FORENSIC LABORATORIES

Focus on Forensics

Kentucky State Police Forensic Laboratories

October 2014

New Measurement of Uncertainty Requirements for Drug and Toxicology reports—What It Means

Uncertainty of Measurement

In a presentation given by a prominent forensic toxicologist on quality assurance the phrase the "Aura of Mythical Infallibility" was used to covey the notion that a scientific result is precisely what it says it is, and scientific data provides conclusive proof of guilt or innocence. This notion contributes to the "CSI effect" as do other concepts such as "one day DNA analysis" or an "every discipline scientist". Unfortunately the world of forensic science is much more complicated, especially as the legal world and scientific world mesh. You may have noticed this meshing of the scientific and legal on toxicology and drug chemistry reports generated since January of this year. There has been a small change on those reports, and based on the volume of phone calls asking, "WHAT IN THE WORLD IS THAT?!" we would estimate that most of you noticed!

Effective January 1, 2014 the accreditation provider for the KSP Forensic Laboratories implemented a new policy regarding the inclusion of "Uncertainty of Measurement" information on the reports of certain forensic analyses that involve the reporting of quantities such as solid dosage drugs and toxicology. This is the forensic community's way of dealing with the myth— by stating the reality that scientific measurements are not absolute and indicating this clearly to jurors and others in the legal system. Unfortunately, the term "Uncertainty of Measurement" can be misleading as it has nothing to do with how "good" or "bad" a measurement is. It has to do with how certain the laboratory is that the reported measurement is accurate. Actually, a better term might really be "Measurement ***Certainty***" in that it answers the question "How close are the reported numbers to the actual measurement?"

So what is Uncertainty of Measurement?

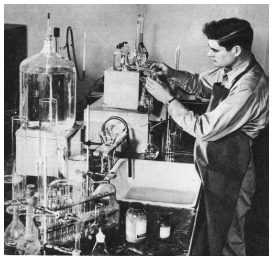
Whenever a value is measured (e.g. the weight of a powder, the volume of a liquid, the concentration of a drug in solution) there is always a small, inherent estimation included in the reported value, which is typically minute relative to the actual measured value. This estimation takes into account small fluctuations in environmental conditions, the resolution of the measuring equipment and several other factors. The end result is a rigorously calculated estimate of how "certain", or confident, we are in the measured value. This is then expressed as a range with a confidence percentage. This confidence percentage for reported measurements will be either 95% for toxicology, or 99.7% for solid dosage drugs. This is best explained by example. See page 3 for examples from solid dosage drugs and toxicology.

Inside this issue:

NIST Names Members to First Forensic Science Standards

As part of its efforts to improve the scientific basis of forensic evidence used in courts of law, the National Institute of Standards and Technology (NIST) and the Department of Justice (DOJ) have made the first appointments to a new organization dedicated to identifying and fostering development and adoption of standards and guidelines for the nation's forensic science community. NIST and DOJ named 17 academic researchers and forensic science experts to the Forensic Science Standards Board (FSSB), a key component of NIST's Organization of Scientific Area Committees (OSAC), which plans to bring a uniform structure to what was previously an ad hoc system.

Among those named was KSP Laboratory's own **Jeremy Triplett**, Forensic Laboratory Supervisor and advocacy chair for American Society of Crime Laboratory Directors. We look forward to the great things from the committee and are honored to have Jeremy representing forensic laboratories. To learn more visit www.nist.gov/forensics/osac.cfm.



KSP Laboratory History– Part 1

Lieutenant Mark Mayes

I have always been interested in history. This includes history of the Kentucky State Police particularly in its formation and transition through the years. Although Governor A.B. "Happy" Chandler played an important role in the formation of the State Police, Union County native Governor Earle C. Clements is the real "Father of the Kentucky State Police". I would also like to add that Representative James B. Hanratty, from my hometown of Hopkinsville, introduced the legislation for creating the State Police on February 11, 1948. In going through KSP history I find there is little about the lab system. We do know it was first authorized in 1949 and that Lieutenant Fred Watson is the "Father of the KSP Lab". I have scoured the various KSP yearbooks and every yearly report I could find. With that, I have come up with some history of our lab that I would like to share. There are quite a few gaps over the years and I hope to one day fill in those gaps.

