



Traceability of oxidised mercury - MercOx project (2017-2020)

Starting date: 1. October, 2017
Total costs: 1,96 Mio EUR, EU: 1,80 Mio EUR

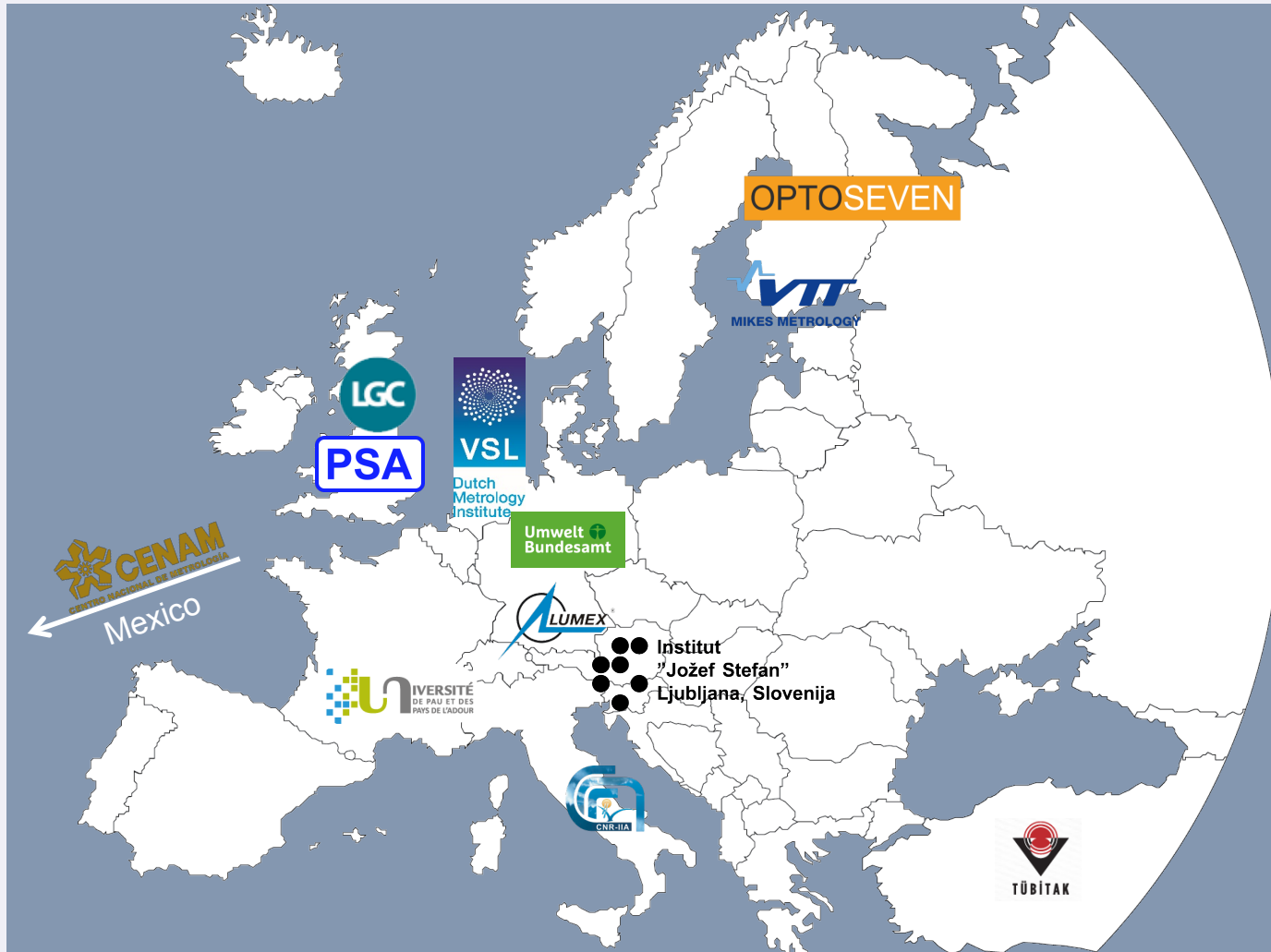
Coordinator: Milena Horvat
Jožef Stefan Institute,
Ljubljana, Slovenia



The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

Kick-off meeting, 9.-11. October, 2017, Jožef Stefan Institute, Ljubljana

MercOx partners, 12 partners, 8 countries



MercOx partners

1. **JSI, Slovenia:** [Coordinator, WP 3 Leader](#) (M. Horvat, J. Kotnik, D. Kocman, M. Štrok, V. Fajon, Y. Shlyapnikov, M. Pavlin)
2. **LGC, UK,** [WP2 Leader](#) (H. Goenaga-Infante, P. Petrov, D. Douglas)
3. **Tubitak, Turkey** (S. Z. Can, M. Tunc O. Cankur)
4. **UBA, Germany,** [WP5 Leader](#) (J. Koschorreck, I. Fettig)
5. **VSL, the Netherlands,** [WP 1 Leader](#) (H. Ent)
6. **VTT, Finland,** [WP 4 Leader](#) (T. Rajamäki)
7. **CNR-IIA, Italy Lumex, Germany,** (N. Pirrone, F. Sprovieri, I. M. Hedgecock)
8. **Lumex, Germany** (R. Mösel, V. Ryzhov, G. Debus)
9. **Optoseven Oy, Finland** (J. Makkonen)
10. **PSA, UK** (W. Corns, M. Dexter)
11. **UPPA, France** (O. Donard, D. Amouroux, S. Berail, M. Monperrus, Z. Pedrero)
12. **CENAM, Mexico** (Y. Mitani, M-R Arvizu-Torres, E. Valle, J. Velina Lara)

