State of Wisconsin **Labor and Industry Review Commission**

In the matter of

EMPLOYEE, Employee

Hearing No. #####

v.

EMPLOYER, Employer

Employee's Brief

Introduction

EMPLOYEE submits the following recommended factual findings and limited legal argument in response to the Labor and Industry Review Commission's ("LIRC" or "Commission") DATE remand order. This order directed an administrative law judge to take additional testimony and evidence as to the following:

- Testimony from a department witness regarding the department's drug testing policy from its disputed claims manual, including the referenced National Institute on Drug Abuse chart on commonly abused drugs. and periods of detection;
- Testimony from a department witness regarding the department's basis for adoption of its policy that urine is the only acceptable specimen for conducting a valid drug test;
- The meaning of laboratory certification of the procedures for and reliability of hair and urine testing by the Substance Abuse and Mental Health Services Administration (SAMHSA), the College of American Pathologists (CAP), and the U.S. Food and Drug Administration (FDA);
- Any expert testimony on behalf of the employee, the employer, and/or the department regarding the strengths and weaknesses of hair drug testing methods, including its reliability, chain of custody guarantees, types of drugs that can be detected, detection periods, established cut-offs, and standards for workplace hair testing, including the reliability and detection periods of hair samples from different sites on the body;
- Any expert testimony on behalf of the employee, the employer, and/or the department regarding the strengths and weaknesses of urine drug testing methods, including its reliability, chain of custody guarantees, types of drugs that can be detected, detection periods, established out-offs, and standards for workplace urine testing;

- The qualifications and credentials of any person who provides expert testimony, the facts or data on which the expert relied, the scientific principles and methods followed by the expert, and how the expert applied the principles and methods reliably to the facts in the case (*See, e.g.*, Wis. Stat. § 907.01, .02, and .03, and Coleman v. Capital Returns, Inc, UI Hearing No. 1600276MW (LIRC Oct. 28, 2011));
- The laboratory certifications of Psychemedics lab and the staff who performed the tests in this case;
- The drug testing procedures used by and the results of the Psychemedics lab tests offered by the employer in testing the employee;
- The laboratory certifications of Omega lab and the staff who performed the tests in this case;
- The drug testing procedures used by and the results of the Omega lab test offered by the employee, for which the employee or department may present evidence of a departmentally certified test result for the Omega lab test; and
- Other relevant evidence the department and the parties are able to provide regarding the nature and reliability of hair and/or urine drug testing, laboratory certification to perform such tests, guarantees of chain of custody of testing samples, standards for drug detection, types of drugs that can be detected, detection periods, established cut-offs, and reliability of sample testing for determining specifically when drug use has occurred.

After three days of hearings pursuant to this remand order, the record was closed, transcripts prepared, and a briefings scheduled issued.

Issues Reserved

At the start of the remand proceedings, Mr. EMPLOYEE objected to any decision regarding a finding that misconduct took place in this matter if the Commission should find that results from hair tests can be considered in unemployment proceedings. Mr. EMPLOYEE made this objection for two reasons. First, the remand order itself does not include the taking of evidence about whether misconduct occurred in this case. Second, the taking of such evidence is premature when the rules and framework are unknown for how such evidence may be relevant. The whole point of this remand proceeding is that the Commission has not previously assessed or determined how drug tests results from hair samples are admissible and relevant in determining whether misconduct has occurred or not. The range in how the Commission might decide these issues could, for example, stretch from two poles. At one end, the Commission could simply make hair tests results procedurally and substantively the same as how urine tests are currently handled (though selection or specification of guidelines for cutoff measures, lab

