Emissions monitoring:
Safe, clean and sustainable


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Emission monitoring is important across many industries. Not only are there anti-pollution laws to comply with, but excessive emissions can be indicative of an inefficiently running plant.

While belching chimneys and flares are visible indicators that dust or chemicals are entering the atmosphere, in some industries, emissions can be less obvious - such as in the food industry, where emissions may be in the form of contaminated wastewater. And many noxious gases are of course totally invisible - representing explosion and health risks to plant personnel and the wider community.

And then there is the cost. Fines imposed over emission violations can be very high, but waste of raw materials - or the emission of by-products that could be better used to improve plant efficiency - also represent a cost to the business. For example, in some processes, waste methane can be re-used as a heating fuel. Steam loss, while relatively harmless as a pollutant, also represents a cost in the form of wasted heat. Emissions are not only a health and safety issue, but an issue of efficiency - in a time when companies are trying to reduce costs wherever possible.

New instrumentation and analysis technologies are making the monitoring of emissions much easier and make it possible to make emission monitoring part of the process control system. Having sound emissions monitoring systems in place is imperative to protect both health and safety, and improve the bottom line.

Glenn Johnson

Editor - *What's New in Process Technology*

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Emission monitoring benefits power plants

John Immelman

Monitoring and measuring the emissions of all process plants can give an indication of the levels of pollution being exhausted into the atmosphere and, as importantly, the degree of efficiency of the plant. In many cases, if the plant efficiency is improved, the emission pollution is significantly reduced; win-win for everyone.

What needs to be monitored nationally?

Although each state and territory has its own anti-pollution agency, the overarching national guidelines emanate from the National Environment Protection (Ambient Air Quality) Measures (NEPM). The desired environmental outcome of this Measure is "ambient air quality that allows for the adequate protection of human health and well-being". The Measure specifies the pollutants; carbon monoxide, nitrogen dioxide, photochemical oxidants (ozone), sulfur dioxide, lead and 'large' particulates (PM10). Additionally, the Measure specifies what reductions are desired by what date.

Other 'pollutants' that are under review are water vapour, oxygen, HCl gas, ammonia, carbon monoxide and more. Typically, water vapour and oxygen are monitored as a measure of plant efficiency and not as an environmental pollutant.

Also in the crosshairs are 'smaller' particles (dust) - PM2.5 - emitted into the atmosphere, normally from the stack. This monitoring is also a direct reflection on the efficiency of the plant, as well as an emission issue.

Local regulators and interested groups

Because pollution through emissions is such an emotional and controversial global topic, there are many local and international interest groups. Greenhouse gases, also in Australia, which make up the majority of the pollutants, are tracked by international institutions like WWF (World Wide Fund for Nature) and Carbon Monitoring for Action. Localised regulators such as each state and territory Environmental Protection Authority (EPA) monitor the greenhouse gases, as well as particulate emissions.

Penalties and fines for transgressions vary from region to region and are enforced with differing levels of urgency, but are generally expensive and time-consuming to resolve.

It is strongly advised that every producer that could cause emission pollution implement a strategy to monitor and measure the emission levels and work with the authorities towards a reduction before the fines are enforced.

Industries of interest

All process and manufacturing industries pollute the atmosphere to a certain degree, some significantly more than others. At the lower end of the scale are the food and beverage producers, water and wastewater plants and various manufacturing facilities. Conversely, the higher end emission polluters are paper and pulp mills, cement plants, iron and steel mills, chemical producers, refineries and thermal power stations. In general, coal-fired thermal power stations are the worst polluters and are under constant pressure from the community and regulators to 'clean up'.

Coal-fired thermal power stations

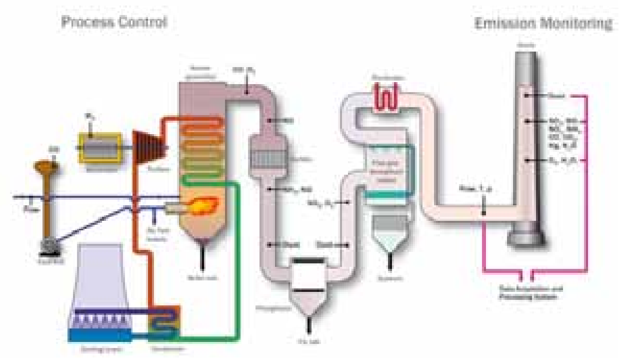
According to the Australian Bureau of Resources and Energy Economics (BREE), coal continues to be the major fuel source for electricity generation, comprising about 64% of the fuel mix in 2012-13. However, this share has decreased from 77% in 2003-04, accounting for much of the decline in total electricity generation. In 2012-13 coal-fired generation declined across all states in Australia, with black and brown coal-fired generation dropping to their lowest levels since 1997-98. This decline in 2012-13 is most likely due to the increase in the relative costs and uncertainty of coal-fired electricity generation under carbon pricing.

Nevertheless, there are 25 coal-fired power stations nationally, varying in capacity from 2880 MW base-load generators down to 150 MW localised generators, and they each require increased emission monitoring and measurement to reduce emissions and increase efficiency.

