

Metrology for the harmonisation of measurements of environmental pollutants in Europe

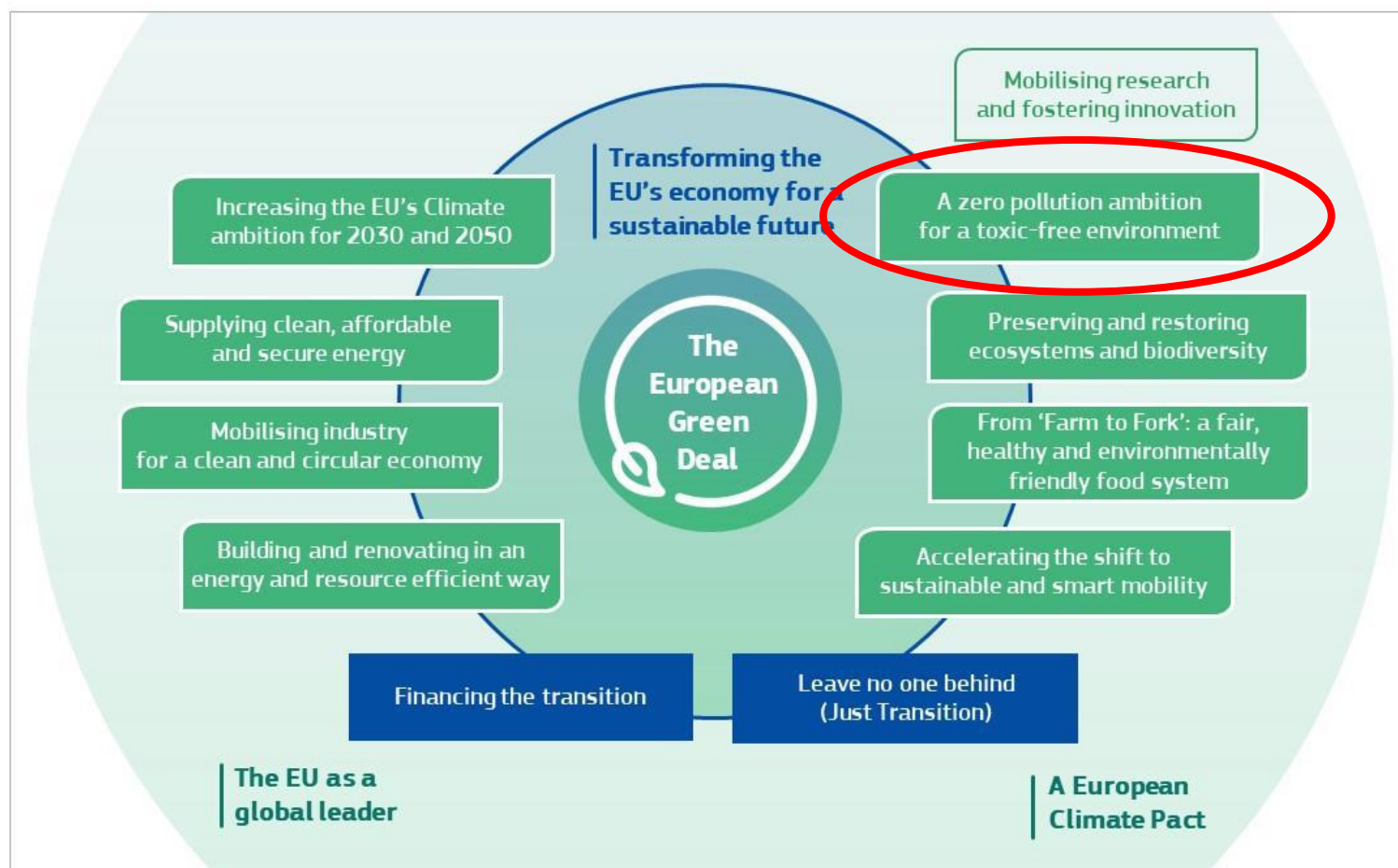
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Introduction of MetroPOEM

