



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Bureau
International des
Poids et
Mesures



Enhancing Air Quality Measurement Accuracy to Support Public Health and Climate Action

MoiAT has developed metrologically traceable measurement services to monitor indoor and outdoor air quality, thereby underpinning the health of the UAE population

*Ministry of Industry and Advanced Technology (MoiAT)
United Arab Emirates (AE)*



The Challenge

Air quality is a critical environmental and public health issue, directly impacting human well-being and environmental sustainability. In the United Arab Emirates (UAE), rapid urbanization and industrial growth have heightened the need for reliable, accurate air quality data to support effective environmental and health policies. Prior to the intervention, there were significant challenges, including inconsistent measurement practices, a lack of metrological traceability, and variability in measurement accuracy across laboratories and environmental monitoring stations. A unified national framework was needed to ensure that air quality data were metrologically traceable, accurate, and comparable.

Accurate air quality measurements are essential for protecting public health and supporting environmental policy. The key issue was the lack of reliable and consistent measurements of air quality indicators, including particulate matter (PM_{2.5}, PM₁₀), and air pollutants such as ozone (O₃), carbon dioxide (CO₂), and nitrogen dioxide (NO₂). Inconsistent measurement practices and gaps in laboratory calibrations and monitoring stations posed risks to data reliability and policy effectiveness in the UAE. These issues directly affected data reliability and limited the effectiveness of evidence-based decision-making.

The main challenges observed included significant variability in measurement results between laboratories, pervasive use of uncalibrated measurement instruments, the absence of structured proficiency testing programmes for testing laboratories, and limited compliance with international accreditation standards. These gaps in the metrological system directly reduced confidence in environmental monitoring data from testing laboratories. Subsequently, this led to significant challenges in evaluating environmental policies and disseminating international alignment and reporting standards. Ultimately, these significant gaps were identified as potential risks to public health, prompting the UAE government to take action to address them.

The Solution

A technical programme for air quality measurements was developed by the Ministry of Industry and Advanced Technology (MoIAT) to ensure proper control and oversight of air quality monitoring stations and laboratories that conduct these measurements, thereby ensuring the accuracy, reliability, and harmonization of measurement results in accordance with approved technical requirements. Coordination and integration among federal and local government entities, along with collaboration with private-sector partners, led to the development of a national technical regulation for air quality monitoring that aligned with the

National Measurement System. This further led to the development and implementation of UAE Cabinet Decision No. 86 of 2023 on the Technical Regulation for Air Quality Measurement Control, which establishes a national regulatory framework for air quality measurement control. The regulation directly improves the efficiency and accuracy of measurements of air-quality parameters, such as ozone, carbon dioxide, nitrogen oxide, sulphur dioxide, and other environmental pollutants.

MolAT's accreditation department is responsible for ensuring the metrological traceability of calibration activities by accrediting laboratories in accordance with the requirements of the international standard ISO/IEC 17025, which includes specific provisions for achieving metrological traceability in measurements and calibrations. In addition, the technical regulation for air quality measurements and testing mandates that all laboratories operating in this field obtain national accreditation. This requirement ensures laboratory competence and the reliability of measurement and testing results in accordance with approved international standards and requirements.

A national-level technical working group implemented the regulation, which included mandatory calibration of all air quality instruments, compliance with ISO/IEC 17025 accreditation requirements for testing laboratories to ensure traceability to the International System of Units (SI), coordination with environmental monitoring stations, and the requirement for proficiency testing (PT) programmes for laboratories and monitoring stations utilizing international standards (i.e., ISO/IEC 17043). All air quality measurements were required to be metrologically traceable to national and international standards.

The rollout of the nationwide proficiency testing infrastructure was deemed essential for appropriate oversight of laboratories and monitoring stations across the UAE. An air quality measurement PT programme consisting of 50 participants, including 47 air quality monitoring stations and three testing laboratories, who participated in the PT rounds, was conducted between June 2025 and January 2026. Performance evaluation was carried out using the En-score methodology, in which results with $|En| < 1.0$ were considered satisfactory, while those with $|En| \geq 1.0$ were considered unsatisfactory and required corrective action. Ten measurands were evaluated, including sulphur dioxide (SO₂), carbon dioxide (CO₂), methane (CH₄), nitrogen oxides (NO_x), BTEX compounds, and hydrogen sulphide (H₂S). A snapshot of the real-time collection of several measurands at an air monitoring station is provided in **Figure 1**.

