Designing the EMPIR project 14RPT03-ENVCRM "Matrix reference materials for environmental analysis"

Alper İşleyen
Head of Reference Materials Lab.
TUBITAK UME-Chemistry Group
Turkey

EURAMET Training and Workshop
Writing JRP proposals for maximal impact
PTB Berlin, Germany, 5/6 June 2018

Messen ▪ Forschen ▪ Wissen

Introduction

Call Research Potential 2014

Initiated by IMBIH (Bosnia & Herzegovina) based on the needs of testing laboratories in the field of environmental analysis.

PRT was submitted and selected
After partnering meeting in Vienna, JRP proposal was prepared
JRP was ranked 3th out of 8 SRTs (5 JRPs awarded funding)
JRP started in June 2015

7 Internal Funded Partners (TUBITAK-Turkey, BAM-Germany, GUM-Poland, IJS-Slovenia, IMBIH-Bosnia & Herzegovina, MoE-DMDM-Serbia, SYKE-Finland)
2 External Funded Partners (NTUA-Greece, UW-Poland)

Needs defined at PRT stage

Reliable analysis of chemical indicators in **water**, **sediment** and **soil** samples for the purpose of **environment pollution** assessment poses one of the greatest **analytical challenge**s, due to the **complexity of sample matrix** and **low concentrations of pollutants.**

Examples: Organics (**pesticides, PAHs, PCBs**, etc.) and
Heavy metals (**Hg, Cd, Ni, Pb** and **As**).

Laboratories performing sampling and tests in this field **regulated** by respective **EU directives**, **need strong support** in terms of providing them with **appropriate matrix Certified Reference Materials (CRMs)** enabling the process of **quality control**.

NMIs and **DIs** with proved metrological capabilities for the **production** and **certification** of such materials are necessary for the provision of quality data.

SRT Objectives

For the participating countries;

1. **Developing research capabilities** in **heavy metal reference materials**, to **develop procedures** for the **preparation of water/waste and soil/sediment samples** containing **certified amounts** (with stated measurement uncertainty) of relevant **heavy metals**.

2. **Developing research capabilities in organic pollutant reference materials**, to **develop procedures for the preparation of water/waste and soil/sediment samples** containing **certified amounts** (with stated measurement uncertainty) of **relevant organics**.

3. **Developing an individual strategy for the long-term development of research capability** in **CRMs** for environmental pollution including

- **priorities** for **collaborations with the research community** in partnering countries,
- **establishment** of appropriate **quality schemes** and **accreditation** (e.g. **participation in key comparisons**, the entry of **CMCs** into the BIPM database, **accreditation** to ISO/IEC 17025).
- **develop** a **strategy** for **offering services** from **the established facilities** to their **own country** and **neighbouring countries**.

The individual strategies should be discussed within the consortium and with other EURAMET NMIs/DIs, to ensure that a **coordinated** and **optimised approach** to the **development of traceability** in this field is developed for Europe as a whole.

The JRP Preparation

Need for the Project

Stakeholders: The **laboratories** operating under the **watershed** and **environment** **sectors**.

- **Establishing** a **quality system** in the testing of environmental samples by dedicated laboratories requires **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.

- Difficulties (complexity, variability and instability) exist in obtaining **appropriate reference materials** with **no local providers**.

- Need for **strong support** from the **metrology system** for **proving competence for dedicated laboratories** in performing **quantitative tests**.

Matrix reference materials produced within the project will **serve stakeholders locally** through the corresponding **NMIs** and **DIs**.

Need for the Project

NMIs & DIs:

Developing capacity to produce CRMs for environmental analysis by

- **transferring** the theoretical and practical **know-how** between the partners and
- **combining** their **skills** to **focus on** environmental CRM production in accordance with ISO Guide 34

Production process includes

- **good manufacturing practices** for **processing** materials,
- **method development** and **validation** for **certification studies** (homogeneity, stability and characterisation tests),
- **calculation of individual uncertainties and combination of uncertainties** to determine **overall uncertainty** of the matrix reference materials.