➤ Key facts:

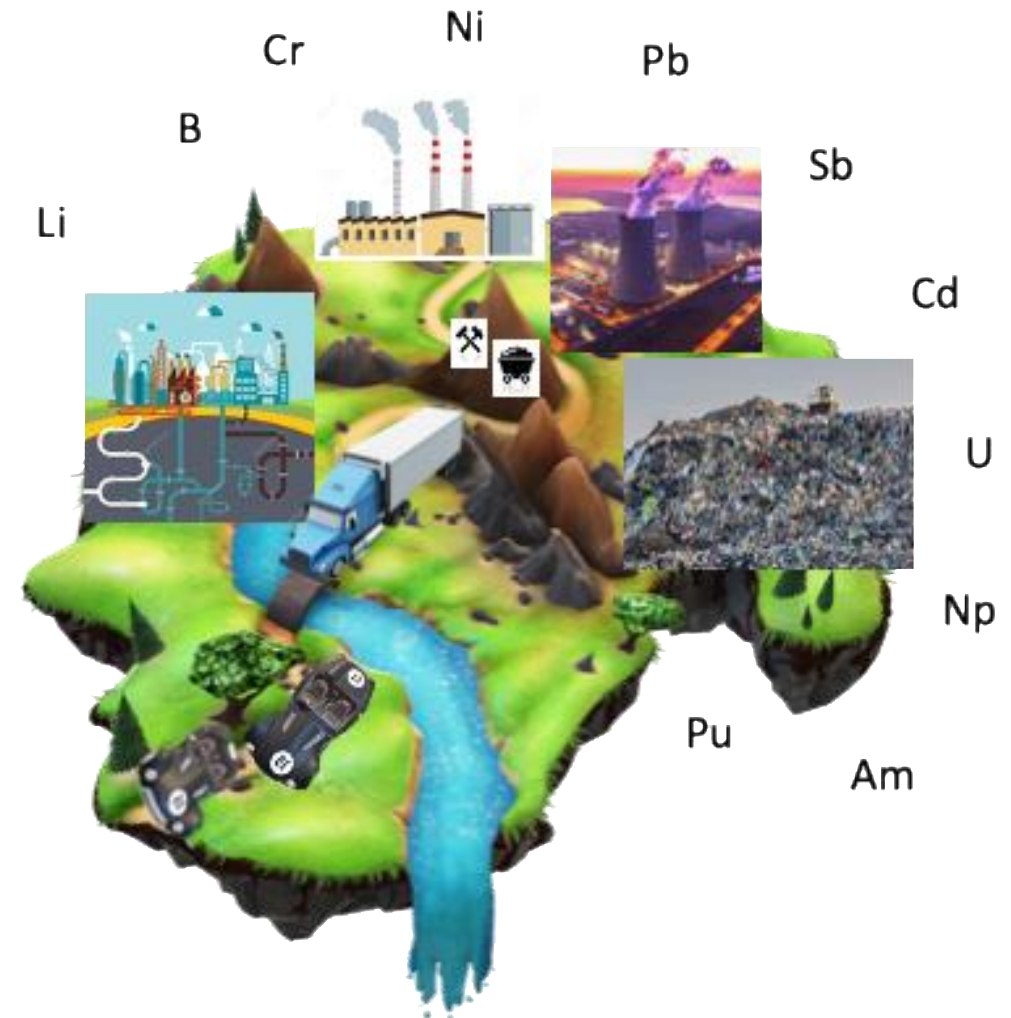
- ✓ Start date: 01 October 2022
- ✓ Duration: 36 months
- ✓ 22 partners from 13 countries will contribute with in total **320 months of work!**
Austria, Czech Republic, Denmark, Finland, France, Germany, Norway, Romania, Serbia, Slovenia, Switzerland, Türkiye and United Kingdom
- ✓ Project Website: <https://www.npl.co.uk/euramet/metropoem>
- ✓ 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/>

