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

Selected Research Topic number: **SRT-v09**
Version: 1.0

Title: Remote and real-time optical detection of alpha-emitting radionuclides in the environment

Abstract

Radiological emergencies involving accidental or deliberate dispersion of alpha emitting radionuclides in the environment can cause significant damage to humans and societies in general. Currently, only hand-held detectors are available to detect these radionuclides. A sustainable metrological infrastructure for outdoor-detection systems which can detect remotely alpha-emitting radionuclides in the environment is needed. This will lead to real-time collection of traceable radiological data and faster, more reliable information for the decision-making authorities.

Keywords

Radiation protection, remote sensing, alpha particles, ionising radiation monitoring, optical techniques, mobile detectors, area dose rate

Background to the Metrological Challenges

Alpha-emitting radionuclides, when released in the environment, for example due to an accident or nuclear attack, can cause severe damage to sensitive living tissues. A detection system to measure large-scale contamination of these radionuclides is currently not available. The only option is to evacuate the population from the affected areas and then run diagnostics.

Conventional detectors of alpha contamination are based on direct interaction between particle and detector material. This includes detectors based on scintillation technology (e.g. silver activated ZnS thin films), gas-filled detectors (Frisch-grid ionization chambers) and detectors based on semiconductor devices (e.g. passivated implanted planar silicon and silicon gold surface-barrier detectors). However, these are hand-held detectors that need to be positioned within few centimetres of the source to detect alpha radiation, posing serious problems for those working with them. New remote detection techniques that keep the operator out of the radiation field is needed.

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 traceable measurement and characterisation of novel optical systems for the remote detection and quantification of large-scale alpha radionuclide contamination.

The specific objectives are

1. To develop a new method and instrumentation for the optical detection of alpha particle emitters in the environment by air radioluminescence.
2. To develop and establish a calibration system for the novel-type radioluminescence detector systems.
3. To extend the optical detection system to an imaging functionality for mapping of alpha contaminations in the environment.
4. To prepare and run a feasibility study for a laser-induced fluorescence spectroscopic method for the detection of alpha emitters.

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5. To facilitate the take up of the results by stakeholders and provide input to relevant standardization bodies and radiation protection authorities.

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.

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 nuclear industry 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.