

MetroPOEM: Metrology for the harmonisation of measurements of environmental pollutants in Europe.

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Key facts

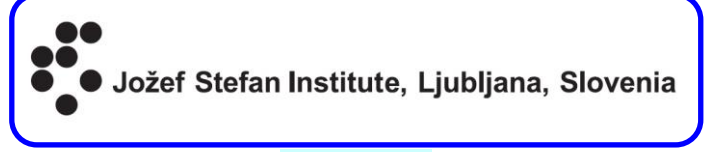
- This project was selected for funding from the Green Deal Call 2021 of the European Partnership on Metrology research funding program:
 - <https://www.metpart.eu/>
- Start: **01 October 2022** End: **30 September 2025**
- Duration: 36 months
- 22 partners from 13 countries will contribute with in total 320 months of work
 - Austria, Czech Republic, Denmark, Finland, France, Germany, Norway, Romania, Serbia, Slovenia, Switzerland, Türkiye and United Kingdom
- Project website
 - <https://www.npl.co.uk/euramet/metropoem>



WP6

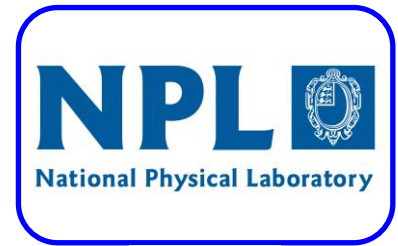


WP3



WP2

LABORATOIRE
NATIONAL
DE MÉTROLOGIE
ET D'ESSAIS



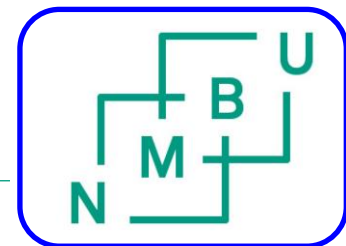
WP1



WP4



Consortium



WP5



Rationale

The European Green Deal's ambition for zero pollution requires the development of highly sensitive techniques to detect ultra-low amounts of pollutants supporting the Basic Safety Standards directive, delivered via strategies described in:

- European Metrology Network (EMN) on Pollution Monitoring (PoIMo) and
- EMN on Radiation Protection

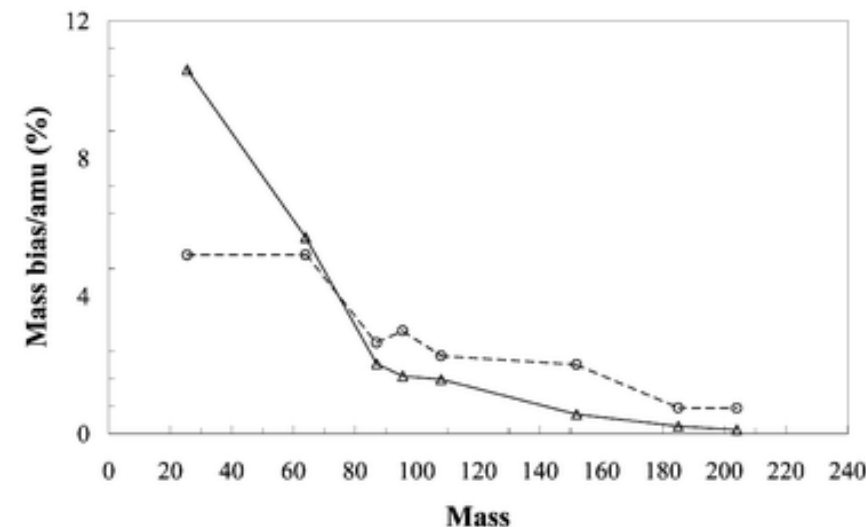
Implicit in these strategies is a strong need for metrology/traceability

- to improve data quality for monitoring and reporting pollution in the air, water, and soil. But...
- the lack of suitable traceability chains and appropriate quality control compromises the comparability and robustness of measurements.

