CROWCON
Detecting Gas Saving Lives

Food and Beverage Production and Processing

Introduction

Introduction

The food and beverage (F&B) industry includes all companies involved in processing raw food materials, as well as those packaging and distributing them. This includes fresh, prepared foods as well as packaged foods, and both alcoholic and non-alcoholic beverages.

The F&B industry is divided into two major segments, which are the production and the distribution of edible goods. The first group, production, includes the processing of meats and cheeses and the creation of soft drinks, alcoholic beverages, packaged foods, and other modified foods. Any product meant for human consumption, aside from pharmaceuticals, passes through this sector. Production also covers the processing of meats, cheeses and packaged foods, dairy and alcoholic beverages. The production sector excludes foods and fresh produce that are directly produced via farming, as these fall under agriculture.

Global companies operating in F&B include Coca-Cola, Pepsico, Nestle, Danone and Asahi, many of which have manufacturing facilities worldwide to cater for local markets.

Food processing can be further divided into three sub-groups. Primary food processing is the conversion of raw food into commodities, e.g. milling wheat into flour and turning milk to cheese. Secondary food processing turns the ingredients into edibles, e.g. turning wheat into bread. Tertiary food processing is the commercial production of ready-to-eat foods, for example frozen pizza, instant meals, etc.

The manufacture and processing of food and beverages create substantial risks of fire and toxic gas exposure. Many gases are used for baking, processing and refrigerating foods. These gases can be highly hazardous – either toxic, flammable, or both. This application note gives a summary of gas hazards in the F&B industry, and describes Crowcon's solutions.

Gas Hazards in the Food and Beverage Sector

Gas hazards in food processing

Secondary food processing methods involve fermentation, heating, chilling, dehydration or cooking of some kind. This section focuses on secondary food processing, as this is where most of the gas hazards are found.

Many types of commercial food processing involve cooking, especially with industrial steam boilers. Steam boilers are usually gas-fired (natural gas or LPG) or use a combination of gas and fuel oil. For gas-fired steam boilers, natural gas consists mainly of methane (CH_4), a highly combustible gas, lighter than air, which is piped directly into boilers.

In contrast, LPG consists mainly of propane (C_3H_8), and usually requires an on-site fuel storage tank. Whenever flammable gases are used on site, forced mechanical ventilation must be included in storage areas, in case of leakage. Such ventilation is usually triggered by gas detectors that are installed near boilers and in storage rooms.

In addition to safety considerations around handling pressurized equipment, boiler rooms must be protected from fire. OSHA boiler safety guidelines recommend that gas detection systems be implemented for any gas-powered equipment (> 2MW). The system should be designed to trigger alarms and relay contacts if gas hazards are detected.

A gas detection system is required for any gas-powered structure and for underground/basement boiler rooms. This gas detection system will trigger alarms and actuators in case of any gas leak. It will also shut down the gas and power supply, except that required for devices intended to operate in explosive atmospheres, low voltage power and emergency lighting.

Crowcon offers gas detection solutions for flammable hazards and to protect personnel from fire and explosion. Crowcon's flammable gas detectors are rated for use in hazardous and safe areas, to suit different applications.

Crowcon controllers can be used to trigger audible alarms and visible beacons to alert personnel to a possible gas leak. In addition, output from controllers can be used to alert a central control room or building management system (BMS).

Gas hazards in chemical disinfection

The F&B industry takes hygiene very seriously, as the slightest contamination of surfaces and equipment may provide an ideal breeding ground for all kinds of germs. The F&B sector therefore demands rigorous cleaning and disinfection, which must meet industry standards.

There are three methods of disinfection commonly used in F&B: thermal, radiation and chemical.

Chemical disinfection with chlorine-based compounds is by far the most common and effective way to disinfect equipment or other surfaces. This is because chlorine-based compounds are inexpensive, fast acting and effective against a variety of microorganisms. Several different

chlorine compounds are commonly used, namely hypochlorite, organic and inorganic chloramines, and chlorine dioxide. Sodium hypochlorite solution (NaOCl) is stored in tanks while chlorine dioxide (ClO_2) gas is usually generated on site.

In any combination, chlorine compounds are hazardous and exposure to high concentrations of chlorine can cause severe health issues.

Chlorine gases are usually stored on site and a gas detection system should be installed, with a relay output to trigger ventilation fans once a high level of chlorine is detected.

Crowcon offers both fixed and portable chlorine detectors.

Gas hazards in food packaging

Food packaging serves many purposes. It allows food to be transported and stored safely, protects food, indicates portion sizes and provides information about the product.

To keep food items safe for a long time, it is necessary to remove oxygen from the container because otherwise, oxidation will occur when the food comes into contact with oxygen. The presence of oxygen also promotes bacterial growth, which is harmful when consumed. However, if the package is flushed with nitrogen, the shelf life of packaged food can be extended.

