EMPIR Call 2019 – Energy, Environment, Normative and Research Potential

Selected Research Topic number: **SRT-v03**
Version: 1.0

Title: Implementation of radon metrology for the analysis of the atmospheric budget of greenhouse gases and for radiation protection in the environment

Abstract

Environmental radon can be used as a tracer for the quantification of greenhouse gas (GHG) emissions and the spatial determination of their origins, as well as for the identification of radioactive sources for radiation exposure assessment. The assessment of GHG emissions has to be improved to optimise reduction strategies. Thus, novel techniques for emission estimates, such as the so-called Radon Tracer Method (RTM), are needed. Furthermore, radon is the main source of natural radiation exposure and understanding its environmental distribution is important for radiation protection issues. Proposals addressing this SRT should contribute towards the evolution of climate observation and radiation protection by providing traceable environmental radon measurement infrastructure.

Keywords

Radon metrology, greenhouse gases (GHG), radiation protection, Council Directive 2013/59/EURATOM, Radon Tracer Method (RTM), radon flux measurement, radon flux inventories

Background to the Metrological Challenges

Enabling traceable radon measurements at the environmental level combines the challenges of climate change, handling and modelling of big environmental data, and the setting up of new services aiming to improve radiation protection as stipulated in Council Directive 2013/59/EURATOM. This directive lays down basic safety standards for protection against the dangers arising from exposure to ionising radiation and addresses environmental radon at workplaces and at homes, which is the biggest source of radiation exposure for every European citizen and thus the second highest risk (after smoking) for inducing lung cancer. The long-term risk from radon exposure needs to be taken into account.

Due to its physical characteristics the radioactive noble gas ^{222}Rn forms an integral part of fundamental research topics such as improving of inverse transport models, estimating emissions of GHG, investigating atmospheric transport and mixing processes within the planetary boundary layer, or the analysis of air mass origin. International and National GHG monitoring infrastructures work towards including atmospheric ^{222}Rn monitors in their stations. As the traceability to the environmental level of a few Bq m^{-3} radon activity concentration is not yet available, improvement in the metrology related with measurements of radon fluxes and atmospheric radon concentrations using continuous monitors is needed. The determination of precise atmospheric radon activity concentrations has the potential to sustainably connect the networks of radiation protection and environmental observation and to open up new scientific approaches to understand the mechanisms of action between geology, atmosphere and anthropogenic activity.

Atmospheric ^{222}Rn measurements are currently carried out at tens of worldwide monitoring networks of GHG emissions using measurement techniques that are not yet harmonised and no traceability to international standards has been developed so far. Besides, radon flux measurements and data inventories are still at an early stage. Reliable measurements techniques and protocols have not been approved and validation of radon flux inventories for the atmospheric and radiation protection scientific communities is lacking. Atmospheric radon concentration data dynamically mapped for Europe, can only be achieved by experimental radon flux measurements, a reference continuous radon monitor and a traceability chain for measurements of low radon concentrations.

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 JRP shall focus on the development of metrological capacity in environmental radon measurement.

The specific objectives are

1. To develop traceable methods for the measurements of outdoor low-level radon activity concentration in the range of 1 Bq/m^3 to 100 Bq/m^3 to be used in climate and radiation protection networks.
2. To improve the accuracy of radon flux measurements for identification of radon prone areas and for application of radon tracer method, including undertaking intercomparison of existing radon flux measurement methods. In addition, to develop standard protocols for radon tracer method to retrieve GHG fluxes at atmospheric climate gases monitoring stations.
3. To validate existing radon flux inventories and models using experimental radon activity concentration data and radon flux data. This includes dosimetric and spectrometric data from the radiological early warning networks in Europe.
4. To provide dynamic radon and radon flux maps for climate change research and radiation protection in line with Council Directive 2013/59/EURATOM.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (NMIs, calibration laboratories), standards developing organisations (e.g. ISO) and end users (e.g. EU Emission Trading System, carbon market).

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 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. In particular, proposers should outline the achievements of the EMPIR project 16ENV10 MetroRADON and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 2.0 M€, and has defined an upper limit of 2.3 M€ for this project.

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

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 JRP 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,
- Transfer knowledge to the climate observation and radiation protection 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 EMPIR 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.

Time-scale

The project should be of up to 3 years duration.