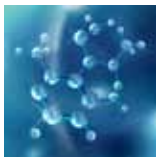
Honeywell

Application Note

Monitoring Ammonia


What is Ammonia?

Ammonia is a compound with the formula NH_3. It is normally encountered as a gas with a characteristic pungent odour. Although Ammonia contributes significantly to the nutritional needs of the earth, the gas itself is caustic and can cause serious damage to health.

Ammonia is one of the most important and widely produced chemicals in the petrochemical industry. In fact, over 200 million tonnes are produced worldwide every year.

When commercially used Ammonia is usually called Anhydrous Ammonia, this term emphasises the absence of water. NH3 boils at -33°C and the liquid must be stored under pressure or at a low temperature. However, the vaporisation heat is sufficiently high that NH3 can be handled in ordinary beakers in a fume hood.

Salts of Ammonia have been used for thousands of years by humans; in fact, the term Hammoniacus sal appears in the writings of Pliny (23-79 AD).

The Effects of Ammonia on organic life

Exposure to naturally occurring Ammonia in the air does not cause any harm. Exposure to higher levels of Ammonia (from inhaling fumes, absorption through the skin or from consuming it), can result in burns to the skin, throat, lungs and eyes. Exposure at very high levels can result in death.

Industrial applications using Ammonia

The main uses of Ammonia are in the production of fertilisers, explosives, and the synthesis of organonitrogen compounds. Because of its many uses, Ammonia is one of the most highly produced inorganic chemicals. Dozens of chemical plants Worldwide produce Ammonia and about 80% or more is used for fertilising agricultural crops.

Ammonia is used in the manufacture of Nitric Acid, certain alkalies such as soda ash, dyes, pharmaceuticals such as sulpha drugs, vitamins and cosmetics, synthetic textile fibres such as nylon, rayon and acrylics and for the manufacture of certain plastics such as phenolics and polyurethanes. The pulp and paper industry uses Ammonia for pulping wood and Ammonia is used in several areas of water and wastewater treatment, such as pH control, in solution form to regenerate weak anion exchange resins, in conjunction with Chlorine to produce potable water and as an Oxygen scavenger in boiler water treatment.

The Properties of Ammonia

Formula	NH_3
CAS No.	(Anhydrous) 7664-41-7
Molecular Weight	17.03
Melting Point	-77.7°C
Boiling Point	-33.4°C
Auto-Ignition Temp. (AIT)	651°C
Lower Explosive Limit (LEL)	15% v/v
Upper Explosive Limit (UEL)	28% v/v
Rel.Vapor Density (Air = 1)	0.59
STEL (10 mins)	35ppm / 25mg.m-3
LTEL (8hr TWA)	25ppm / 18 mg.m-3
Hazchem code	2PE & 2P

Short-term Exposure Limit (STEL) and Long-term Exposure Limit (LTEL) data taken from EH40/2005: Workplace Exposure Limits (as consolidated with amendments October 2007)

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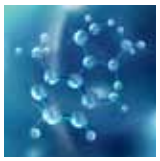


Manufacturing Processes

All the major processes for production of Ammonia depend on the synthesis of its separate Nitrogen and Hydrogen components in about a three-to-one ratio. The source for the Nitrogen is always by liquefaction of air, while Hydrogen can be obtained from a variety of sources such as natural gas, water, oil refining products such as Naptha or residual oils, coal etc. In all cases, part of the Hydrogen is derived from water.

Current Ammonia plants use a high capacity single train, with centrifugal compressors, highly active catalysts and efficient heat recovery to generate steam. A very high proportion of the current large scale manufacturing plants - almost 90% - use a process known as the Haber-Bosch (or just Haber) process. There are various versions of the Haber process depending on the raw materials used.

Small scale production, on the other hand, can only achieve similar scales of production efficiency and costs with the LCA (low cost Ammonia) process introduced by ICI. Unlike the single train approach, this method separates the elements of the process and uses tight system control and energy recovery to obtain cost savings.

Storing Ammonia

Anhydrous Ammonia is stable at normal temperatures and pressures but decomposes at temperatures above 450°C. It therefore has to be stored in steel containers with pressure relief valves and welded (not brazed) joints, since Ammonia will corrode copper, brass and bronze materials.

