
Publishable Summary for 14RPT03 ENVCRM Matrix reference materials for environmental analysis

Overview

This project aims to develop capacity to produce certified reference materials (CRMs) for environmental analysis by transferring know-how between the partners and combining their skills to focus on environmental CRM production. The production process includes good manufacturing practices for processing materials, method development, the validation and application of homogeneity, stability and characterisation tests, the calculation of individual uncertainties (between-unit inhomogeneity, long term stability, characterisation) and combination of uncertainties to determine overall uncertainty of the matrix reference materials. An inter laboratory comparison registered as a EURAMET project is set as the ultimate project outcome, confirming the partners' capabilities in applying newly acquired skills.

Need

The need for quality assessment of anthropogenic impact on environmental pollution is increasing due to discharge from various industries, the use of chemicals in agriculture, and the consumption of fossil fuels. Diminishing resources such as drinking water, soil used for the cultivation of agricultural products, and plant and animal habitats are under severe pollution pressure and are at constant risk. The EU has stipulated the maximum allowable concentration of priority pollutants in different classes of surface water under the Water Framework Directive in Directive 2008/105/EC Annex I "Environmental quality standards for priority substances and certain other pollutants", and for the purpose of assessing the quality of river and marine sediment, Canadian and Dutch guidelines are used. Prescribed limits for pollutants are adopted and adapted by regulations at the local level. In addition to ISO Guide 34 prescribing the general requirements for the competence of reference material producers, standardised methods such as ISO and EN standards for sampling, homogenisation and testing of the pollutants in water, sediment and soil samples are available.

In order to establish a quality system in the testing of environmental samples conducted by dedicated laboratories, it is necessary to provide appropriate quality control materials i.e. matrix CRMs. The term "appropriate" relates to the unique sample matrices representing typical samples in the geomorphological and anthropological sense. In addition to that, bearing in mind the complexity, variability and instability of environmental samples, it is very difficult to obtain appropriate reference materials with no local providers. Dedicated laboratories require strong support from the metrology system for proving competence in performing quantitative tests. Laboratories operating under the watershed, environment and health sectors are recognised as the main stakeholders of this project. Matrix reference materials produced within the project will serve stakeholders locally through the corresponding National Metrology Institutes (NMIs) and Designated Institutes (DIs).

Objectives

The overall objective of this project is to develop research capability for the production of environmental reference materials. The specific objectives are:

1. **Production of CRM Candidates** – through design and production of two inorganic (heavy metal) and one organic pollutant candidate CRMs at NMIs having production facilities for developing traceability to SI units of the measurements performed by environmental analysis laboratories.
2. **Homogeneity and Stability Tests of CRM Candidates** – by designing and carrying out tests to measure the analyte composition of a calculated number of randomly selected units covering the whole production batch for each candidate CRM and determining the effect of storage and transport temperature and time on the uncertainties.



3. **Characterisation of the CRM Candidates** – via certification campaigns among NMIs, DIs and university research laboratories with comparable measurement capabilities by employing reference analyte measurement techniques such as IDMS for high accuracy and low uncertainty (target uncertainties will depend on the analytes selected and will be in the range of 10 % to 20 %).
4. **Certification of the CRMs** – by drafting and reviewing certification reports with all the information collected throughout the investigation of the materials.
5. **Long term research capability for environmental CRMs** – via development of individual and/or consortium strategies for each partner with discussions within the consortium in collaboration with the communities of each country to determine the priorities and draw up a road map for quality schemes and develop plans to offer services and products from the established capacities.
6. **Contribution to impact** – via contribution to regional and international standards and committees and dissemination of outputs of the project to the end users (e.g. providing the developed CRMs for use by environmental analysis laboratories).

Achieving these objectives will improve and support the quality infrastructure of Europe in the field of environmental analysis via the developed capabilities, strategies and network which will provide materials according to current and future needs.

Progress beyond the state of the art

The progress beyond the state of the art will be measured on a local level (at NMIs) in terms of matrix CRM production capability, thus fulfilling preconditions for providing suitable matrix CRMs and proficiency test services to stakeholders. At the end of the project, all the NMIs involved will have the capacity to carry out all aspects of CRM development and certification including material sampling, preliminary measurements, production of candidate materials (including spiking/blending, homogenisation, bottling and storage), homogeneity and stability testing, development of reference methods (including methods for homogeneity and stability tests, instrument-based methods and standardised technical methods), sample preparation and characterisation, calculation of the results and uncertainties and drafting of certificates. Each partner will benefit from an individual plan for further research and development of CRMs based on stakeholder needs and the results achieved in the project.

Additionally, as a direct result of this project new CRMs will be available that differ in matrix, analyte(s) and concentration from those currently on the market. Uncertainty values for the analytes will be comparable to commercially available CRMs (e.g. 7 % to 11 % for Cd and Pb in contaminated soil). The mix of analytes and the matrix composition of the new CRMs will be appropriate to the region in which the partner NMIs are located. The stability and transportation conditions of the CRMs will be analysed as part of the certification process, allowing uptake by industry.