Top level objective

The overall aim of MetroPOEM is to

- Bridge the gap between radiometric techniques and mass spectrometry for the characterisation and detection of:
 - long lived radionuclides
 - stable elements and
 - element tracers
- **Mass bias effects brought into traceability chain**
- Achieved by comparing and linking both techniques, thus significantly improving measurement uncertainties and detection limits

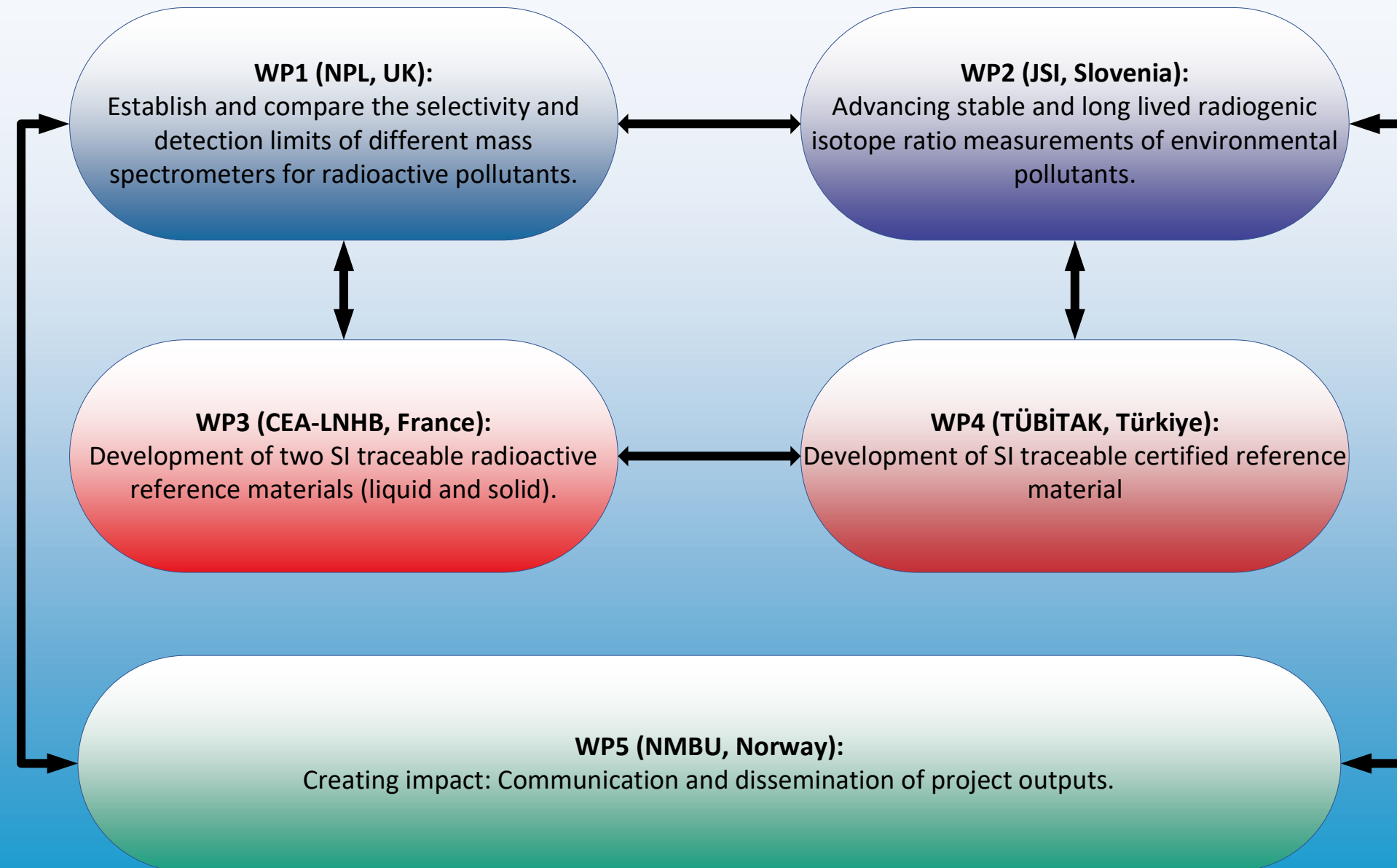
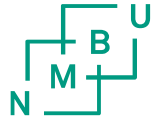