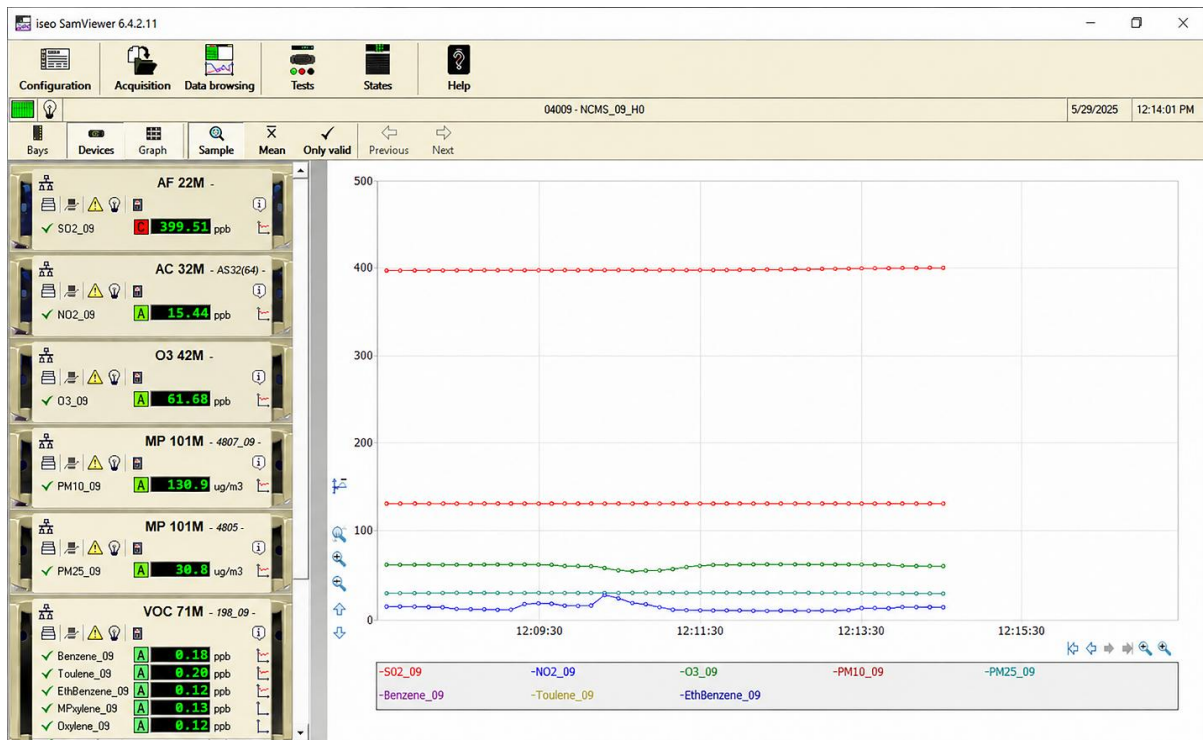


Figure 1. A screen capture of the data management system for tracking the real-time measurements of ambient air quality parameters, including sulphur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀ and PM_{2.5}), volatile organic compounds (VOCs), and BTEX compounds (benzene, toluene, ethylbenzene, and xylenes).

This multi-stakeholder effort involved a wide range of authorities and ministries, including the Ministry of Industry and Advanced Technology (MOIAT), the Ministry of Climate Change and Environment (MOCCAE), the National Center of Meteorology, local environmental authorities, and national accreditation bodies.

A Quantifiable Impact

From the outset of the UAE's Air Monitoring programme, metrology-based data were collected from 73 environmental monitoring stations across the UAE. A campaign to apply metrologically traceable calibrations to all monitoring instruments was implemented across all UAE monitoring stations, utilizing ISO/IEC 17025-accredited laboratories. An example of a monitoring station is provided in **Figure 2**.



Figure 2. Air monitoring stations are used for proficiency testing (PT) of outdoor ambient air quality monitoring, conducted in industrial areas.

At the start of the programme in 2023, it was determined that only approximately 75 % of the measurement instruments used in laboratories measuring indoor and outdoor air quality were properly calibrated. Following the implementation of this programme based on regulatory audits and compliance assessments performed by MoIAT, over a short period, it has been verified that 100 % of instruments are calibrated using metrologically traceable national standards and procedures under a national quality system. Not only has traceability to the SI been established for air quality measurements, but this intervention has also contributed to improved measurement consistency and comparability across monitoring facilities.