The KSP's first lab chief was Corporal (later Lt.) Fred S. Watson—shown in both photos. He was a 1949 chemical engineering graduate from the University of Louisville. He, along with another KSP detective, was sent to the Indiana State Police Lab in Indianapolis for two weeks training in chemical testing, blood analysis, firearms ID, and photomicrography. In 1949, Commissioner Guthrie Crowe authorized the purchase of a comparison microscope with a camera mounted on top for $1200 to be used for bullet and cartridge examinations. This would become the lab's first piece of equipment. On February 26, 1950, they were told to organize a lab for the State Police. It opened May 15, 1951 announcing its services would henceforth be available to any officer in the state. It was six (6) years before a chemist was hired to help Watson and another year before a full time typist was hired. Equipment and associated support items weren't prevalent, as perfume bottles were scrounged to serve as "reagent atomizers". There were times in the winter the lab would be heated by filling the sinks with hot water. They did not get a new location until around 1959-1960, which was approximately 3080 square feet. That location was later expanded in 1969-1970 with 2800 additional square feet.

Although a shortage of workers and funds existed, there was no shortage of work. With the 1953 passage of a DUI law (.15), the workload jumped about 40% within 6 months with most of that attributed to blood samples. With other evidence being submitted, the lab was soon to be known as a "FBI wrapping room" as so much evidence had to be outsourced to them. The lab also turned to professors from the University of Kentucky for assistance.

Still nothing changed much with the lab for the next 10 years, until the murder of a Transylvania co-ed in Lexington. Much attention was focused on the lab although little physical evidence was available for analysis. It was one time that being blamed was a good thing for the lab. The press attacked the lack of modern equipment in the lab. Gov. Bert T. Combs took notice of the media and cut a check from his contingency fund for $30,000 to be given to the KSP lab. Then in the 70's, money from federal grants started trickling down from the US Omnibus Crime Control and Safe Streets Act of 1968.

In 1975 overcrowding in the lab became a problem. Rather than expand in Frankfort, Commissioner Ron Johnson proposed to expand the KSP crime lab with 5 regional labs with the Frankfort location becoming known as the Central Lab. The first to open were the Western and Jefferson Labs on May 1, 1975. Following were the Eastern and Northern Labs opening September 1, 1976 and the Southeastern Lab on June 1, 1977. More details on the laboratories' expansion will be presented in Part 2 along with other significant events in lab history.

I hope this has given you some insight into the KSP lab system. As I said earlier, information about the history of our lab is scarce. If you run across any old publications or additional information I ask that you share it with me. Knowing where we have been is as important as where we are going.

"Coming together is a beginning; keeping together is progress; working together is success." Henry Ford

AFIS– not a part of the lab?

Also related to the history of KSP...did you know that AFIS has never been a part of the forensic laboratory? When AFIS first started latent print examiners had to access fingerprint cards held by the records section, so AFIS was located near records, not in the lab. In 1985 they came into the computer age and things started to change, but AFIS and the lab continued to be separate entities as they still are today. AFIS is currently located at 1266 Louisville Road in Frankfort.

Current AFIS staffing includes 3 system coordinators, 7 latent analysts, a supervisor/analyst, 5 ten print examiners, 1 ten print supervisor and 1 evidence custodian. AFIS received 1,657 cases last year, with a total of 5,960 pieces of evidence. 513 identifications were established with 144 cold case reverse search identifications being made. If you have questions about AFIS, please contact Paul Dorman at 502-782-9821. Also, see the FAQ's for answers about evidence that needs to be processed by AFIS and the lab.

