European Partnership on Metrology
Call 2024 –Digital Transformation, Green Deal, Normative and Research Potential

Selected Research Topic number: **SRT-v15**
Version: 1.0

Title: Metrology to support zero pollution from industrial emissions

Abstract

Damage to human health and the environment due to pollution costs between €277-433 billion per year, with 20 % of all EU pollution coming from installations regulated by the Industrial Emissions Directive (IED). In order for the EU's Zero Pollution action plan to successfully reduce the pollution burden to zero by 2050, there is a clear need to revise the IED. However, this requires the development of measurement infrastructure to underpin the key legislative changes: an order of magnitude decrease in emission limits; new reporting and uncertainty requirements; monitoring species of emerging concern. Proposals addressing this SRT should provide the measurement infrastructure necessary for the implementation of the revised IED.

Keywords

Industrial Emissions Directive, Best Available Techniques Conclusions, CEN/TC 264, air quality, pollution, emissions, zero pollution, associated emission level, emission limit.

Background to the Metrological Challenges

The EU's Zero Pollution action plan targets reducing pollution to "levels no longer considered harmful to health and natural ecosystems" by 2050, with intermediary targets to reduce premature deaths and the number of ecosystems threatened by air pollution by 55 % and 25 %, respectively, by 2030. One of the key pillars in realising the Zero Pollution action plan is the revision of the Industrial Emissions Directive. Published in 2011 and enforceable from 2013, the directive has successfully reduced industrial emissions, however, despite its success, damage to health and the environment is still significant – estimated to be up to €433 billion per year. Hence, given the directive regulates around 52000 industrial installations accounting for 20 % of EU pollutants, the need for revision is clear if the EU's Zero Pollution targets are to be met.

The IED requires national regulators to stipulate emission limits drawn from some 34 industry-specific Best Available Techniques Conclusions (BATC) legislative documents. BATC legislation details associated emission level (AEL) ranges for each pollutant associated with the industry, within which the national regulator is required to set the emission limit. Accredited emissions monitoring organisations then carry out periodic (annual) measurements following mandatory Standard Reference Methods (SRMs) that are compared to emission limits. This measurement system must stand up to scrutiny if warnings, fines or legal proceedings are to be possible.

Currently, 75 % to 85 % of all emission limits across Europe are set at the highest value of the AEL ranges, however the revised IED will require national regulators to set emission limits at the lowest end of the AEL ranges. This will result in many cases in an order of magnitude change, but the measurement infrastructure is not prepared for this. Also, there is a ruling that no measurement method can be published as a full CEN standard (EN) unless it has been formerly validated. Therefore, the work most needed is extension of European stack simulator capability and identification of industrial installations as appropriate test sites for the validation/characterisation of HF, formaldehyde, polycyclic aromatic hydrocarbons (PAHs) and heavy metals SRMs (a need recognised by CEN/TC 264 'Air Quality').

Work using flow stack simulators and Computational Fluid Dynamics (CFD) modelling is also needed to characterise and understand the uncertainty that is added at the lowest AELs. This is most relevant to dust, but also any other pollutant not residing exclusively in the gas phase. Any deviation of the sampling extraction

flow rate from the flow rate of the stack results in disproportionately too many or too few particles being drawn into the sampling apparatus. Hence, with reports that the same flow rate in calibration and subsequently in the stack measures differently due potentially to different ducting geometries during calibration compared to the stack (and other physical parameters) evaluation is needed.

Under the EU's review of environmental legislation, it was found that "there were some concerns on coherence with data reported […] such as the Industrial Emissions Directive (IED)". Consequently, the EC will pass an Implementing Act (yet to be written) for comparing measurements to emission limits for compliance assessment. This will exacerbate two areas, namely when the measurand is a summation of pollutants and accounting for uncertainty when comparing measurements to emission limits. With respect to the former, and using heavy metals as the example, EN 14385 requires the quantities of Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V to be summed, but gives no guidance of how to account in the summation for individual species measured around the detection limit. This results in significant national divergence, some nations require values at or below the limit of detection (LOD) to be set to zero for the summation, others require values between the limit of quantification (LOQ) and LOD to be set to 0.5 x LOQ, and other variations beside. This undermines a key pillar of standardisation, i.e., comparability.

