

**Center for Substance Abuse Prevention (CSAP)  
Substance Abuse and Mental Health Services Administration (SAMHSA)**

**Drug Testing Advisory Board Meeting**

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**Open Session Proceedings**

**One Choke Cherry Road  
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## Open Session

### Call to Order

DR. COOK: Good morning everyone. I apologize for the inaccurate call-in codes, but I did re-email the codes to anyone who had registered for this meeting.

As the Designated Federal Official of the Drug Testing Advisory Board (DTAB), I officially call this meeting to order. First, a few reminders. The minutes, proceedings, and presentations from the open session will be posted on the DTAB website sometime in the near future. For those of you in unmuted mode, please silence your electronic devices because these will interfere with both the audiovisual as well as the transcription equipment. The public is participating in listen-only mode. If you need to contact the web conference operator, please do so by pressing \*1. If you have any questions or comments concerning the material presented during today's open session, please submit your questions and comments by pressing \*1 to contact the operator. Submitted questions and comments will be considered by the Board during the closed session today. Finally, the proposed dates for the last fiscal year 2014 DTAB meeting are September 3-4, 2014.

For our first presentation today, I would like to introduce Brian Makela, who will be providing a summary of a literature review on hair contamination from the last 10 years. This compilation of the reference summaries were given to the DTAB members as homework. Based on these summaries, they submitted questions for discussion at today's meeting.

### The Science of Hair Testing – Hair Contamination

MR. MAKELA: Thank you, Janine. As a reminder, we have compiled a bibliography of about 1,200 peer-reviewed journal articles covering a wide range of topics related to hair analysis. The search of this bibliography was performed to identify those articles that dealt with the issues surrounding contamination. There may be other pertinent articles not mentioned here, but our focus was on articles from the last 10 years. These articles were then grouped by common themes and summarized. This presentation does not necessarily represent anybody's opinion, statement of fact, or any prevailing industry standards. These are just common ideas that we are seeing across the literature review.

*We reviewed all of these articles. Contamination doesn't just deal with one single topic. We broke it down here. There are about seven. There are a number of articles in each of these seven subtopics. They might deal with drug-specific studies, methods for hair analysis, itself, decontamination procedures, the proficiency testing programs, mostly in Europe by the Society of Hair Testing, a number of passive exposure studies in children. There are even articles on how hair is collected and the variability associated with that and then just general review that might have touched on a number of these subjects.*

Based on this review, a few conceptions were accepted as fairly well established. Hair grows at about 1.5 centimeters per month. The preferred area of collection for hair is the posterior vertex region of the scalp, although, it can be collected from various locations on the body. Most hair analyses represent a longer time window of 30-90 days of previous drug use. The posterior vertex region provides the most consistent area of hair growth and thus is the collection site of choice. Hair from other locations on the body may not be as consistent in their growth patterns.

There are three general ways that drugs can be deposited. First is from the blood supply into the cortex area of the hair. Sweat and sebum can also contribute to drug incorporation into hair, as can the external environment. There are multiple aspects to external contamination, including passive smoke and surface transfer from hands, including those of law enforcement personnel involved with evidence handling. Drugs may also be inhaled, metabolized by the body, and then further incorporated into hair.

Another common theme in the literature is that wash steps are critical and must be performed in the course of the analysis. While there are many different opinions on how washes are performed, nonetheless, the wash is critical to address external contamination.

Concerning hair specimen collection, one study showed that even if you provide specific instructions on how hair is to be collected, sampling can vary from collector to collector. Individual hair growth rates can vary as well, which may affect the time window of drug use that is actually examined. This is especially important for segmented hair analysis, which can provide a history of drug use. As hair grows longer and drugs disperse over the length of the hair, the impact of growth rates becomes less and less important. If a hair specimen is collected, digested, and analyzed as one specimen, the variability in collections becomes less of an issue.

There were many studies examining passive exposure in children. What these studies showed is that children in drug user environments routinely test positive for drugs in their hair. The passive exposure for children can lead to both an external contamination situation, as well as absorption into the body. We assume that no children are actively taking drugs, but the issue can be muddled when trying to distinguish between actual use and external contamination.

Finally, the use of drug metabolites and ratios can be useful. In these children passive exposure studies in which the researchers are fairly certain that the exposed children were not using drugs, these ratios were not always definitive. In the analysis of hair from children exposed to drugs, all the metabolites and ratio qualifications are met, but, obviously, the children had not been using any drugs.

There is about 10 years of historical hair proficiency testing (PT) data. There is no set standard on how to prepare hair proficiency samples. How they are analyzed varied quite greatly over these 10 years ago. In the past year, there has been steady improvement in reducing the hair analysis variability from laboratory to laboratory. These findings were mostly concluded from the historical PT data of the Society of Hair Testing, which is fairly prominent in Europe.

For decontamination procedures, there is no industry standard. All of these procedures involved singular organic wash, an aqueous wash, or a combination of the two. Most of the wash procedures incorporated both. There is an ongoing debate concerning the length of the washes. Some people argue that longer washes serve as a mechanism to produce metabolites from drugs that might be present in the hair. In addition, the longer wash might provide a longer timeframe for drugs present as external contamination to incorporate into the hair cortex. Shorter washes are oftentimes advocated to remove just the outer contamination on a hair segment. Thus, this area of debate continues on how washes are approached.

The one commonly accepted belief for decontamination is that all external contamination cannot be removed in a reasonable amount of time. This is why some laboratories performing hair analysis utilize a wash criterion, which factors in the drug concentrations found in those wash solutions produced during their hair decontamination procedures. They assign a factor as an extrapolation for an extended wash period, and use that calculation as part of their interpretation.

