

# Quality control of routine sampling in chemical analysis

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In sampling terminology, the 'target' is the mass of material that the customer needs to characterise, usually to support a decision about its acceptability or price. For most such materials there is an established sampling protocol regarded as fit for purpose. This is mainly because all targets are actually or potentially heterogeneous. But even when a protocol is followed exactly, repeat samples differ in composition from each other and from the target. Moreover, there is a distinct possibility that the target may be atypically heterogeneous. These circumstances, particularly the last, mean that a sample may not be fit for purpose, even when the sampling is executed strictly according to the protocol. And, of course, there is always the possibility that the sample was not collected according to the protocol! As either of these conditions might give rise to a  $\sigma$  based on sampling and analytical uncertainties described by variances  $\sigma_s^2$  and  $\sigma_a^2$  respectively.

## Basics

Quality control of sampling differs from the familiar analytical internal quality control (IQC), in which the charted variable is the analytical result on a control material that acts as a surrogate for the test materials. In sampling a surrogate target is not practicable—control has to be exercised by using duplicate results derived from the

$\sigma_s^2$  and  $\sigma_a^2$  respectively. It is this combined uncertainty that is relevant for the customer in making decisions about the target. It is also relevant to setting action limits for control charts.

An out-of-control event could indicate an abnormally high value of  $\sigma_s^2$  or  $\sigma_a^2$  (or both). The ambiguity could be resolved by reanalysis of the two samples in a separate run, although standard analytical QC would also provide relevant information.

The mean  $(x_1 + x_2)$