European Association of National Metrology Institutes - EURAMET

Members:

37 European NMIs

28 of them are participating in EMPIR

Associates:

IRMM (EC)

75 DIs (Designated Institutes)

Liaison Organisations:

4 RMOs & BIPM

3 NMIs beyond Europe

KDM (Kosovo under UNSCR 1244)

6 regional/international Organisations



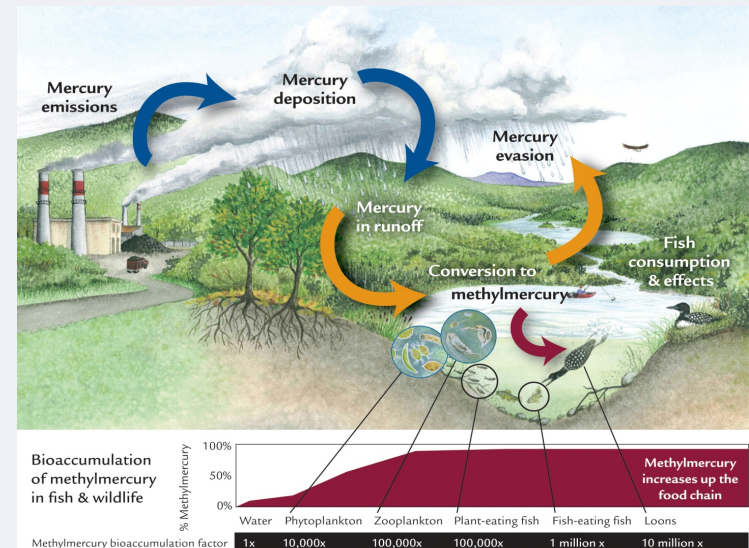
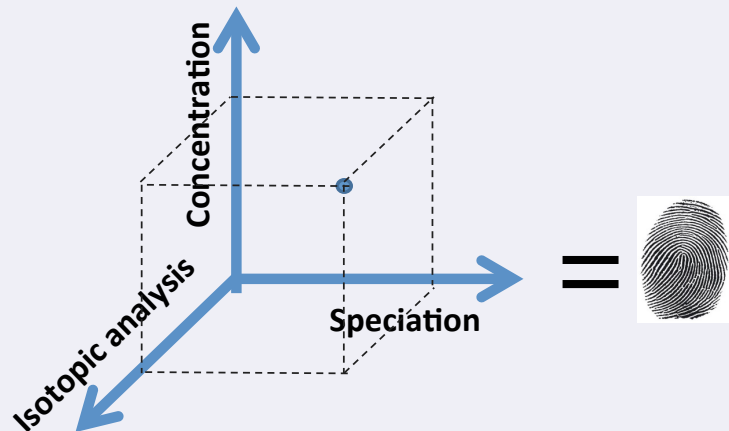
EMPIR