The drug-specific studies tended to examine those issues surrounding a singular drug. The first study focused on methamphetamine/MDMA. They found was that the metabolite ratios for hair exhibited a wide range of variability. This is in contrast urine metabolite ratios where there is a commonality for the presence of methamphetamine in a certain cutoff of amphetamine present. The hair metabolite ratios in this particular amphetamine study were not necessarily definitive.

In a comprehensive paper dealing with the external contamination of hair with cocaine, it was determined is that the 2004 proposed Mandatory Guidelines might not be sufficient to distinguish contamination from actual use. In addition, the study also established a relationship with hair color bias, a topic to be discussed later.

The next paper addressed marijuana/hashish consumption. Using the metabolites for THC, they were able to distinguish external exposure, confirm a false negative, and confirm passive inhalation in a two year old. The second study, also dealing with the presence of the THC metabolite, had more definitive results. They were also able to determine that the presence of the tetrahydrocannabinolic acid metabolite was a nice marker for external contamination. In conclusion, marijuana is one of the only drugs with a consistent metabolite for analysis in hair.

The next section on methodologies showed that this area of the science is well advanced. In one study dealing with solid phase extraction methods, they were found to a little bit more efficient than some of the liquid-liquid extractions used in previous analyses. Solid phase extractions minimized carryover, included a wash procedure, and was efficient for them.

The next two studies involved the analysis of a number of drugs. The first examined 17 different common drugs. The other investigated the simultaneous analysis of cocaine and morphine. These studies demonstrated that drugs in hair can be analyzed with a fair degree of certainty as far as method validation and other aspects of the laboratory analysis of the hair and drug detection are concerned. The decontamination and interpretation procedures are where questions still might exist.

The list of references that were used from this summary is shown here and will be posted to our DTAB website in the near future, along with yesterday's presentations. Any questions or concerns from the public will be discussed by the Board in closed session. In conclusion, I have presented a summary of the literature that was reviewed over these past few months regarding hair contamination. Notice the range of subject areas that were examined in these 42 references.

DR. COOK: Do any members of the Board have questions for Brian? If so, please state your name and your question.

As I mentioned earlier, we prepared a compilation of these references and submitted the reference summaries to the Board members. Their task was to generate questions based on this literature. They submitted seven questions. To make sure I reflect the questions accurately, I will be reading them verbatim.

Question number one is in the general category of proficiency testing. "If labs are required to have hair testing methods that will allow them to distinguish contaminated hair, what is the realistic concentration of drugs that hair must be spiked or contaminated with in order to validate the ability of the laboratory to be able to detect and classify the hair sample as contaminated?"

The next question, question number two, pertained to the wash procedure. "Given the numerous publications on hair contamination, especially with cocaine, would you agree that the hair washing procedures used by Schaeffer et al. appear to be the most effective in determining hair contamination even though there is no published rationale for the formula that was used?"

Question number three dealt with standardization. "It seems that the inclusion of hair drug testing in the federal workplace drug testing programs must include either or both of the following elements: 1. the lab must test hair for a true metabolite that arises only from the use of the drug and is not present as a manufacturing byproduct and 2. the lab must use appropriate lab procedures and apply a wash criterion to the differentiate between drug use and drug in hair from external contamination. Since we seem to be far away from being able to satisfy element one for some drugs, that is using cocaine as an example, most published work has focused on absolute values for benzoylecgonine, cocaethylene, and norcocaine or ratios of these compounds to the parent cocaine. None of them appears to adequately distinguish use from contamination. Would the program consider mandating a rigid decontamination protocol, i.e., all labs must use the same solvents and aqueous wash solutions, same time periods, etc., and a standardized wash criterion that must be followed by all certified hair testing laboratories?"

Question four was on the topic of quality control. "If a decontamination protocol is required by certified laboratories, there would have to be a mechanism to assess adequacy of that protocol in each confirmatory batch. How feasible is it to produce a stable, externally contaminated hair specimen that could be used as a quality control material to monitor effectiveness of the decontamination in every batch, in other words, a decontamination control to be used in addition to the usual analytical performance control?"

Question five dealt with metabolite criteria. "It was stated that the analysis for metabolites or metabolite ratios may be a key in distinguishing contaminations from use. Is there a consensus on what drugs this has been established for and what are those criteria?"

Question six concerned spiking. "Interference studies for urine drug testing included analyte addition to samples spiked at specific drug concentrations. Have any hair studies to evaluate contamination and the effectiveness of the wash step included such an approach?"

Finally, question seven dealt with contamination studies. "There appears to be only one study noted where non-drug users were exposed to drugs to evaluate contamination. The other studies noted used in vitro drug exposure for evaluation. Please comment on how reliable contamination studies are based on this approach."

Those are the questions submitted to the Board on the hair contamination literature from the last 10 years. These questions will be discussed in closed session. For any questions that the Board is unable to resolve or produce an adequate answer, we will reach out to the public and ask them to submit any pertinent scientific studies that they have, since we have only searched peer-reviewed literature, to see if they can assist us with finding answers to these questions. Do I have any comments or questions from the Board?

MR. FLEGEL: Since there seems to be no questions, I also want to mention to the public that there will be, as Janine mentioned, a request for information (RFI) published which will include those questions addressed today as well as others. This RFI will be published shortly and will request public comment on these questions. Again, we are searching for literature or answers to those questions.

DR. BROWN: I think these questions cover the landscape, based on my recollection of prior discussions that we have had at the Board.

DR. COOK: Thank you. Any other questions or comments from the Board? I will now adjourn the open session. Will the public please disconnect? The Board will take a short break before convening in closed session. Thanks everyone.

(Whereupon, the open session adjourned.)