



UNDERSTANDING ISO 17025 CLAUSE 7.6 – EVALUATION OF MEASUREMENT UNCERTAINTY

Understanding Measurement Uncertainty – Confidence Behind Every Result

Measurement uncertainty is one of the most important concepts in ISO/IEC 17025. Clause 7.6 requires laboratories to evaluate uncertainty wherever it is relevant to the validity of results.

Uncertainty is not about doubt — it is about **quantified confidence**. It tells clients how reliable a measurement is and whether it can support a technical or compliance decision.

Every measurement is influenced by multiple factors: **equipment resolution, calibration accuracy, environmental conditions, operator technique, sample variability and method limitations**. Uncertainty brings these influences together into a single value that expresses the reliability of the reported result.

Laboratories that understand and evaluate uncertainty demonstrate scientific maturity, transparency and technical credibility.

The core principle: **uncertainty strengthens results, it never weakens them.**

Identifying Sources of Uncertainty – Finding What Influences the Result

Before uncertainty can be calculated, laboratories must identify the factors that influence measurements.

Clause 7.6 requires a structured approach to recognising contributors such as:

- **Equipment** – resolution, drift, calibration status, repeatability
- **Environment** – temperature, humidity, vibration, lighting
- **Operator influence** – technique, interpretation, reaction time
- **Sample variability** – homogeneity, preparation effects, stability
- **Method limitations** – sensitivity, repeatability, reproducibility
- **Reference materials** – certified values and associated uncertainty

Identifying sources of uncertainty is the foundation of any uncertainty evaluation. When laboratories understand what influences results, they can **quantify** those influences with confidence and transparency.

This step ensures the uncertainty evaluation is grounded in **real laboratory behaviour, not theoretical assumptions**.

Quantifying Uncertainty – Turning Influences into Numbers

Once sources of uncertainty are identified, laboratories must estimate their contribution.



Clause 7.6 allows laboratories to use available data — not complex statistics — to quantify uncertainty:

- **Repeatability studies** – standard deviation of repeated measurements
- **Calibration certificates** – stated uncertainty values and coverage factors
- **Reference materials** – certified uncertainty values
- **Environmental monitoring** – temperature/humidity variation data
- **Method performance information** – validation, verification, PT results

Each contributor is expressed as a standard uncertainty. These are then combined to produce a single value representing the overall measurement uncertainty (expanded uncertainty).

Quantification is not about perfection — it is about **realistic, evidence-based estimation** that reflects actual laboratory performance.

Combining and Reporting Uncertainty – Presenting Reliable Evidence

Clause 7.6 requires laboratories to combine individual contributors into a single uncertainty value and report it clearly.

This includes:

- **Combining standard uncertainties** using the root-sum-square method
- **Applying coverage factors** (typically $k = 2$ for 95% confidence)
- **Reporting expanded uncertainty** alongside the result
- **Stating units, confidence level and method used**
- **Ensuring consistency** with calibration certificates and method requirements

Reporting uncertainty is essential when results are used for compliance decisions, specifications or regulatory limits. It ensures clients understand the reliability of the measurement and can make informed decisions.

Uncertainty is not an optional extra — **it is part of the result.**

Technician-Level Application – Using Uncertainty in Daily Work

Measurement uncertainty is not only for managers or statisticians — technicians use it every day.

Clause 7.6 supports practical decision-making:

- Understanding when results are **close to specification limits**
- Recognising when uncertainty affects **pass/fail decisions**
- Knowing how equipment, environment and technique influence uncertainty
- Applying uncertainty when interpreting borderline results
- Using uncertainty to improve repeatability and method performance

Technicians who understand uncertainty make better decisions, reduce risk and strengthen laboratory credibility.

Uncertainty is not a burden — it is a **quality tool** that empowers daily work and protects the validity of results.



Quantifying Confidence, Strengthening Decisions

With **Clause 7.6 – Evaluation of Measurement Uncertainty**, one message stands out: **uncertainty is not about doubt — it is about quantified confidence**. It tells clients, regulators and auditors how reliable a measurement is, and whether it can support a technical or compliance decision. This week highlighted how uncertainty transforms results from simple numbers into defensible evidence.

Understanding Uncertainty – Confidence Behind Every Result

We began by recognising that every measurement carries **influences**: equipment, calibration, environment, operator technique, sample variability and method limitations. Clause 7.6 requires laboratories to evaluate these influences and express their combined effect as a single uncertainty value.

Identifying Sources – Knowing What Affects the Result

Understanding sources is the foundation of any uncertainty evaluation. When laboratories know what influences results, they can quantify those influences with clarity.

Quantifying Uncertainty – Turning Influences into Numbers

We examined how laboratories use available data — repeatability studies, calibration certificates, reference materials, environmental monitoring and method performance information — to estimate uncertainty. Clause 7.6 does not demand complex statistics; it demands **evidence-based estimation**.

Combining and Reporting – Presenting Reliable Evidence

We reinforced that uncertainty must be combined, expanded and reported clearly. Reporting units, confidence levels and coverage factors ensures clients understand the reliability of the measurement. Uncertainty is not an optional extra — **it is part of the result**.

Technician-Level Application – Using Uncertainty in Daily Work

Finally, we focused on practical application. Technicians use uncertainty when interpreting borderline results, understanding specification limits, improving repeatability and recognising when uncertainty affects decision-making. When technicians understand uncertainty, the entire laboratory becomes more reliable.

Measurement uncertainty is a quality tool — not a mathematical burden. It strengthens decisions, protects impartiality and ensures every result can withstand scrutiny. Accurate results begin with **quantified confidence**.