European Metrology Programme for Innovation and Research

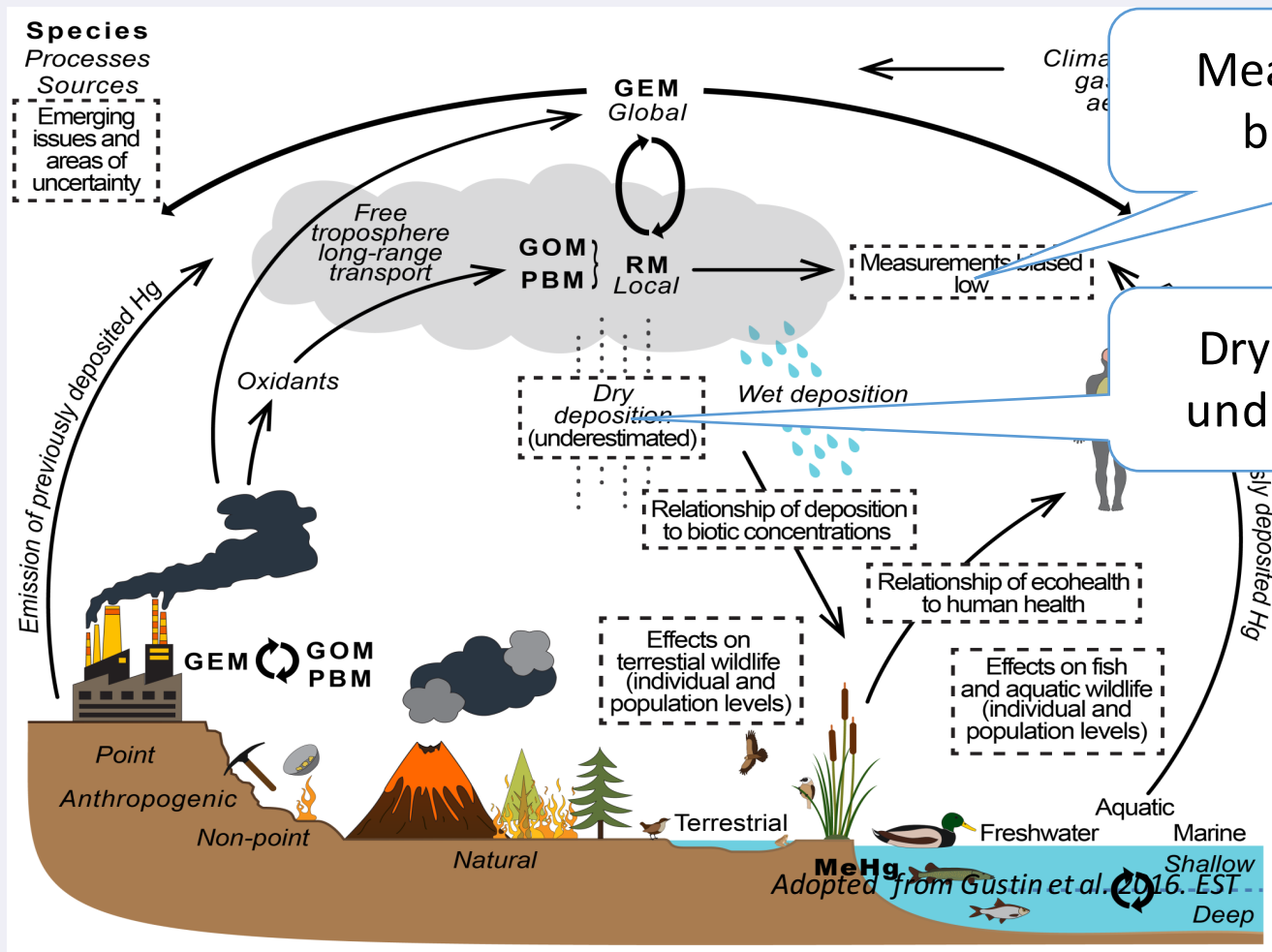
- It is about improving measurement to drive innovation and competitiveness.
- It enables European metrology institutes, industrial organisations and academia to collaborate on joint research projects.
- It is implemented by EURAMET (European Association of National Metrology Institutes).
- It is based on Article 185 of the Lisbon Treaty.
- It is jointly funded by the EMPIR participating countries and the European Union and has a budget of approximately 600 M€ over seven years.

EMRP/EMPIR - Hg related projects

- **Part Emission (2011-2014)** Develop a **gravimetric primary standard** in order to link the mercury (Hg(0)) traceability chain to gravimetry instead of the currently used mercury vapour concentration equations, at ambient level in the range $5 \text{ ng Hg/m}^3 - 60 \mu\text{g Hg/m}^3$.
- **MeTra (2014-2017)** The aim was to develop metrological infrastructure to measure key **mercury species and isotope ratios in all relevant environmental matrices**, aiming to provide tools to ensure reliability and comparability of measurement results.



