EMRP Call 2013 – Energy and Environment

Selected Research Topic number: **SRT-v05**
Version: 1.0

Title: Metrology for VOC indicators in air pollution and climate change

Abstract

Volatile Organic Compounds (VOCs) in air are diverse gaseous substances. Some are particularly harmful for the environment and human health, whilst others are key-players in photochemical formation of air pollutants. The measurement of VOCs is complex due to the many different molecules present in the atmosphere at very low concentration levels ((sub) part-per-billions) and currently only a very few VOC indicators can be measured routinely at monitoring stations and laboratories. In addition, regional (EMEP) and global (WMO/GAW) VOC programmes are struggling to obtain high quality and comparable data. In order to address these issues more accurate measurement of VOCs are required, including improving the current measurement infrastructure for VOCs, providing traceable gas standards and validating measurement systems.

Conformity with the Work Programme

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Energy and Environment on pages 8, 9, 24 and 25.

Keywords

Volatile organic compounds, air pollution, climate change, air quality, indoor air, VOC emissions, measurement standards, portable measurement devices

Background to the Metrological Challenges

VOCs are widely used indicators for air quality (for both indoor and ambient atmospheres) and climate measurements. However, the comparability of the generation of and measurement methods for VOCs need to be improved. Issues such as the adsorption and reactivity of VOCs at trace levels (part-per-billion) are significantly contributing to the uncertainty of measurements and to the preparation of stable gas standards, which, in turn, affects both the preparation of static reference materials (gas mixtures in compressed gas cylinders) and the measurement of VOCs. Another issue contributing to the uncertainty of VOCs at low concentrations is the availability of VOC free zero gas (nitrogen or air). Even if a zero gas contains only a few hundred of part-per-trillion of VOCs, this will significantly contribute to the uncertainty of the gas standard prepared. Therefore the efficiency of purification technologies in removing VOC impurities needs further investigation.

Almost all existing labelling schemes, measuring VOC emissions from construction products, make use of the ISO 16000 series of standards. The comparability of results obtained with the existing emission test procedures has been checked with inter-comparisons, however recently tests based on the existing ISO standards 16000-3, -6, -9 and -11 showed a typical uncertainty of around 20 % for VOCs and formaldehyde. Furthermore, for compounds emitted at low concentration levels (e.g. below 20 µg/m^3), polar compounds such as glycols or some aldehydes, or products presenting inhomogeneous emissions, uncertainties levels of 40 % were demonstrated.

Currently, gas standard preparation methods for VOCs at trace levels vary, depending on the class of compounds and whether static gravimetric or dynamic dilution standards are used. VOC sensors and portable measuring systems for air monitoring applications are commercially available and manufacturers claim these are in principle suitable to measure down to trace levels total (TVOC) or specific VOCs.

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However, only limited tests are presently carried out before such systems enter the market and these devices are mainly used for qualitative purposes.

Scientific and Technological Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the JRP-Protocol.

The JRP shall focus on the traceable measurement of VOCs and improving the measurement infrastructure for VOCs by providing traceable gas standards and validating new measurement systems.

The specific objectives are

1. To develop accurate measurement and transfer standards for VOC indicators, with a long-term stability. Such standards should include monoterpenes and oxygenated-VOCs with uncertainties better than half of the target uncertainty values set by the WMO/GAW VOC Programme.
2. To develop reference materials and measurement standards (e.g. polar-VOCs and semi-VOCs) for the quality assurance and quality control of indoor air monitoring. This should include the production of “VOC free” zero gas standards, as well as demonstrating the comparability of the VOCs gas standards and assessing their measurement uncertainty.
3. To investigate the adsorption and reaction effect of VOCs on surface materials.
4. To validate sensors and portable on-line measuring devices for targeted VOC measurements. This should include the development of validation and calibration protocol(s) and laboratory and field validations for VOCs indicators regulated by law (e.g. benzene).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the R&D work, the involvement of the user community such as industry, and standardisation and regulatory bodies, as appropriate, is strongly recommended.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this and EMRP JRP ENV01 (MACPoll) ‘Metrology for Chemical Pollutants in Air’.

EURAMET expects the average size of JRPs in this call to be between 3.0 to 3.5 M€, and has defined an upper limit of 5 M€ for any project. The available budget for integral Research Excellence Grants is 30 months of effort.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (e.g. letters of support) is encouraged.

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies
- transfer knowledge to the environmental and health sectors.

You should detail other impacts of your proposed JRP as detailed in the document “Guide 4: Writing a Joint Research Project”

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology and includes the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.