

Title: In situ metrology for decommissioning nuclear facilities

Abstract

Currently, many of the nuclear facilities operational in EU countries are in the decommissioning phase with more following in the near future. The decommissioning industry needs a metrological framework in order to support the reliable and safe disposal of radioactive waste as well as to minimise the environmental and financial burden of decommissioning nuclear facilities. To address this, collaboration is needed between metrological and industrial organisations, to build on existing knowledge, take advantage of in situ research at decommissioning and repository sites and to upgrade and validate novel traceable measurement systems and methods for decommissioning nuclear facilities.

Keywords

Decommissioning, nuclear facility, ionising radiation, free release, radioactive waste repository.

Background to the Metrological Challenges

By 2025 it is estimated that over 200 nuclear power reactors worldwide will be at some stage of decommissioning. This means that thousands of tons of waste materials will have to be disposed of efficiently and without contaminating the environment. Currently, decommissioning and the safe disposal of radioactive waste is a very expensive process and it is essential that a significant reduction in this large financial burden can be achieved.

Previous EMRP JRPs have addressed a variety of aspects of the decommissioning process, including the characterisation of radioactive waste materials at decommissioning sites, preselection of radioactive waste materials prior to free release or repository acceptance measurement, free release measurement, measurement of the thermal power of radioactive waste packages prior to the repository storage, and the long-term monitoring of radioactive stored wastes and repositories. But despite this research, the measurement of radioactive materials at decommissioning sites and repositories remains diverse and complex and currently there are no commercially available systems for traceable in-situ decommissioning measurements. Further research is needed to develop in situ testing and on site validation of radioactive waste materials including collaboration with decommissioning operators, measurement device producers, and radiation protection regulators in order to facilitate rapid and user-friendly implementation of the technology.

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 traceable in-situ measurement methods for the decommissioning of nuclear sites and the subsequent waste management.

The specific objectives are

1. To develop in-situ methods for the rapid radionuclide characterisation of the different types of materials present on decommissioning sites. This should include the development of novel measurement techniques that improve the mapping of contamination inside nuclear facilities and the determination of statistically valid and effective sampling methods based on frequentist and Bayesian analysis.
2. To develop and implement traceable measurement systems and methods for waste pre-selection and free release to the environment. This should include the on-site validation of

existing waste pre-selection and free release measurement systems and evidence of their traceability to primary standards.

3. To develop a validated waste repository acceptance characterisation system for use on site with very low, low and intermediate radioactive waste. The system should have a gamma scanning module and active/passive neutron module, and should be sensitive to fissile material,
4. To develop improved measurement systems and methods for monitoring radioactive waste repositories. This should include developing miniaturised, portable and rapidly deployable gas monitoring systems, improved water monitoring systems and systems for the long term monitoring of temperature and strain inside repositories. All systems should be verified with on-site testing.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by nuclear decommissioning operators, measurement device producers, radiation protection regulators and standards developing organisations. In addition to establish, in collaboration with the end-user community, a European network that will coordinate a measurement infrastructure for decommissioning nuclear facilities.

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. In particular, proposers should outline the achievements of the EMRP projects ENV09 MetroRWM and ENV54 MetroDecom 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 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 environmental sector and nuclear facilities.

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.