European Metrology Programme for Innovation and Research

Delivering Impact

Robust sulfur dioxide emissions monitoring

The Industrial Emissions Directive prepares operators to comply with reduced maximum allowable emissions of sulfur dioxide from industrial plants. Evidence emerged that the standard test method for verifying compliance might not be sufficiently accurate for targeted concentration levels to come into force. New technologies showed potential as a basis of an alternative method but lacked quality procedures, leaving enforcement bodies unable to offer clear advice on investing in compliance for the long term.

Europe's National Measurement Institutes working together

The European Metrology Programme for Innovation and Research (EMPIR) has been developed as part of Horizon 2020, the EU Framework Programme for Research and Innovation. EMPIR funding is drawn from 28 participating EURAMET member states to support collaborative research between Measurement Institutes, academia and industry both within and outside Europe to address key metrology challenges and ensure that measurement science meets the future.

Challenge

Air pollution remains the main environmental factor in human ill-health, with about 400,000 premature deaths attributed to ambient air pollution annually in the EU.

Industrial processes account for a sizeable share of polluting emissions, including sulfur dioxide (SO_2), produced by burning fuels containing sulfur compounds and waste incineration. This toxic gas contributes to the formation of particulate aerosols that, along with other oxide compounds, can be responsible for respiratory illnesses, especially in children and the elderly.

The 2010 Industrial Emissions Directive (IED) commits member states to control and reduce the effects of emissions, that according to the European Commission, if successfully enforced, could reduce premature deaths and years of life lost each year in Europe by 13,000 and 125,000, respectively.

Around 50,000 industrial facilities will be expected to comply with reduced emission limit values (ELVs) through the use of abatement technologies, the performance of which overseen by continual emission monitoring systems, in turn periodically tested according to approved Standard Reference Methods (SRMs).

The European Commission mandated Comité Européen de Normalisation (CEN) to develop SRMs to support previous legislation, assigning special status to these standards. For SO_2 emissions, the SRM became specified by EN 14791, but this manual 'wet chemistry' method takes days to weeks to provide feedback, depending on the time needed to perform analysis. Attaining lower limits would be a favourable outcome for air quality but evidence emerged raising doubts about the suitability of the SRM for measuring at levels of SO_2 targeted by the IED.

Portable automated measuring systems (P-AMS) were sometimes used instead, not least due to inherent advantages for operators of real-time feedback. However, it was uncertain if these instrumental methods could be developed as an SRM for showing compliance with the IED, since necessary quality assurance and control procedures had not been formulated.

In 2015, CEN requested that a potential alternative method be investigated as it anticipated that EN 14791 was unlikely to comply with limits scheduled to come into force.

The Environment Agency (EA), the body responsible for environmental protection in England, permitted the use of P-AMS for measuring SO_2 but wanted specifications to be published by CEN to build confidence in the approach.

Solution

The project *Metrology for sampling and conditioning SO_2 emissions from stacks* clarified limitations of the existing SRM, proved the equivalence of instrumental methods, and led to the development of a new method for measuring SO_2 concentration.

Appointed as lead author, the project coordinator led the drafting of a CEN technical specification based on the method devised in the project. Drafts were enhanced by contributions of partners and other expert members of the technical committee for standardisation of methods for air quality (CEN/TC 264/WG 16).

Project findings and subsequent tests were shared at TC 264 annual meetings at Helsinki in 2017, Seville in 2018, and Copenhagen in 2019. These and various other discussions set the course for publication of the technical specification CEN/TS 17021, in January 2017.

Impact

The EA amended its guidance on *Monitoring stack emissions: techniques and standards for periodic monitoring,* recommending, as an option, instrumental extractive sampling and measurement according to CEN/TS 17021. It also suggested quantifying interference as advised in the project.

Evidence from the project also prompted the EA to impose new requirements on analytical laboratories that opt to continue using the existing SRM.

As a result, plant operators in England can use CEN/TS 17021 to demonstrate compliance with legislated emissions limits, and benefit from real-time feedback of emissions and reduced costs. Manufacturers of portable instrumental techniques may also exploit new markets as emissions monitoring organisations embrace this less labour-intensive approach.

The specification supports stricter SO_2 emission limits of the IED by future-proofing quality control procedures for instruments suited to measuring hoped for reduced levels of this significant pollutant.

Assessing existing and automated methods for measuring emissions to meet stricter limits

Analysis of proficiency testing using EN 14791 showed performance met existing requirements of the IED, but would not routinely meet lower limits that were being considered for waste incineration plants. Tests highlighted potential under-reading issues with EN 14791 for high SO_2 concentrations, and a potentially significant source of error related to positional uncertainty in stacks.

The project demonstrated and quantified the effects of different sample conditioning systems, and improved understanding of the practical issues.

Laboratory and field-based comparisons of the SRM and alternative methods for SO_2 measurement according to EN 14793 showed equivalence: Fourier-transform infrared spectroscopy, ultra-violet fluorescence with dilution probe and non-dispersive infrared with permeation dryers all passed equivalency tests where effects of alternative drying systems for conditioned sampling were quantified.

EMPIR EURAMET

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