Packagers often use nitrogen (N_2) flushing methods for preserving and storing their products. Nitrogen is a non-reactive gas, non-odorous and non-toxic. It prevents oxidation of fresh food with sugars or fats, stops the growth of dangerous bacteria and inhibits spoilage. Lastly, it prevents packages from collapsing by creating a pressurized atmosphere. Nitrogen can be generated on site using generators, or delivered in cylinders. Gas generators are cost effective and provide an uninterrupted supply of gas.

Nitrogen is an asphyxiant, capable of displacing oxygen in air. Because it has no smell and is non-toxic, workers may not become aware of low oxygen conditions before it is too late. Oxygen levels below 19% will cause dizziness and loss of consciousness. To prevent this, oxygen content should be monitored with an electrochemical sensor.

Installing oxygen detectors in packaging areas ensures the safety of workers and early detection of leaks.

Gas hazards in refrigeration facilities

Refrigeration facilities in the F&B industry are used to keep food cool for long periods of time. Large-scale food storage facilities often use cooling systems based on anhydrous ammonia (> 50% NH_3), as it is efficient and economical. However, ammonia is both toxic and flammable; it is also lighter than air and fills up enclosed spaces rapidly. Ammonia can become flammable if released in an enclosed space where a source of ignition is present, or if a vessel of anhydrous ammonia is exposed to fire.

Read more about ammonia in our factsheet.

Ammonia is detected with electro-chemical (toxic) and catalytic (flammable) sensor technology. Portable detection, including single- or multi-gas detectors, can monitor instantaneous and TWA exposure to toxic levels of NH_3. Multi-gas personal monitors have been shown to improve workers' safety where a low-range ppm for routine system surveys and flammable range is used during system maintenance.

Fixed detection systems include a combination of toxic- and flammable-level detectors connected to local control panels – these are usually supplied as part of a cooling system. Fixed systems can also be used for process over-rides and ventilation control. Detector placement should be carefully considered, as ammonia will fill up breathing spaces rapidly.

Gas hazards in the brewing and drinks industry

Once an archetypal example of manual production, the wine and brewing industries now incorporate sophisticated processes to ensure high levels of quality and efficient output.

In some cases, traditional approaches have been scaled up or are used under more stringent monitoring. Elsewhere, innovations such as nitrogen-pressurised canning/bottling have been introduced. Regardless of the approach used, appreciation and understanding of the associated gas hazards, and the need to protect workers from toxic gas exposure and asphyxiation risks, has grown.

Please visit our interactive map for an overview of beer and wine production

Situations that generate gas hazards within wineries and breweries include:

- CO_2 from fermentation, chilling, blanketing and recovery.
- Disinfectants such as ClO_2, O_3 and SO_2 used for cleaning equipment.
- Argon and N_2 used as blanketing gases to create inert atmospheres.
- NH_3 from refrigeration equipment.
- O_2 monitoring is required in confined spaces.

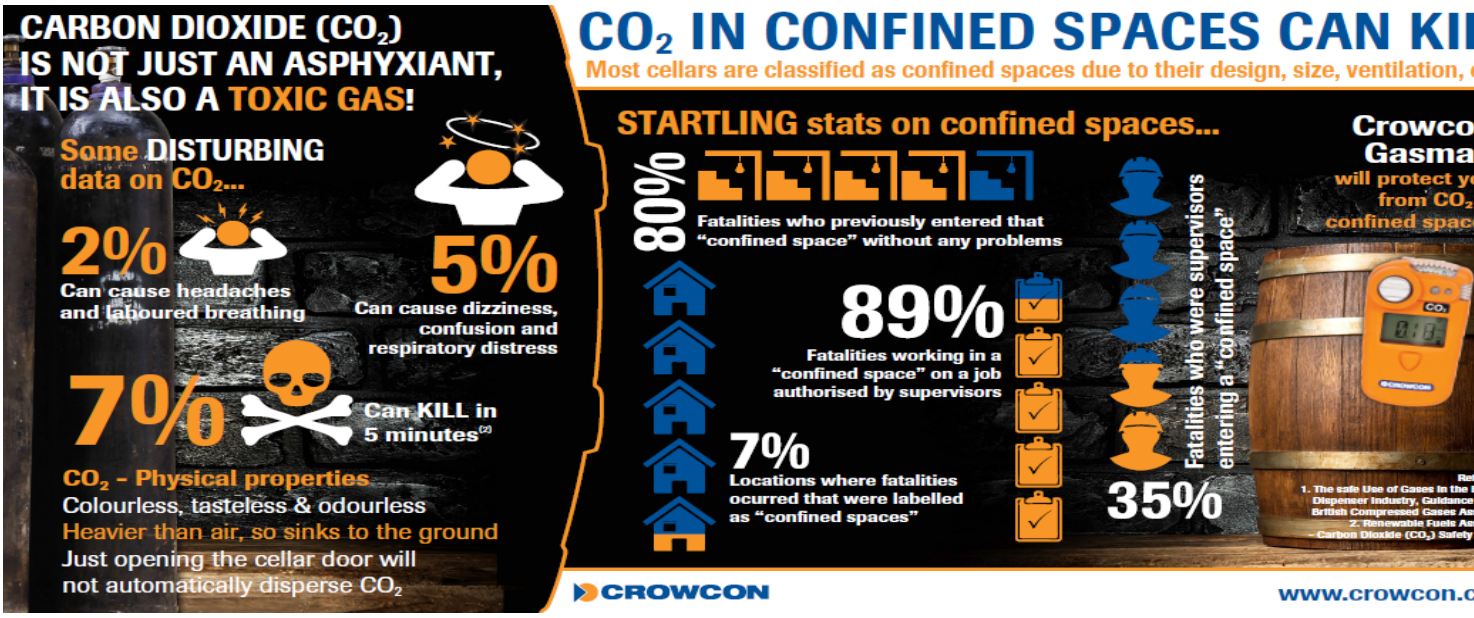
Gas hazards in packaging, transport and dispensing