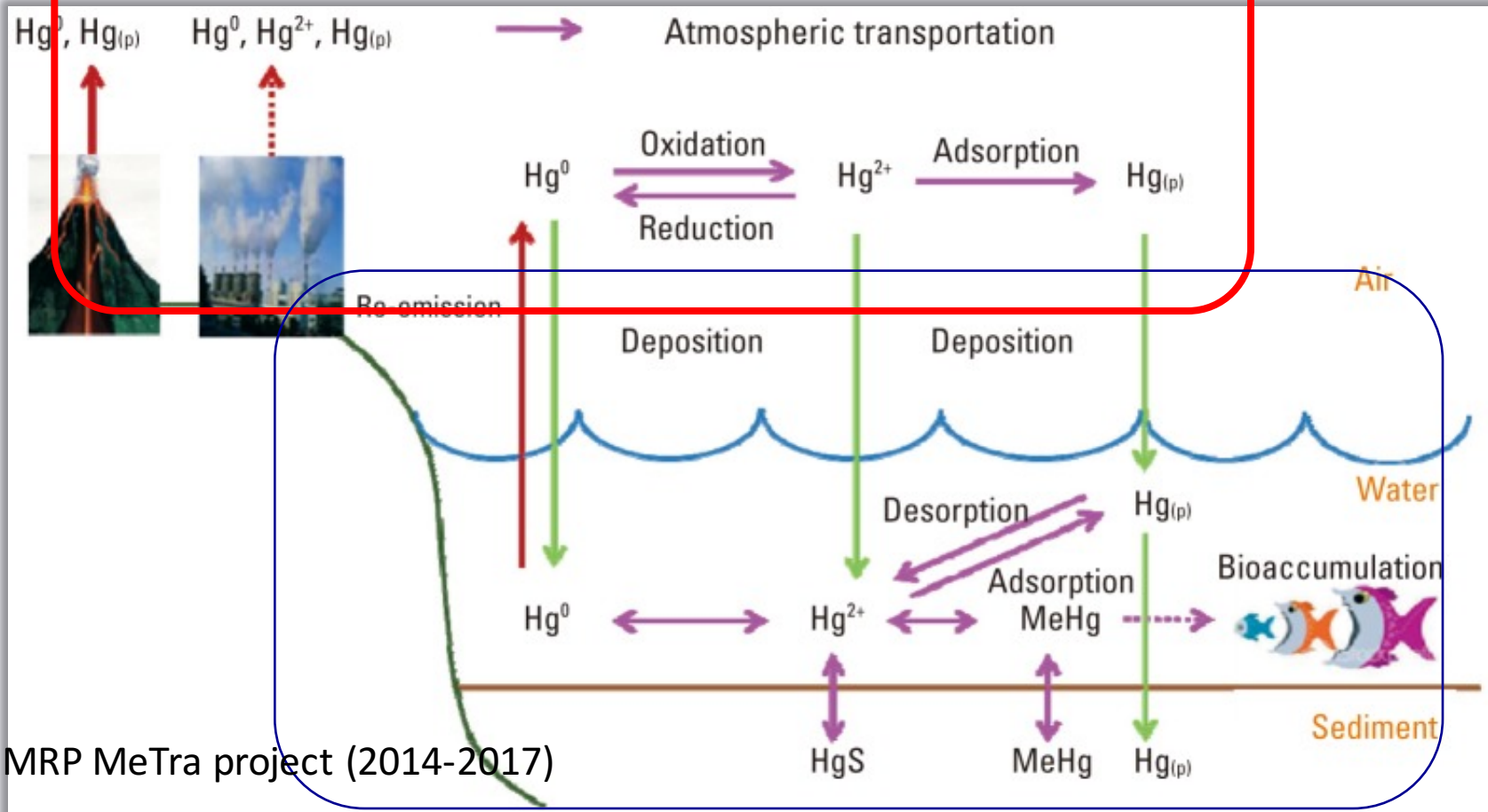
Emerging issues and areas of uncertainties



Currently no metrological infrastructure for traceable, validated and accurate measurements of oxidised mercury species in the atmosphere and emission sources exists.

MeTra & MercOx

EMPIR MercOx project (2017-2020)

