Title: Enhanced metrology for innovative radon measurement and management

Abstract:

A harmonised European indoor radon measurement infrastructure with a robust scientific base is needed to support the development of measurement products, and surveying services that will give those involved in radon monitoring a competitive edge in the global marketplace. Counting processes and the uncertainty of individual radon measurements are well defined but large natural fluctuations in indoor radon concentrations over time create significant measurement challenges that make demonstrating compliance to the EU Basic Safety Standards Directive difficult. Development of validated instrument characterisation methods and procedures for determining indoor radon concentrations with potential for use in ISO 17025 accreditation schemes are required to create greater standardisation in this sector of the radiation protection industry.

Keywords

EU Basic Safety Standards Directive, indoor radon, radon measurements, radon instrumentation, radon surveys, temporal variations, uncertainty.

Background to the Metrological Challenges

Exposure of the workforce and public to radon indoors is regulated by the Euratom BSS Directive 59/2013. Radon is a major cause of lung cancer and these regulations require the development and implementation of National Radon Action Plans and the identification of radon priority areas in order that preventive and corrective actions inside buildings can be implemented. A radon reference level of 300 Bq m^{-3} in indoor air has been set generating a need for a standardised European approach to radon risk assessment, measurements and remediation methods to help safeguard the public. A robust measurement infrastructure is urgently required to enable the European radon monitoring instrumentation industry to demonstrate regulatory compliance.

Whilst it is possible to measure radon concentrations reliably under well controlled laboratory conditions, field measurements, where environmental conditions such as ambient temperature, air pressure, and humidity create real temporal and spatial radon variability are challenging. These temporal variations have a significant influence on indoor radon concentration measurements and introduce the need for greater accuracy and improved measurement uncertainty evaluations. In some buildings and workplaces, the use of a combined real-time radon and air pollution monitoring system with the capability to simultaneously record environmental parameters could provide a comprehensive novel single solution that anticipates Industry 4.0 expectations.

Currently there are no ISO 17025 accreditation schemes for indoor radon monitoring, therefore validated measurement methods and procedures for testing radon indoor air monitoring instrumentation will address the needs of European service providers to demonstrate compliance with the EURATOM BSS. The development of these types of measurement capabilities will provide the international standardisation bodies with methods for potential adoption as a first step towards an accreditation scheme for indoor radon concentration measurements.

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 establishing metrologically sound and innovative radon measurement procedures, instruments and regulation methods focused on compliance with the EU-BSS radon reference level.

The specific objectives are:

1. To review and evaluate the uncertainties that are associated with temporal variations in indoor radon concentrations. This should consider the mode and duration of the measurements (short-term and long-term tests) under different environmental conditions and under typical European usage patterns.
2. To evaluate radon monitor and detector performance under different environmental conditions and to assess their compatibility with Industry 4.0. This should include determining the temporal response of active monitors in highly variable radon concentrations. In addition, to develop accurate methods for measuring the annual average indoor radon concentration and for validating measurement services.
3. To develop a novel radon measurement system that integrates continuous radon concentration measurements with the concentration measurement of other indoor air pollutants (e.g. VOCs, CO_2) and environmental parameters (e.g. temperature, air pressure, humidity). This system should include a real-time decision-making capability, connectivity to remote databases and to systems intended for indoor air quality improvements.
4. To review existing international and national standards on radon measurement, prevention and mitigation (e.g. ISO 11665 series) and to develop procedures and guidelines based on the industrial application of these standards. This should include justification of the need for the ISO 17025 accreditation of radon measurement services.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (radon measurement instrument suppliers, radon measurement service suppliers etc.), standards developing organisations (ISO) and end users (agencies and regulators related to EURATOM BSS).

Proposers shall give priority to work that meets documented industrial needs and include measures to support transfer into industry by cooperation and by standardisation. An active involvement of industrial stakeholders is expected in order to align the project with their needs – both through project steering boards and participation in the research activities.

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 this.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 1.5 M€, and has defined an upper limit of 1.8 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution across all selected projects in this TP.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded 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 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 radon measurement and measurement service 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.