What coal-fired power plant processes should be monitored?

Coal-fired power plants comprise similar sections/processes, some more sophisticated than others, but the emission measurements are similar for all. The sections that interest emission monitoring are:

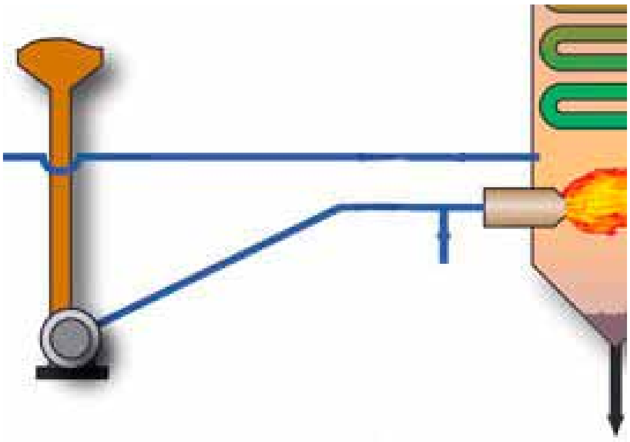
- coal bunker, hopper, coal mill, pulverised fuel (PF) mill, coal conveyers
- steam generator, boiler drum, combustion control, superheater
- flue gas denitrification (DeNOx plant)
- precipitator, bag-house, de-dusting
- flue gas desulfurisation, scrubbers (FGD plant)
- stack, emission monitoring



Coal bunker, PF mill, conveyors

Pulverised coal (PF) is typically used to fire the boiler of power plants. For safety reasons, monitoring of CO in coal bunkers and coal mills is a critical measurement. CO is an odourless and very toxic gas and poses a serious explosion threat at levels above 8 vol.% in air. Elevated CO concentrations may indicate a source of smouldering and require immediate counter measures. In addition, O_2 concentrations provide significant information for coal pulverising plants which are operated under inert purging conditions: an increasing oxygen concentration value monitors the entrance of false air into the system and thus protects against the risk of explosion.

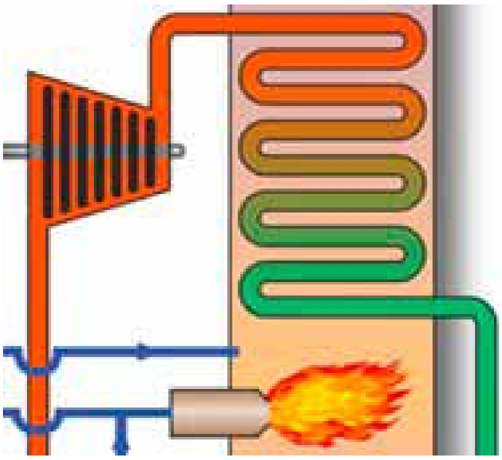
Situated in the process, an in situ O_2 measuring sensor, using laser spectroscopy, provides immediate warning of pending problems. To monitor both CO and O_2, a remote sampling system is preferred.



Steam generator, boiler drum, combustion control, superheater

Power plant efficiency requires continuous monitoring and optimising of the combustion process. Supply of combustion air is a primary task because it delivers the required amount of oxygen, which must be optimised and controlled carefully to ensure safe and efficient combustion, to minimise fuel consumption as well as reduce the emission of pollutants like CO, CO_2, NOx. Therefore, reliable and accurate monitoring of primary combustion air volume flow at the boiler inlet is a very important responsibility.

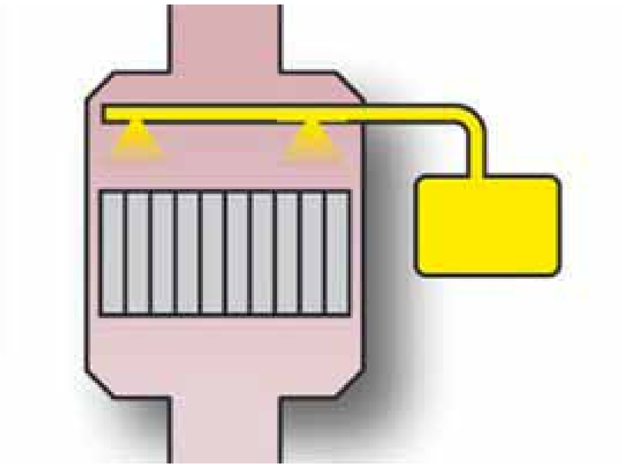
Due to the harsh conditions in this process, the O_2 is best measured with an in situ zirconium dioxide sensor and the CO and CO_2 with a cross-duct in situ gas filter correlation probe.



Flue gas denitrification (DeNOx plant)

Environmental regulations demand efficient reduction of the NOx content of the flue gas before it is released into the atmosphere. The selective catalytic reduction (SCR) process is typically implemented using an added reagent such as ammonia (NH_3), which converts nitrogen oxide (NO) into water and nitrogen over a catalyst at approx. 400°C. NO concentration is measured at the inlet of the DeNOx plant to determine and control the required amount of ammonia. At the outlet of the DeNOx plant NO and NH_3 are measured: the NH_3 concentration (ammonia slip) indicates the efficiency of the denitrification process while the NO concentration is controlled to ensure compliance with the environmental regulations.