Interlaboratory comparisons registered under EURAMET / CCQM are set as the ultimate project outcome, **confirming** the partners' **capabilities** in applying newly acquired skills.

State of the Art

NIST ERM European Reference Materials RTC

✓ NMIs, DIs and Private companies are producing CRMs

These organizations are at their limits and number of laboratories capable of producing **matrix CRMs** is still **insufficient** considering the **increasing** and **changing needs** of the laboratories with wide variety of **analyte / level / matrix / matrix property** combinations.

Matrix composition of CRMs should **mimic** the local environment as closely as possible to represent real samples measured by the labs.

Very limited number of **CRMs** are available (Elements in Spring Water from Turkey and Soil from Poland) from the partnering countries (except BAM, Germany)

Beyond the State of the Art

- Measured on a **local level** (at NMIs) in terms of matrix **CRM production capability**, to provide matrix CRMs and proficiency test services to stakeholders.
- All the NMIs involved will have the **capacity** to carry out all aspects of **CRM development** and **certification**.
- 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.
- **New CRMs** will be available that differ in **matrix**, **analyte(s)** and **concentration** from those currently on the market with **comparable uncertainty** values to commercially available CRMs (e.g. 7 % to 11 % for Cd and Pb in contaminated soil).
- Analyte 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**.

Material Sampling and Preparation of a CRM Candidate for Organic Analytes (WP1)

Aim: Producing a **ground water** CRM candidate for **organic analytes** which will be designed according to the needs of the environmental analysis and monitoring labs.

Workshop with Stakeholders
Kick-off Meeting: Planning

Sampling & Preliminary Tests

Processing

Candidate CRM

Ground Water

Homogeneity & Stability Tests

Material Sampling and Preparation of CRM Candidate for Inorganic Analytes-1 (WP2)

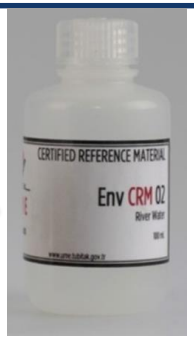
Aim: Producing a **river water** CRM candidate for inorganic analytes which will be designed according to the needs of the environmental analysis and monitoring labs.

Workshop with Stakeholders & Kick-off Meeting: Planning

Sampling & Preliminary Tests

Processing

Candidate CRM



River Water

Homogeneity & Stability Tests

Material Sampling and Preparation of CRM Candidate for Inorganic Analytes-2 (WP2)

Aim: **Producing** a **soil** CRM candidate for inorganic analytes which will be designed according to the needs of the environmental analysis and monitoring labs.

Workshop with Stakeholders & Kick-off Meeting: Planning

Sampling & Preliminary Tests

Processing

Candidate CRM

Soil

Homogeneity & StabilityTests

Characterisation of CRM candidates for inorganic and organic analytes (WP3)

Aim: **Characterizing** the produced CRM candidates based on **inter-comparison** studies between the partners.

Partners already having **validated methods** will use them

Others will transfer / develop and validate methods

Traceability to the **SI units** will be achieved by

- Use of SI traceable calibrants
- Use of reference methods Such as ID MS or k_0-INAA

Appropriate **available CRMs** will be used as **Quality Control** materials for the **validation/verification** of the methods