With respect to uncertainty, there is national divergence in terms of how the uncertainty is estimated and then how it is used (sometimes not at all) in comparing the measurement to the limit. In the extreme, this risks an emission in one nation being declared a breach, but the same emission elsewhere being declared in compliance. The proposed Act is recognition that uncertainty has to be considered, but to support this - and summation measurands (heavy metals, dioxins and furans, PAHs) - guidance (with worked examples) is needed on how to correctly account for such parameters under metrologically sound principles.

The IED has, contrary to the intentions of legislators, not been treated holistically and, consequently, the revision will strengthen the directive in this regard such that national regulators will account for all relevant polluting substances, including those yet to be specifically regulated. A key class of pollutants in need of redress are PFAS, given their widespread presence in many industrial processes and their link to adverse health effects such as, liver disease, kidney disease, and cancer. However, setting emission limits is problematic as knowledge is lacking as to which compounds are released and at what concentrations. Hence, development of a sampling method (for eventual standardisation at CEN) is needed for deployment for a screening exercise in a series of field trials at suspected industrial installations (e.g., metal coating, textile coating). Determining exactly which PFAS are emitted and at what levels will take a significant step forward in the ability to set emission limits and monitor the pollution.

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 protocol.

The proposal shall focus on the development of metrology capability for measuring and characterising pollutants to support key revisions of the Industrial Emissions Directive.

The specific objectives are

1. To extend and validate European stack simulator capability and identify real stacks at industrial installations for the generation/release of emission matrices commensurate with enforcing emission limits at lowest end of associated emission level range. To utilise this enhanced capability to characterise the uncertainty to which CEN Standard Reference Methods for HF, formaldehyde, heavy metals (Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V) and polycyclic aromatic hydrocarbons will be able to enforce this more stringent legislation.
2. For dust measurements and isokinetically sampled gaseous species, to determine the sensitivity of different physical parameters between calibration and use (duct geometry, off-axis flow components) and, subsequently, variance in isokinetic sampling when sampling the same dust loading but with different size distributions. To draft new uncertainty methodology and propose as revision to EN 15259.
3. For Standard Reference Methods SRMs, to determine a metrologically sound basis for: reporting emissions close to the quantification limits of measurement methods; reporting when the measurand is a summation of collected species with some individual measurements close to the detection limit (e.g., summation of heavy metal measurements); carrying out long term sampling; comparing measured emissions to emission limits with correct account taken of uncertainty before declaring a breach, and create of a series of industry guidance documents from this work.

4. To develop a measurement method for sampling Per- and Polyfluoroalkyl Substances (PFAS) from industrial stacks and deploy it across industrial installations suspected of PFAS emissions, collecting samples. To identify key PFAS species emitted from these processes and quantify them to inform future monitoring requirements and appropriate emission limit levels.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain, standards developing organisations (CEN/TC 264 'Air Quality'), and end users (e.g., national regulators, emissions monitoring organisations, EU DG Environment, Task Force on Emissions).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. Proposers shall give priority to work that meets documented needs, in particular those supporting the European Green Deal. To enhance the impact of the research, the involvement of the appropriate user community such as industry, standardisation and regulatory bodies is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art and explain how their proposed project goes beyond this.

Proposers should note that the programme funds the activity of researchers to develop the capability, not the required infrastructure and capital equipment, which must be provided from other sources.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 2.8 M€ and has defined an upper limit of 3.5 M€ for this proposal.

EURAMET also expects the EU Contribution to the external funded beneficiaries to not exceed 35 % of the total EU Contribution across all selected projects in this TP.

Any industrial beneficiaries that will receive significant benefit from the results of the proposed project are expected to be beneficiaries without receiving funding or associated partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the 'end user' community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the "end user" community (e.g., letters of support) is also encouraged.

You should detail how your proposal's results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Facilitate improved industrial capability, or improved quality of life for European citizens in terms of personal health, protection of the environment and the climate, or energy security,
- Transfer knowledge to the emissions monitoring sector.

You should detail other impacts of your proposed JRP as specified in the document "Guide 4: Writing Joint Research Projects (JRPs)"

You should also detail how your approach to realising the objectives will further the aim of the Metrology Partnership to develop a coherent approach at the European level in the field of metrology and include 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 EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work.

Timescale

The project should be of up to 3 years duration.