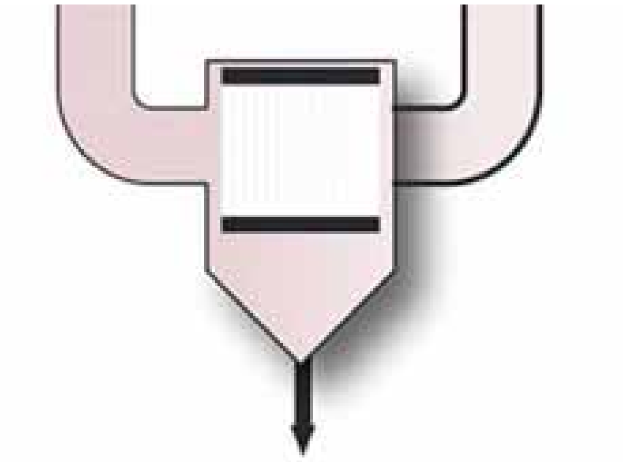
Typically, the NOx content is monitored using UV spectroscopy technology as a direct measurement. The NH_3 concentrations can also be measured with this technology, but experience has shown that diode laser spectroscopy is the preferred in situ method.



Precipitator, bag-house, de-dusting

Flue gases from coal-fired combustion processes are loaded with particulate matter (PM) and, due to environmental regulations, must be cleaned before release into the atmosphere by passing a de-dusting device. Bag-house filters, where the particles are collected by passing through a tightly woven fabric, are common practice. Alternatively, electrostatic precipitators can be used. Particles are deposited on electrodes when passed through an electric field. The correct operation of the de-dusting plant and compliance of the residual dust content with the regulations is ensured by continuously monitoring the dust concentration after the filter.

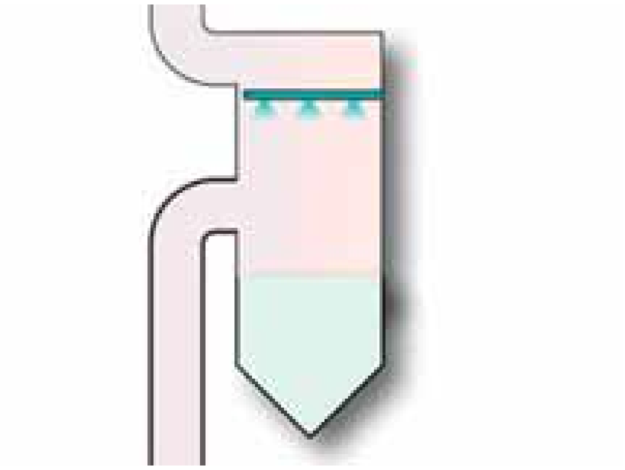
Opacity is a measure of the dust concentration and the most cost-effective technology is cross duct transmittance measurement for medium to high concentrations.



Flue gas desulfurisation, scrubbers (FGD plant)

Wet scrubbing systems are typically used for flue gas desulfurisation. After leaving the dust removal plant, the flue gas enters a tower where it is sprayed with a calcium-based slurry (scrubbing liquid, eg, ground limestone in water) that is fed from a tank. The gaseous pollutants such as SO_2 are dissolved in the liquid and react with the liquid to form calcium sulfite or sulfate, which is removed by dewatering and settling into a thickener. Alternatively, calcium sulfite is oxidised to form gypsum by bubbling compressed air through the sulfite slurry.

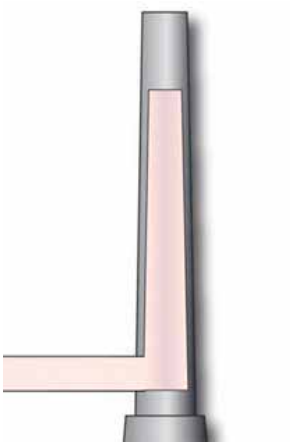
SO_2 can also be measured using UV spectroscopy technology.



Stack, emission monitoring

Depending on the type of fuel and local environmental regulations, a number of gas components, predominantly CO, NOx and SO_2, are to be monitored continuously in the flue gas at the stack along with dust (particulate matter, PM), gas flow, temperature and O_2 (frequently H_2O as well). In case of co-incineration of alternative fuels, additional components such as HF, HCl, Hg and VOC may be required to be monitored as well (emission monitoring in waste incineration). Measuring data are transferred to a specific data acquisition system for further processing and reporting to the authorities.

Since the stack is the final interface between the power station processes and the environment, these measurements are critical for avoiding penalties and ensuring optimum plant efficiency. It is important to quantify the volumetric flow rate to establish the amount of discharge. This is best achieved with a time-of-flight ultrasonic flowmeter. All other parameters to be measured have been monitored earlier in the process so the same technologies are suitable for these stack measurements.



