Introduction to Metrology

Measurement uncertainty – part 1

3 Measurement uncertainty – part 1: Introduction

1. Terminology
2. Importance of the measurement uncertainty

3.1
Terminology

Terms

QUANTITY

- Property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference

(A reference can be a measurement unit, a measurement procedure, a reference material, or a combination of such.)

- Quantity can be a general quantity (e.g. length) or particular quantity (e.g. wavelength of Sodium D line)

MEASURAND

- Quantity intended to be measured

ESTIMATE (of the measurand); called also MEASURED QUANTITY VALUE

- measured value of a quantity measured value
- quantity value representing a measurement result

MEASUREMENT ERROR

- measured quantity value minus a reference quantity value

3.2 Importance of the measurement uncertainty

Measurement result and its uncertainty

- Estimated quality of a result is expressed as the uncertainty
- The uncertainty is an essential part of a measurement result:

Measurement result = Estimate ± uncertainty

- The uncertainty gives the limits of the range in which the "true" value of the measurand is estimated to be at a given probability.
- Too often the uncertainty is not presented explicitly with the estimate

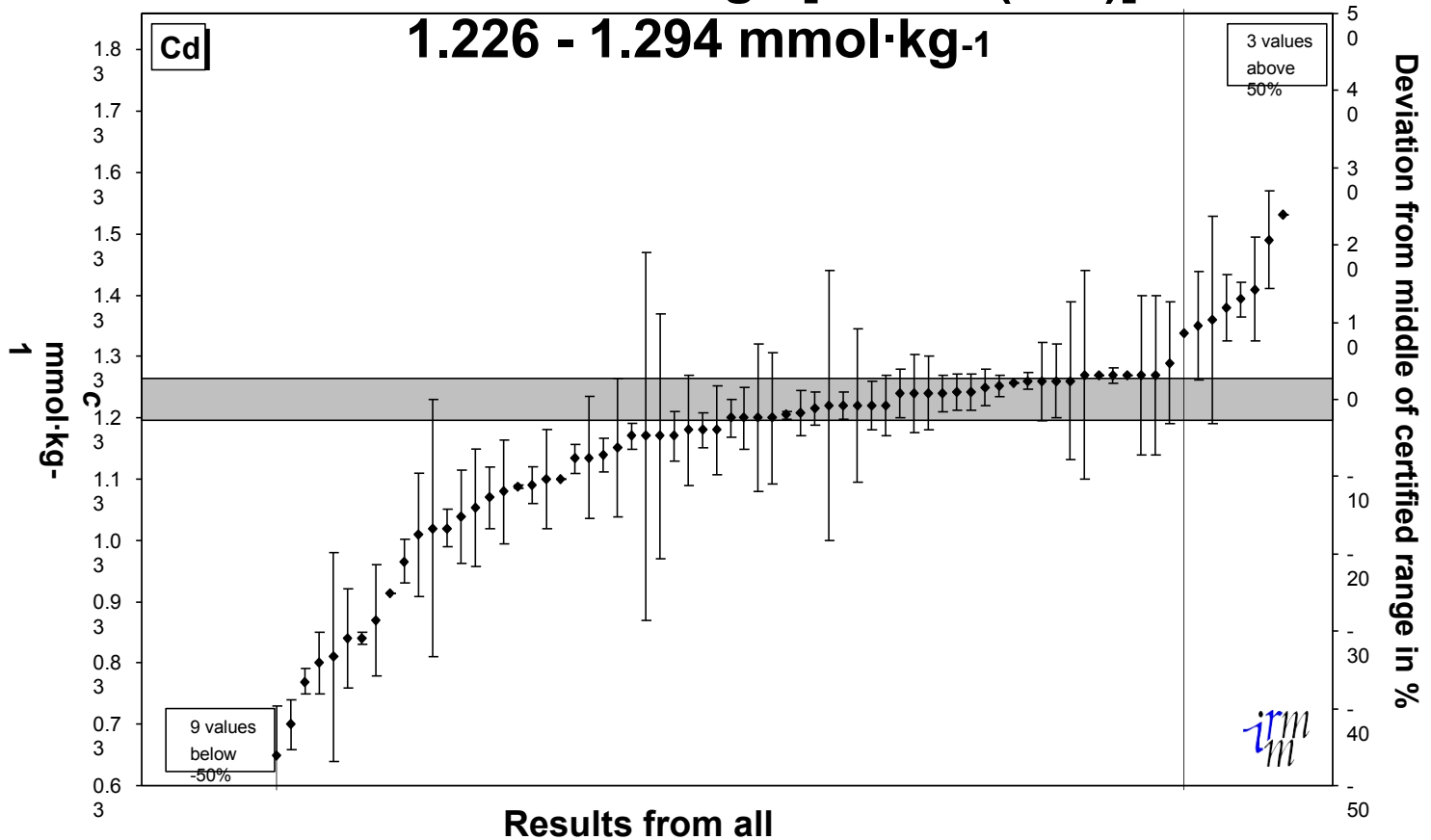
$\Rightarrow$ confusion, incorrect conclusions, non-equal users etc.

- If the uncertainty is not taken into account, incorrect conclusions are drawn and the number of unsatisfactory products increases.
- When you know the uncertainty in a measurement, then you can judge its fitness for purpose.

Importance of uncertainty of measurements

- Measurements are never absolutely accurate, but there is always some uncertainty in the measured values.
- Measurement result without uncertainty estimate is meaningless.
- Estimation of measurement uncertainties is one of the most important parts of practical metrology.
- A proper uncertainty budget indicates what parts of the measurement should be developed to decrease the overall uncertainty most effectively.

Certified range [$U = k \cdot u_c$ (k =2)]: 1.226 - 1.294 mmol·kg^{-1}



[Mittaustulosten epävarmuus, MIKES 26.6.2005]