Once wine is bottled and beer is packaged, they must be delivered to the relevant outlets. This commonly includes distribution companies, warehousing and in the case of breweries, draymen. Beer and soft drinks use carbon dioxide or a mix of carbon dioxide and nitrogen as a way of delivering a beverage to the 'tap'. These gases also give beer a longer-lasting head and improve the quality and taste.

Even when the beverage is ready to deliver, gas-related hazards remain. Those arise in any activity at premises that contain compressed gas cylinders, due to the risk of increased carbon dioxide levels or depleted oxygen levels (due to high levels of nitrogen).

Carbon dioxide (CO_2) occurs naturally in the atmosphere (0.04%). CO_2 is colourless and odourless, heavier than air and if it escapes, will tend to sink to the floor. CO_2 collects in cellars and at the bottom of containers and confined spaces such as tanks and silos. CO_2 is generated in large amounts during fermentation. It is also injected into beverages during carbonation.

Read more about CO_2 in our factsheet. The infographic below shows the dangers of CO_2.



Through our recent work with breweries worldwide, Crowcon has discovered a niche requirement for single-gas carbon dioxide (CO_2) detectors for workers associated with the delivery of carbonated beverages. More companies are recognising the problems of CO_2 exposure and asking about gas detection.

Crowcon has worked successfully with a multinational brewery, which equipped its entire fleet of delivery drivers with Crowcon personal detectors. Please read our case study for more information.

In some regions, cellars may have fixed CO_2 detectors and/or O_2 depletion detectors. However, many still do not recognise the inherent dangers of using and storing compressed gases. Employers have a duty of care to their workers, including those who regularly enter another business to perform their duties (e.g. service, maintenance, delivery or sales). Providing portable monitors that can detect either CO_2 or CO_2 and O_2, can improve the safety of their working environment.

In an era of increasing legislation and the need to demonstrate a high level of workforce protection, detectors with inbuilt data- and event-logging capabilities, as well as customer-focused asset management reporting, can directly help to improve the visibility of information and streamline unit maintenance and calibration activities.

Crowon Connect provides visibility and insights from personal detectors, which can be used to ensure compliance, improve efficiency and raise levels of safety.

Solutions for the Food and Beverage Industry

Portable Monitors

T4

- Easy to use one button functionality
- TWA resume function
- MED certification
- Easy servicing and quick turnaround
- Bump test station available

Gas-Pro

- Integrated pump (up to 30 m sampling)
- One button operation
- IR sensor for wide range of hydrocarbons
- MED certified
- Confined space entry (CSE) kit available
- Bump test station available

Gasman

- One button operation
- Suited for CO_2 and NH_3

Fixed Monitors

Xgard

- Rugged reliable detector
- Available in various gases and material
- mA or mV output

Xgard Bright

- Addressable
- Local display
- Non-intrusive calibration
- Modbus or Hart output

Vortex

- Up to 12 configurable channels
- MODBUS compatibility
- SIL 1 (IEC 61508) validated

GM Controllers

- Up to 128 channel inputs
- Modular configuration
- Screen display

Crowcon's GM64, with its modular design and selectable output card, channel module, relay module and power module, makes a very scalable controller. The GM64 can also record events, such as alarm, fault, calibration, warning, power-on and power-off. The GM64 can be linked to various off-site control equipment, which enhances system integration and allows the user to read gas data remotely.