The capabilities of the testing laboratories and environmental monitoring stations were further validated through interlaboratory comparisons via the PT programme and through implementation of international documentary standards for uncertainty and measurement comparability (ISO/IEC 17025 *General requirements for the competence of testing and calibration laboratories* and ISO/IEC 17043 *Conformity assessment — General requirements for the competence of proficiency testing providers*). A total of 50 participants, including 47 air quality monitoring stations and three testing laboratories, participated in the PT round conducted between June 2025 and January 2026. Performance evaluation was carried out using the En-score methodology, in which results with $|En| < 1.0$ were considered satisfactory, while those with $|En| \geq 1.0$ were considered unsatisfactory and required corrective action.

In contrast, some parameters demonstrated excellent analytical performance and full compliance among all participants. For instance, nitrogen oxides (NO_x) achieved 100 % satisfactory performance, reflecting excellent comparability and consistency between laboratories and monitoring stations. Similarly, BTEX compounds and hydrogen sulphide (H₂S) also showed very strong analytical reliability and compliance. For the sulphur dioxide (SO₂) assessment, most participants achieved satisfactory En-scores, while only a limited number of participants showed deviations requiring corrective action. Similar trends were observed for carbon dioxide (CO₂) and methane (CH₄), with a small number of participants (n=2 and n=4, respectively) producing En-scores exceeding the acceptance criteria, suggesting possible calibration or analytical bias. Methane (CH₄) recorded the highest number of unsatisfactory results among the assessed parameters.

Overall, the participation of testing laboratories in the PT programme for determining indoor and outdoor air quality has resulted in 95 % satisfactory outcomes. The high satisfaction rate reflects robust calibration practices, reliable analytical methodologies, and strong comparability among participating laboratories and monitoring stations. At the same time, the limited number of unsatisfactory results helped identify areas requiring targeted improvement, particularly in calibration procedures, uncertainty estimation, instrument maintenance, and method validation.

The national metrology system of the UAE also achieved a significant milestone in 2023, with the recognition of its metrology and calibration capabilities for over 41 CMCs by the Emirates Metrology Institute (EMI), as published in the BIPM KCDB. This covered physical measurement areas such as frequency, electrical, temperature, ionizing radiation, and mass, enabling the metrology laboratories to conduct metrological traceability measurements. This fundamental capability enabled the Ministry of Industry and Advanced Technology (MoIAT) to develop a national-level testing programme for air quality monitoring and to review and enhance the performance of environmental metrology laboratories and monitoring stations across the UAE. These internationally-recognized programmes were enhanced through specialized technical committees operating under the auspices of GULFMET and were launched in collaboration with accreditation bodies and local environmental departments to drive sustainable industrial development nationwide. Furthermore, the legal and scientific metrology achievements of the National Measurement System in the UAE have underpinned technical regulations that support public health and safety requirements and ultimately ensure fairness and accuracy in measurements, including those used in commercial transactions.

The collaborative effort between federal and local authorities (**Figure 3**) clearly demonstrated the critical role of metrology in environmental governance and sustainable industrial development. This was illustrated by the importance and value of metrologically traceable calibration and accreditation processes in routine laboratory and monitoring facilities. Overall, the metrological intervention through the PT programme has improved measurement accuracy and consistency of national air quality data, increased confidence in monitoring systems, reduced errors, and aligned practices with international standards.

Data from reliable, metrologically-traceable air quality measurements generated by monitoring stations and testing laboratories also support climate action policies by providing precise information on pollutant concentrations to assess emission trends and mitigation measures, and to evaluate the effectiveness of overall emission-reduction policies. These high-quality datasets also contribute to atmospheric and climate assessments by improving the accuracy of emission inventories and providing reliable inputs for environmental models and climate-related analyses.

This metrological intervention has strengthened national air quality policies and regulatory enforcement, while also supporting public health policy and improving public health protection. This effort has also increased trust in environmental data, thereby informing and strengthening the UAE's evidence-based environmental policymaking and promoting the reduction of pollutants to support climate action and improve air quality and public health.



Figure 3. The collaborative team with members from MoIAT and the UAE's Ministry of Climate Change and Environment and representatives from local environmental authorities and national accreditation bodies at an air monitoring station managed by the UAE's National Center of Meteorology.

Acknowledgements. This initiative was developed and implemented through collaboration between the UAE's Ministry of Industry and Advanced Technology (MoIAT), the UAE's Ministry of Climate Change and Environment, and the local environmental authorities and national accreditation bodies.

POC: Amina Hassan Mohammad AlBastaki, aalbastaki@moiat.gov.ae