Time to act

The thermal coal-fired power station has been used as an example of what can be measured and what benefits can be derived through investment in the most suitable probes and sensors. But the same strategy can be applied to all process and manufacturing industries since they all pollute the atmosphere to a certain degree, some significantly more than others. The pressure to ‘clean up’ will continue to increase and if it’s not measured it cannot be managed.

Now is the time to implement an emission pollution strategy sanctioned by top management.

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Combustible gas safety monitoring - infrared versus catalytic gas detectors

When designing a combustible gas safety monitoring system for oil and gas, petrochemical or other applications, how do you decide whether to use infrared or catalytic gas detector technology?

Both infrared and catalytic detector technologies have their advantages for gas detection, depending on your application's specific requirements. A thorough analysis of your application's unique field environment is needed to ensure optimal performance, safety, reliability and cost-effectiveness. A quick decision, of course, can lead to poor detector choices as well as safety, performance, maintenance and life-cycle cost consequences.

Catalytic sensing

Catalytic (or electrocatalytic) detectors (Figure 1) are based on a highly responsive technology with about 40 years of proven field experience. They are single-point detectors for combustible gas detection. Based on the simple principle that as combustible gas oxidises it produces heat, the sensor converts the temperature change via a standard Wheatstone bridge-type temperature transducer to a sensor signal. The sensor components consist of a pair of platinum heating coils embedded in a catalyst.

Since the reactants are all gaseous, the reaction takes place on the surface of this element with the combustible gases reacting exothermically with oxygen in the air to raise its temperature. This results in a change of resistance within the embedded coil, which is linearly proportional to gas concentration.

Figure 1: Catalytic bead sensor.

Some detectors also utilise a pair of catalytic beads that are identical except for a glass coating on one of them (see Figure 2). This method of providing an inert 'reference' bead ensures it remains permanently non-responsive to gas, thereby acting as a stable 'baseline' signal generator to compensate for environmental changes such as ambient temperature fluctuations which would otherwise affect the sensor's stability. Physical and electrical matching of the bead pairs eliminates the need for compensating resistors, which cause drift in operation.

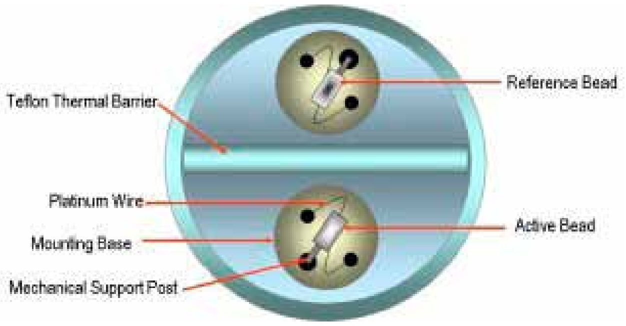


Figure 2: Combustible gas detector.

The secret of a catalytic detector's accuracy, longevity and reliability is in the design of the substrate and catalyst system. It is critical to maintain an abundance of active sites as some may become poisoned in service. This can be achieved by using a highly porous substrate with catalyst deposition down to the core.

Advantages

The major advantages of catalytic detectors are that they are:

- robust;
- simple to operate;
- easy to install, calibrate and use;
- long lived with a low life-cycle cost;
- proven technology with exceptional reliability and predictability;
- immensely flexible with application;
- easily calibrated individually to gases such as hydrogen which cannot be detected using infrared absorption.

Disadvantages

The limiting factors in catalytic detector technology are that:

- catalysts can become poisoned or inactive due to contamination;
- the only means of identifying detector sensitivity loss due to catalytic poisons is by checking with the appropriate gas on a routine basis and recalibrating as required;
- when a sensor is located in an area known to contain potential poisons, it should be calibrated at regular intervals and the results should be logged. The interval between calibrations should be recommended by the manufacturer and then verified in the field;
- they require oxygen for detection;
- prolonged exposure to high concentrations of combustible gas may degrade sensor performance.

Infrared detectors

Gas sensing by the infrared (IR) detection method is based on the absorption of infrared radiation at specific wavelengths as it passes through a volume of gas. IR detection technology incorporates a light source and a light detector that measures the intensity of two different wavelengths, one at the absorption wavelength and one outside the absorption wavelength. If a gas intervenes between the source and the detector, the level of radiation falling on the detector is reduced and can be continuously monitored. Gas concentration is determined by comparing the relative values between the two wavelengths.

Infrared gas detection is based on the ability of some gases to absorb IR radiation. It is generally understood that almost all hydrocarbons absorb IR at a wavelength of approximately 3.4 µm and at this region H_2O and CO_2 are relatively transparent.

It follows, therefore, that a dedicated spectrometer operating at this wavelength could be used to detect combustible hydrocarbons in the air.

In IR point detectors, there is a fixed path length between the IR source and the IR detector (Figure 3). The path length is typically short (a few centimetres) and the gas concentration is assumed uniform across the path. With a fixed path length, the measurement of IR beam absorption by the gas being measured can be expressed directly (% lower explosive limit in this case). Thus, a point IR detector is capable of giving a true measurement of gas concentration at the point of detection.