Detecting Ammonia

Many applications require Ammonia gas detection and these include:

- Wastewater treatment plants
- Petrochemical plants
- Chemical plants
- Refrigeration for food/drink storage

Ammonia is both flammable and toxic and is classified by the authorities as a hazardous substance. It has a lower explosive limit (LEL) of 15% Vol and according to EH40/2005 Workplace Exposure Limits (as consolidated with amendments October 2007), it has a STEL of 35ppm / 25mg/m^3. Consequently, there are a number of international safety regulations and standards including the wide use of gas detection and monitoring instrumentation.

Fixed point and portable gas detection equipment are widely used throughout an Ammonia manufacturing plant. This would also apply where Ammonia is used as the refrigerant in an industrial or commercial plants chilling and cooling systems.

Ammonia Density in relation to air

Ammonia is both lighter than air at normal temperature and pressure (NTP), and heavier than air at very cool temperatures:

- Lighter than air at NTP, meaning sensors should be placed in high lying areas
- Heavier than air when in cold storage (-20°C), meaning sensors should be placed in low lying areas

References:
EH40/2005 Workplace Exposure Limits (as consolidated with amendments October 2007)

Honeywell Analytics has a number of products optimised for the detection of Ammonia; from cost effective compliance solutions to high functionality devices that can reduce the ongoing cost of gas detection.

Series 3000 MkII
Intrinsically safe toxic gas transmitter with remote sensor mounting capability

Apex
High performance flammable and toxic gas detector with over 40 gases detectable

Sensepoint Range
ATEX certified Exd flammable, toxic and Oxygen detector with IP65/66 rating

Midas®
Extractive transmitter with sensor with over 40 detectable gases and power over Ethernet (PoE) comms/power platform

CM4
Continuous monitoring system for toxic gases on four points utilising Chemcassette technology

SPM Single Point Monitor
Single point monitor customised for harsh industrial environments with sensitivity to ppm/ppb

Vertex™
Central monitoring system with up to 72 points of continuous gas detection with optional Chemcam camera

Vertex M
Cost effective 8-24 point toxic gas monitoring with physical evidence of a leak

Satellite XT
High tech industry specific products for use in clean room environments with over 40 gases detectible

Sat-Ex
High tech industry specific products for use in clean room environments with over 40 gases detectible

GasAlertExtreme
Reliable single-gas monitoring with a wide variety of toxic gases supported

GasAlertMicro 5
Continuous monitoring of up to 5 gas hazards at an attractive price point

Impact Pro
High specification device capable of monitoring four gases simultaneously

Our Product Range

Fixed Gas Monitoring

Honeywell Analytics offers a wide range of fixed gas detection solutions for a diverse array of industries and applications including: Commercial properties, industrial applications, semiconductor manufacturers, energy plants and petrochemical sites.

- Detection of flammable, oxygen and toxic gases (including exotics)
- Innovative use of 4 core sensing technologies – paper tape, electrochemical cell, catalytic bead and infrared
- Capability to detect down to Parts Per Billion (ppb) or Percent by Volume (%v/v)
- Cost effective regulatory compliance solutions

Portable Gas Monitoring

When it comes to personal protection from gas hazards, Honeywell Analytics has a wide range of reliable solutions ideally suited for use in confined or enclosed spaces. These include:

- Detection of flammable, oxygen and toxic gases
- Single gas personal monitors – worn by the individual
- Multi-gas portable gas monitors – used for confined space entry and regulatory compliance
- Multi-gas transportable monitors – used for temporary protection of area during site construction and maintenance activities

Technical Services

At Honeywell Analytics, we believe in the value of great service and customer care. Our key commitment is providing complete and total customer satisfaction. Here are just a few of the services we can offer:

- Full technical support
- Expert team on hand to answer questions and queries
- Fully equipped workshops to ensure quick turnaround on repairs
- Comprehensive service engineer network
- Training on product use and maintenance
- Mobile calibration service
- Customised programmes of preventative/corrective maintenance
- Extended warranties on products

Find out more
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