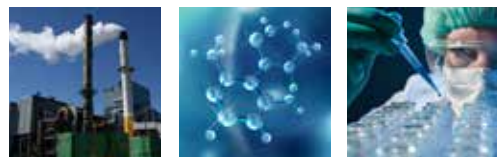
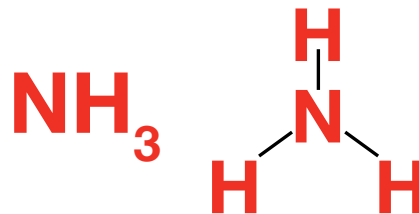


# Application Note

## Monitoring Ammonia



**Ammonia is a compound with the formula NH<sub>3</sub>. 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. NH<sub>3</sub> boils at -33°C/-27.4°F and the liquid must be stored under pressure or at a low temperature. However, the vaporisation heat is sufficiently high that NH<sub>3</sub> can be handled in ordinary beakers in a fume hood.

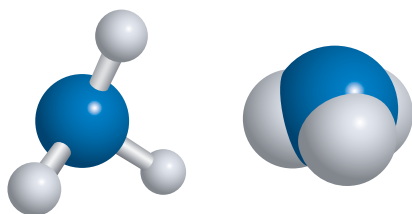
Salts of Ammonia have been used for thousands of years by humans; in fact, the term Hammoniacus sal appears in the writings of Pliny (23-79 AD).

### 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. It is also used in conjunction with Chlorine to produce potable water and as an Oxygen scavenger in boiler water treatment.

#### The Properties of Ammonia

Formula	NH <sub>3</sub>
CAS No.	(Anhydrous) 7664-41-7
Molecular Weight	17.03
Melting Point	-77.7°C/-107.9°F
Boiling Point	-33.4°C/-29.2°F
Auto-Ignition Temp. (AIT)	651°C/1,203.8°F
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 and 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 (United Kingdom data), INRS ED 984 (Aide Mémoire Technique) (French data), DHHS (NIOSH) Publication No. 2005-149 (North American data). Please check country-specific data for the STEL/LTEL in your location as national legislation may apply.*

### 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 (NG), 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 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/842°F. 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

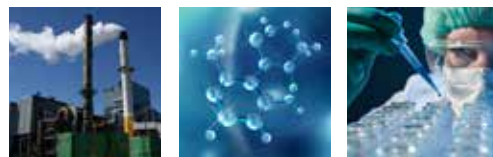
Many applications require Ammonia gas detection and these include:

- Wastewater treatment plants
- Petrochemical plants
- Chemical plants
- Refrigeration for food/drink storage
- Catalytic oxidation
- Hazardous Material (HAZMAT) emergency response

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

# Application Note

## Monitoring Ammonia



with amendments October 2007) and it has a STEL of 35ppm / 25mg/m<sup>3</sup>. Consequently, there are a number of international safety regulations and standards including the wide use of gas detection and monitoring instrumentation.

In France, the INRS Edition R242 regulation governs the storage of NH<sub>3</sub>, when used as a refrigerant. This means that cooling storage companies with 5,000 kg or more NH<sub>3</sub> located on-site must use fixed toxic gas detection monitoring.

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 plant's 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/-4°F), meaning sensors should be placed in low lying areas

### Fixed gas detection

#### Series 3000 MK III



The Series 3000 range of transmitters provide comprehensive monitoring of toxic and Oxygen gas hazards in potentially explosive atmospheres. Suitable for mounting both indoors and out, they are available in two versions and offer excellent versatility. The Mk III has an intrinsically Safe (IS) barrier allowing the complete transmitter to be used in Zone 0 applications, providing excellent flexibility for Ammonia monitoring.

#### Apex



Apex offers the highest performance and installation flexibility, combined with a wide range of accessories and a choice of communication outputs. The unit features a large backlit LCD display and simple four button operation, 3 fully configurable relay outputs and selectable sink, source or isolated 4-20mA signal. Apex sensors can be mounted directly on the transmitter or remotely up to 328 ft (100 m) away. The device's Intrinsically Safe (IS) design allows cartridges to be changed with the unit under power and Apex recognises a newly fitted sensor helping to reduce ongoing maintenance.

#### Sensepoint Range



The Sensepoint range of flammable, toxic and Oxygen gas detectors offer users a low-cost solution to their gas monitoring needs, in or out of doors and even in potentially explosive atmospheres. Supplied with a pre-wired junction box, a detector can be installed using conduit or armoured cable and glands depending on individual site standards. These devices are designed for use in potentially explosive atmospheres and allow for hands free, unhindered access to terminals via the hinged lid of the junction box.

#### Midas®



Midas® is a gas monitoring system for fast and reliable response to the presence of a wide range of gases including Ammonia. Midas® offers a low cost of ownership through a combination of extended sensor calibration periods, flexible communications architecture and patented diagnostics that monitor sensor performance and flow control. The device's pre-calibrated 'plug-and-play' smart sensor cartridge makes sensor replacement quick and easy and points can be situated up to 30 m/100 ft away from the transmitter.

#### CM4



CM4 delivers continuous monitoring of toxic gases on 4 points, using Chemcassette®. The unit represents the latest in interference-free, low maintenance, low cost of ownership detection of gases like Ammonia. A variety of signal outputs are available making CM4 a truly flexible product and it can easily install into most building alarm systems. An optional rack mount enclosure and printer fill out the product range, providing convenient housing and documentation capability.