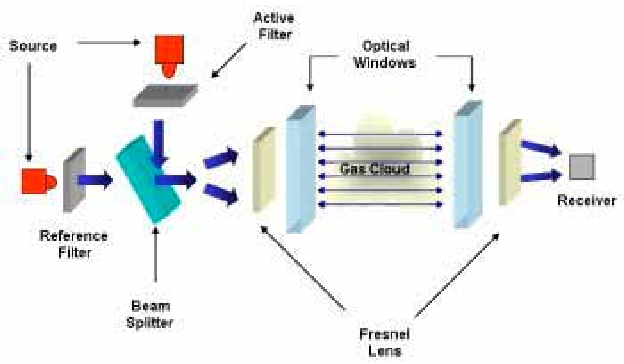


Figure 3: Point detector - optical scheme.

Open path IR detectors, as opposed to point detectors, expand the gas sampling path from a few centimetres up to 100 metres to monitor large facilities for gas clouds (Figure 4).

Advantages

The major advantages of IR gas detectors are:

- immunity to contamination and poisoning;
- fail-safe operation;
- no routine calibration;
- ability to operate in the absence of oxygen or in enriched oxygen;
- ability to operate in continuous presence of gas.

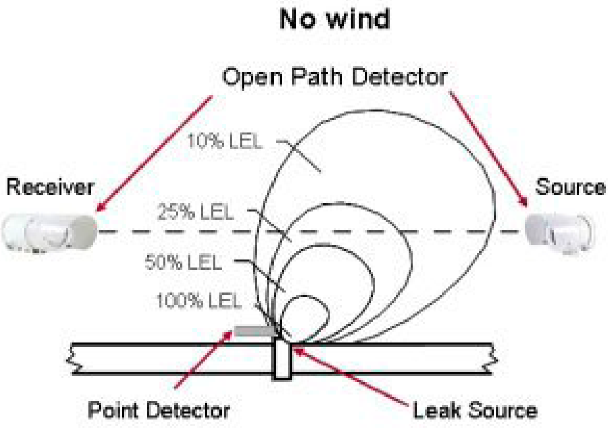


Figure 4a: IR gas detector and a leaking gas cloud in still air.

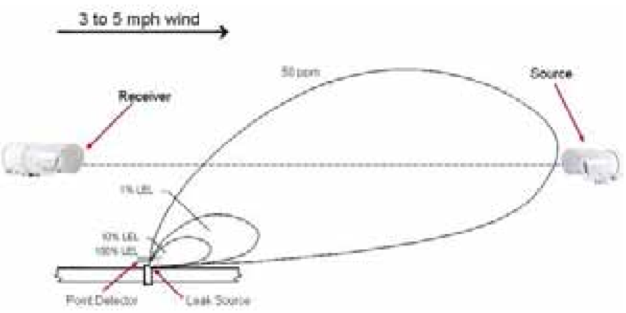


Figure 4b: IR gas detector and a leaking gas cloud in the presence of wind.

With the sophisticated optical designs currently in use, IR detectors are factory calibrated and are virtually maintenance free. They are particularly desirable where detectors must be located in inaccessible areas. Maintenance is limited to periodic cleaning of the optical windows to help ensure dependable performance.

Disadvantages

The limiting factors in IR technology are:

- They have a higher initial cost per point. IR detectors in the past have been more expensive than catalytic detectors at initial purchase, but they are rapidly coming down in price to cost parity with catalytic detectors.
- They have a higher spare parts cost.
- The gas to be measured must be infrared active, such as a hydrocarbon.
- Gases that do not absorb IR energy (such as hydrogen) are not detectable.
- High humidity, dusty or corrosive field environments can increase IR detector maintenance costs.
- Routine calibration to a different gas is not practical.
- A relatively large volume of gas is required for response testing.
- Ambient temperature for detector use is limited to 70°C.
- They do not perform well for multiple gas applications.
- IR sources cannot be replaced in the field - they must be returned to the factory for repair.

Typical gases monitored	Other gases monitored
Methane	Isopropylamine
Ethane	Propylene
Propane	Ethylene oxide
Butane	Propylene oxide
Hexane	Ethanol
Butadiene	Methanol

Table 1: Gases monitored.

Application requirements

There are many important factors to consider when deciding whether to select an infrared or catalytic detector for a particular application. Reliable application of either infrared or catalytic detectors depends on a detection system that matches the detectors and sampling techniques to the monitored area. It is important to recognise that different gases can require different detection technologies. No single detection principle can provide the sensitivity and response time required for every gas. Similarly, the detector heads must be matched to ambient conditions surrounding the measurement point.

Site location and experience

Both IR point detectors and catalytic detectors enjoy long life expectancies, even in severe environments such as the North Sea. In the harsh environments of refineries, IR detectors offer fail-safe operation, but still should be checked with gas periodically to verify that gas is free to enter the optical path. Splashguards and dust shields can become blocked in certain conditions or environments. Experience has shown that users of both IR and catalytic technology do prefer to check the detectors with gas and, as such, perhaps there is no significant difference in the overall maintenance requirements. In climates with low and high temperature extremes, very humid conditions and around hot or vibrating machinery, catalytic detectors are the best choice.

