



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Bureau
International des
Poids et
Mesures



Development of Physical Metrology Infrastructure to Support Healthcare, Environmental Monitoring, and Industry

KazStandard now performs thousands of calibrations and measuring instrument verifications in mass, dimensional, temperature, and humidity metrology per year, and has provided a range of reference materials for routine chemical and gas measurements

*National Metrology Institute of Kazakhstan, (KazStandard)
Kazakhstan (KZ)*



The Challenge

Accurate, metrologically traceable measurements are the foundation for the functioning of healthcare, mechanical engineering industry, environmental monitoring, and government oversight. In Kazakhstan, the development of metrological infrastructure is crucial for ensuring the safety of medical equipment, effectively monitoring environmental conditions, and enhancing industrial competitiveness. National standards of measurement units provide metrological traceability of measurements through the chain of verification and calibration of measuring instruments used across various sectors of the economy.

Before the strengthening of Kazakhstan's national metrology infrastructure, many industrial enterprises, testing laboratories, and healthcare organizations relied on limited domestic calibration capabilities and, in some cases, on calibration services provided abroad. This increased costs, extended turnaround times, and reduced the availability of metrologically traceable measurements for industry, healthcare, and environmental monitoring. As Kazakhstan's economy expanded in sectors such as mining, metallurgy, oil and gas, agriculture, and environmental protection, the need for nationally available measurement standards, calibration services, and certified reference materials became increasingly important.

This case study focuses on physical metrology in the healthcare sector, particularly on medical weighing instruments used in clinical diagnostics and patient monitoring. Accurate, metrologically traceable measurements of body mass are essential for determining medication dosages, assessing patient health conditions, and ensuring the reliability of medical decisions. It also applies to the testing of measuring instruments used for environmental monitoring, such as dust monitors, gas analyzers, and other pollution control devices, ensuring the accuracy and reliability of environmental protection measurements.

The Solution

The development of Kazakhstan's modern metrological infrastructure has been a gradual process spanning more than two decades. Modernization activities accelerated following the implementation of national legislation on ensuring the uniformity of measurements and continued through the expansion of national measurement standards, calibration capabilities, and accredited testing laboratories.

A comprehensive range of metrological services, including testing of measuring instruments (MIs) for type approval, metrological certification, verification and calibration of MIs, and



Figure 1. KazStandard metrologists performing calibrations and preparing CRMs. Left: calibration of viscosity standards. Top: calibration of a laser interferometer. Bottom: calibration of mass standards. Right: preparation of a conductivity CRM.

certification of testing equipment (see **Figure 1**). All work is carried out in accordance with national standards.¹ The services are provided by the testing laboratories of KazStandard and its regional branches, which form part of the Republic of Kazakhstan's national metrological infrastructure and support nationwide metrological traceability.

Verification and calibration of medical equipment ensure the reliability of measurements in the healthcare sector. National measurement standards transmit units of measurement through the chain of verifications and calibrations to equipment used in industry, healthcare, environmental monitoring, and scientific research.

In the early 2000s, Kazakhstan had limited domestic capabilities for several high-accuracy calibration and measurement services. Industrial enterprises and laboratories frequently faced the need to obtain calibration services, reference materials, or technical support from foreign metrology institutions. This increased costs, extended turnaround times, and limited access to traceable measurements. The subsequent development of the national metrology infrastructure significantly reduced dependence on foreign services and improved access to measurement traceability within the country.

In 2025, KazStandard performed 1 438 calibrations and 1 300 verifications of measuring instruments. In addition, 2 270 certified reference materials were produced, including 551 gas calibration mixtures, 1 314 certified reference materials for solutions of metals, 226 CRMs

¹ Standards and regulatory documents of the Republic of Kazakhstan. ST RK 2.4. State Measurement Standards and Measurement Standards of Accreditation Entities. Procedure for the Establishment, Approval, Registration, Comparisons, Calibration, Application, Investigation, Improvement (Modernization), Decommissioning, Storage, Preservation, and Transportation.; Standards and regulatory documents of the Republic of Kazakhstan. ST RK 2.11. Calibration System of the Republic of Kazakhstan. Basic Provisions.; Standards and regulatory documents of the Republic of Kazakhstan. ST RK 2.21. Procedure for Conducting Type Tests and Approving the Type of Measuring Instruments.; Standards and regulatory documents of the Republic of Kazakhstan. ST RK 2.30. Procedure for Conducting Metrological Certification of Measuring Instruments.; Standards and regulatory documents of the Republic of Kazakhstan. ST RK 2.75. Procedure for Certification of Testing Equipment. <https://new-shop.ksm.kz/>

solutions of organochlorine pesticides, and 179 reference materials of other types. The Institute also manufactured and supplied 111 hardness reference blocks and 79 mass standards (weights M1), supporting SI traceability and measurement reliability in environmental monitoring, grain and agricultural products exports, metallurgy and mechanical engineering.

KazStandard and its regional branches have developed more than 480 types of standard reference materials to support measurement traceability and laboratory quality assurance in Kazakhstan.

Services to industry are supported by calibration and verification services, certified reference materials, and gas calibration mixtures produced by the National Metrology Institute. Such metrological support provides traceability of measurement results and ensures the reliability of data used to monitor air quality, pollutant emissions, and compliance with environmental regulations.

A Quantifiable Impact

The laboratory's activities contribute to improving the reliability of measurements in medical equipment, advancing industrial infrastructure and technological processes, and ensuring accurate environmental monitoring and pollution control. The development of Kazakhstan's metrological infrastructure has strengthened the capabilities of industrial enterprises and testing laboratories by providing access to national measurement standards, calibration services, and certified reference materials within the country. Studies in industrial quality management indicate that improvements in measurement systems and calibration practices reduces defect rates by approximately 10–30 %, depending on the industry and production process.

The impact of these activities is further demonstrated through international recognition and participation in regional metrology cooperation. In 2025, three Calibration and Measurement Capabilities (CMCs) entries were published in the BIPM KCDB database following participation in the COOMET.T-K6.1 bilateral key comparison “Bilateral key comparisons of dew point temperature standards of national metrological institutes”, involving the State Primary Standard of the Dew/Frost Point Temperature Unit. In addition, four comparisons were successfully conducted within the framework of the COOMET and APMP regional metrology organizations. These results strengthen international confidence in Kazakhstan's measurement capabilities, improve metrological traceability for industry and testing laboratories, and reduce the need for calibration services abroad.

POC: Dulat Moldybayev, d.moldybayev@ksm.kz