The European Green Deal, Document: "COM/2019/640 final"



Introduction of MetroPOEM

- **Key Aspects:**
- **The zero-pollution ambition promoted by the European Green Deal**, requires highly sensitive and state-of-the-art detection techniques for the measurement of ultra-low amounts of pollutants.
- **Mass spectrometry** is a key method,
 - ✓ with high potential for reducing measurement uncertainties and detection limits,
 - ✓ but there is no existing traceability chain for **radioactive elements**,
 - ✓ and there is a lack of SI-traceable isotope reference materials for **stable isotopes**.



Mass spectrometry systems included in the project

- **ICP-QMS** Inductively Coupled Plasma Quadrupole Mass Spectrometer
- **ICP-MS/MS** Inductively Coupled Plasma Tandem Mass Spectrometer
- **ICP-SFMS** Inductively Coupled Plasma Sector Field Mass Spectrometer
- **MC-ICP-MS** Multi-Collector Inductively Coupled Plasma Mass Spectrometer
- **SIMS** Secondary-Ion Mass Spectrometer
- **TIMS** Thermal Ionisation Mass Spectrometer
- **AMS** Accelerator Mass Spectrometer
- **ICP-TOF-MS** Inductively Coupled Plasma Time of Flight Mass Spectrometer
- **SNMS** Secondary Neutral Mass Spectrometer
- **HR-ICP-SF-MS** High Resolution Inductively Coupled Plasma Sector Field Mass Spectrometer
- **ICP-QQQ-MS** Triple quadrupole Inductively Coupled Plasma Mass Spectrometer

Work packages

WP6: Management and coordination

Radioactive Pollutants

WP1: Establish and compare the selectivity and detection limits of different mass spectrometers

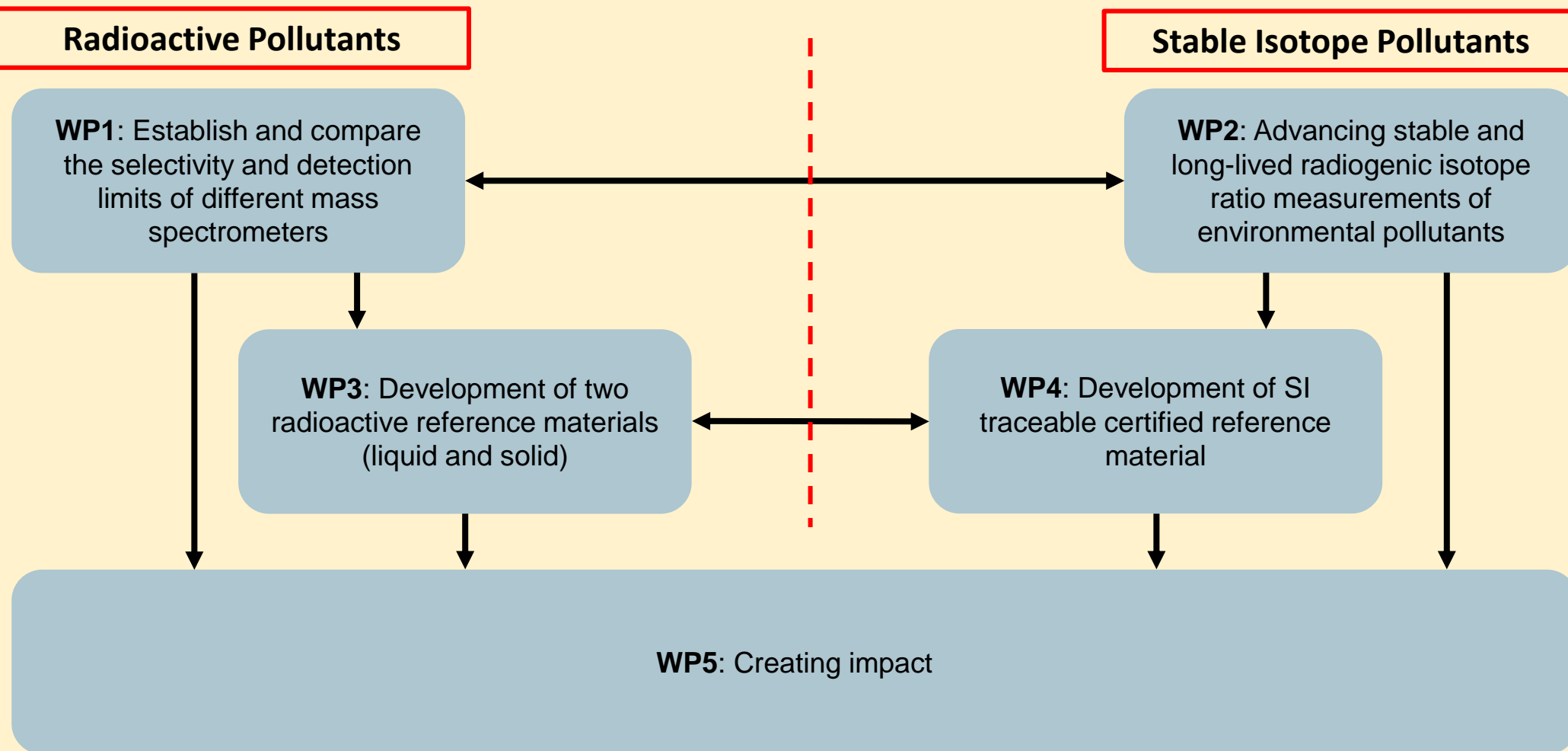
WP3: Development of two radioactive reference materials (liquid and solid)

