Technical Information

Advice Sheet 29: Measurement Uncertainty

All analytical results have a measurement error associated with them and are only an estimate of the 'true' value. The **measurement uncertainty** is a quantitative indication of the size of error for a particular parameter and gives the analytical variability surrounding a value. For example:

Measured Cadmium value = 2.20 mg/kg

Measurement Uncertainty = 8%

Range of values the result could represent = 2.02 – 2.38 mg/kg

To evaluate the measurement uncertainty every part of the process where variation could occur is considered. For example; sample homogeneity, changes in the measuring device or the accuracy of the analytical equipment used (pipettes, volumetric flasks, balances etc.).

Most of the measurement uncertainty components can be quantified using the data produced from a series of replicate measurements of a sample(s) which have a known value (e.g. analysis of spiked samples / certified reference materials or proficiency scheme test data). The concentrations and matrices chosen should represent those likely to be encountered in the analysis of customer samples. Variation is introduced by analysis on several different days ideally by different analysts.

There are two main components which are essential in assessing the performance of an analytical method and in estimating the measurement uncertainty – precision and bias.

Precision – How close together replicate measurements are (Repeatability)

This takes account of the unpredictable errors and variation in the analysis which may be caused by changes in the sample, instrument conditions, environmental factors, analyst. It is the % relative standard deviation of the data set.

Bias – How close to the 'true' value a result is

This gives an indication of the systematic errors inherent in the method e.g. purity of calibration standards, interferences, stability of parameter being measured etc. It is the average % difference of the measured value from the target value.

There will also be an uncertainty associated with the nominal 'true' value e.g. the spike standard used. This is taken into account in evaluating the bias uncertainty. The reproducibility uncertainty and bias uncertainty are combined to estimate an ***expanded uncertainty*** for the method.

NRM Laboratories have estimates of the measurement uncertainty for a range of matrices and concentrations for the UKAS accredited methods. These are available for customers to help review the data and are essential in comparing results to any action limits.

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