

ENVIRONMENTAL TECHNOLOGY - MAKING A DIFFERENCE

Analytical instrumentation and specialty gases at the forefront of environmental technology at the AQE

Out with unabated diesel generators, in with food-grade carbon dioxide and up with clean bio-methane. That's how we might summarise some of the main environmental lessons from this year's AQE exhibition and conference.

Big names from the specialty gases calibration gas mixtures industry were exhibiting this year in Telford. Air Liquide, Air Products and NPL were there and Praxair were represented by their UK based Portagreen distributor, Spantech.

These products are essential to calibrate the latest analytical instrumentation which were also show-cased in abundance by companies such as ABB, Bruker, Gaset, Horiba, Protea and Shimadzu.

Keynote presentations from the Environment Agency and Uniper also shed light on how the Medium Combustion Plants Directive (MCPD) will change the air emissions monitoring landscape, which could drive growth in instrumentation sales, consultancy services and calibration products related to particulates, CO, NOx and SO₂.

Game over for unabated diesel-fuelled power generators

The new Europe-wide MCPD legislation will have a significant



impact on major consumers of electricity who sometimes supplement grid supply with local diesel power generators. These electricity generators may be sized to serve the full site demand or used for supplemental power generation to avoid high consumption at peak electrical power usage periods, known as "triads".

Triads are used for price management by the UK national grid to encourage users to reduce power consumption at peak load periods and avoid un-necessary investment in the power transmission grid. Many companies use diesel generators during these periods, in addition to power management strategies, ie shutting down non-essential site operations, and many of these generators will come under the scope of the MCPD.

The MCPD has different rules relating to a range of scenarios that depend on (amongst others) the combustion technology, size of the unit, year that it was (or will be) brought into operation and its annual total operating hours. John Henderson from the UK Environment Agency summarised the situation as follows: "whilst the legislation is complex, and covers many pages, one simple over-riding objective is clear – DEFRA wishes to see an end to unabated diesel engines for non-emergency power generation to preserve environmental air quality and save lives".

So, what needs to be done? First and fore-most check whether any power generation / combustion equipment falls within the scope of the MCPD, either as a combustion plant or as a 'specified generator', or SG. And, if it is covered, take note of the timeline that it will be impacted by the legislation. In some cases, it will be necessary to make a permit application before the end of 2018, to ensure continued operation in 2019. For some other categories of combustion plant, or electrical power generation equipment, the permit application will need to be made during the summer of 2019, to ensure ongoing operation beyond October 2019.

In most cases, retrofit of an SCR-type NOx emissions abatement system to the diesel generator will be required to ensure its ongoing use. But... don't expect a quick turn around on this kind of installation just now... demand has spiked and the exhaust gas treatment equipment suppliers are heavily loaded. And, to compound the problem, a tightening of supply for appropriate SCR catalysts has emerged in the value chain.