Use of different methods by partners

- Structurally Defined Measurands
- Certified Values free of method bias

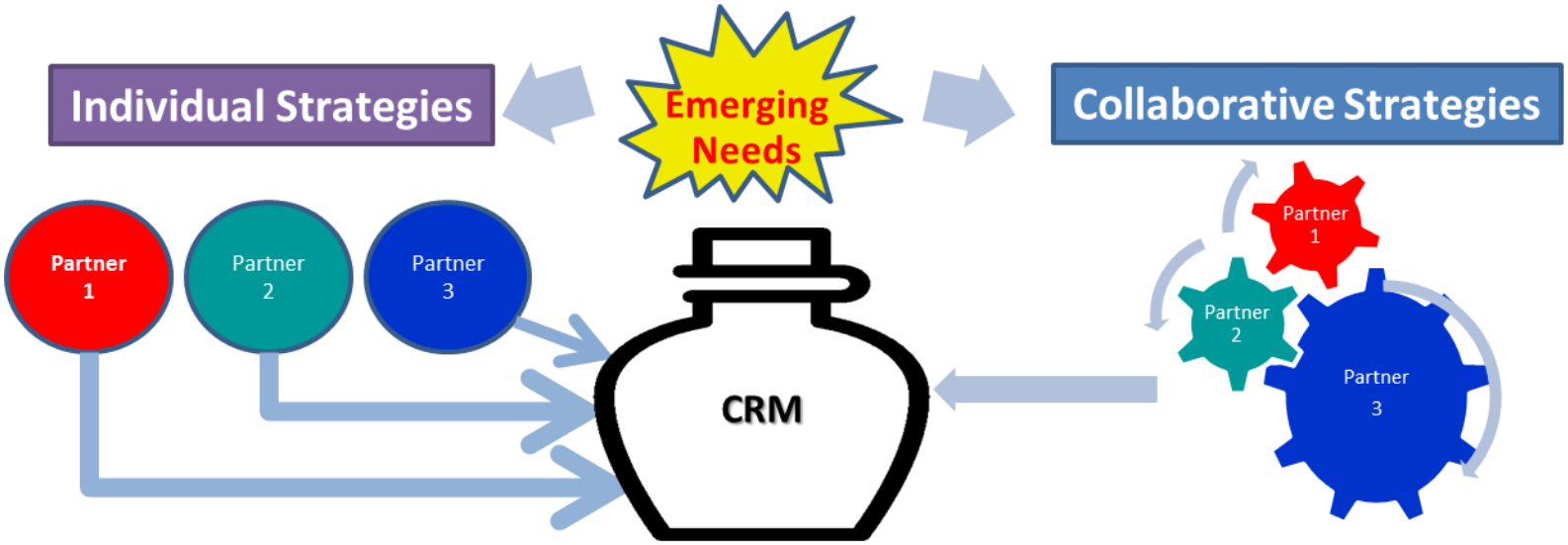
Analytes (trace; ppt-ppb-ppm level), Target Expanded Uncertainties: 10-20%

Certification procedure and strategy for further research / development (WP4)

Aim: **Summarizing** and **reviewing** all collected data and finalize certification campaign.

