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Facilitating Access to Certified Reference Materials (CRMs) for Industry, Environmental Monitoring, and Healthcare Applications within the COOMET Region

A Register of CRMs has facilitated access to critical measurement calibration capability within the region, encouraging joint development of new reference materials and capacity building within COOMET

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The Challenge

Certified Reference Materials (CRMs) serve as the foundation for metrological assurance of many measurements, particularly in chemistry and biology. Given the vast diversity of matrices to be controlled — from industrial materials to natural objects — the key challenge is to have sufficient CRMs of appropriate quality across the broad range of critical measurements required. Before the emergence of the Register of COOMET CRMs, the reference material system was fragmented: CRMs were recognized only within national borders, and there was no single official database that could be relied upon to verify the reliability of results obtained in another country.

The development of CRMs for complex natural matrices is a substantially more intricate task than preparing mixtures of reagents or synthesizing pure substances. In contrast to high-purity compounds, the certification process for analytes in soils, biological tissues, and bottom sediments is critically dependent on the microheterogeneity of the material. As an example for inorganic measurands, it is insufficient to know only the total element content. Rather, it is necessary to account for the various forms of their chemical bonding (e.g., oxidation states) and to preserve the sample's native structure throughout all processing stages in CRM production. A separate challenge is ensuring long-term stability as the CRM is prepared. A balance must be achieved between ensuring that the analyte remains in an unchanged form and that any stabilization additives and/or techniques do not significantly alter the chemical status of the measurand in the matrix material.

Given the complexity described above, it is not surprising that many countries in the COOMET region have only limited capabilities in matrix CRM development, validation, and production. Without a system in place to aid cross-border recognition, their analytical laboratories faced significant challenges in assuring the quality of their measurements.

The Solution

It clearly made sense to pool resources within the COOMET region and ensure that users could easily and efficiently identify and access available CRMs. The key step was compiling the Register of COOMET CRMs. The publication of an up-to-date and properly maintained regional register ensures that not only Russia, but also the other COOMET countries, have easily accessible information on available CRMs. This is accomplished by assigning registration numbers and collating any additional information, ensuring that national CRMs are sufficiently described in accordance with the protocols for the Register.

UNIIM is responsible for maintaining the Register of COOMET CRMs through the Secretariat of COOMET TC 1.12, which contains information on types of COOMET CRMs approved in the prescribed manner, as well as regulatory and technical documentation on the issues related to joint development, approval, and registration of CRMs within COOMET. As an example, the Register of COOMET CRMs includes a series of CRMs for biological objects to address environmental monitoring tasks:

- COOMET CRM 0065-2008-RU, composition of Canadian pond weed (EK-1)
- COOMET CRM 0066-2008-RU, composition of mixture of meadow herbs (TR 1)
- COOMET CRM 0067-2008-RU, composition of birch leaf (LB-1)
- COOMET CRM 0093-2010-RU, composition of KATEK coal fly ash (ZUK- 2)
- COOMET CRM 0094-2010-RU, composition of magnetic cenosphere concentrate (CMC 1)
- COOMET CRM 0095-2010-RU, composition of magnetic cenosphere concentrate (CMC 2)
- COOMET CRM 0096-2010-RU, composition of magnetic microsphere concentrate (CMM 1)
- COOMET CRM 0136-2024-RU, composition of Siberian pine needles (HSS-1)

These CRMs were produced by Russia, whose metrological characteristics were established in collaboration with laboratories from COOMET member countries.

A specific example is the CRM for the composition of Siberian pine (*Pinus sylvestris*) needles HSS-1, which has been extensively characterized and has a total of 29 elements with certified values. Plants serve as indicators of pollution in terrestrial and aquatic ecosystems. The species was chosen as a CRM matrix due to its ability to rapidly change its elemental composition under deteriorating environmental conditions, its wide geographical distribution, and its capacity to accumulate sufficient biomass for CRM production. This CRM has no international equivalent and is thus unique in both providing an extensive number of measurands over a wide concentration range and for its specific pine needle matrix.

A Quantifiable Impact

The development and availability of matrix-matched CRMs are critical to supporting the metrological assurance of high-tech production in the metallurgical, chemical, oil, and oil refining industries, as well as for enterprises involved in environmental monitoring and safety, including water and soil analysis, healthcare, and the pharmaceutical industry. COOMET countries now have easy access to all registered regionally available CRMs. As a result, assurance in biological and chemical measurement in the COOMET region has taken a substantive step forward. The Register of COOMET CRMs serves as an official source of information on jointly developed and mutually recognized CRMs, ensuring confidence in measurements and removing technical barriers to mutual trade in the COOMET area. Information from the Register of COOMET CRMs is openly accessible to all interested parties:

metrological institutes, industrial enterprises, and scientific organizations. Such openness increases the efficiency of CRM use and makes processes more transparent.

The total number of national CRMs registered in the Register of COOMET CRMs (from its creation to March 10, 2026) is 150 (see **Table 1**). The Register of COOMET CRMs is maintained for the purpose of registering national CRMs of COOMET member countries whose types have been recognized as COOMET CRMs, and for updating the information contained in the Register of COOMET CRMs as relevant data on the extension of validity or removal of national CRM types becomes available.

With the advent of the Register of COOMET CRMs, instead of scattered national catalogues, participants have access to a single, official database, which encourages joint development of new CRMs within COOMET. Joint development is not merely about producing standards—it is also an effective form of professional development. Professional growth occurs through real-world practice rather than formal training: participants analyze alternative approaches, seek answers to unconventional questions, and adopt best practices.

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Table 1. Seven types of CRMs that are available in the Register of COOMET CRMs (total of 150).

Class of CRM	Measurand(s)	Number of CRMs	Example
Oil and Oil Products	Composition (components such as sulfur, water, and benzene) and properties (viscosity, etc.) of oil	37	COOMET CRM 0089-2010-RU CRMs for benzene mass and volume fraction in motor petrol (MODB-1)
Environmental Monitoring	Mass fraction of elements in soil, water, dust, plants, and animal tissues	29	COOMET CRM 0136-2024-RU: CRM for composition of Siberian pine needles (HSS-1)
Metals and alloys (non-ferrous metals, steels, alloys)	Mass fraction of elements in metals, steels, alloys	26	COOMET CRM 0031-2004-RU: CRM of alloyed steel, type 35GS (S58)
Minerals and Raw Materials	Control of mass fraction of elements; rocks, ores, concentrates	25	COOMET CRM 0114-2018-RU CRM of mass fraction of metals in slag of copper smelting production (SHM CRM UNIIM)
Food Control	Mass fraction of components such as protein, fat, and moisture in alcohol products, wheat, rapeseed, milk powder	18	COOMET CRM 0137-2025-RU CRM of powder milk composition (ASM-1)
Gases and Gas Mixtures	Mass fraction/mole fraction of gases	9	COOMET CRM 0128-2022-KZ CRM for the composition of the calibration gas mixture of propane in nitrogen (C3H8-N2)
Nanoindustry	Properties such as specific surface area and specific pore volume	5	COOMET CRM 0146-2025-RU CRM of sorption properties of nanoporous silicon oxide (6-SiO2 SO UNIIM)
Other	Solutions that are used in many industries	1	COOMET CRM 0150-2025-RU CRM of beryllium solution composition (Be set)