Uncertainty of Measurement

continued from page 1

SOLID DOSAGE DRUGS

In solid dosage drugs the measurement of uncertainty is calculated for the weight of a drug sample using the KSP Laboratories' analytical balances (those balances weighing down to 0.001 gram or better). After taking into account the factors for measurement uncertainty, the KSP Laboratories' can provide an "Uncertainty of Measurement" of ± 0.004 g. for all measurements using these balances. What that means is, if a powder drug sample is weighed on these balances and the reported weight is 1.234 grams, the laboratory is 99.7% certain that the "actual" value of that powder is between 1.230 and 1.238. Even though what we've calculated is called an Uncertainty of Measurement, that measurement is VERY *certain*.

TOXICOLOGY

The Toxicology Unit has adopted the 95% confidence percentage as their standard; therefore, any report that has a measurement provided has a degree of certainty of at least 95%. As an example a drug toxicology report may state the quantity of hydrocodone 15ng ± 4 ng/mL. The laboratory measured the quantity to be 15 ng/mL, and then applied the 95% confidence level so the measurement could be as low as 11 ng/mL or as high as 19 ng/mL. Basically, the laboratory is 95% confident that the actual value of this sample is between 11 and 19 ng/mL.

Keep in mind in both examples that the measurement of uncertainty has no bearing on the confidence that the reported sample IS a particular drug, but relates only to the quantity of the drug present. The type of drug has been independently confirmed and is not in question.

How does it affect me?

Generally, Uncertainty of Measurement does not have a significant legal effect. In areas where there are no statutory limits or thresholds involving measured values, it has no significance at all. In areas where there are statutory limits (e.g. 2.0 grams of heroin is a statutory threshold between a Class D Felony and a Class C Felony for trafficking in the 1st degree), measurement of uncertainty *may* play a role. If a measured quantity of heroin weighed 4.654 grams there is no affect, as the uncertainty of this measured value would be a 99.7% confidence that the weight was between 4.650 and 4.658 grams. This range is well over the 2 grams required for the charge. If, however, the measured value of the powder was 2.001 grams, there will be an affect. The laboratory can only say that it is 99.7% confident that the actual value is between 1.997 and 2.005 grams, therefore we cannot provide guaranteed confirmation that this substance exceeds the penalty of a Class C felony for trafficking in the 1st degree as the lower end of the confidence level falls in the lesser penalty.

Summary

During the last year the KSP Laboratories have implemented this new policy on the Uncertainty of Measurement for some measured values in our analyses. The inclusion of these values on laboratory reports should not be seen as negative or indication that the lab is "uncertain" of their work. In fact, the inclusion of these values on our laboratory reports should instill confidence in the judicial community that the laboratory is able to state with high probabilities its certainty of measurements.

If you have questions regarding the policies, please contact Katrina Featherson, Quality Assurance Supervisor .

Frequently Asked Questions– Evidence

Q: **What is the meaning of the phrase "don't shoot the messenger"?**
A: **NEVER** mail or hand deliver a loaded firearm. Please ensure all weapons are unloaded and packaged safely before transporting. Hand delivered items must be boxed or wrapped before being accepted by a laboratory analyst.

Q: **How should evidence be packaged?**
A: Each **ITEM** of evidence should be in its own clearly marked package, if possible. Each package should be marked with the case and item numbers and sealed with evidence tape including the initials of the person creating the seal. Hand delivered evidence must be properly sealed before being accepted by a laboratory analyst.

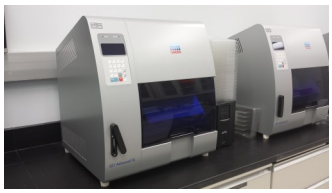
Q: **How do I send evidence via mail?**
A: Send packages via registered mail or a commercial carrier so the chain of custody can be tracked. Always indicate the section of the lab to which your evidence should be directed, e.g. Attention: TRACE SECTION, and PLEASE attach a copy of the KSP 26 in an envelope to the exterior of the package.