Results

Production of CRM Candidates:

Two inorganic (heavy metals in water and soil) and one organic pollutant candidate CRMs will be produced at NMIs having production facilities for developing traceability to SI units of the measurements performed by environmental analysis laboratories.

Homogeneity and Stability Tests of CRM Candidates:

Tests will be carried out to measure the analyte composition of a calculated number of randomly selected units covering the whole production batch for each candidate CRM and determining the effect of storage and transport temperature and time on the uncertainties.

Characterisation of the CRM Candidates:

Certification campaigns will be organised among NMIs, DIs and university research laboratories with comparable measurement capabilities by employing reference analyte measurement techniques such as IDMS for high accuracy and low uncertainty.



Certification of the CRMs:

Certification reports will be prepared by drafting and reviewing with all the information collected throughout the investigation of the materials.

Long term research capability for environmental CRMs:

Individual and/or consortium strategies will be developed for each partner with discussions within the consortium in collaboration with the communities of each country to determine the priorities and draw up a road map for quality schemes and develop plans to offer services and products from the established capacities.

Contribution to impact:

The project will contribute to regional and international standards and committees by dissemination of outputs to the end users (e.g. providing the developed CRMs for use by environmental analysis laboratories).

Impact

The project will result in long term public benefit by providing tools for the reliable analysis of environmental pollutants.

The EU water quality directive 2000/60/EC with corresponding directives (Environmental Quality Standards Directive 2008/105/EC etc.) aims at adequate control of water resources. By conducting specific measures against pollution of water by individual pollutants or groups of pollutants presenting a significant risk to or via the aquatic environment, long-term deterioration of freshwater quality and quantity can be avoided, therefore achieving sustainable management and protection of freshwater resources.

The impact of the project will be to reduce the risk of exceeding the maximum allowable data quality objectives set by EU directive. This will be achieved by preparing each country for the production and/or certification of matrix CRMs needed for adequate QA/QC activities, and improvement of the services offered by calibration laboratories to end-users by achieving full traceability for CRMs developed in this project. Ultimately, the outcome of this project will contribute to a more reliable and robust water monitoring network incorporating a harmonised approach able to fulfil EU regulation.

Impact on relevant standards

There are several EC directives and position papers which deal with contaminants in the environment, in food, and in water, and related directives and regulations ensuring environmental and health protection, such as those listed below:

- Water Framework Directive (2000/60/EC, amended by Decision 2455/2001/EC and Directives 2008/32/EC, 2008/105/EC and 2009/31/EC);
- Registration, Evaluation, Authorisation and Restriction of Chemicals, Regulation (EC) No 1907/2006;
- Waste Electrical and Electronic Equipment Directive 2012/19/EU;
- Restriction of the use of certain hazardous substances, directive 2011/65/EU.

All these directives and papers have an underpinning need for more reliable measurement data of environmental contaminants to support their implementation, which in turn requires a larger number of reliable CRMs. Particularly with regard to upcoming new legal limits for contaminants, there is a pressing need for more CRMs. Current reference material institutes are at their limits and therefore it is necessary to introduce or increase the capability and capacity of new upcoming institutes to produce CRMs, which is the primary objective of this project. Institutes producing CRMs automatically contribute to and influence standardisation working groups and technical committees.

Impact on industrial and other user communities

The project will have substantial impact on NMI dealing with the production and certification of matrix reference materials, on the water quality monitoring networks, in particular the National Reference Laboratories (NRLs) involved in QA/QC activities, and with industry dealing with water quality.



The impact will be created by making available:

- Robust and comparable analytical data, based on homogeneity and stability of selected organic and inorganic analytes,
- Improved knowledge and good practice of production and certification of matrix reference materials,
- Better understanding of influencing matrix components and impurities,
- Newly gained and improved traceability in production and certification of matrix reference materials.

The project goal is to achieve data quality objectives set by EU regulation and implement them in participant countries. By doing this, measurements of water pollution will achieve better comparability with European regulations and will have improved traceability in each participant country.

Impact on the metrological and scientific communities

The main impact of this project will be to build the capacity and capability in the partner institutes for producing and certifying environmental reference materials. This in turn will have an impact on environmental monitoring in those countries and on the scientific community, who will use the newly developed reference materials. Furthermore, the NMIs/DIs will develop strategies for producing new CRM either on their own or in cooperation with partner institutes. This will lead to regional CRM programmes serving scientific and official laboratories.

The NMIs/DIs participating in this project will apply for new Calibration and Measurement Capabilities (CMCs) statements recorded in the BIPM Key Comparison Database (KCDB). The CMCs focus on the determination of inorganic and organic analytes in environmental matrices and on the reference materials certified within this project.

Additionally the partners will contribute to the EURAMET Technical Committee for Metrology in Chemistry (EURAMET TC-MC) and keep them informed during its annual meetings about the progress achieved in the project.

Project start date and duration:		01 Jun 2015, 36 Months
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