Structure of project

The project is delivered via six work packages led by

- WP1: NPL, UK
- WP2: JSI, Slovenia
- WP3: CEA, France
- WP4: TÜBİTAK, Türkiye
- **WP5: NMBU, Norway**
- WP6: PTB, Germany

WP6 (PTB, Germany): Management and Coordination



WP 1: Establish and compare the selectivity and detection limits of different mass spectrometers

Objectives

- Establish the capabilities of different mass spectrometry designs using radionuclide standard solutions
- Radionuclides identified: ^{237}Np , $^{234,235,236,238}\text{U}$, $^{239,240}\text{Pu}$, ^{241}Am , possibly ^{226}Ra and ^{90}Sr
- Preparation of single and mixed standards with and without the inclusion of spectral interferences at levels relevant to regulatory limits
- Distribute standards for inter-laboratory comparison exercise

WP 1: Establish and compare the selectivity and detection limits of different mass spectrometers

Outcomes

- New standard solutions for instrument calibration and method validation to support the increasing use of mass spectrometry for radionuclide detection.
- Comprehensive assessment of mass spectrometry instruments for measurement of low-level radionuclides, including detailed evaluation and reporting of results from a Europe-wide comparison exercise.

WP 1: Establish and compare the selectivity and detection limits of different mass spectrometers

Progress

- Discussion of radionuclides of interest, activity levels and isotopic ratios depending on laboratory limits and nature of research undertaken.
- Survey sent to WP1 participating laboratories to provide a summary of the point above. Results received by the end of December 2022.
- Discussion of results with CEA on 1st February to ensure good links between WP1 and WP3 activity levels and isotopic ratios. This discussion will also determine the starting materials to be used.

WP 2: Advancing stable and long-lived radiogenic isotope ratio measurements of environmental pollutants

Objectives

- Develop measurement methods for isotope ratios, traceable to the SI by using multi-collector ICP-MS.
- Apply to more commonly available techniques (ICP-MS/MS, ICP-QMS).
- Providing suitable operating procedures focusing on stable polluting elements (e.g. Li, B, Cr, Cd, Ni, Sb, Pb, U).
- Produce recommendations for sample processing, treatment, uncertainty budgets, and the quantification of the mass bias.

WP 2: Advancing stable and long-lived radiogenic isotope ratio measurements of environmental pollutants

Outputs

- SI traceable methods for determination of isotope ratios of Li, B, Cr, Cd, Ni, Sb, Pb, U by MC-ICP-MS and single collector ICP-MS.
- Analyte separation methods for high precision analysis.
- To evaluate and model instrumental mass fractionation for ICP-based mass spectrometers.

WP 2: Advancing stable and long-lived radiogenic isotope ratio measurements of environmental pollutants

Progress

- A list of reference materials for Li, B, Cr, Cd, Ni, Sb, Pb and U for study calibration approaches for isotope ratio measurements compiled.
- WP2 participants divided the elements, so that all will be covered with as much MS techniques as possible.
- Laboratories started with the development of methods for matrix/element separation
→ matrix: sea water.
- Work on the investigation and modelling of correction approaches for instrumental isotope fractionation is in progress.

WP 3: Development of radioactive reference materials

Objectives

- To develop 2 radioactive reference materials (liquid & solid) containing radioactive pollutants (e.g. U, Np, Pu, Am)
- For use in 2 inter-laboratory comparisons to assess measurement capabilities (e.g. detection limits and uncertainty budgets)

WP 3: Development of radioactive reference materials

Outputs

- Extensive comparison of instrument capabilities (15 partners)
- Harmonisation of mass spectrometry measurement methods
- Addressing isotopic fractionation