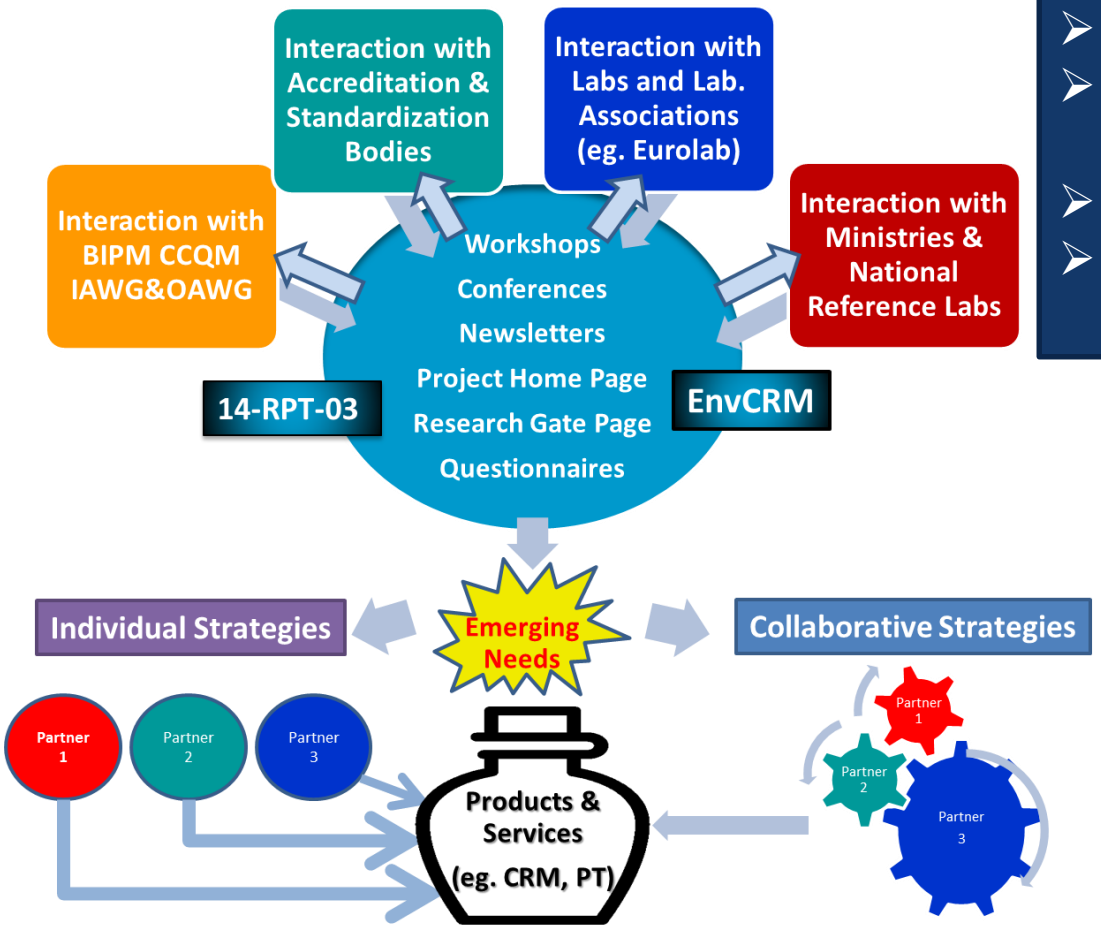
&

Developing **strategies** for further CRM R&D in partnering countries

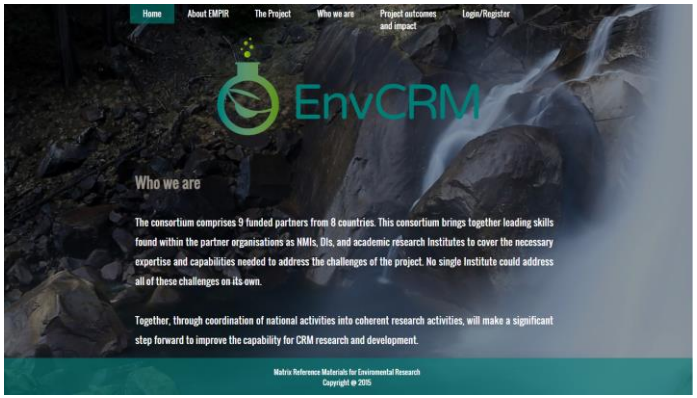


Creating Impact-Knowledge Transfer (WP5)

Aim: Sharing the results of the project with wider scientific and stakeholder community



- Project website
- Presentations at National & International Conferences
- Organizing Proficiency Tests
- Registration of developed CRMs to databases such as COMAR