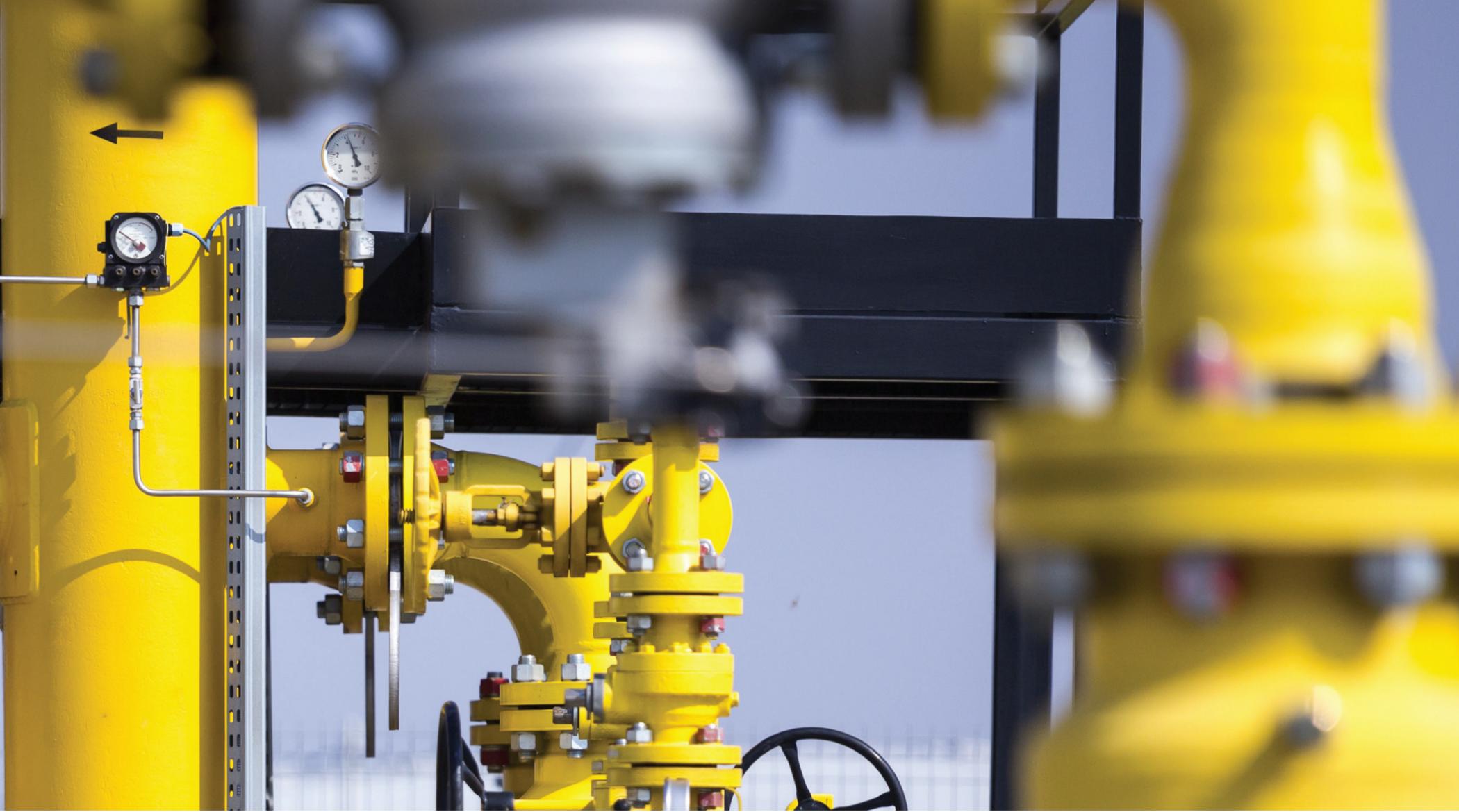


Biogas props up the creaking CO₂ supply chain

The shortage of CO₂ has been the topic of attention in the popular press in recent months. The situation has encouraged industrial gases companies that are involved in the CO₂ supply chain to diversify and expand their sourcing options. Biogas production, with subsequent separation of methane and purification of CO₂ to produce 'green' food-grade CO₂ has recently emerged as a realistic route to support this sourcing diversification strategy.

Companies such as the gas analyser manufacturer, Horiba have been playing a critical role to help the biogas plant operators maintain a consistent quality of product that will meet the tight food-grade specifications. Lee Swanson, a specialist in this type of instrumentation at Horiba UK Limited, spoke about the role that his company plays: "the industrial gases companies that purchase CO₂ run extensive quality tests in their sophisticated labs. The best grades of product are used for food applications and attract the best prices. Lower grade batches are destined for industrial usage in welding gas mixtures or pH control and command lower prices. So, investment in CO₂ analysis and quality control is advantageous for the biogas producer to ensure that they meet the tight food grade specifications on every batch and maximise their revenue and profit. Our instrumentation is helping them to check continuously for low levels of total sulphur and hydrocarbons. This analysis allows them to pro-actively make process adjustments to optimise their operations and business."