WP 3: Development of radioactive reference materials

Progress

- Concentration/activity ranges for isotopic ratios and targeted uncertainties selected
- CEA/NPL discussions on-going to use common starting materials for WP1 and WP3
- Synthesis of the solid RM matrix @CEA/LNHB: modification of the synthesis to lower moisture uptake (very small scale experiments)
- Starting soon: design of preparation procedures for both RMs (include a statistically valid sampling scheme, designs of homogeneity and stability studies)

WP 4: WP4 (TÜBİTAK, Türkiye): Development of SI traceable certified reference material

Objectives

- Preparation of a candidate seawater CRM
- Characterisation based on interlaboratory comparison study between the participants.
- Achieved using analytical methods developed and validated in WP2
- Verification of all data obtained for homogeneity, short term stability, long term stability and characterisation for consistency and correctness

WP 4: WP4 (TÜBİTAK, Türkiye): Development of SI traceable certified reference material

Outputs

- Assign the certified values for seawater reference material and their associated combined uncertainty.
- Compilation of characterisation into a certification report and CRM certificate.

WP 4: Development of SI Traceable Certified Reference Material

- Development of a processing and production plan has been started with the WP partners and is close to be finalized.
 - The following decisions have been taken so far..
 - ✓ 100 L North Sea water divided into 400 250 mL aliquots
 - ✓ Concentration ranges and uncertainties for target elements, Li, B, Cr, Cd, Sb, Pb and U, selected
 - ✓ Storage conditions for the raw material and units
 - ✓ Test temperatures for stability analysis
 - On going:
 - ✓ Homogeneity measurement
 - ✓ The necessity for short term stability measurements is being discussed
 - ✓ Long term stability measurement
 - ✓ Detailed design for characterization of Li, B, Cr, Cd, Sb, Pb and U has been started to be settled with the WP partners.

WP5: Creating impact

Objectives

- Dissemination of the project outcomes
- Communication of the project outcomes via a range of dissemination routes to the general public, academia, governmental agencies and industry
- Exploitation via the uptake of project outcomes
- Outputs communicated via project website, LinkedIn, Research Gate &c

WP5: Creating impact

Outputs

- Establishment of a stakeholder committee and project website
- Trade and non-technical press publications
- At least 12 presentations at suitable conferences
- At least 12 peer reviewed papers in appropriate journals
- At least 4 professional workshops
- Input into ISO, CEN, BIPM, EURAMET &c standards committees
- Publication of 2 good practice guides
- Training course
- Dissemination of reference materials

WP5: Creating impact

Progress

- Stakeholder committee in progress
- Website in place: <https://www.npl.co.uk/euramet/metropoem>
- Presence in LinkedIn and ResearchGate
 - <https://www.linkedin.com/in/metropoem-project-308762251/>
 - <https://www.researchgate.net/project/MetroPOEM-Metrology-for-the-harmonisation-of-measurements-of-environmental-pollutants-in-Europe>
- First press release issued
 - <https://www.stuk.fi/web/en/about-us/cooperation/metropoem-project>

WP6: Management and coordination

Regular Reporting:

- Publishable Summary
- Data Management Plan (DMP)
- Progress Reports
- Impact/Output reports
- Periodic Reports
- Final Reports
- Dissemination, Communication and Exploitation (DCE) Plan with respect to Key Performance Indicators (KPIs)

Finally...

The project (21GRD09 MetroPOEM) has received funding from the European Partnership on Metrology, co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States.

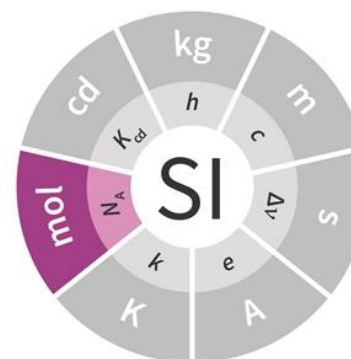
- Funder name: European Partnership on Metrology
- Funder ID: 10.13039/100019599
- Grant number: 21GRD09 MetroPOEM



Activity ($\text{Bq} = \text{s}^{-1}$)

$$n = \frac{A \cdot T_{1/2}}{N_A \cdot \ln 2}$$

Amount of substance (mol)



Tusen takk!