Q: **What is a buccal swab and how do I collect?**
A: A buccal swab is a swab collected from the inside of an individual's mouth to use as a DNA reference standard.
To collect— open a sterile swab package (available in the KSP Buccal Standard Collection Kit) and rub the 2 swabs on the inside of the individual's cheeks for about 30 seconds on each side, rolling the swabs to collect evenly. Allow the swabs to air dry before placing in a labeled, sealed swab carton or envelope. Seal the container with evidence tape.

Q: **What if evidence needs to go to AFIS and requires laboratory analysis?**
A: Clearly indicate the analysis requested of both the laboratory (e.g., DNA and Firearms) and AFIS on the KSP 26. The order in which the analysis is done is crucial to prevent rendering the evidence unsuitable for other types of analysis. Indicating the types of analysis on the KSP 26 allows the AFIS and/or laboratory analysts to make an informed decisions on handling the evidence.

Q: **What if your evidence question is not addressed in this section?**
A: Call the lab!

What's New at the Lab?



Robotics for the DNA Casework Section

In September, analysts in the DNA Casework section began training to use robotics in casework sample processing. While the DNA Database section has been utilizing robotics in their analysis for nearly a decade, it is only in the last several years that advances in technology have allowed the expansion of robotics into the casework realm. This new processing option will replace the "manual" process currently utilized for extraction, dilution, and sample placement, allowing for less hands-on time for the analysts and increased throughput of samples. In addition the extraction robots will provide a more robust method for dealing with problem samples, which could not always be processed successfully using the manual method. This project has been in the works for almost 5 years, so the culmination is incredibly exciting. There will be some growing pains with these changes, but the end result will assist in decreasing the turnaround time for DNA cases. We anticipate incorporating robotics into our casework process by mid-October.

New Drug Screens for Toxicology

Toxicology has included several new drugs to the general screening panel allowing for better coverage of the drugs of abuse important to the Commonwealth. These include— Heroin metabolite 6-Acetylmorphine, Morphine, Clonazepam (Klonapin) and its metabolite 7-Amino-clonazepam, Lorazepam (Ativan) and benzodiazepine metabolites Oxazepam and Temazepam.

New Laboratory Director

Julie Ferguson has been appointed the laboratory director of the Jefferson Laboratory since the retirement of Terry Comstock this past spring. Julie started her career at the Central Laboratory in 2005, became the Toxicology Technical Leader in 2009 and is now the director of the Jefferson Laboratory. Julie will be a great asset to the laboratory system in her new role!

New Forensic Biologist

At the end of 2013, the Forensic Biology unit found itself in an unprecedented situation— it was fully staffed with DNA analysts! Unfortunately, the regional labs, which perform serological analysis, were nearly decimated. Serology is a vital step in evidence analysis as it is the serologists who must locate and do initial testing on body fluids before DNA testing can be done. Basically, longer wait times at the regional laboratories equate to longer turnaround times for DNA. So slowly we have rebuilt the troops, and boy, have we added some great people! Meet the newcomers:

Hannah Durham, Louisville lab – Hannah comes to us from Floyds Knobs, Indiana. She has a bachelor's degree in biology from Indiana University Southeast. She began a master's program in marine biology but decided that research was not the direction she wanted to go in life. However, she still has a deep love for nature and animals!

Amanda Riefenberg, Northern lab – Amanda is from West Virginia originally, but has lived all over the U.S. She has a double major in Forensic Science and Aviation. Prior to working for KSP, she was employed as a dispatcher for an airline in Utah. The only thing she misses is the free flights to anywhere the airline flew!

LaDonna Jones, Western lab – LaDonna grew up in Corbin, KY. She has a bachelor's degree in biology from Transylvania University and a PhD in molecular, cellular and developmental biology from Indiana University. LaDonna strongly believes that one should bring their skills and experience back home to benefit the community.

