WHITE PAPER

Why Gas Detection is Crucial in Farming and Agriculture

The farming and agriculture sector plays an irreplaceable role in our lives, reliably bringing an array of crops, fruits, vegetables, dairy and meat products to our tables and businesses every day. However, due to the processes involved, this industry is also confronted by regular toxic gas risks, which have unfortunately recently led to the deaths of some well-known public figures. As well as seeking to utilise less hazardous, alternative materials within farming and agricultural processes, it is down to those in the sector to implement reliable and robust monitoring and gas detection equipment to stay abreast of the gas levels in each environment.

CROWCON
Detecting Gas Saving Lives

Applications

Gas detection within farming and agriculture is very important to ensure the proper functioning of the crucial processes that bring valuable products to our shops and tables. As well as ensuring this, gas detection safeguards the health and safety of the environments that farming and agricultural work is undertaken within, protecting workers and visitors alike.

Gas detection across these areas is complex due to the wide-ranging applications within them. Let's explore these applications now.

Meat production references the rearing and slaughter of animals whose bodies are consumed, including beef, pork, lamb, mutton and chickens. The methods of meat production vary from free range grazing and concentrated animal feeding operations (CAFOs).

Aquaculture is another application within this sector, which involves the farming of seafood. Businesses in this arena breed and harvest plants and animals, such as fish, shellfish and crustaceans for human consumption within fresh or sea water. The breeding of fish is the most common form of aquaculture. Whatever the organism being bred, every aquaculture environment is created under controlled or semi-natural conditions to produce the desired end results.

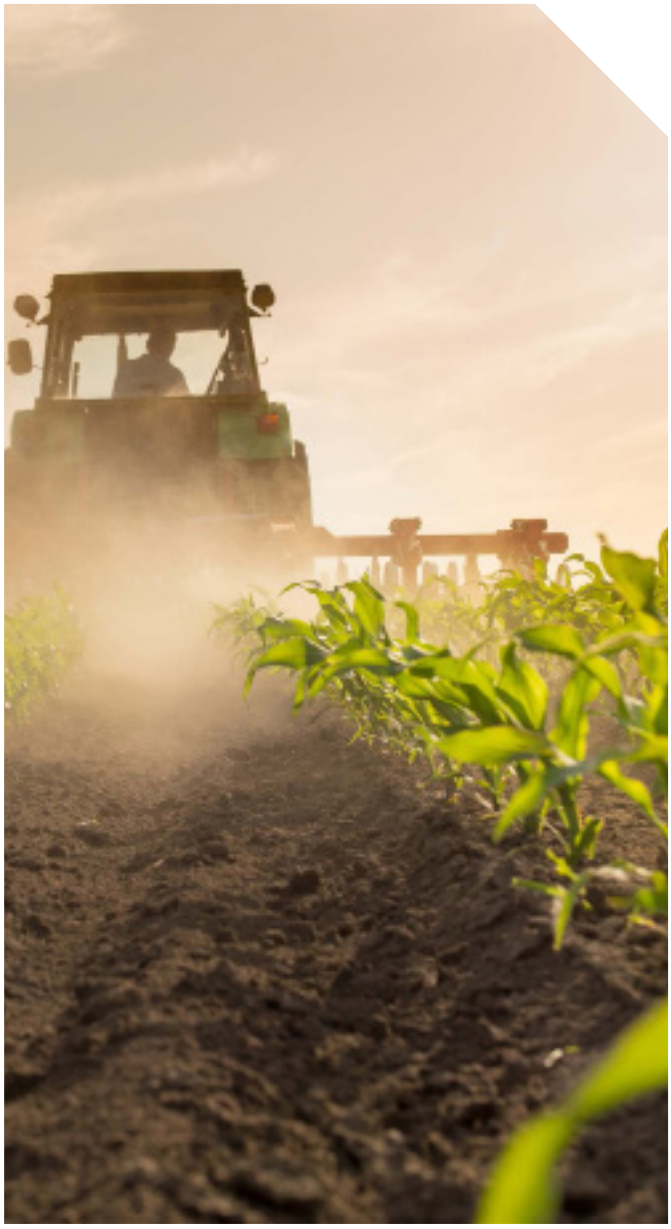
Soil management involves the improvement and protection of soil through specific and targeted practices. The treatments administered to soil within this field spans conservation, amendment and optimal soil health. Without effective soil management processes in place the cultivation of healthy crops is more difficult, as plant needs may not be sufficiently met.

Once the crops have grown, they need to be harvested. Harvesting methods can be undertaken with hand tools or machinery and are carried out through reaping, threshing, cleaning and hauling stages.

