

European Metrology
Programme for Innovation
and Research

Delivering Impact



Improving inner city air quality

Small particles from petrol and diesel engine exhausts create major hazards in city air, especially for those with asthma or other breathing problems. The EU's Air Quality Directive requires monitoring of airborne pollution which is important for assessing the effectiveness of strategies such as London's ultra-low emission zone. Ensuring the accuracy of instruments used for measuring vehicle particle emissions in city air relies on introducing standardised aerosols and testing regimes.

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

In our cities, small airborne soot particles form a serious health risk, generating an estimated 492,000 premature deaths per year from respiratory and cardiovascular problems in Europe. The EU's Air Quality Directive requires Member States to limit exposure to these particles, many of which are produced by vehicle engines. Cities are implementing their own strategies to combat this problem, such as London's ultra-low emission zone and other German and French initiatives. For reliable enforcement, accurate measurements of the particle size, mass and number in a volume of air are required.

The United Nations Economic Commission for Europe Particle Measurement Programme (UNECE PMP), brings together NMIs with instrumentation and vehicle manufacturers, and vehicle testing laboratories. It is responsible for devising workable and acceptable methods for measuring engine emissions. Recently their efforts have been augmented by the European and international standards organisation, CEN and ISO, to produce documented methods for characterising vehicle exhaust emissions and airborne concentrations, for example CEN 16976 and CEN/TS 17434. This places increased importance on the accurate calibration of relevant instruments.

The automotive industry is required to reliably demonstrate that vehicle emissions conform to environmental regulations and to do this emission testing is performed on a test bench. The reduction of permitted emissions and requirements to measure smaller and smaller particle sizes mean that instruments must achieve greater sensitivity than previously possible. Testing this relies on the use of well-characterised aerosols that conform to documented test procedures to ensure measurements provide reliable data that matches real-world requirements.

Solution

Research in the EMRP project *Emerging requirements for measuring pollutants from automotive exhaust emissions* established the types of particles suitable for simulating vehicle exhausts and developed reliable preparation methods for the aerosols used in testing. These were rigorously assessed in two EURAMET organised measurement comparisons between European NMIs, joined by the NMI from Japan and a laboratory from the USA. As a result, EMRP project developments are being incorporated into the revision of an ISO standard on particle size distribution measurements in aerosols.

Building on this, the EMPIR project *Automotive particle emissions: dissemination of aerosol measurement expertise to standards bodies* enabled NMIs to participate in both the EC mandated CEN technical committee and the UNECE PMP working groups focusing on improving the accuracy for measuring exhaust aerosol particle emissions. As part of this interaction, the German NMI, PTB, was able to support the PMP / JRC Ispra measurement exercise that brought together members of the European Automotive industry to confirm the performance of their test methods.

Impact

TSI, a leading manufacturer of instrumentation for characterising vehicle exhaust emissions, provided their condensation particle counter, model 3792E to confirm the properties of all the participants' aerosols in the PMP / JRC exercise. The TSI 3792E is a

good example of commercially available instruments that have sensitivity across a wide range of particle sizes. SI traceability for the instrument, used in the comparison exercise, was achieved using facilities developed in the EMRP project.

Resulting from the PMP / JRC study, the European automotive community now has a greater appreciation of the challenges associated with making traceable and accurate measurements of engine emissions and the need for a collective approach to formulating a common calibration procedure.

CEN mandated standards for emission monitoring

The economic cost of air pollution from Heavy Goods Vehicle emissions alone is estimated at €43 billion per year within the EC. Increasing the accuracy of roadside vehicle particle emission monitoring is key to setting pollution baseline measurements and identifying the success of mitigation strategies. EC mandates to CEN require the introduction of Technical Specifications in this area. They enable users from across the air quality monitoring community to evaluate the methods they promote, speeding a consensus on their potential for use in a new CEN standard.

Identifying and understanding the sources of environmental particles is a key requirement for the formulation of successful air quality remediation strategies.



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