A102 Using Quality Control (QC) Data for Estimating the Measurement Uncertainty Associated With Purity Results

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After attending this presentation, attendees will learn how to use quality control analyses to estimate the uncertainty associated with purity determinations.

This presentation will impact the forensic science community by providing laboratories with easy to implement procedures to comply with accreditation requirements pertaining to the uncertainty of measurement.

Accreditation under the ISO/IEC 17025:2005 standard requires testing and calibration laboratories to have established procedures for estimating the uncertainty of their measurements. Forensic chemistry laboratories throughout the world provide law enforcement customers with a variety of analytical results, including weight measurements, controlled substance identification, and in many cases, results pertaining to the purity of the substances present. Purity determinations are not routinely performed by smaller, local, and state crime laboratories in the United States; however, such measurements are commonly reported during the analysis of controlled substances throughout the Drug Enforcement Administration (DEA) laboratory system. As a result, laboratory reports generated must also include the uncertainty of measurement associated with purity results.

The uncertainty associated with purity measurements can be evaluated using the strictly mathematical approach recommended by the ISO *Guide to the Expression of Uncertainty in Measurement* (GUM). However, for most forensic chemistry applications, such an approach is somewhat impractical due to the variability of samples and matrices encountered by analysts on a day-to-day basis. A more reasonable and applicable approach is necessary for measurements performed in forensic chemistry laboratories. Technical Reports published by the European Federation of National Associations of Measurement, Testing, and Analytical Laboratories have provided alternative methods for the evaluation of measurement uncertainty; among them, estimation of uncertainty using quality control data and inter-laboratory comparisons.[1,2] This presentation will describe the use of quality control samples for

the estimation of the uncertainty associated with purity measurements.

The approach presented is applicable to multiple controlled substances and analytical techniques used throughout crime laboratories. This methodology represents a top-down approach for uncertainty evaluation, where the contributions of multiple factors can be considered at once, avoiding tedious uncertainty budget re-calculations resulting from variations in instrument performance, sample and matrix changes, and environmental conditions. The use and evaluation of quality control samples also provides a way for verification of uncertainty of measurement estimates previously obtained using different methods, such as collaborative studies or budget approaches.

Results from the analysis of four quality controlled samples will be presented and discussed. These samples were prepared using authenticated reference materials and were kept under controlled environmental conditions. Two of the samples contained cocaine HCl concentrations of approximately 25% (CocaineQC#1) and 75% (CocaineQC#2), respectively. The other two samples were prepared to contain methamphetamine HCl at 20% (MethQC#1) and 80% (MethQC#2), respectively. Multiple adulterants and diluents were also added to the samples, in order to mimic routinely encountered compositions. Quality Control (QC) solutions were prepared fresh prior to analysis using a laboratory-validated HPLC quantitative method.

Results from more than a year of QC analyses will be presented in the form of control charts. Statistical analysis of the data will demonstrate that the QC results represent a reasonable estimate for the uncertainty associated with the quantitation of cocaine and methamphetamine using the selected method and instrumentation. Results will also provide verification for previously reported uncertainty estimates obtained via the statistical analysis of proficiency testing samples.

This presentation is expected to be of interest to other forensic chemistry analysts and laboratory personnel involved in the evaluation of measurement uncertainty, as required for accreditation under the ISO 17025:2005 standard.

References:

1. EUROLAB Technical Report 1/2006 – Guide to the Evaluation of Measurement Uncertainty for Quantitative Test Results.
2. EUROLAB Technical Report 1/2007 – Measurement uncertainty revisited: Alternative approaches to uncertainty evaluation.

Uncertainty, Purity, Controlled Substances

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