B55 Weight Measurements in the Forensic Chemistry Laboratory: A Surrogate Weight Study

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After attending this presentation, attendees will better understand the importance of weighing processes in the laboratory.

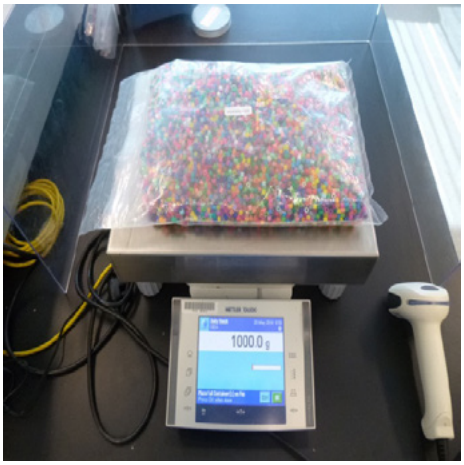
This presentation will impact the forensic science community by demonstrating the advantages of implementing a surrogate weight program for monitoring the performance of laboratory balances.

Analysis of controlled substances in the forensic chemistry laboratory involves both qualitative and quantitative measurements. Although final identification of the main psychoactive component(s) is often the final goal of many analytical schemes, some laboratories also provide customers with purity determinations, as well as adulterant and salt-form identifications, if needed based on jurisdictional requirements; however, there is one very relevant quantitative test that is performed by every law enforcement laboratory, regardless of its jurisdiction: the determination of the net weight of a substance. That is, the measurement of the amount of powder, plant material, liquid, etc. present in a particular piece of evidence.

Seized-drug weight determinations are important laboratory measurements that have direct effect on the judicial process. The net weight of material seized is often the very factor that determines a controlled substance felony level. Therefore, forensic chemistry laboratories should have well-established procedures for the appropriate procurement, maintenance, verification, and utilization of laboratory scales and balances. These procedures should include, at minimum, annual calibration by an external entity and a documented program for the routine maintenance and performance verification of balances. The use of weight standards (reference weights) must also be part of a balance verification program as it provides the traceability necessary for all weight measurements performed.

However, monitoring the performance of a weight measuring apparatus using standard reference weights may not provide a full picture of the weight measurement process. Standard weights are ideal for monitoring balance properties such as linearity, accuracy, and eccentricity; however, they are not expected to represent routine laboratory weighing processes where the buoyancy and density of the materials being tested can drastically differ from those of a standard reference weight. Controlled substance laboratory submissions are often irregularly shaped and submitted in plastic bags, buckets, bottles, etc. Weight measurements for these materials are therefore expected to be affected by multiple factors that may not be accounted for using standard reference weights.

This study presents the use of surrogate weights to monitor the variability of laboratory weight measurements over an extended period of time. Surrogate weights are made of plastic beads in flexible, clear plastic, heat-sealed bags that were barcoded for identification purposes. Surrogate weights were prepared (representing four different sizes) and are currently being used to monitor a total of 33 laboratory balances. Balances with readability of 0.1g, 0.01g, 0.001g, and 0.00001g are monitored using surrogate weights of 1,000g, 500g, 100g, and 40g, respectively. Surrogate weight measurements are performed once a day and have been on-going since December 2013. The data is collected and statistically analyzed to obtain the standard deviation of measurements for each balance being monitored. This provides a quantitative measure of the variability of weight results over an extended time period, supplementing the balance verification data obtained using standard reference weights.



This presentation will summarize the results of this surrogate weight study. Calculated standard deviation values will be used to calculate minimum weight thresholds and to suggest acceptance performance criteria for each type of balance. This study will also provide a better understanding of the uncertainty of measurement associated with surrogate weights as representatives of routine weight measurements in the forensic laboratory.

Weight Measurements, Controlled Substances, Measurement Uncertainty