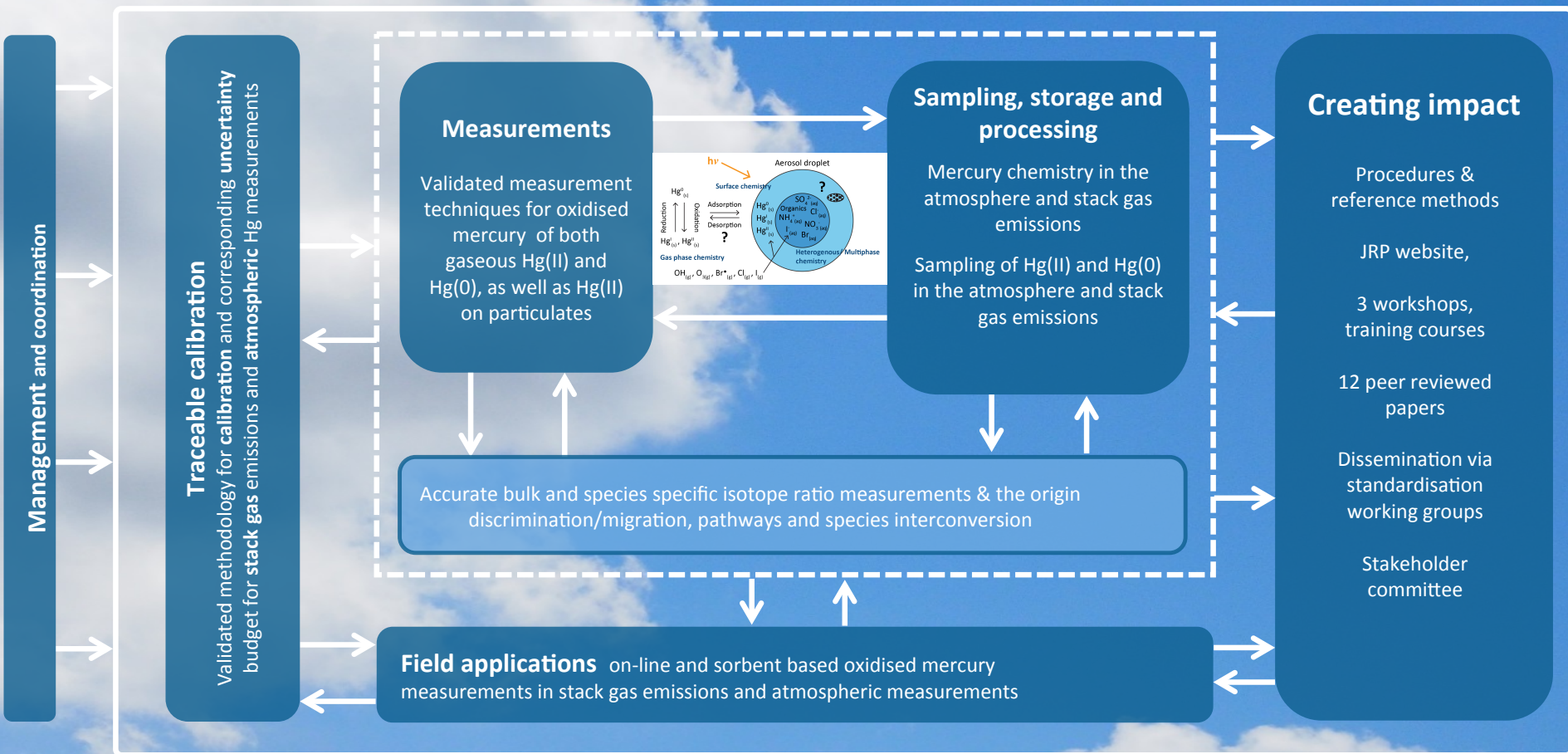


EMRP MeTra project (2014-2017)

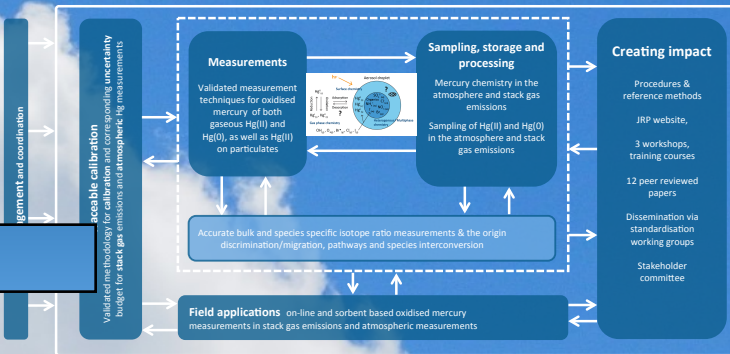
Aims

- MercOx aims to **validate and develop traceable oxidised Hg standards** and methods for **sampling and analysing oxidised Hg species** in **flue gas** emissions and in **the atmosphere**. This will result in significant improvement in measurement **uncertainty and comparability** of measurement results.
- MercOx will introduce **comparability of measurement** results to enable legislation and support Europe's international obligations to reduce Hg emissions. Europe and the NMIs involved will be able to take a leading role in the future of metrology for mercury measurements.

Project structure



WP 1 Traceable calibration



Traceable calibration method for the most important Hg (II) species, including HgCl₂, based on a validated method to accurately compare the Hg concentration in generated standard gases for Hg(0) and HgCl₂.

Traceable generation of HgCl₂ at **µg/m³** levels for **stack gas emission measurements**, including a certification protocol for confirming the output of liquid evaporative HgCl₂ generators

Transfer reference gas standards for **atmospheric (oxidised) Hg** measurements for the calibration of liquid evaporative HgCl₂ generators at **sub-ng/m³** levels

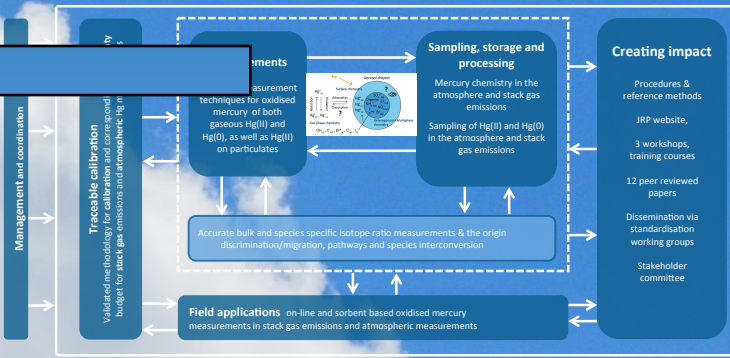
Deliverables:

D1 Optimised and traceable calibration methods for oxidised mercury (Hg) species, including mercury chloride (HgCl₂)

D2 Certification protocol for the output of liquid evaporative HgCl₂ generators



WP 2 Measurement of Hg(II)