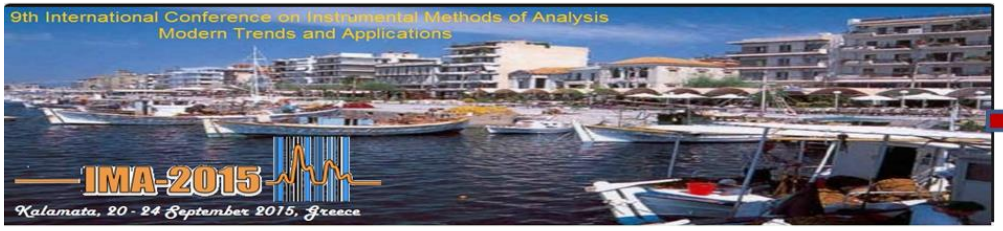


www.envcrm.com

Messen ▪ Forschen ▪ Wissen

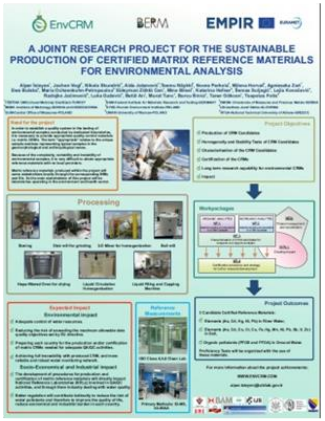
Presentations

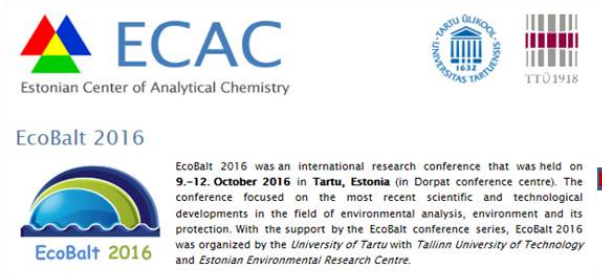
Conference Presentations

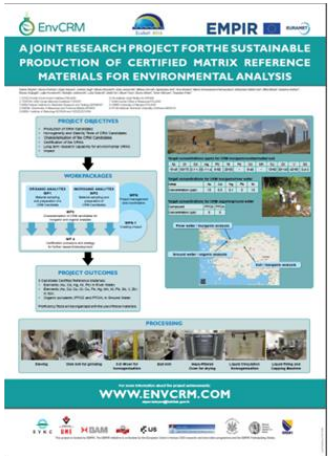


Oral Presentation

Poster Presentations







Creating Impact-Training (WP5)

Aim: Training partners on reference measurement techniques and aspects of reference material production.


Training on Reference Measurement Techniques, such as ID MS at BAM, Germany


Training on Reference Material Procesing at TÜBİTAK UME, Turkey

Knowledge transfer and trainings for stakeholders


2 Workshop organizations at the beginning and at the end of the project at TÜBİTAK UME, Turkey

EXPECTED OUTPUTS

- **3 new CRMs** available in partnering countries
- **SOPs** for the **quantification** of analytes in water and soil samples
- **SOPs** for reference material **processing**
- New **CMCs** (EURAMET Supplemantary Comparison & CCQM Comparison)
- Individual / Consortium **strategies** for long term research for CRMs
- **Workshops** for end-users on primary methods, selection and use of CRMs
- **Presentations** at relevant national and international conferences

EXPECTED IMPACT

In Short Term

Availability of **3 new CRMs** for **traceable** and **comparable QA/QC** applications in environmental analysis

Measurement services for the newly acquired **capabilities** for customers in partnering countries

Proficiency testing services for laboratories in partnering countries

Further collaborative **studies** among the consortium for new CRM development and PT services

In Longer Term

More **accurate**, **reliable** and **comparable** analysis **results** will minimize the unnecessary repetition of analysis, thus will **reduce** the **costs**.

Better monitoring of natural resources like **water** and **soil** will **increase** the **quality of life** by increasing the **quality** of **drinking / irrigation** water and as a consequence increasing the quality of **agricultural products**.

Messen ▪ Forschen ▪ Wissen

Project Consortium

TUBITAK UME (Coordinator)
Accredited RM Producer
Experienced in Inorganic & Organic Analysis
Processing and Storage Facilities, PT Provider

