European Partnership on Metrology
Call 2025 – Health, Integrated European Metrology, Regulation and Research Potential

Selected Research Topic number: **SRT- n02**
Version: 1.0

Title: Validated service platform for emergency management for nuclear or radiological events

Abstract

Early protective measures, in the event of a nuclear or radiological emergency, have a dramatic impact on personal freedom and can have extreme economic consequences: evacuating people, keeping people indoors and taking iodine tablets, early harvest or disposal of contaminated crops. To have a regulated and targeted use of these measures, proposals are sought to enable a service platform that provides fast and accurate results. To facilitate this, it is necessary to provide a framework of methods, tools, and regulatory standards for the analysis of data from modern spectrometric detectors installed in radiological surveillance networks across Europe.

Keywords

Metrology of ionizing radiation, spectrometry analysis techniques, radiological monitoring networks, mobile monitoring units, calibration procedure, artificial intelligence, citizen science

Background to the Metrological Challenges

During nuclear or other radiological emergencies, the highest priority for national and international radiation protection authorities is to protect the population against radiological threats. Following the Chernobyl accident, radiological surveillance networks were built in most European countries. In the early stage, mainly counting detectors (e.g., Geiger-Müller or proportional counters) were used in these networks. Today, more than 5000 stations are installed in Europe. Meanwhile an increasing number of these simple counters are accomplished with gamma-spectrometric detectors with the ability to not only detect, but also identify and quantify radionuclides deposited on the ground and/or contained in the air in real-time.

The Fukushima Daichi Nuclear Power Plant disaster in March 2011 highlighted the inadequacy of the power plant operator (TEPCO), relevant Japanese government agencies, and international oversight bodies to provide ad-hoc relevant data for the evaluation of radiation risks and to share it with national authorities responsible for emergency response as well as with the general public. As a result, immediately after the start of the accident, Safecast, an international, volunteer-based organization devoted to monitoring and openly sharing information on environmental radiation, was initiated. This open-source and citizen-science-centred group of individuals developed radiation mapping solutions which have proven useful to experts, to policy makers, and to the public. One of the lessons learned in these “mapping projects” was that modern data acquisition systems integrating spectroscopic detection systems and advanced data analysis techniques help to reduce the need for manpower and to improve data quality, efficiently. Secondly, to assure consistency of data, to allow advanced analysis techniques, and to make them available to the public in an open and consistent way, a database was constructed and maintained.

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.

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The proposal shall focus on metrology research necessary to support regulation in rapid actions in emergency situations.

The specific objectives are

1. To develop a comprehensive metrological framework for gamma-spectrometry detection systems, including modern AI based software tools for spectrum analysis, guidance for hardware use in national radiation monitoring networks and harmonised calibration procedures, based on use of traceable radionuclide mixed activity sources with $u(A) < 2$ % for $k=1$ and validated Monte Carlo models.
2. To facilitate improvement of monitoring networks for faster decision-making in radiological emergencies by providing recommendations for the design and application of mobile and stationary detector systems, thus assuring high quality and metrologically sound data as input for long-term measures. To assure stable technical measurements and analysis methods with elaborated data transmission procedures and to bring information from different databases into a state-of-the-art database framework.
3. To provide guidance in prioritising of actions by reaching relative combined standard uncertainties below 15 % for dose rate summing up to an effective dose above 10 mSv and 10 % for radionuclide activities (per nuclide in hourly measurements). To implement new tools for the identification and determination of activities of short-lived radionuclides measured in the field stations networks.
4. To propose measures in deregulation by focusing on a generalised approach and providing recommendations, procedures, and tools for mobile and stationary applications in the field of radiological monitoring. To include the following approaches: (i) focusing on precise data since small uncertainties enable a smaller safety surcharge, (ii) reducing detection limits (e.g., subtraction of background caused by natural radionuclides), and (iii) prioritising measures according to the degree of risk.
5. To support the implementation of Council Directive 2013/59/EURATOM, and facilitate the take up of the technology, methods and measurement infrastructure developed in the project by the International Commission on Radiological Protection (ICRP), International Committee for Radionuclide Metrology (ICRM) and International Atomic Energy Agency (IAEA), EURATOM Article 35 Experts' group, JRC's REM programme as well as the European Radiological Data Exchange Platform (EURDEP)

The proposed research shall respond to documented requirements related to specific regulations and legislation or explore the background and feasibility of expected possible future regulation. To enhance the impact of the research, the involvement of the appropriate user community such as regulatory authorities, conformity assessment bodies, standardisation bodies, and industry, is strongly recommended. Where relevant, proposals are encouraged to build on, or seek collaboration with, existing projects and develop synergies with other relevant European, national or regional initiatives and funding programmes. In particular, links are encouraged with (i) the projects funded under earlier relevant topics of the Horizon Europe programme; or (ii) other relevant European Partnerships.

Proposers should establish the current state of the art and explain how their proposed research goes beyond this. In particular, proposers should outline the achievements of the EMRP ENV57 MetroERM and EMPIR 16ENV04 Preparedness projects and how their proposal will build on those.

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 1.0 M€ and has defined an upper limit of 1.3 M€ for this proposal.

EURAMET also expects the EU Contribution to the external funded beneficiaries to not exceed 30 % 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 industries utilising or producing radiation, the radiation protection sector and regulatory authorities.

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.

Additional information

The links provided in this section are only correct at the time of publication up until the end of the Call year.

These references have been provided by EURAMET.

[1] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation https://eur-lex.europa.eu/eli/dir/2013/59/oj

[2] 001 CLC TC 45B Implementation of new quantities in radiation protection https://www.metpart.eu/go/need01

[3] EMN Radiation Protection Strategic Research Agenda https://www.euramet.org/european-metrology-networks/radiation-protection