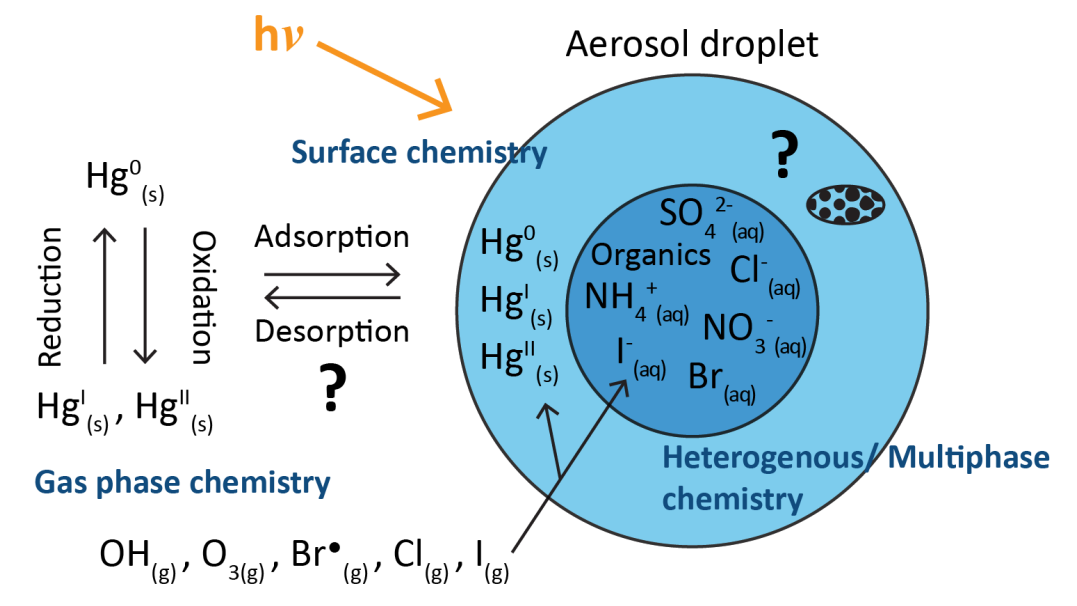
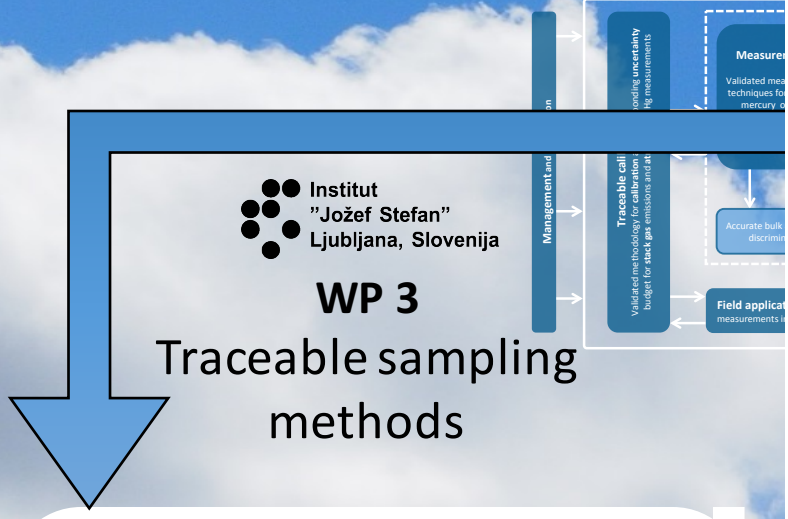
Measurement of gaseous Hg (II) selectively trapped gaseous Hg (II) at environmentally relevant concentrations (Atmospheric-pressure chemical ionisation mass spectrometry (APCI-MS), Laser ablation, and other conventional techniques).

Measurement of Hg (II) on particulate matter (PM)

Deliverables:

D3 Report on the comparison of different methods for measuring oxidised Hg (Hg(II))

D4 Report on **bulk and species specific isotope ratio measurements to determine Hg migration pathways, its origin and species interconversion** including the use of biomonitors as passive monitors for Hg speciation and isotopic signatures representing the origin and fate of atmospheric Hg



To investigate how atmospheric and stack gas emissions chemistry influences Hg sampling and measurement

Identify the critical components and parameters, that can alter Hg speciation during sampling and to study these processes using tracer experiments.

Deliverables:

D5 Best practice guide for Hg sample preparation and interspecies conversion correction

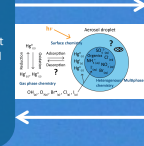
D6 Optimised and validated sampling methods for gaseous Hg species using traceable reference standards for Hg(0) and Hg(II))

Management and coordination

Traceable calibration
Validated methodology for calibration and corresponding uncertainty
get for stack gas emissions and atmospheric Hg measurements

Measurements

Validated measurement techniques for oxidised mercury of both gaseous Hg(II) and Hg(0), as well as Hg(II) on particulates



Sampling, storage and processing

Mercury chemistry in the atmosphere and stack gas emissions
Sampling of Hg(II) and Hg(0) in the atmosphere and stack gas emissions

Accurate bulk and species specific isotope ratio measurements & the origin discrimination/migration, pathways and species interconversion

Creating impact

- Procedures & reference methods
- JRP website,
- 3 workshops, training courses
- 12 peer reviewed papers
- Dissemination via standardisation working groups
- Stakeholder committee

Applications on-line and sorbent based oxidised mercury measurements in stack gas emissions and atmospheric measurements

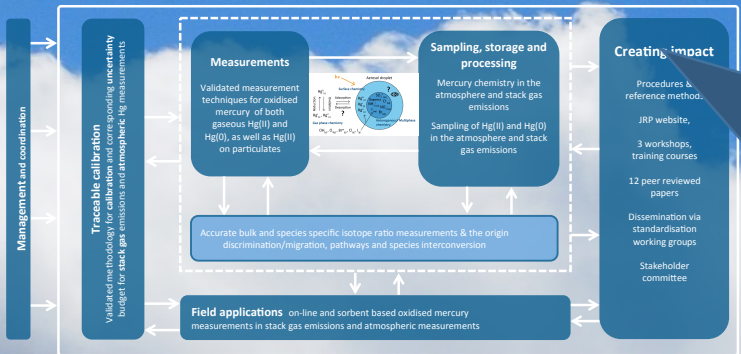
Deliverables:

D7 Validation report on the field testing of new and existing methods for on-line and sorbent based Hg measurements in stack emissions

D8 Validation report on the field testing of new and existing methods for on-line and sorbent based Hg measurements in the atmosphere

Test and validate existing methods for on-line Hg monitoring from process stack emissions (coal TPP, Cement production)

Test and validate existing methods for on-line Hg monitoring in the atmosphere (GMOS sites: South, Central, Northern Europe)



WP 5: Impact



- Procedures & reference methods
- JRP website
- 3 workshops & training courses
- 12 peer reviewed papers
- Dissemination via standardisation working groups
- Stake holder committee

- Minamata Convention on Mercury
- GEO Work Plan
- Human Bio-monitoring Programmes
- UNEP and its Partnership Programmes
- Task Force on Hemispheric Transport of Air Pollution

- Fourth Air Quality Daughter Directive (2004/107/EC)
- Industrial Emissions Directive (2010/75/EU)

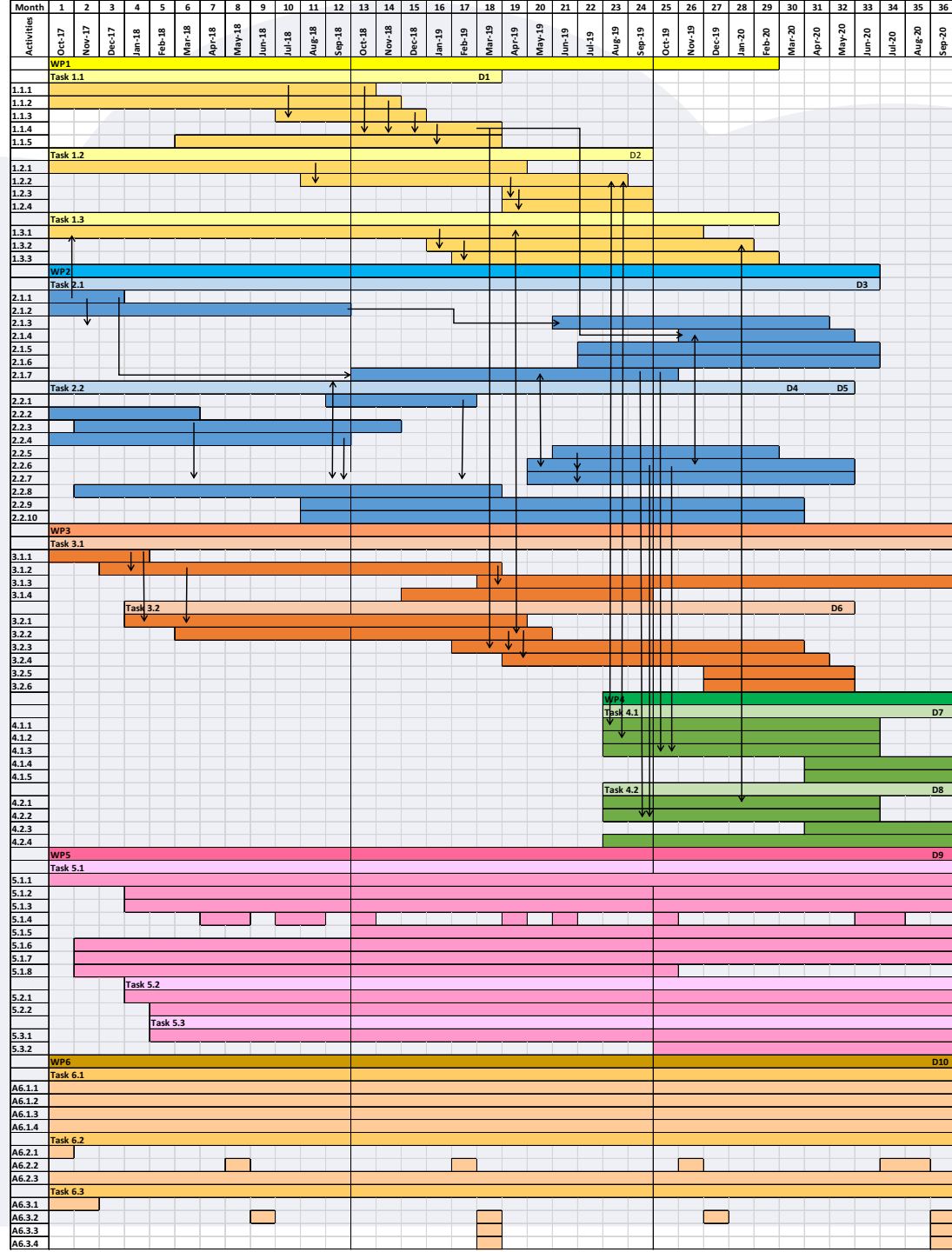
- EN 15852: Standard method for the determination of total gaseous mercury
- EN 13211: Manual method of determination of the concentration of total mercury