BAM
Accredited experienced RM Producer
Experienced in ID MS, TIMS methods

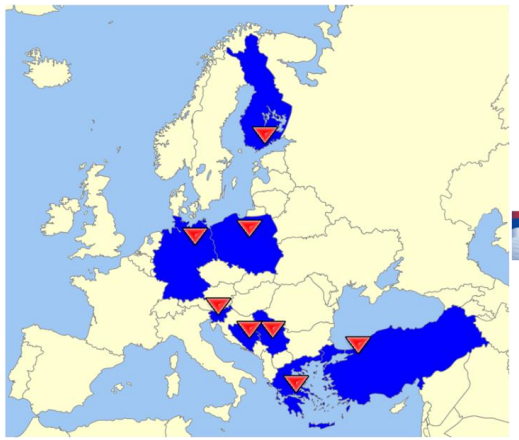
IJS
Experienced in characterisation of RMs for inorganic analysis, expertise in Hg measurements, Nuclear reactor facility for primary k_0-INAA analysis

SYKE
Experienced in analysis of organic pollutants in water, PT provider, uncertainty estimations

IMBIH
Accredited PT provider, **needs** trainings on RM processing, method development and validation

DMDM
Designs web page, **needs** trainingsRM processing, method development and validation

GUM
Experienced in ICP-OES



SYKE Finland
BAM Germany
IJS Slovenia
IMBIH Bosnia-Herzegovina
National Technical University of Athens Greece
Poland
Serbia
TÜBİTAK UME Turkey

NTUA
Experienced in certification exercises
ICP-MS, ICP-OES, AAS, ASV,
Experienced in organizing International Conferences

UW
Acredited testing lab, experienced in production and certification of RMs

Project Outline

Needs

- **Establishing** a **quality system** in the testing of environmental samples by dedicated laboratories requires **appropriate quality control materials, i.e. matrix CRMs**.
- **Developing capacity** to produce CRMs for environmental analysis by **transferring** the theoretical and practical **know-how** between the partners and **combining** their **skills** to **focus on** environmental **CRM production** in accordance with ISO Guide 34.

State of the art

- **NMIs**, **DIs** and **Private companies** are producing **CRMs**
- These organizations are at their **limits** and number of laboratories capable of producing **matrix CRMs** is still **insufficient** considering the **increasing** and **changing needs** of the laboratories with wide variety of **analyte / level / matrix / matrix property** combinations.
- **Matrix composition** of CRMs should **mimic** the local environment as closely as possible to represent real samples measured by the labs. **Very limited** number of **CRMs** are available from the partnering countries.

Beyond the state of the art

- Measured on a **local level** (at NMIs) in terms of matrix **CRM production capability**, to provide matrix CRMs and proficiency test services to stakeholders.
- All the NMIs involved will have the **capacity** to carry out all aspects of **CRM development** and **certification**.
- 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.
- **New CRMs** will be available that **differ in matrix**, **analyte(s)** and **concentration** from those currently on the market with **comparable uncertainty** values to commercially available CRMs.
- Analyte 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 will be analysed as part of the certification process, allowing **uptake by industry**.

Impact

- Availability of **3 new CRMs** for **traceable** and **comparable QA/QC** applications in environmental analysis.
- **Measurement services** for the newly acquired **capabilities** for customers in partnering countries.
- **Proficiency testing** services for laboratories in partnering countries.
- **Further** collaborative **studies** among the consortium for new **CRM development** and **PT services**.
- More **accurate**, **reliable** and **comparable** analysis results will **minimize** the **unnecessary repetition** of analysis, thus will **reduce** the **costs** of laboratories in partnering countries.
- In long term, **better monitoring** of natural resources like **water** and **soil** will increase the **quality of life** by increasing the quality of drinking / irrigation water and as a consequence increasing the **quality** of **agricultural products**.

Messen ▪ Forschen ▪ Wissen

Final Meeting & Workshop, 14-16 May 2018

*The power dominating the lives of people and their efforts is the ability to **create** and **find** something **new**.*

M. K. Atatürk (1881-1938)

Messen ▪ Forschen ▪ Wissen

Thank you for your attention!

Triga Mark II Nuclear Reactor Visit, Ljubljana,Slovenia, Midterm Meeting, Dec 2016

alper.isleyen@tubitak.gov.tr

Bridge of locks Lubljana, Slovenia

Dinner after final meeting, İstanbul,Turkey, May 2018