Stable Isotope Pollutants

WP2: Advancing stable and long-lived radiogenic isotope ratio measurements of environmental pollutants

WP4: Development of SI traceable certified reference material

WP5: Creating impact



WP1: Establish and compare the selectivity and detection limits of different mass spectrometers

Objectives

- Define and prepare **traceable aqueous standards containing radioactive pollutants** (U, Np, Pu, Am, Sr, Ra).
- Establish the **advantages and limitations** of commercially available instruments and decay counting techniques.
- Produce **recommendations** for low-level radionuclide measurement using mass spectrometry.

Outputs

- Production of **traceable standards** and methods for single, mixed and isotopic ratio radionuclide measurements.
- **Comprehensive assessment** of mass spectrometry instruments for low-level radionuclide measurement.

Progress

- Determination of **activity levels** and **isotopic ratios** depending on laboratory limits
- Good link between WP1 and WP3 established.

WP3: Development of 2 radioactive reference materials (liquid & solid)

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 & uncertainty budgets)

Outputs

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

Progress

- Concentration/activity ranges for isotopic ratios and targeted uncertainties selected
- Good link between WP1 and WP3 established
- Synthesis of the solid RM matrix: Modification of the synthesis to lower moisture uptake
- Starting soon: Design of preparation procedures for both RMs (include a statistically valid sampling scheme, designs of homogeneity and stability studies)

WP2: 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** these methods on 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, quantification of the mass bias.

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.
- **Evaluated instrumental mass fractionation** for ICP-based mass spectrometers.