certifications, and Medical Review Officers, for example, would still need to be decided by the Commission). At the other end, the Commission could make hair test results just one factor among many in determining whether prohibited drug use occurred and institute detailed instructions based on the evidence presented at this remand hearing for how hair samples are procured and testing is done for the results to even be considered. In other words, Mr. EMPLOYEE cannot defend himself against an accusation of misconduct based on speculation about how the Commission might decide how evidence of hair tests will be handled. Not only would a requirement for him to present such a case raise procedural due process concerns, Bituminous Casualty Co. v. ILHR Department, 97 Wis.2d 730, 734, 295 N.W.2d 183, 186 (Ct. App. 1980), *quoting* State ex rel. Richey v. Neenah Police & Fire Commission, 48 Wis.2d 575, 580, 180 N.W.2d 743, 746 (1970) (due process includes the right to be heard upon the probative force of the evidence adduced by both sides and upon the law applicable thereto), but it also would have obviously lengthened the remand proceeding at least by several days as Mr. EMPLOYEE would have needed to mount a defense on every possible way the test results from hair tests could be handled in an unemployment hearing. *See, e.g.*, Boston Police Department Drug Testing Appeals ("D" Cases), Mass. Civil Service Comm'n, (28 February 2013) (hereafter Boston Police Cases), *slip op*. at 1-2 (in case to decide how and to what extent the scientific admissibility and relevance of hair test results matter in civil service discharge cases, discovery took place over several years followed by 18 days of hearings) (available at http://www.mass.gov/anf/docs/csc/decisions/discipline/boston-police-drug-testing-appeals-022813.pdf).

Furthermore, the order for this remand proceeding does not allow for argument or evidence regarding other elements necessary for a showing of misconduct in regards to the use of prohibited drugs. In determining whether an employee's use of drugs or alcohol constitutes misconduct for unemployment purposes: the employer must demonstrate that it has applicable work rules/policies that are (1) known to the employee, (2) rationally related to the employer's business interests, and either (3a) the employee's positive test shows a violation of that work

rule/policy or (3b) the employee admits alcohol or drug use in violation of that policy/work rule. *See* McClary v. AAcer Flooring LLC, Hearing No. 02403673AP (15 May 2003) (setting forth these elements), Koss v. Menominee Indian Tribe, Hearing No. 97400031GB (10 April 1998) ("It is not enough to establish that a work rule has been violated, as the mere violation of a work rule does not establish misconduct. The commission must determine whether the rule was reasonable . . . [and that], where the rule concerns off-duty conduct, the [proscribed] conduct must be reasonably related to the employer's interests."), Gregory v. Anderson, 14 Wis.2d 130, 137, 109 N.W.2d 675, 679 (1961) (to show that a violation of a work rule while off-duty qualifies as misconduct, an employer must show that the work rule in question is reasonably related to the employer's business interests). At present, the essential dispute in this case has turned on whether the employee's positive test result of a hair sample taken on 9/22/09 is even admissible in showing a violation of an employer's work rule/policy (element 3a). Since hair tests results have been inadmissible in unemployment cases, neither EMPLOYER nor Mr. EMPLOYEE have had the opportunity to address whether these requirements for a finding of misconduct have been met in this case, especially since Mr. EMPLOYEE took numerous hair tests with conflicting results. Accordingly, if hair test results become relevant in some way in unemployment matters, Mr. EMPLOYEE reserves the opportunity to brief whether all of the elements necessary for a finding of misconduct in drug use cases have been met in regards to the various hair tests Mr. EMPLOYEE took.[1]

Finally, Mr. EMPLOYEE points out that hair testing for use of prohibited drugs raises privacy concerns and medical review problems separate from those that currently exist with urine testing. As elaborated on below, there are valid and real concerns over whether current hair testing procedures adequately distinguish between external contamination and ingestion. If hair

1 Pursuant to Wis. Stat. § 108.22(8)(c), any finding of misconduct also requires examination of the issue of whether the repayment of unemployment benefits is to be waived. As the remand order did not address this issue and in the 2010 appeal tribunal hearing this issue was irrelevant and not taken up, there is no available evidence in the record currently to address this question. As a result, a hearing for additional evidence would be required on whether repayment of unemployment benefits could be waived if the Commission found that misconduct has occurred because of prohibited drug use.