Horticulture is a branch of plant agriculture which involves the growing of garden crops such as fruits, vegetables and ornamental plants. Horticulture is specifically important because it enables the cultivation of valuable forms of sustenance which enrich diets and provides the humans and animals who eat them with much needed nutrients and vitamins for a balanced food intake.

Slurry pits are the areas in which farmers gather animal waste, and unusable organic matter. Often overlooked, these are some of the more dangerous environments from a gases point of view. Slurry often has the propensity to reduce or even remove oxygen from the surrounding atmosphere, which if confined can quickly become unbreathable.

Storage of crops in silos presents an explosive gas risk, caused inadvertently in grain storage or with deliberate intent to preserve fruit. Sometimes this may be combined with different toxic gas risks for storage during transport, that have anti-pest benefits. The point is, gases used for pest control are often toxic to people too, and even if they aren't being used, atmospheres used to preserve produce is often unbreathable.



Gas Hazards and Associated Dangers

With so many applications at play within agriculture and farming environments, it is understandable that many hazards arise as a result of these processes.

Livestock grazing, enteric fermentation, manure management and crop cultivation result in high methane emissions because of the processes involved. Methane is a by-product of enteric fermentation and the decomposition of manure under anaerobic conditions. Animals such as cattle, sheep, pigs and horses produce methane. When manure is stored or treated as a liquid in a lagoon, pond or tank it tends to decompose anaerobically and also produces a significant quantity of methane. However when manure is handled as a solid or deposited on pastures, it tends to decompose aerobically and so little or no methane is produced. It is therefore important to reassess the manure management system that is in use within the sector, as this could dramatically affect emission rates. However more methane needs to be extracted in order to make blue hydrogen, and the passing through reformers, pipelines, and ships, means there is more likelihood for leaks. The transport also uses energy lessening the overall efficiency.

Statistics from the UK government's Department for Business, Energy & Industrial Strategy showed that methane emissions in 2021 from agriculture and farming processes had actually decreased since figures released in 2019. In order to gauge these emissions the studies undertaken measured the number of livestock animals and the amount.

Due to methane (CH4) being a colourless and odourless, combustible gas, that comes from the process of anaerobic digestion of organic material. Depending on the storage and management of manure, which undergoes anaerobic decomposition over long periods of time, the concentrations of the gases it produces vary. Poorly ventilated spaces and higher temperatures can increase the amount of methane emitted. If there is a lack of airflow, such as in covered buildings and barns, methane levels can build up, get trapped and cause explosions. However if stored safely it can be used as fuel for agricultural equipment and engines.

Hydrogen Sulphide (H2S) is another hazardous gas which is formed due to the breakdown of waste matter, and is often found within manure and slurry pits, or silos. It is harmful because of its toxicity, and its anaesthetic effects. The rotten egg smell that is given off by H2S can be deceptive as the intensity of the smell actually lessens as exposure times increase, which can lead farmers or workers to feel a false sense of security. Oxygen concentrations are often reduced in these same locations leading to asphyxiation in areas where levels are high.

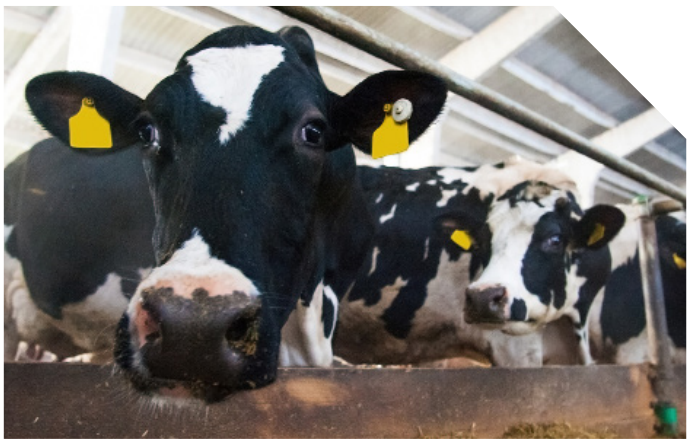
At lower levels, if inhaled, H2S can cause headaches and nausea, fatigue, ENT irritation, loss of appetite and stomach upsets. However, as levels increase the health impacts worsen with individuals experiencing severe nose, throat and lung irritation, an entire loss of sense of smell, fluid build-up in the lungs, bronchitis, pneumonia, and it can severely attack the proper functioning of the nervous system.

Ammonia emissions are another dangerous gas released from the processes within farming and agriculture. Ammonia is a volatile organic compound (VOC) and commonly is created when the matter within slurries, manure and nitrogen fertilisers hit the air. Ammonia concentrations are often high in poultry farms, where high concentrations may harm the animals and people looking after them, unless they are dealt with using appropriate ventilation.

