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Hummingbird News

Precision & Balance
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(September 2005)

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Keep Justice in the Balance
Maintaining Control Standard Weights

The article "Why Use Weights" in the February – March 2005 Forensic Magazine covered the reason for traceability and proving quality of the laboratory. This article is more detailed on the effects of not having a quality process in place to determine the weight of substances.

It is unlawful for any person, knowingly or purposely, to obtain or to possess a controlled substance, unless the substance was obtained by a valid prescription. This article will address the opposition facing the State's prosecutors in proving beyond a reasonable doubt the weight of an illegal substance. Since drug trafficking laws vary from state to state, the facts used in creating this article may not apply to every state. However, a constant exist in that it is the obligation of the state forensic laboratories to assist the state in proving the correct weight of the substance. It is the forensic verification that will ultimately determine whether the accused will stand trial in Superior Court or Municipal Court.

Degrees of crime in a narcotics case are distinguished by the weight of the illegal substance in question. Sentencing can range from a hefty jail term to a one year probationary period, both typically accompanied by a fine. Because weight determines the degree and the degree ultimately determines the sentence, weighing standards are quick to be attached by defendants' legal counsel

It has often become the immediate strategy of the defense lawyers to question the accuracy of the balance, placing the burden of proof of that accuracy on the forensic laboratory. It becomes

the responsibility of the forensic scientist to provide the confidence in the process needed to erase any doubt as to the true weight of the substance.

Let us examine this by way of example. The case is possession of 5g or more of hashish in the State of New Jersey and the defense lawyer is trying to have the case heard in Municipal Court by proving the amount measured is less then 5g. The forensic laboratory has determined that the weight is 5.0020g ±0.0014g. The defense lawyer in an effort to get the case heard in a lower court will investigate the process for determining the weight, hoping for reasonable doubt that will persuade the prosecutor to reduce the offense to 5g or less and enter the case into Municipal Court.

The defense lawyer will place the "weight" of the case on the responses provided by the forensic scientist to the following questions.

How is the weight of the substance determined?

The substance is placed on a 200g 4 place balance with a digital readout. The sample in question has a weight of 5.0020g ±0.0014g. The value ±0.0014g is the error in the process. This error is caused by the error of the balance and of the control standard. The substance is over the limit for Municipal Court even with the accountability for the probability of error. This result will of course disappoint the lawyer. The lawyer must now investigate further to determine if the balance measurement error is in error and the results not sufficient to send his client to Superior Court.

How do you determine the balance is correct?

The balance used to determine the weight of the substance is located on a solid base that is not affected by area vibrations, heating and cooling system and away from direct light. The temperature and humidity are controlled to not vary by more then 2^0C or 10%RH during the test. The balance is serviced and calibrated yearly by a certified vendor that has met the laboratory's internal quality standards. The balance is checked to determine the errors in the balance caused by repeatability, linearity and corner loading effects. Repeatability determines the balance ability to indicate the same value for the same weight. Linearity test for error caused by different nominal values being weighed, such as placing a 5g control standard and then a substance that is estimated to be 5g. Corner loading is the error caused by not centering the substance being weighed on the weighing pan. The accumulative error caused by these effects has been determined to be ± 0.0005g. The balance is verified between calibrations by using a control

standard weight that is equal to the estimated weight of the substance to be weighed prior to using the balance.

How do you determine that the control standard is correct?

The control standard is calibrated yearly by an accredited laboratory meeting the guidelines of ISO 17025 and the internal quality standards of the forensic laboratory. The as found data is compared to the previous calibration data and the data collected prior to placing a weight into service.

The process for placing the weight in service is to perform 10 weighings. The average of the weighing is now the expected value of the weight in our laboratory environment. Every time the weight is used to verify the balance the value indicated on the balance is compared to the average and must be within the control limits set by the internal quality standards. The value is entered into a spreadsheet that will provide an indication of the weight value and balance operation over time. The spreadsheet and the calibration data are used to determine if the new calibration is correct and determine the calibration interval of the control standard. The spreadsheet for the 5g weight indicates a variation of 0.0005g.

There is an error associated with the process of 0.0005 for both processes. How is this error combined to get a final error of 0.0014?

The confidence the forensic scientist has in the process has been determined statistically. The variation in the test performed using the balance and control weight has induced a possible error of 0.0005g. Since both tests are independent, the values are squared then summed and the square root determined. The root sum square value is multiplied by 2 which provide the test a confidence interval of 95% and the total uncertainty of 0.0014g. The final weight of the substance is 5.0020g ±0.0014g.

Can the test repeat no matter who uses the balance?

Yes; if handled in accordance with internal procedures for handling and process evidence is followed. It is the policy of the lab that all forensic scientists handle the control standards with plastic or fiber tweezers, or lint free gloves. If the weight appears dirty then the weight is compared to values in the spreadsheet to determine if the weight has changed. If the weight changes then the weight is cleaned gently with a lint free cloth. After cleaning the weight, it is compared again to previous readings in the spreadsheet to determine if the weight has changed in value. If the weight has changed in value, outside the limits set by the laboratory then the weight is removed from service and sent for calibration.

The lawyer has completed the questioning of the forensic scientist and draws the following conclusions. The laboratory has a process to maintain the balance and control standard used to determine the weight of the substance, and has evidence of traceability and control of the substance. Faced with the process being proven tried and true, the lawyer in our example now lacks reasonable doubt. The burden now "weighs" on the lawyer to present his case in Superior Court.

For more information visit our website at www.troemner.com or contact us at 1.800.352.7718.

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