And, where there's smoke, there's fire. The process-monitoring



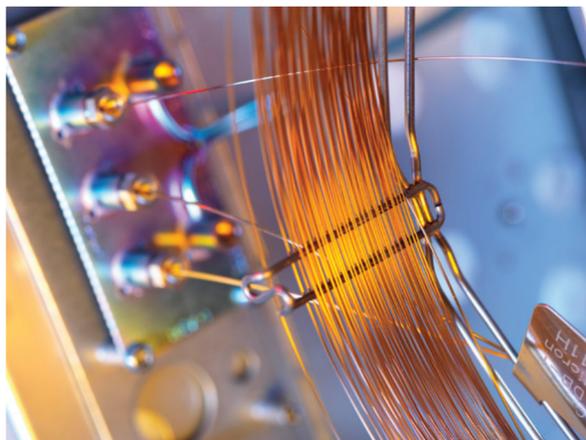
analytical instrumentation requires periodic calibration with high precision specialty gases mixtures for its operation. It's a closed loop... ultimately, the industrial gases companies are providing the specialty gases calibration mixtures to ensure that the raw materials they purchase meet a suitably high standard of purity.

FTIR instrumentation protects the gas grid

One of the critical issues with the introduction of biogas to the natural gas distribution grid is that it should contain extremely low levels of siloxane compounds. This is particularly an issue for landfill gas and biogas generated from domestic waste-water anaerobic sludge digesters, but less so for purpose-built biomass to biogas plants because the siloxanes generally originate from domestic cleaning and personal hygiene products. Siloxanes can cause tremendous damage to gas turbines and instrumentation in the gas distribution grid as abrasive silicon oxide particles can build up on the equipment.

To monitor and control this potential issue, measurement of siloxanes in a matrix of biogas can be achieved using FTIR instrumentation. Victoria Brewster, Product Leader for Spectroscopic Solutions at Protea commented on the analyser that her company offers for this application: "Protea used to operate a UKAS accredited stack emissions testing laboratory as well as manufacturing analysers. But, we were never really satisfied

with the instrumentation that was commercially available for some of the more exotic challenges that this sector presented to us. So, we began to innovate our own instrumentation and data analysis software. Over the years, this has evolved to the highly sophisticated and robust solutions that we have brought to the AQE this year, including our atmosFIR, which is ideally suited to sub-ppm level siloxanes analysis in the biogas sector".



GC column for Siloxane gas mixtures analysis - NPL

High tech specialty gases set the standard

When it comes to specialty gases calibration mixtures for the above instrumentation, gas standards containing siloxanes are amongst the most difficult to prepare. Molecules such as H₂S and NO_x were challenging 20 and 30 years ago, but these are now produced widely, with high reliability and stability. The equivalent cutting-edge of specialty gases technology today lies in this area of siloxanes. Very few companies active in specialty gases have the competence to prepare such mixtures for commercial use. One of the few that is active in this area, and were presenting at the AQE is NPL, located in Teddington, UK.

Giving the last word to Lucy Culleton, a scientist at NPL who plays a leading role in the oversight of the production of these

primary reference materials produced by NPL: "siloxanes are not particularly volatile, so the preparation of gas mixtures containing them can be a technical challenge. Despite these difficulties we have perfected methods to produce stable siloxane gas mixtures at the ppb level concentrations required in the biogas production sector in a matrix of methane, nitrogen or synthetic biogas. The future will undoubtedly bring about further challenges in the field of calibration mixture preparation and I am confident that NPL will continue to be at the forefront of developing reliable metrological reference materials to meet the needs of the energy transition that is taking place internationally".



Preparing Siloxane gas mixtures - NPL

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