Nitrous Oxide, which is commonly known as laughing gas, is present within and a by-product of synthetic fertiliser usage. These types of fertilisers are used to ensure greater crop yields, specifically within more intensive farming practices. When nitrogen fertiliser is used on the soil, bacteria within the soil are fed and as a result they produce more nitrous oxide. When this bacteria runs down rivers and into seawater it also produces nitrous oxide.

Soils emit greenhouse gases as carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). The largest emissions from soils are as CO_2 as a result of respiration by soil micro-organisms from the decomposition of the active soil organic matter (SOM) pool. This active SOM contains carbon and is constantly being added to by plants as a result of their roots, when these plants take CO_2 from the atmosphere to produce simple carbohydrates and all other organic compounds that enable them to grow.

Agriculture has an influence on the rates of carbon addition and losses to the SOM. The most significant effect is from mechanical cultivation of soils. Through cultivating soils the disturbance allows for greater oxidation of the slow SOM through soil micro-organisms that have a consequent release of CO_2. Soils contain between 30 – 90t carbon/ha at 30cm depth. The number of factors is dependent on preceding cropping, soil type, intensity of the cultivation and moisture content. Cultivated soils can lose 3t of soil carbon/ha/year.



With agricultural emissions predicted to rise to 30% of worldwide total emissions, it is clear that sector workers and owners need to take responsibility for their footprint.

Responsibilities for Workers and Owners

With hazardous and toxic gases widespread within farming and agriculture applications, owners and workers within the sector need to take accountability to ensure accurate monitoring of the hazards present.

Utilising reliable gas monitoring equipment is the best way to raise awareness of the types and levels of gases, and thus allow appropriate actions to be taken. Installing remote gas sensors into spaces such as milking pens or barns provides the opportunity for continual monitoring and awareness without disruption to livestock.

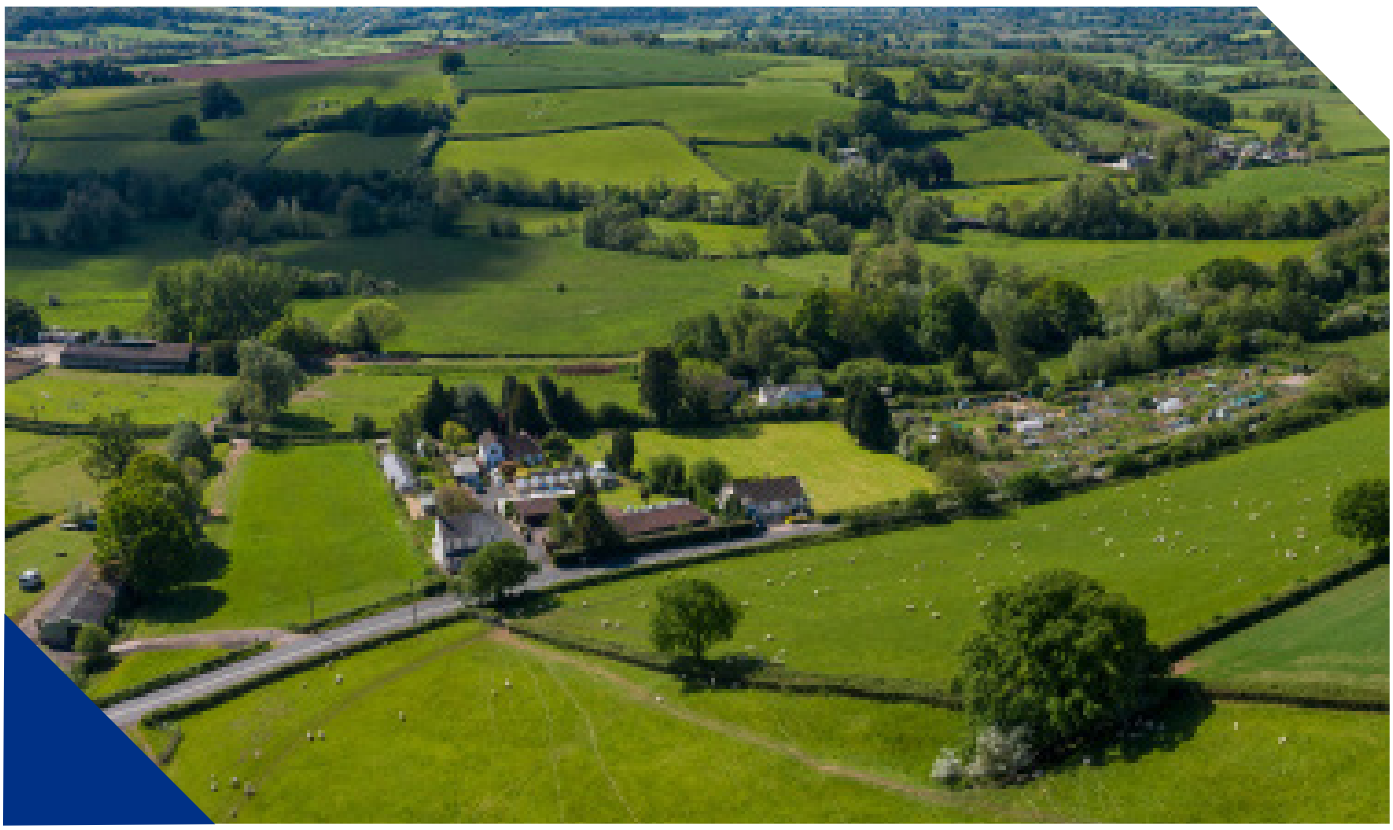
As well as being the way to maintain safety, monitoring of gas levels is a great research tool which can provide local and national information to further add to the growing body of evidence about the impact of methane, ammonia, nitrous oxide and hydrogen sulphide emissions within farming and agriculture.