#### SPM Single Point Monitor



SPM is a fast response device detecting down to ppb of toxic gases including Ammonia. SPM utilises our interference-free Chemcassette® detection technique, providing physical evidence of a gas event. SPM's standard weatherproof enclosure can withstand the rigors of outdoor operation and a purged enclosure is optional for hazardous areas.

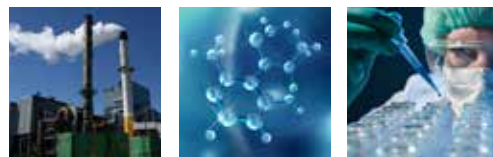
#### Vertex™



Vertex™ delivers up to 72 points of continuous gas detection and can be used with as few as eight points. Sampling points can be located up to 120 m/400 ft from the system and there is a choice of universal analyser modules and/or pyrolyzer analysers. Vertex™ offers powerful, built-in system redundancy as standard to effectively safeguard against downtime. The device utilises Chemcassette® technology, providing physical evidence of gas event.

# Application Note

## Monitoring Ammonia



### Vertex M



Vertex M is one of the industry's most flexible, advanced toxic gas monitoring systems offering ppb detection levels and physical evidence of a gas leak through the use of Chemcassette® technology. Delivering cost-effective, 8-24 point toxic gas monitoring, Vertex M can adapt to meet changing gas detection needs. Sampling points can be situated up to 120 m/400 ft from the system and there is a choice of universal analyser modules and/or pyrolyzer analysers. Please Note: If Vertex M is used with one pyrolyzer module, the maximum number of points of detection is 16.

### Satellite XT



Satellite XT is a simple solution offering flexible, simplified Ammonia monitoring. The system is built on LonWorks® technology and this network platform allows users to leverage cost efficiencies of distributed controls, while maintaining the integrity and reliability necessary for code compliant safety applications.

### Sat-Ex



Sat-Ex provides the ideal solution for monitoring corrosive, combustible, and toxic gases in areas subject to explosive atmospheres. Sat-Ex delivers excellent flexibility in terms of sensor use and can be combined with the whole range of Honeywell Analytics' intelligent sensors. The unit's large LCD screen displays gas concentration and alarm condition. Monitoring, maintenance functions, individual configuration and calibration settings can be chosen from a range of programme menus.

### Portable gas detection

#### GasAlert Extreme



Compact and affordable, GasAlert Extreme reliably monitors for any single toxic gas hazard. With easy on/off operation, this single gas detector offers extended longevity with a two year field-replaceable battery and sensor.

#### GasAlertMicro 5



Compact and lightweight, GasAlertMicro 5 Series instruments are available in diffusion or pumped formats. These portable gas detectors simultaneously monitor and display up to five atmospheric hazards. Model variants include the GasAlertMicro 5 PID model for the low level detection of VOCs.

#### Impact Pro



High specification, 4-gas simultaneous monitoring solution designed to meet the needs of the most challenging applications. Model variants include Impact Pro, which features an integrated automatic pump, Impact IR and Impact (standard).

#### PHD6™



Simultaneous monitoring of up to six gas hazards with 18 sensor choices including PID for the low-level detection of VOCs. PHD6™ features an integrated blackbox data recorder and event logger that records all atmospheric hazards experienced during operation. (Compatible with IQ6 Multi-Gas Docking Station).

### ToxiPro®



A compact and rugged single-gas toxic portable detector with one-button simplicity, continuous real-time display and highly visible/audible alarms for high noise locations. ToxiPro® features an integrated blackbox data recorder and event logger as standard (compatible with IQ Express Single Gas Docking Station).

### Automatic device testing solutions

#### MicroDock II



The MicroDock II is an easy, cost-effective way to bump-test, calibrate and charge a device as well as manage records. Fully compatible with the complete BW Technologies by Honeywell product range, its accompanying Fleet Manager II software allows the user to download information faster than ever from the MicroDock II. Improved functionality allows the creation of accurate and user-friendly reports, print receipts of calibration, sort and graph data and archive information, helping to dramatically simplify fleet management activities.

#### Enforcer



Designed for use with the Impact range of portable gas detectors, Enforcer is a small, lightweight test and calibration station that is fully portable. With no batteries or mains power required, Enforcer permits quick testing on the move and helps to reduce the ongoing cost of portable device maintenance.

#### ToxiPro IQ Express



A fully automated bump test, calibration and datalogging station for use with the ToxiPro® portable range, allowing four devices to be linked to a single gas supply. Connects to a PC via USB port or Ethernet (optional).

#### References:

*EH40/2005 Workplace Exposure Limits (as consolidated with amendments October 2007)*  
 Institut National Recherche et de Sécurité (INRS) ED 984 (Aidé-Mémoire Technique)  
 National Institute for Occupational Safety and Health (NIOSH) – DHHS (NIOSH)  
 Publication No 2005-149 INRS Edition R242 NH3 Detection

# Honeywell Gas Detection



Honeywell is able to provide gas detection solutions to meet the requirements of all applications and industries. Contact Honeywell Analytics or BW Technologies by Honeywell in the following ways.

## Fixed Gas Detection

### Honeywell Analytics Experts in Gas Detection

[www.honeywellanalytics.com](http://www.honeywellanalytics.com)

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## Portable Gas Detection



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