Sara Bamberger, Northern lab – Sara lives in Covington, KY and has a bachelor's degree in Forensic Biology from Northern Kentucky University. She comes to us from her previous position as a Pharmacy technician, so she is no stranger to customer service or having to be detail oriented!

Hannah and Amanda completed their training in April of this year. LaDonna and Sara began training this summer and will be stationed at their permanent posts by late 2014/early 2015.

PAINT ANALYSIS...
what you need to know

Paint, like any mass-produced material, varies. It is important when collecting known paint samples that they be collected from areas as close as possible to, but not within, the point(s) of damage or transfer. This is important for three reasons:

1. The damaged area itself is usually not suitable for providing a known sample: sub-coating and other incidental materials may lie within the damage and cause contamination of the standard.
2. Because of manufacturing variation, differences may exist between parts of an object. On an automobile, for example, the paint on the right rear quarter panel may be analytically different from the paint on the hood. Or, as another example, the hood may have been repainted because of previous damage—it could even be a new hood!
3. Environmental factors, such as sunlight and seasonal weathering, can alter a paint's chemical composition. For example, a painted door's exterior surface may be analytically different from the door's interior surface.

It is helpful for the analyst to have all paint samples clearly labeled as to where they were collected, with drawings or photographs as documentation. Because variations can occur, if the laboratory analyst is not aware of how the item was sampled at the crime scene, it may hinder the analysis, causing paint samples to appear analytically different when in fact they are the same. If proper samples are collected, however, the known and unknown paint samples that should be of common origin will be consistent in all tested respects.

LEGAL NOTES

CHAIN OF CUSTODY

A BIG THANK YOU to those courts that rely on Rabovsky v. Commonwealth, 973 S.W.2d 6, 8 (http://www.ecases.us/case/ky/2466439/rabovsky-v-com) to keep analysts on the bench working cases instead of sitting in court only to testify to chain of custody. The use of electronic chain of custody that can be produced in a PDF format has saved us countless hours in court. Need the chain of custody for a lab report? Please contact the records section at the laboratory and an electronic version can be provided to you.

*Even with respect to substances which are not clearly identifiable or distinguishable, it is **unnecessary to establish a perfect chain of custody** or to eliminate all possibility of tampering or misidentification, so long as there is persuasive evidence that "the reasonable probability is that the evidence has not been altered in any material respect."*
Rabovsky v. Commonwealth

COURT ORDERS/DISCOVERY REQUESTS

Per Kentucky Rules of Criminal Procedure (RCr) Rule 7.24, upon notice by the Commonwealth that laboratory items are needed for discovery, the laboratories will assemble the requested documents, photos, data, etc. Should an order, having been signed by the judge, be received from Defense Counsel, the laboratory will also comply and provide said items to defense counsel on the particular case. Discovery requests are a part of laboratory process, but unfortunately in recent years, they have become very complicated and even burdensome. Please keep in mind that even a routine request can take a week or more to compile, so please notify the laboratory as soon as possible about any court orders.

If you have a discovery request and are not sure that it is reasonable or that the laboratory will be able to comply, we would be happy to review the request. We frequently see orders that have been copied from the internet that include unrealistic items, such as requests for data from types of testing that have long been discontinued by the laboratory (i.e. DNA analysis by RFLP) or data from every blood alcohol sample run on one instrument in a 5 year period. Some items we can provide, others are just not practical, or even possible. If you are unsure whether an order is reasonable, please call as we would prefer to discuss it with you before the order is final.

OPEN RECORDS REQUESTS

Open record requests must be submitted to the custodian of records in the KSP Legal Services Branch. Please keep in mind that certain case files are exempt from open records and can only be obtained through the discovery process. Exempt files include records related to active or ongoing investigations, DNA case files and offender records. Once KSP Legal is aware of the request they must comply within 3 days, so it is imperative that open record requests sent to any department other than legal should be forwarded immediately. For open record requests contact Emily Perkins at 502-573-1786 or fax the request to 502-573-1636.