Progress

- Relevant reference materials for calibration identified, including lack of materials (e.g., Sb)
- Elements/isotope systems assigned to participants
- Method development for matrix/element separation in seawater ongoing
- Investigation and modelling of instrument-induced fractionation ongoing

WP4: Development of SI Traceable Certified Reference Material

Objectives

- To develop **one certified seawater reference material** for stable inorganic pollutant elements:
 - ✓ Processing and production plan
 - ✓ Sampling and processing of raw material
 - ✓ Homogeneity and stability measurements
 - ✓ Characterization, value assignment and reporting

Outputs

- Availability of **one certified seawater reference material** for stable inorganic pollutant elements

Progress

- 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
- Ongoing:
 - ✓ 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

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 and standards committees
- Publication of 2 good practice guides
- Training course
- Dissemination of reference materials

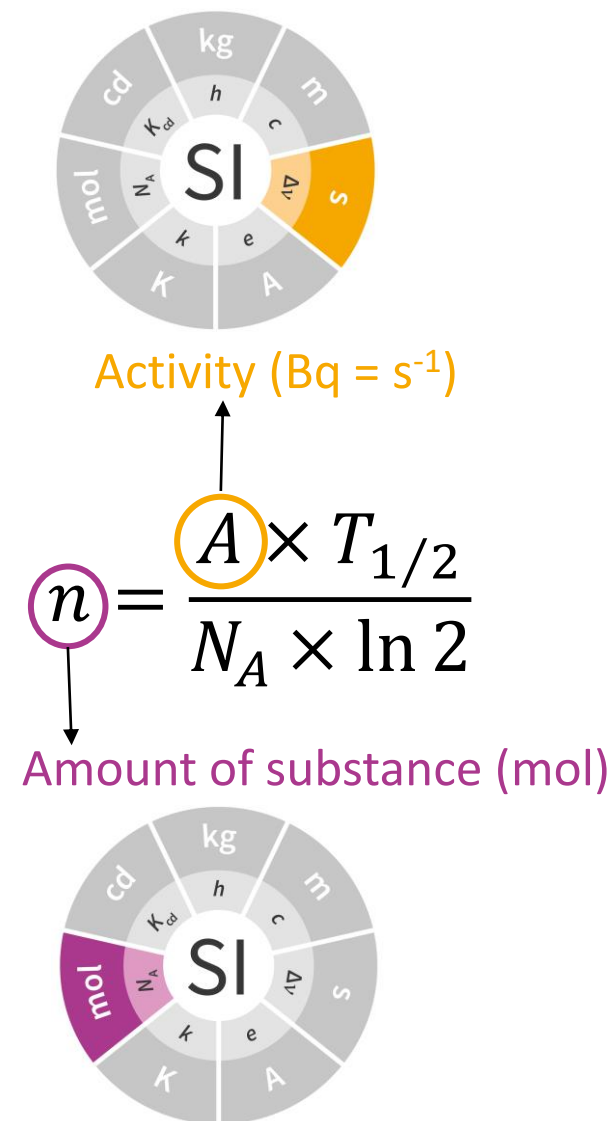
WP5: Creating Impact

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>

Impact of MetroPOEM

- **Establish link** between radiometric techniques and mass spectrometry, bridging the gap between the activity (Bq) and the amount of substance (mol) of an isotope
- Close the **traceability gap** for isotope ratio measurement resulting from isotopic fractionation (mass bias)
- Guide on the use of mass spectrometry for **low level radionuclide detection**
- Report of different instrument's **advantages and limitations**
- Three Si-traceable **reference materials**
- Establish Si-traceable **calibration chain** for single collector ICP-MS
- **Harmonized methods** for measurement of polluting elements using mass spectrometric techniques





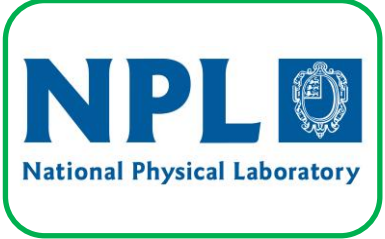
WP6



WP3



WP2



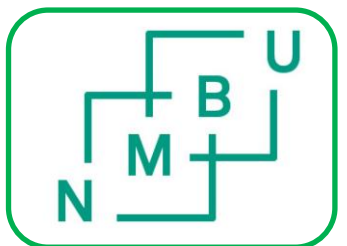
WP1



WP4



Consortium



WP5



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