

European Metrology
Programme for Innovation
and Research

Delivering Impact



Detecting contaminants in soil

Companies building on sites contaminated by previous industrial use, must first perform soil analyses to identify pollutants. Measurement traceability is underpinned by reference materials that need to closely match real-world samples. Increasing the capability of National Metrology Institutes (NMI) in emerging EU member states to produce these materials and perform proficiency exercises is essential to harmonise SI traceability in environmental monitoring throughout Europe.

Europe's National Metrology Institutes working together

The European Metrology Programme for Innovation and Research (EMPIR) has been developed as part of Horizon 2020, the EU Framework Programme for Research and Innovation. EMPIR funding is drawn from 28 participating EURAMET member states to support collaborative research between Metrology Institutes, academia and industry both within and outside Europe to address key metrology challenges and ensure that measurement science meets the future.

Challenge

Land reclamation and redevelopment is converting old industrial sites for new uses such as housing. Ensuring that no lingering contamination remains and that any found is not redistributed to other locations is becoming increasingly important. Construction companies are required to conduct detailed soil analyses to identify pollutants, including mercury and lead that can bio-accumulate, before building begins.

Detecting the metals present relies on the soil's chemical composition, for example metals contained in organic material from topsoil can be extracted using aqua regia treatments to give information on site contamination. Whilst determining more firmly bound metals in deeper limestone or sand deposits requires far more aggressive and complex chemical treatments.

Laboratories performing these measurements use certified reference materials to confirm their methods are reliable and participate in proficiency exercises to demonstrate their results match those of their peers. In Europe increased numbers of reference materials that match the type of environmental samples to be analysed are needed, coupled with increased NMI capabilities to support national environmental traceability through the performance of proficiency test exercises.

Solution

The EMPIR project *Matrix reference materials for environmental analysis* brought together emerging EU member states with more experienced NMI/DI in a collaboration based on participants having complimentary skills which when combined enabled knowledge sharing and the extension of existing environmental measurement capabilities. The project created well characterised soil sample from ground previously contaminated with coal ash at levels common in environmental analyses. These were initially analysed by IJS, the Slovenian DI in this measurement area, using neutron activation analysis (NAA) technique – a highly accurate reference method for identifying about 60 elements of the periodic table.

The soil samples were then used in a comparison exercise in which other project partners analysed the samples using aqua regia extraction followed by inductively coupled plasma mass spectrometry. Results were combined to create a certified reference material suitable for use in confirming on-going analysis accuracy.

The project's comparison exercise highlighted a difference in detected contamination due to the sample preparation stage and enabled the participating NMI to better understand contributions of differing steps during measurement uncertainty determinations.

Impact

IKEMA d.o.o. is an accredited lab that performs over 100 soil analyses annually to identify heavy metal contamination as Slovenian construction companies prepare to build on previous industrial sites. It routinely uses the aqua regia digestion method followed by mass spectrometry to identify soil contamination and regularly participates in proficiency exercises. Participation in the project's proficiency exercise using the new certified soil reference material confirmed their measurement capability, creating additional confidence in their measurement expertise. Participation in this type of exercise is important for confirming that accredited laboratory results are of a comparable accuracy.

Confirming that reliable measurement techniques are used by accredited labs performing contamination assessments and linking these to the highly accurate reference methods used at NMI relies on having certified materials to link laboratories. These materials need to be similar in composition to those routinely encountered in environmental monitoring in order to create a robust measurement system. As a result of this project emerging EU Member State NMIs now have increased knowledge and measurement capabilities to underpin the accuracy and harmonisation of environmental measurements across the EU.

Building environmental analysis capability

The EMPIR project *Matrix reference materials for environmental analysis* enabled NMIs with in depth experience in environmental measurement techniques to share knowledge and build expertise in emerging EU Member State NMI. New reference materials based on contaminated soil and water samples containing key pollutants such as the metals cadmium, mercury and lead, and organic perfluorooctanes released from detergents into water supplies were developed. Materials characterised using instrumental neutron activation analysis and other reference methods by the more experienced project partners generated samples for analysis by NMI partners wishing to gain the necessary measurement skills for new BIPM authorised Calibration and Measurement Capabilities (CMCs). The project's soil reference material is a candidate for use in the first BIPM international measurement comparison of NMI capabilities in detecting rare earth metals from the Information and Communications Technology (ICT) and defence sectors that can contaminate soil.



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www.euramet.org/project-14RPT03

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