Calibration of detectors

Measurement quality with both combustible and IR gas detectors is dependent on accurate calibration with known gas concentrations. Both IR and catalytic bead detectors from General Monitors are smart microprocessor-based devices featuring single-point calibration. They feature an automatic calibration adjustment sequence with no tools or area declassification necessary.

Placement of detectors

For IR and catalytic detectors, there are three types of monitoring strategies:

- Point
- Area
- Site perimeter

When you know the potential source of a gas leak, you can design a point monitoring strategy to place detectors close to the potential leak sources, such as tank valves, so that detection is prompt. In large refining or chemical processing plants, a point detector grid system can be developed to monitor specific zones, such as a storage tank area, as shown in the example in Figure 5.

For plants where the site layout makes it difficult to identify specific leak sources that may spread into other locations, a wider area monitoring system can be developed with point gas detectors placed at preset geographic distances.

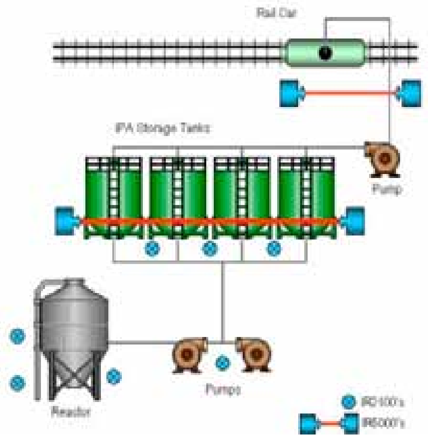


Figure 5: Typical installation for point and open path gas detectors.

Some plants also require outer perimeter monitoring along property fence lines to guard against gas passing beyond the facility's boundaries. In some cases, open path IR detectors may be useful in detecting gas clouds that can become airborne and disperse over a wide area (Figure 4).

Detector system communication

Infrared and catalytic detectors should at least provide both 4-20 mA analog and RS-485 serial output that is Modbus protocol compatible for use in large distributed control systems. Using a Modbus-compatible remote transmitter unit provides two-way addressable communications for status, alarm, fault and other information for operation, troubleshooting or programming of the detectors. With Modbus, up to 128 point detectors may be networked in series, and up to 247 point detectors can be networked with repeaters. A typical system configuration linking 20 gas detectors and 20 flame detectors is shown in Figure 6.

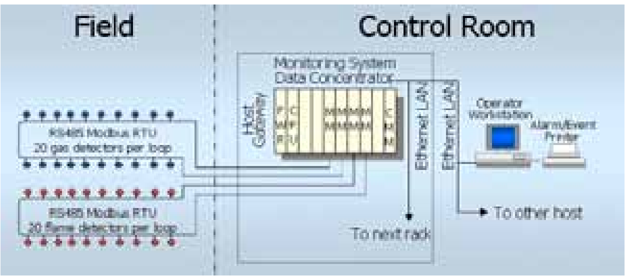


Figure 6: Multi-drop addressable system.

Maintenance and repair

Catalytic gas detectors require a routine check every 90 days. While no routine calibration is actually required for IR detectors, a gas check is still recommended every 90 days. Typically, calibration takes between one and three minutes. Should a catalytic sensor require replacement, it can easily be changed out in the field. IR point detectors require factory repair; however, repair frequency is typically very low. Also, a spare IR detector can be installed while the defective one is sent to the factory.

Expected detector life

Both catalytic and IR gas detectors have a sensor life expectancy of up to five years. Catalytic detectors can be calibrated 50 times with one cylinder of gas. IR detectors require no routine calibration; however, if calibration is performed, they are limited to 10 times maximum per cylinder of gas. The initial cost of catalytic detection is typically lower than IR, but overall IR maintenance costs are lower.

Life-cycle cost analysis

Both IR point detectors and catalytic detectors share similar installation and wiring costs. Inspection frequency is the same for both, but IR detectors feature self-diagnostics while catalytic detectors require a gas check. As stated previously, IR detectors do not require routine calibration; however, 90-day gas checks are recommended. Repair data shows that in many cases catalytic detectors may be more quickly repaired in the field than IR detectors that often require factory expertise for repair. This minor inconvenience, however, is easily overcome by keeping a spare IR detector on hand in the unlikely event that repair is needed.

