WHITE PAPER

The Complexities of Monitoring Ammonia

Identifying and managing Ammonia risks and hazards

Ammonia (NH_3) is a colourless, commonly occurring alkali gas that has a pungent odour, but this can sometimes be masked when it reacts with acidic gases.

Ammonia can be found naturally within the environment, including in air, water, and soil. It is used in a variety of industrial processes, as well as being produced as a byproduct in some chemical processes. Ammonia is often stored and used as a compressed gas in refrigeration and food production.

Ammonia is a non-flammable gas at low concentration, but at higher concentrations in the air it can explode when ignited. Ammonia containers are also prone to explosion if exposed to high temperatures.

In this whitepaper, we take a detailed look at the industrial processes that feature the use or production of ammonia, the hazards that arise when the gas is present, and how to control the risks.

CROWCON
Detecting Gas Saving Lives

The Applications of Ammonia

Solvents

In its liquid form, ammonia can be used as an ionising solvent that dissolves ionic compounds such as nitrites, nitrates, thiocyanates, and cyanides, as well as all alkali metals, including calcium and barium. In lower concentrations, ammonia can be used as a cleaning solvent.

Fertiliser

Ammonia can be added to fertiliser solutions to increase crop yields when added to soil, particularly in wheat and maize farming.

Refrigerant Gas

Ammonia gas is commonly used in refrigerators as a replacement for chlorofluorocarbons (CFCs) which were phased out due to their detrimental effect on the ozone layer.

Water Purification

Liquid ammonia is commonly added at drinking water treatment plants to add to the disinfectant properties of other chemicals.

Plastic Manufacturing

Ammonia is used as a component in the production of some types of plastic and polymers.

Pharmaceutical Production

Ammonia is frequently used in the pharmaceutical industry as disinfectant to inhibit the proliferation of bacteria and as a neutralising agent.

Clinical Applications

Ammonia gas can be used in medical settings to stimulate a respiratory response and prevent loss of consciousness and fainting.

Oil and Gas Processing

Ammonia is sometimes used during oil and gas production to neutralise acidic compounds that often exist in crude oil.

Mining

In the mining industry, ammonia is used to extract metals such as nickel and copper.

Energy Production

Coal and oil-fired power stations use ammonia in their reactors to detoxify nitrogen oxides in the smoke, turning them into nitrogen and water. It will in future become a fuel of choice in a significant number of countries where sustainability end environmental issues are i

Ammonia as a Byproduct

Ammonia occurs as a natural byproduct in many chemical and biological reactions, such as the decomposition of organic materials, including plants, animals, and waste. Anaerobic digestion, which uses the decomposition of organic waste to create biofuel, is well-known for generating large amounts of ammonia.

The food industry is another industry that produces large amounts of ammonia, especially businesses that create a lot of nitrogenous waste such as livestock or poultry farming.

Ammonia Risks & Hazards

Ammonia can present a hazard to human health through inhalation of the vapours or gas, as well as moisture or liquid contact with the skin and eyes. Exposure to ammonia happens as a result of accidental release or a moderate to high concentration build up of the gas in a confined space.

Anhydrous ammonia gas rises as it is lighter than air, but when there is moisture or humidity present, it turns into a vapour that is heavier than air and causes a risk to health where there is poor ventilation and airflow.

Negative health effects of ammonia

- Inhalation – If ammonia gas or vapour gets into the airways it can cause immediate and intense irritation and burning of the throat, respiratory tract, and nose. The result can be respiratory distress, trauma, or even failure. At lower concentrations, ammonia tends to cause light coughing and mild to moderate irritation. At higher concentration the effects can be more severe and even fatal.
- Skin and eye irritation – Exposure to a low concentration of ammonia can bring on skin or eye itching and irritation. Higher concentrations of ammonia in the air can cause burns and severe damage, including permanent sight impairment or blindness.
- Ingestion – Swallowing and ingesting liquid ammonia can corrode the tissue of the mouth, throat, and stomach.
- The treatment for ammonia exposure depends on the concentration. The first step is to decontaminate the affected areas with water. Breathing assistance and airway management may also be needed.

Fire and explosion risks of ammonia

Although ammonia gas is non-flammable at low concentrations, it presents an explosion risk at higher concentrations between 15 and 33% by volume in the air. However, research has shown that when ammonia vapour or liquid is mixed with lubricating oil the explosive range becomes wider, so extra care should be taken to ensure that this combination is avoided.

Both the EU and ISO (International Organization for Standardization) produce guidance.

Regulations governing the use or production of ammonia

The main regulatory control over the use and production of ammonia in the UK is governed by the Health and Safety Executive (HSE).

In particular, the Control of Substances Hazardous to Health Regulations 2002 are applied to the production, storage, and use of ammonia, which includes EH40/2005 workplace exposure limits.

The EH40/2205 workplace exposure limits for ammonia (anhydrous) are:

- Long-term exposure limit (8-hr reference period) of 25 ppm (parts per million)
- Short-term exposure limit (15 minute reference period) of 35 ppm.

European regulations

Both the EU and ISO (International Organization for Standardization) produce guidance that include safety requirements for ammonia. The EU passed legislation EN 378 that cover safety requirements for refrigeration systems and heat pumps, and includes the use of anhydrous ammonia.

The EU has also drawn up specific directives that recommend formal risk assessments, policy, and incident investigation plans for the production and use of ammonia. The directives include ATEX, PED, and Seveso-III.

Gas detection is a necessary control measure to meet health and safety standards.

Applying gas detectors to reduce the risk of ammonia harm

In order to ensure that the safe working limits for exposure to ammonia gas are not exceeded, it is recommended that any business or organisation involved in the production or use of ammonia implement gas detection technology.

Gas detection is a necessary control measure to meet health and safety standards and comply with the regulations that apply to ammonia.

Here at Crowcon, we offer a wide range of gas detection products to help you improve construction site safety. Our personal portable gas monitors such as the Gas-Pro and Tetra 3 offer versatility and flexibility for workers that may be exposed to ammonia. Our fixed gas monitors Xgard and Xgard Bright provide constant readings from a specific location and therefore can be implemented throughout industries with a risk of ammonia exposure. Gasmaster is a reliable and cost-effective control panel to connect all of your gas detection sensors and alarm systems.

For more information about gas detection solutions for industries with anaerobic digestion, or to ask further questions about best practice on monitoring gases in ammonia, get in touch today.