



Formaldehyde emissions monitoring

Formaldehyde, emitted from furnishing and construction materials and from the combustion of organic materials, can cause health problems. Regulations govern safe limits, and monitoring systems check these are not exceeded. Gas standards – cylinders with accurate formaldehyde amount fractions – are used to calibrate these systems, but as air quality limits become stricter, new methods are required for producing standards with lower, stable amount fractions to confirm the performance of monitoring instrumentation.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Trace amounts of volatile organic compounds (VOCs), such as formaldehyde, are released into the environment by the manufacture of housing materials such as furnishings, wood-based products, plastics and varnishes and also from the combustion of ethanol added to petrol to reduce carbon monoxide. Traces of formaldehyde can make people feel unwell, and prolonged exposure can cause respiratory problems, and in rare cases may induce nasal cancer.

EU regulations limit acceptable levels in buildings and the environment for VOCs, limits which are expected to be tightened. The World Meteorological Organization Global Atmosphere Watch (WMO-GAW) has implemented a worldwide VOC monitoring programme, and Europe alone has more than 50 monitoring stations, to evaluate air quality and track global trends.

To confirm air quality meets data quality objectives, monitoring instruments must be calibrated to detect trace amounts of formaldehyde at the low levels found in air. This requires stable standards – gas cylinders containing accurate amount fractions of formaldehyde – against which instruments can be calibrated.

However, formaldehyde is very reactive and sticks to the cylinders, so its amount fraction may reduce with the passage of time. As air quality regulations become stricter, new formaldehyde standards are needed which use inert materials to ensure their contents remain stable over time, in order to reliably confirm the performance of monitoring instrumentation.

Solution

The EMRP Project *Metrology for VOC indicators in Air Pollution and Climate Change* investigated materials which are inert to formaldehyde and used these to improve the design of systems used to generate formaldehyde gas standards, and the cylinders used for storing them.

This led to the development of a new dynamic production facility for creating very low-level formaldehyde mixtures for use as calibration standards. The inert facility creates known quantities of formaldehyde and carefully dilutes them with VOC-free gas to produce amount fractions of one part per million (ppm), which is very low for a gas reference standard. The project also investigated the stability of cylinders containing formaldehyde gas standards over time through repeated testing with highly accurate measurement instruments and confirmed that their amount fractions held and therefore these are fit for purpose.

Impact

Air Liquide, the world's largest supplier of industrial gases, routinely supplies reference gas standards to industry and academia, including formaldehyde standards. It was one of the first to use the new project developed LNE dynamic production facility for formaldehyde gas standards to calibrate its own in-house standards.

Air Liquide anticipates increasingly stringent building regulations and outdoor air directives with tighter VOC emission requirements, which will increase the market for low level standards for confirming the performance of formaldehyde monitoring instrumentation. Air Liquide aims to be ready with a capability in place to provide these low part-per-million formaldehyde standards.

Access to more accurate standards will help polluting industries such as builders and fuel producers, as well as governments and local authorities, to monitor, control and reduce formaldehyde emissions and to demonstrate compliance with increasingly strict regulations.

Monitoring volatile organic compounds in air

The EMRP project *Metrology for VOC Indicators in Air Pollution and Climate Change* developed new point-of-use reference materials and gas standards at the low amount fractions required for monitoring volatile organic compounds (VOCs) in the environment. The project investigated the use of coatings and materials to reduce interactions between VOCs and metal surfaces which is important in both maintaining gas standard stability in storage as well as the in-situ production of gas standard before use to characterise analytical instrumentation. The project standards were used to evaluate the performance of low-cost gas sensors for environmental monitoring of VOCs and generated increased knowledge in the use of this type of sensors. This work builds on outcomes from the EMRP project *Metrology for Chemical Pollutants in Air*.



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