DESTRUCTION OF EVIDENCE

We have just one word for you on the destruction of DNA evidence—DON'T. The destruction of DNA evidence is a Class D felony. According to KRS 524.140 (2) "No item of evidence gathered by law enforcement, prosecutorial, or defense authorities that may be subject to deoxyribonucleic acid (DNA) evidence testing and analysis in order to confirm the guilt or innocence of a criminal defendant shall be disposed of prior to trial of a criminal defendant unless:

(a) The prosecution has determined that the defendant will not be tried for the criminal offense;
(b) The prosecution has made a motion before the court in which the case would have been tried to destroy the evidence; and
(c) The court has, following an adversarial proceeding in which the prosecution and the defendant were heard, authorized the destruction of the evidence by court order."

The laboratory may not knowingly destroy DNA evidence without notice, KRS 524.140 (5). The Investigating Agency and/or the Commonwealth Attorney for the jurisdiction will be notified if an item of evidence needs to be consumed in analysis. Analysis will not proceed until the appropriate authorization has been obtained.

KSP Photography Laboratory

The Kentucky State Police Photography Laboratory is located at the Central Forensic Laboratory in Frankfort. The Photo Lab provides a full range of forensic photographic services to the Kentucky State Police. Photographic prints from agency case and accident investigations are provided to Kentucky State Police Agency personnel, Prosecutors, Court Officials and Public Defenders at no cost. Private attorneys, insurance companies, and private individuals may purchase photographic prints for a fee.

All requests for agency photographs of traffic collisions and cases shall be treated in accordance with the Kentucky State Police Policy Manual. Inquiries and additional information related to the Kentucky State Police Photography Laboratory, can be directed to Charles Moffett, Supervisor of the Photography Laboratory.

CONTACT US

Laboratory Management

Major Eddie Johnson, Central Lab (eddie.johnson@ky.gov)

Lt. Mark Mayes, Western Laboratory (mark.mayes@ky.gov)

Lt. Jim Shelton, Eastern Laboratory (jim.shelton@ky.gov)

Laura Sudkamp, Laboratory System Director, Central Laboratory (laura.sudkamp@ky.gov)

Laboratory phone numbers and contact info

Western Laboratory, 270-824-7540

David Hack, Laboratory Director (david.hack@ky.gov)

Jefferson Laboratory, 502-426-8240

Julie Ferguson, Laboratory Director (julie.ferguson@ky.gov)

Northern Laboratory, 859-441-2220

Jeanna Oxenham, Laboratory Director (jeanna.oxenham@ky.gov)

Southeastern Laboratory, 606-877-1464

Beverly Wagoner, Laboratory Director (Beverly.wagoner@ky.gov)

Eastern Laboratory, 606-929-9142

Larry Boggs, Laboratory Director (larry.boggs@ky.gov)

Central Laboratory, 502-564-5230 or 800-326-4879

Central Laboratory Section Supervisors:

Matthew Clements, Firearms/Toolmark Supervisor (matthew.clements@ky.gov)

Whitney Collins, Forensic Biology Casework Supervisor (Serology/DNA/Bloodstain Pattern) (whitney.collins@ky.gov)

Katrina Featherston, Quality Assurance Supervisor (katrina.featherston@ky.gov)

Ryan Johnson, Toxicology Supervisor (ryan.johnson@ky.gov)

Charles Moffett, Photo Lab Supervisor (charles.moffett@ky.gov)

Stuart Mullins, Breath Alcohol, Systems Technician Specialist IT (stuart.mullins@ky.gov)

Jack Reid, Trace Supervisor (jack.reid@ky.gov)

Jeremy Triplett, Drug Chemistry Supervisor (jeremy.triplett@ky.gov)

Stacy Warnecke, DNA Database Supervisor (stacy.warnecke@ky.gov)

SUGGESTIONS WELCOME!!

Please contact stacy.warnecke@ky.gov with comments or suggestions.