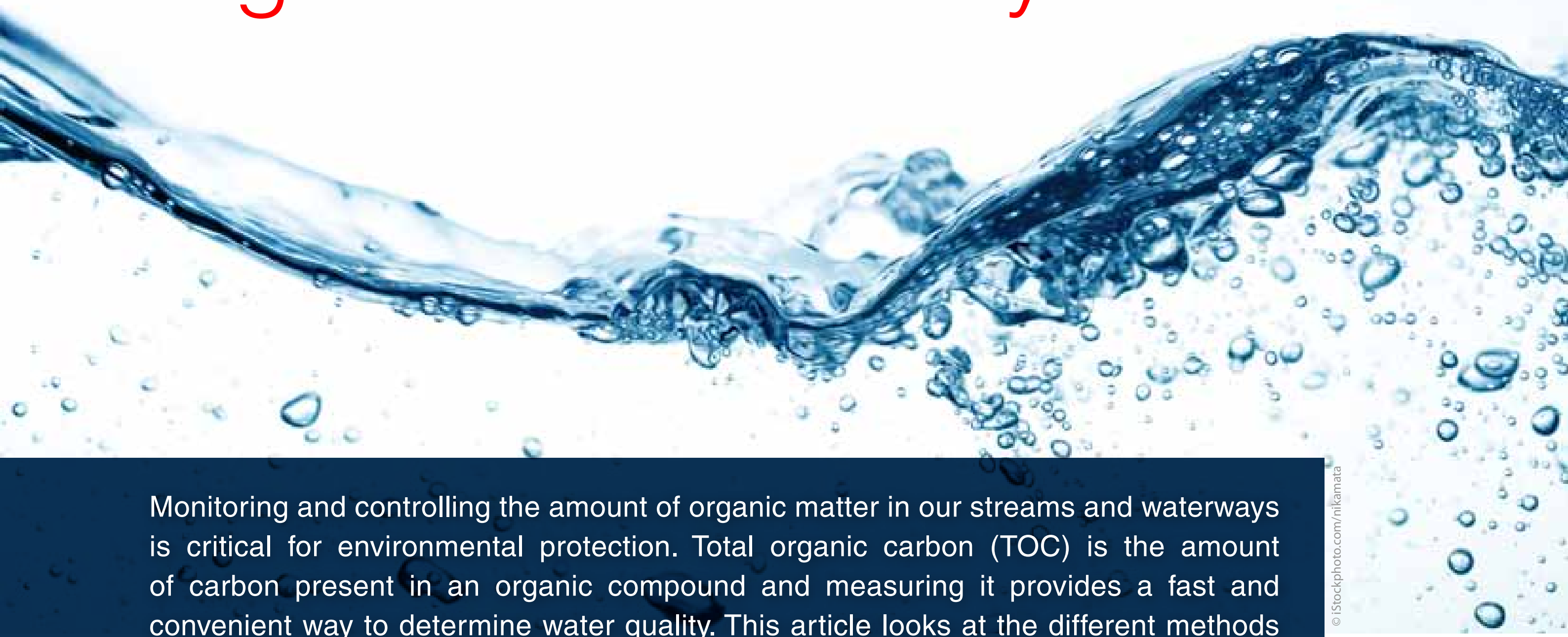
Performance and reliability

While IR detectors do offer enhanced reliability due to their fail-safe function, immunity to poisons and ability to function without oxygen, catalytic detectors offer application flexibility, simple maintenance and lower replacement costs. Both technologies are reliable, fast detecting and accurate. Neither is necessarily the answer to everything and, in most plants, a combination of both types is the correct and sensible solution.

Conclusion

There is clearly a requirement for both IR and catalytic detectors. When making a choice, be sure to strongly consider the field environment and variables in detector design from manufacturer to manufacturer. Life-cycle cost assumptions will not hold true in all environments. The same can be said for detector mean-time-to-repair or failure data among various manufacturers. Careful analysis of detectors, suppliers and field experience will help you select the best catalytic or IR detectors for your application.

Protecting the environment and your reputation with organic carbon analysis



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Monitoring and controlling the amount of organic matter in our streams and waterways is critical for environmental protection. Total organic carbon (TOC) is the amount of carbon present in an organic compound and measuring it provides a fast and convenient way to determine water quality. This article looks at the different methods now available for analysing TOC.

Jimmy Britz

Why measure TOC?

TOC analysis is used for evaluating water quality in industry and in environmental laboratories. It determines the level of organic contamination for quality control and wastewater monitoring in a range of industries including the chemical, pharmaceutical and food and beverage industries.

Analysing TOC is essential for compliance monitoring of drinking water, groundwater, soils and wastewater. By itself, TOC isn't harmful but it can react with the disinfectants used in drinking water processing plants to produce harmful disinfectant by-products (DBPs). Because organic matter is a precursor to DBP formation, TOC is used to determine the quantity of naturally occurring organic matter in the drinking water source so that the levels of disinfection by-products can be predicted.

Monitoring and controlling TOC is also critical when it comes to processed and discharged effluent. Industrial, manufacturing and process plants need to be extremely careful before releasing water into the municipal system or into streams. The environmental protection authorities (EPAs) in each state provide extensive guidelines to ensure TOC levels are correctly monitored and wastewater adequately treated before being discharged into the municipal system. The consequences of pollution are financial as well as environmental due to strict laws on tolerance limits for contaminants. There are severe financial penalties, and even the possibility of jail, for breaching these limits. With social responsibility high on the corporate agenda, protecting reputation requires tight control of effluent strategies.

