EMRP Call 2011 - Health, SI Broader Scope & New Technologies

Selected Research Topic number: **SRT-s08**
Version: 1.0

Title: Primary standards for challenging elements

Abstract

A demonstrated traceability system for elemental measurements is not yet developed for a range of critical elements although millions of elemental measurements are performed in Europe each year. Primary standards need to be established through impurity determination and techniques need to be developed for dissemination through differential measurements. Technical work is focused on metrologically challenging non-metal determination and decomposition with full recovery of refractory materials. By joining fragmented capabilities of European NMIs this aims in establishing a coherent traceability system for amount of substance measurements of the chemical elements.

Conformity with the Work Programme

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Health, New Technologies & Fundamental Metrology on pages 13 and 14.

Keywords

Chemistry; elemental measurement; primary elemental standards; elemental calibration solution; purity determination; dissemination; high precision comparison; reference material; chemical analysis.

Background to the Metrological Challenges

Primary materials are necessary for almost all elements of the periodic system. Unfortunately only a limited number of those primary elemental materials necessary for the realisation of the link to the SI and for providing traceability to the field laboratories are available. Standards of central importance are missing because of the scientific effort required for their realisation and the difficulty of the purity determination of the corresponding materials.

First attempts addressing this subject in CCQM exemplify this situation. Results on calibration solutions as tested in CCQM-P46 phenomenologically show lack of comparability, because underlying primary standards for pure materials are missing. This is further confirmed by the results of CCQM-P62 & CCQM-P107, which demonstrate the insufficient capabilities to realise primary standards in this field.

There is an urgent need to develop procedures for the characterisation of pure materials especially for elements of particular importance and challenging chemical behaviour. Furthermore methods for digestion and dissolving of the primary materials and methods for linking secondary elemental solutions for dissemination with primary solutions are required. Additionally new approaches avoiding the digestion step (e.g. NAA) must be investigated concerning their applicability for a direct link of secondary solutions made from arbitrary sources with solid primary elemental materials.

Scientific and Technological 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 JRP-Protocol.

The JRP shall focus on the realisation and dissemination of primary standards for chemical elements through impurity determination and differential measurements.

Specific objectives are:

1. To develop measurement methods for measuring the total purity of high purity materials of the selected elements (at mg/kg level). This should include:
   - Measurement of non-metallic impurities (especially O, H and halogens) and the full recovery decomposition.
   - Determination of metallic impurities
2. To develop of purification techniques for more volatile elements (e.g. Mg) by distillation
3. To develop measurement methods for comparing two elemental solutions of similar composition with small uncertainty (0.05 %).
4. To develop methods for the complete and loss-free digestion of refractory elements for the preparation of primary elemental solutions including investigations of the feasibility to link secondary solutions with the primary solid material directly.

JRP proposals for this topic should explain the choice of the elements they intend to develop methods for, on the basis of documented stakeholder need and engagement with the project.

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 work, the involvement of the larger community of metrology R&D resources outside Europe is recommended.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

The total eligible cost of any proposal received for this SRT is expected to be around the 2.7 M€ guideline for proposals in this call.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (eg letters of support) is encouraged.

You should detail other impacts of your proposed JRP as detailed in the document “Guide 4: Writing a Joint Research Project”

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies
- transfer knowledge to the Analytical Chemistry sector.

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology. 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 Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.