Deliverable:

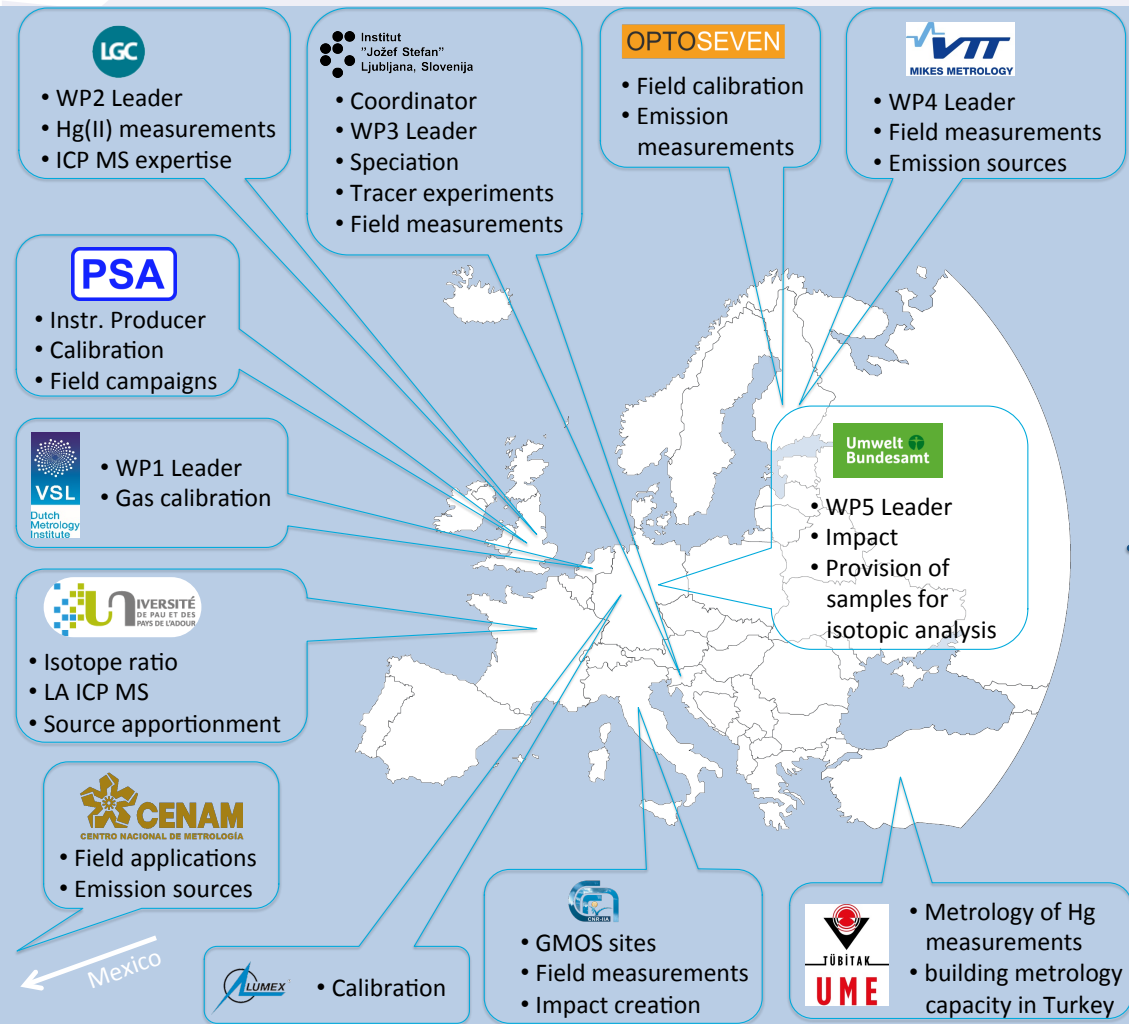
D9 Evidence of contributions to new or improved international standards with a specific focus on CEN TC264 WG8 and WG25, ISO TC146 SC3 and SC1, ISO TC158, CCQM GAWG and IAWG and ISO/REMCO.

Examples of early uptake of project outputs by end users.

Gantt chart



Partners and stakeholders



User group & Stakeholders
(28 Support Letters)

(28 letters of support in total)

Regulation and policy makers:
UNEP, US EPA, IEA CCC, SAICM, EA (UK), CEMBUREAU, INECC;

National metrology institutions:
NIST, CENAM;

Monitoring programmes:
GEO, AMAP;

Standardisation bodies:
ISO/TC 158, ISO/TC 264;

Industrial partners:
Uniper, Finnsementti, Saloniit, Ekokem, Helen, CFE;

Instrument manufacturers:
Tekran, ESI, PS Analytical, Mercury Instruments;

SMEs:
Arcadis, Ohio Lumex;

Academic institutions:
McGill University, University of Reno, UNAM

Thank you for your attention