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Development of Metrological Infrastructure in Kazakhstan to Support Healthcare, Industry, and Environmental Monitoring

KazStandard has developed a range of measurement procedures to underpin food safety, water quality and environmental monitoring, and consumer products and material safety

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The Challenge

Reliable measurements are essential for protecting public health, ensuring food safety, monitoring environmental quality, and facilitating fair trade. In Kazakhstan, however, laboratories previously lacked a number of standardized and validated measurement procedures required for the determination of critical safety and environmental indicators. This limited the ability of testing laboratories to conduct conformity assessment, support regulatory enforcement, and monitor risks affecting human health and the environment. As the National Metrology Institute responsible for ensuring the uniformity and reliability of measurements, KazStandard plays a key role in protecting citizens and the national economy from the consequences of inaccurate measurement results.

The need for nationally recognized measurement procedures became increasingly important for compliance with the Technical Regulations of the Eurasian Economic Union (EAEU), environmental monitoring requirements, and food safety legislation. To address these tasks, in accordance with the National Standardization Plan and as part of the implementation of the Budget Program, KazStandard was tasked with developing more than 30 standardized measurement procedures to support laboratories in Kazakhstan and throughout the Commonwealth of Independent States (CIS). These procedures were intended to provide reliable methods for determining contaminants, food safety indicators, environmental parameters, and chemicals associated with consumer products and industrial materials.

The Solution

Between 2021 and 2024, KazStandard implemented a comprehensive programme to develop, validate, and approve measurement procedures addressing priority areas of public health, food safety, water quality, environmental protection, and product safety. A total of 35 measurement procedures were developed as part of the National Standardization Plans and Budget Programs. Of these, 13 procedures supported SDG 3: Good Health and Well-being, while 9 procedures contributed directly to SDG 6: Clean Water and Sanitation. The work focused on three major areas: 1) food safety, 2) water quality and environmental monitoring, and 3) consumer products and material safety.

Food safety. Kazakhstan is one of the world's major grain-producing countries, making reliable monitoring of food contaminants essential for consumer protection and international trade. Measurement procedures were developed for the determination of Deoxynivalenol (vomitoxin) in grain and grain-based products, zearalenone in grain and grain products, and nitrates and nitrites in fresh fruits and vegetables. These measurement procedures support

the implementation of EAEU Technical Regulation TR CU 021/2011 "On Food Safety" and provide laboratories with validated tools for monitoring harmful contaminants in food products.

Water quality and environmental monitoring. To improve environmental protection and drinking-water monitoring, measurement procedures were developed for determining a range of water quality parameters. This included barium, iron, calcium, magnesium, water hardness, chlorides, hydrogen sulfide, sulfites and thiosulfates, water-insoluble substances, and permanganate oxidizability. These measurement procedures support the national system of environmental monitoring and provide reliable measurements necessary for assessing drinking water, natural waters, and wastewater quality.

Consumer products and material safety. A further series of measurement procedures was developed to evaluate chemicals that may migrate from packaging materials, toys, children's products, polymer materials, and personal protective equipment. This included phthalic anhydride, vinyl chloride, phenol, ϵ -caprolactam, styrene, acrylonitrile, vinyl acetate, butyl acrylate, butyl methacrylate, epichlorohydrin, benzene, toluene, ethylbenzene, acetone, butyl alcohol, and xylene isomers. These measurement procedures support implementation of EAEU Technical Regulations relating to packaging materials, toys, products for children and adolescents, and personal protective equipment, helping to protect consumers from exposure to potentially hazardous substances. Examples of measurement procedures developed in response to the requirements of EAEU Technical Regulations include:

- 1) Products made of vinyl chloride-based materials. Determination of vinyl chloride in surrogate environmental matrices (air- and water-based) by the gas chromatographic method, developed to support implementation of TR CU 007/2011 *On the safety of products intended for children and adolescents*;
- 2) Polymer containers for food products. Determination of butyl acrylate and butyl methacrylate in surrogate environmental matrices (air- and water-based) by the gas chromatographic method, developed to support the implementation of TR CU 005/2011 *On packaging safety*;
- 3) Polymer materials. Determination of epichlorohydrin in surrogate environmental matrices (air- and water-based) by the gas chromatographic method, developed to support the implementation of TR CU 007/2011 *On the safety of products intended for children and adolescents*, TR CU 008/2011 *On the safety of toys*, TR CU 019/2011 *On the safety of personal protective equipment*;

All developed measurement procedures underwent validation studies and were registered within the *State System for Ensuring the Uniformity of Measurements of the Republic of Kazakhstan*.¹ Validation included assessment of measurement range, repeatability, interlaboratory precision, and expanded measurement uncertainty. The finalized

¹ <https://techreg.gov.kz/index/>

measurement procedures were subsequently made publicly available, allowing laboratories and other interested organizations to implement them without additional validation or registration requirements.

A Quantifiable Impact

The work undertaken by Kazakhstan extended beyond national implementation. In 2023, the developed measurement procedures formed the technical basis for the preparation of 10 interstate standards (GOST) intended to support implementation of EAEU Technical Regulations. The resulting standards contributed to greater harmonization of testing methodologies across EAEU and CIS countries by ensuring that laboratories use comparable and scientifically validated measurement approaches when conducting conformity assessment and regulatory testing. This strengthened regional cooperation in metrology and standardization while improving consistency and mutual confidence in measurement results across participating countries.

Between 2021 and 2023, Kazakhstan developed and validated 22 measurement procedures addressing food safety, environmental monitoring, polymer materials, and personal protective equipment. These procedures provided laboratories with standardized methods for determining more than 30 critical safety and environmental indicators. The developed procedures enabled reliable food safety measurement of mycotoxins in cereal products and nitrates and nitrites in fruits and vegetables. In the sector of consumer protection, this enhanced measurement capacity has facilitated accurate measurements of a range of chemical migrants from polymer materials, in addition to a range of organic solvents and volatile compounds. Furthermore, the measurement procedures have allowed for reliable measurements of water quality indicators and inorganic contaminants and atmospheric and industrial pollutants for more confident environmental contaminant monitoring.

As an illustrative example, the national standard ST RK 4037-2025, *“Wheat Flour. Method for Determining Contamination with Causative Agents of Potato Disease of Bread,”* was developed in 2024 and in accordance with the National Standardization Plan. Its application contributes to ensuring the safety and quality of bakery products by enabling the timely detection of contamination of wheat flour with the causative agents of potato disease of bread. The National Standardization Plans and Budget Programs have enabled and continue to enable the strengthening of Kazakhstan’s national quality infrastructure. They also contribute to improving the availability of nationally approved measurement procedures for conducting regulatory testing. In addition, these initiatives help increase confidence in measurement results used to monitor food safety, protect the environment, and ensure compliance with the requirements of the EAEU technical regulations.

Through the systematic development of validated measurement procedures and interstate standards, KazStandard significantly strengthened the metrological infrastructure supporting food safety, public health protection, environmental monitoring, and product conformity

assessment in Kazakhstan. The project improved measurement reliability, enhanced regulatory enforcement, supported implementation of EAEU technical regulations, and contributed directly to Sustainable Development Goals. The resulting methods continue to provide laboratories with practical and scientifically robust tools for protecting consumers, safeguarding water resources, and supporting sustainable economic development.

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