2008:

Pictogram: #



Signal word: Danger

Hazard statements:	H221 Flammable gas.
	H280 Contains gas under pressure; may explode if heated.
	H331+EUH071 Toxic if inhaled. Corrosive to the respiratory tract.
	H314 Causes severe skin burns and eye damage.
	H400 Very toxic to aquatic life.

CONTACT INFORMATION WITHIN COMPANY

For further information on this substance or product safety summaries in general, please contact:

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Additional information can be found at:

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GLOSSARY

Acute toxicity	Harmful effect resulting from a single or short term exposure to a substance.
AICS	Australian Inventory of Chemical Substances.
Biodegradation	Decomposition or breakdown of a substance under natural conditions (actions of micro-organisms etc).
Bioaccumulation	Progressive accumulation in living organisms of a chemical substance present in the environment.
Canadian DSL	Domestic Substances List of Canada.
Carcinogenicity	Substance effects causing cancer.
CAS	Chemical Abstracts Service (division of the American Chemical Society).
Chronic toxicity	Harmful effect after repeated exposures or long term exposure to a substance.
EINECS	European Inventory of Existing Commercial Chemical Substances
ENCS	Existing Notified Chemical Substances (Japan).
Flash point	The lowest temperature at which vapor of the substance may form an ignitable mixture with air.
Genotoxicity	Substance effect that causes damage to genes, including mutagenicity and clastogenicity.
GHS	Globally Harmonized System of Classification and Labeling of Chemicals
HPV	High Production Volume Chemicals.
Hydrolyze	Undergo hydrolysis; decompose by reacting with water.
IECSC	Inventory of Existing Chemical Substances Produced or Imported in China.
Intermediate	Substance that is manufactured for and consumed in or used for chemical processing in order to be transformed into another substance.
KECI	Korean Existing Chemical Inventory.
Monomer	Means a substance which is capable of forming covalent bonds with a sequence of additional like or unlike molecules under the conditions of the relevant polymer-forming reaction used for the particular process.
Mutagenicity	Substance effect that cause mutation on genes.
NZIoC	New Zealand Inventory of Chemicals

PBT	Persistent, bioaccumulative, toxic chemical.
Persistence	Refers to the length of time a compound stays in the environment, once introduced.
PICCS	Philippine Inventory of Chemicals and Chemical Substances.
Risk Management Measures	Engineering controls, conditions and protective equipment needed to be implemented to ensure that the risks to human health and the environment are adequately controlled.
REACH (EC) No. 1907/2006	European Commission Regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals.
REGULATION (EC) No 1272/2008	European Commission Regulation on Classification, Labeling and Packaging of Substances and Mixtures.
Reproductive toxicity	Including teratogenicity, embryotoxicity and harmful effects on fertility.
Sensitizing	Allergenic.
Sediment	Topsoil, sand and minerals washed from land into water forming in the end a layer at the bottom of rivers and sea.
TSCA	Toxic Substance Control Act (USA).
Vapor pressure	A measure of a substance's property to evaporate.
vPvB	Very persistent, very bio-accumulative.

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