TOC as a sum parameter

The total carbon of a liquid sample can be divided into total inorganic carbon (TIC) and total organic carbon (TOC). TOC can again be divided into three groups:

- Dissolved organic carbon (DOC)
- Non-purgeable organic carbon (NPOC)
- Purgeable organic carbon (POC) or volatile organic carbon (VOC)

For the classification of organic carbon, it is important to note the difference between POC and VOC. POC is actively eliminated during online analysis of TOC (during stripping, for example). VOC is a scientific term that describes the properties of volatile organic carbons. Volatilisation of substances is a passive process strongly influenced by temperature and pressure.

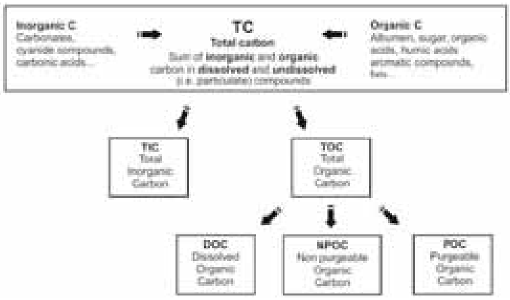

Figure 1: Classification of carbon parameters.

Figure 2: Types of online TOC analysers - on the left a high temperature oxidation analyser, in the middle some UV absorption analysers, and on the right a chemical oxidation analyser.

Methods for measuring TOC

With today's environmental awareness and regulatory climate to consider, continuous online measurement of TOC is the preferred option. There are three common online methods: chemical oxidation, high-temperature oxidation and UV absorption. The selection of the method is dependent on the application and level of accuracy required.

TOC analysers measure total organic carbon present in a liquid sample. However, there is always an amount of inorganic carbon (IC) in a sample that needs to be ignored. In the UV absorption method IC is not measured, whereas in the chemical and high-temperature oxidisation methods the inorganic organic carbon needs to be removed to obtain an accurate TOC measurement. So the first step in these methods is to remove the inorganic carbon from the sample.

This is done by adding acid to the sample, dropping its pH to approximately 2.0 to convert all carbonate and bicarbonate forms of inorganic carbon into carbonic acid - which is dissolved carbon dioxide (CO_2). A CO_2 free carrier gas is bubbled through the sample, removing the carbonic acid from the sample in the form of CO_2. This process also removes the POC through diffusion and osmosis.

Chemical oxidation

The next stage differentiates the chemical from the high-temperature methods. After stripping out the inorganic carbon, the chemical method uses a power oxidant - sodium metabisulfite - in conjunction with a powerful UV lamp to oxidise the liquid sample and liberate the organic carbon as CO_2. The CO_2 concentration is then measured using a non-dispersive infrared analyser (NDIR) detector and is directly proportional to the concentration of TOC.

As POC is also stripped out at the inorganic carbon removal stage, the resulting measurement is a TOC direct measurement, which includes only the dissolved and suspended solid TOC.

This method is ideal for limit violation monitoring in water applications where high accuracy is paramount, such as in effluent streams feeding into rivers or oceans and in water recycling plants.

High-temperature oxidation

In the high-temperature method, after the liquid sample has the inorganic carbon stripped out, it is combusted in an oxygen-rich atmosphere in a high-temperature oven at 850°C. This causes all organic carbon to be liberated as CO_2. The gas is cooled and the CO_2 concentration is again measured using an infrared detector and is directly proportional to the concentration of TOC. This method is ideal for limit violation monitoring in industrial wastewater applications, where the sample is likely to contain complex organic compounds such as ketones which need the high-temperature oxidisation to be broken down.

In the case of wastewater with a high salt load, an optional heated salt trap can be added. The salts are caught in the salt trap so they don't clog up the furnace. The trap can be cleaned and replaced in under five minutes while the furnace is in operation. In cases of varying pH values, pH control can be added to ensure effective acid dosing during the inorganic carbon stripping process. This minimises acid consumption and prevents salt particle formation caused by excess acid addition.

UV absorption

The third TOC method uses ultraviolet light (UV) and measures the absorption at the 254-nanometre wavelength to provide a correlating TOC content of the sample. This in-situ method is therefore low maintenance and doesn't require chemicals. As this is an inferred measurement it does not provide the same accuracy as the oxidisation and chemical methods, but it does provide the repeatable, continuous and instantaneous measurements required for process control.

The UV absorption method of TOC measurement is suited to sewerage treatment plants for controlling the aeration process and to measure the incoming load of the inlet stream.

The online future for organic carbon

The reduced biological and environmental health of some of Australia's major water bodies, such as the Murray-Darling river system, highlights the need to protect the quality of water in our rivers, estuaries and lakes. However, TOC measurement is not only important because of its effects on the environment - human health and manufacturing processes are affected by TOC content as well.

The TOC measuring processes described above are now used in a variety of applications. While grab sampling is still being used in some industries, the online approach is the only way to provide continuous and real-time water quality information.

EPA legislation, together with increasing public awareness and concern about the environment, make online measuring and monitoring of TOC an essential part of water and wastewater management.

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SICK is one of the world's leading manufacturers of sensors, safety systems and automatic identification products for Factory Automation, Logistic Automation and Process Automation applications. Whether automating factories or optimising distribution centres, or monitoring emissions from a stack, SICK provides cost-effective solutions.

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