EMPIR Call 2016 – Energy, Environment, Normative and Research Potential

Selected Research Topic number: **SRT-v18**
Version: 1.0

Title: Metrology for mobile detection of ionising radiation following a nuclear or radiological incident

Abstract

The protection of the public against ionising radiation and radioactive contaminations caused by nuclear or other radiological incidents is vital. Public confidence in governmental emergency preparedness depends on reliable radiological data, and following a radiological incident, radiation protection authorities and other decision makers need quick and credible information on contaminated areas. However, in order to provide such data, accurate and traceable methods for measuring radioactive contamination and dose rates need to be developed, as well as transportable air-sampling systems and aerial detection systems, which are needed for immediate and remote measurements.

Keywords

Radiation protection, emergency preparedness, ionising radiation, mobile detectors, area dose rate, gamma spectrometry, crowd monitoring.

Background to the Metrological Challenges

The International Atomic Energy Agency (IAEA) Safety Standard, No. GSR Part 7: 'Preparedness and Response for a Nuclear or Radiological Emergency' states that safety and security measures have in common the aim of protecting human life and health and protecting the environment; and it also emphasises the importance of adequate protective measures in the aftermath of nuclear and radiological emergencies. The safety standard was jointly published by the IAEA, OECD Nuclear Energy Agency (OECD/NEA), United Nations Environment Programme (UNEP), World Health Organization (WHO), World Meteorological Organization (WMO) and other international organizations such as the Food and Agriculture Organisation of the United Nations, International Civil Aviation Organisation, International Maritime Organisation, INTERPOL, Pan American Health Organisation, Comprehensive Nuclear-Test-Ban Treaty Organization and Office for the Coordination of Humanitarian Affairs; who together have recognised that reliable radiological data, available at the earliest possible stage, is a prerequisite to effectively protecting the public from unexpected but potentially highly dangerous radiological incidents.

The current state-of-the-art in terms of the measurement of ionising radiation following a nuclear or radiological incident includes:

- Unmanned aerial detection systems for the early monitoring of areas affected. Currently, however the interpretation of measured data is problematic as there are no traceable calibration procedures.
- Transportable air-sampling systems: Currently, airborne radioactivity monitoring is predominantly done using stable field stations. However, the average distance between the field stations in Europe is up to hundreds of kilometres and therefore the collected data is not representative for localised nuclear or radiological incidents. Instead, transportable and mobile air-sampling systems are needed that can be easily and quickly transported to places of interest.
- Crowd monitoring: The densities of these civilian networks are now, in some cases, comparable to professional systems. The high density and mobility of these networks suggests that their usability in supporting decision makers needs to be investigated, however the metrological quality of the data produced is much lower.
- Passive dosimetry for environmental radiation monitoring: A survey by the European Radiation Dosimetry Group (EURADOS), showed that such passive dosimetry services were often not

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traceable nor accredited. In addition, they variety of methods used, were not entirely comparable. Further to this, due to natural background radiation, the compliance of such passive dosimetry methods may be difficult to verify with the low reference levels defined by the European Basic Safety Standards for radiation protection (normally 1 mSv per year but sometimes even lower).

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 mobile detection of ionising radiation following a nuclear or radiological incident. It shall contribute to the development of the associated joint European metrology infrastructure.

The specific objectives are

1. To develop unmanned aerial detection systems installed on drones and helicopters for the remote measurement of dose rates and radioactivity concentrations. In addition to establish novel methods applicable to core and remote areas of a nuclear or radiological incident for air-based radiological measurements including dose rates, radioactivity concentrations, traceable calibrations for the determination of ground surface activities and interpretation methodologies for drone or helicopter based radiological measurements.
2. To develop transportable air-sampling systems for immediate information on radioactive contamination levels in air. This should include generating industry appropriate prototypes of modular and portable air-sampling systems based on gamma spectrometric detectors that can be quickly transported to places of interest.
3. To investigate the metrological relevance of 'crowd monitoring' data on dose rates and provide recommendations on the usability of such data.
4. To establish stable and reproducible procedures to measure ambient dose equivalent rates using passive dosimetry in order to harmonise passive dosimetry for environmental radiation monitoring across Europe.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (instrument manufacturers, accredited laboratories), standards developing organisations (ISO, IEC) and end users (national nuclear regulatory bodies, decision/policy makers e.g. IAEA, European Community Urgent Radiological Information Exchange (ECURIE), OECD/NEA, EURADOS, UNEP, WHO, WMO).

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 research 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 to the project.

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 nuclear and environmental sectors.

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.