European Metrology Research Programme

Delivering Impact

Improved exhaust monitoring

Air pollution continues to be responsible for more than 430,000 premature deaths each year in Europe. Automotive vehicles are a major source of air pollution - of particular concern are the fine particles emitted by diesel and direct injection petrol engines. To improve public health and environmental quality, the EU regulates pollution from road vehicles and new passenger cars must meet the European emission standards (the standard currently in force is known as *Euro 6*) before they can be type approved.

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

Since their introduction, the Euro regulations have significantly reduced exhaust pollution by progressively decreasing the permitted emissions. As a consequence, the low levels of particulate permitted by the next iteration of Euro regulations, *Euro 6c*, due to be implemented in September 2017, are now beyond the sensitivity of currently-used technology.

The *Euro 6* standard and its predecessor *Euro 5* introduced a particle number limit in addition to the particle mass-based limits. The UNECE Particle Measurement Programme, an intergovernmental research programme set up to develop improved measurement procedures to support Europe's emission standards, has identified condensation particle counters as the best technology for this purpose.

However, previously, the only way manufacturers and accredited testing laboratories could validate the performance of these instruments was through inter-laboratory comparison exercises. A traceability chain is required to link the measurements made by test laboratories directly to the SI units, enabling the production of robust, comparable emissions measurements which meet the stringent requirements of *Euro 6c*.

Solution

EMRP project *Emerging requirements for measuring pollutants from automotive exhaust emissions* has helped to establish this traceability chain through contribution to a new ISO standard (ISO 27891:2015) and the development of a new facility for calibrating condensation particle counters, that enables emissions testing laboratories to make particle number measurements directly traceable to the SI for the first time. This improved accuracy will ensure instruments are available that can detect the low levels of particulate permitted by the upcoming *Euro 6c* standard and support consistent emissions testing across Europe.

New particle number concentration calibration facilities at METAS were used to supply traceability for a comparative study conducted by the Swiss Laboratories for Materials Science and Technology. This study tested new diesel, petrol and natural gas vehicle engine types using UNECE defined test procedures and demonstrated their compliance with the *Euro 6* particle number limit.

Impact

TSI, a leading manufacturer of condensation particle counters, was one of the first beneficiaries of a new calibration facility to support the implementation of the ISO standard. After calibration at NPL, TSI's internal reference instrument can now be used in conjunction with the ISO standard to provide traceability for TSI's commercially-available condensation particle counters, which are used by engine manufacturer and emissions testing laboratories.

This will link the measurements made by engine manufacturers and testing laboratories to the SI, ensuring robust, comparable measurements of exhaust emissions to meet the forthcoming *Euro 6c* standard. By supporting the implementation of a key piece of the EU's air quality policy framework, this is an important step towards realising Europe's goal of improving health and environmental quality through cleaner air.

Tackling exhaust emissions

EMRP project *Emerging requirements for measuring pollutants from automotive exhaust emissions* provided the underpinning metrology infrastructure to better understand, measure and consequently control automotive exhaust emissions. The research focussed on the three main pollutants in exhaust emissions for which measurement infrastructure was lacking: soot particles, platinum group elements and mercury.
The capabilities developed will simplify, and increase the comparability and accuracy of, vehicle particle emission measurements, leading to the more effective implementation of legislation designed to protect human health.

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Martin Thedens
PTB, Germany
+49 531 592 3730 | martin.thedens@ptb.de

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