

WARTIME CHALLENGES AND “UNCERTAINTIES” FOR METROLOGY IN UKRAINE

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Ukraine’s metrological system has faced a number of serious challenges and needs related to security risks, infrastructure destruction, economic instability, and changes in legislative regulation. At the same time, this has revealed significant opportunities for development and modernization. The challenges caused by the war have stimulated the search for new solutions, particularly in the areas of digitalization, cooperation with international partners, and strengthening the defense sector.

Main Problems and Needs:

- **Logistical Difficulties and Infrastructure Damage:** Hostilities have led to damage or destruction of metrological laboratories, National Measurement Standards, and equipment. Due to the occupation of the village of *Lyptsi* in the Kharkiv region, near the border with Russia, 8 standards in the field of ionizing radiation, 2 hardness standards, and a rangefinder calibration baseline were lost. This, combined with disruptions to supply chains, complicates the timely delivery of instruments for verification, calibration, and repair, especially in regions affected by fighting. It is necessary to restore and modernize these facilities to ensure the uniformity and traceability of measurements.

- **Loss of Human Resources:** Mobilization, forced displacement, and emigration have led to a decrease in the number of qualified personnel in the metrological field, creating a shortage of specialists. This necessitates the implementation of training and retraining programs.

- **Lack of Budget Funding:** The introduction of martial law led to the reallocation of state funds, which affected the financing of metrological research and equipment modernization. Metrological enterprises need financial support, including investments and grants, to update equipment and restore operations.

Opportunities for Metrology Development:

- **International Cooperation:** International and regional metrological organizations, as well as National Metrology Institutes, provide support to Ukrainian metrologists, including through knowledge exchange, equipment provision, and humanitarian aid. This creates opportunities for integration into the European metrological infrastructure. Ukrainian metrological institutions, in particular the NSC “Institute of Metrology”, are actively participating in international and European scientific projects, for example, within the European Partnership on Metrology, international comparisons of national standards, and in EURAMET activities. Thanks

to the support of PTB, a significant amount of reference equipment from Ukraine's National Scientific Centres has been and is planned to be calibrated directly at PTB.

- **Modernization and Innovation:** The destruction of part of the infrastructure can be an impetus for creating modern, technologically equipped laboratories. This makes it possible to implement the latest technologies and standards.

- **Attracting Investments:** The recovery of the economy and large-scale reconstruction projects will require significant funding. The metrology sector, as a critically important element of infrastructure, can attract investments from both Ukrainian and international partners.

- **Digital Transformation:** The development of digital technologies allows for the transfer of many processes to an online format, which reduces physical risks and increases efficiency. This applies to both document flow and remote monitoring.

Despite significant challenges, Ukraine's metrological sector continues to adapt to new conditions, ensuring the uniformity and traceability of measurements, which are vital processes for the economy and defense.