With data from the World Wildlife Fund illustrating that agriculture in the UK is responsible for 9% of total agricultural greenhouse gas emissions, with agricultural emissions predicted to rise to 30% of worldwide total emissions, it is clear that sector workers and owners need to take responsibility for their footprint.

The vehicular, respiratory and biological hazards at play make farm workers particularly at risk from a variety of health risks. Although everyone is affected by resulting global warming, the toxic effects of gases in agriculture are usually only encountered by people in the industry who come in to contact with these often unseen toxins on a daily basis.

As well as complying with the legal requirements, to be explored further below, workers and owners can further safeguard themselves and their teams by implementing rigorous training protocols and processes to be adhered to on site.

Training should be administered to all staff working in agricultural and farming environments with regards to proper handling of machinery and equipment, the safety processes in place, and the correct usage of gas detection equipment.



COSHH provides guidance and compliance outlines for employers to protect employees from these hazards.

Standards and Certifications

In the UK, the Control of Substances Hazardous to Health is a regulation relevant across all sectors in which those within are regularly exposed to a number of harmful chemicals. None more applicable than in the farming and agricultural sector, through which workers encounter detergents, disinfectants, pesticides, fertilisers including ammonium nitrate and veterinary medicines. COSHH provides guidance and compliance outlines for employers to protect employees from these hazards.

The UK's Code of Good Agricultural Practice (COGAP) for Reducing Ammonia Emissions was created by DEFRA in collaboration with the farming sector. It details the steps that need to be taken to reduce ammonia emissions within the given timeframe; of 8% by 2020 and 16% by 2030. Steps to be taken include, the best way to store and apply organic manures, ways to apply manufactured fertiliser, and ways to amend livestock diet and housing. Because diet has a significant effect.

The European Commission has launched a range of directives and schemes to govern safety within the farming sector in its member states. These include EU regulation 1151/2012 on quality schemes for agricultural products and foodstuffs, and EU regulation 668/2014 on how it should be applied.

Crowcon's portable range comprises T4, Gas-Pro, Clip SGD and Gasman all of which offer reliable, transportable detection capacities for a variety of gases.

Products

For farm and agricultural workers moving around portable gas detectors will be required to ensure they remain aware of the risks within changing environments. Crowcon's portable range comprises T4, Gas-Pro, Clip SGD and Gasman all of which offer reliable, transportable detection capacities for a variety of gases.

For focused environmental and geographical monitoring, fixed detection is often the best option. Crowcon's Xgard range offers a comprehensive selection of fixed multi gas detectors that meet the diverse requirements for gas detection across the varying applications. Xgard Bright is another of Crowcon's fixed offerings, which meets flammable and toxic gas detection and oxygen monitoring requirements, whilst simultaneously providing ease of operation and reduced installation costs.

The Bright system provides analogue 4-20mA and RS-485 Modbus signals as standard, in addition to Alarm and Fault relay as standard, plus optional HART communications.

With a low cost of installation, the 4-wire addressable implementation reduces cabling requirements, and because the OLED display allows users to easily work with Xgard Bright during install, calibration and routine maintenance there is no need to open the housing.

For fixed detection systems control panels act as a central hub to enhance and activate alarm and detection processes. Crowcon's Vortex is a flexible gas controller package that can be customised to meet site requirements, without the need for extensive cabling. Our Addressable Controllers offer local non-intrusive operation with simultaneous live reading display and alarm functions via a colour LCD display.

For more information about gas detection within farming and agricultural environments, or to explore more of Crowcon's gas detection range, please get in touch with our friendly team.