test results become admissible in unemployment disputes, employees who test positive via hair tests because of possible external contamination will have to explain how their contact with others, their family circumstances, and their contacts outside of their employment could have led to their exposure and allegedly positive test result.[2] In these circumstances, employees will have to reveal not only their own personal choices and concerns but also those of the individuals with whom they interact. Besides the obvious question over whether this kind of inquiry into the lives of individuals who are not employees of the employer is something that is connected with employment, there are very real and substantial objections to an employer forcing individual employees to chose between their jobs and revealing the private matters of others who have no direct connection to the employer in order to explain the circumstances of passive exposure.[3] In such circumstances, both claimants and these third-parties may well have viable claims about their privacy being invaded, *see* Denning v. Northwoods Family Eyecare LLC, Hearing No. 02201829EC (30 April 2003) (employee had good cause to quit when employer discussed in public private matters of a patient's marital difficulties), or that they are being forced to waive constitutional rights, LeBron v. Fla. Dep't Children and Families, No. 11-15258 *slip op*. (11th Cir., 26 February 2013). Given the focus here in this remand order on evidence relating to the efficacy of hair tests for the use of prohibited drugs, Mr. EMPLOYEE requests that additional briefing be undertaken to address claimants' and third-party' privacy and constitutional concerns at stake in hair testing, should the Commission conclude that hair tests will be admissible in some way in unemployment cases.

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2 The employee, for example, might have to admit about the drug use of a child or spouse or explain that he or she lives in neighborhood where drugs are openly sold. Day 2 Tr.219:17-23.

3 In addition, there is nothing in the record to suggest that Medical Review Officers have training for such a query or even should conduct such a query.

Recommended Facts[4]

A. Drug testing in general

The Department of Workforce Development ("DWD" or "Department") allows blood, urine, and breathalyzer test results to be admitted in unemployment cases and provides specific forms (Ex.40) for an employer to complete to show that (1) the chain of custody regarding the sample is intact and (2) the results actually demonstrate the prohibited drug or alcohol use in question. In regards to prohibited drug use, these test results are almost always from urine or blood samples, and, if completed satisfactorily, these forms provide *prima facie* evidence of use of prohibited drugs.

While some testing for prohibited drugs is done on blood samples, most of the testing that appears in unemployment cases is based on urine samples (breathalyzer testing is done predominately for alcohol use, not drugs). The testing protocols of urine for prohibited drugs such as opiates, marijuana, cocaine, PHP, and amphetamines are well developed and understood, Ex.33 (detailing those protocols and the 2008 changes to the protocols, such as the new requirement for split samples), and provide evidence of prior use, for instance, in the last eight hours (LSD), several days (cocaine), from one day to five weeks (marijuana), and from three weeks or three months or longer depending on how the intake occurred (anabolic steroids), Ex.37. Federal guidelines from the Substance Abuse and Mental Health Services Administration ("SAMHSA") provide generally universally accepted guidelines for laboratory procedures, testing regimens, and the cut-off levels for finding positive results needed for reliable and valid testing of urine samples. *See* Ex.31 for these protocols.[5] These protocols, moreover, provide

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4 References to the transcript from the remand hearing will be in the form of Day 1/2/3 Tr.pp:ll-ll. While the remand hearing days are technically days 2, 3, and 4 in this matter since one hearing day originally occurred on 15 December 2009, these transcripts are themselves labeled day 1, 2 or 3. As a result, this pattern will be continued.

5 The 2008 guidelines set forth in Ex.31 and elaborated on in Ex.32 and 33 also encompass an effort to harmonize these SAMHSA-sponsored protocols with Department of Transportation regulation of commercial transportation companies and individuals with commercial driver's licenses, specifically the drug-testing requirements and prohibitions in those regulations. As a result, the current SAMHSA drug testing protocols for urine match the requirements that

effective counter-measures against efforts to substitute or tamper with samples during collection as well as to verify that results are not from external contamination or mistakes in handling of samples. *See* Ex.32 at 3-5 for a description of these issues. For instance, because the urine sample is a homogeneous substance (the contents are uniformly and evenly distributed within the sample itself), tests on different portions of the sample should have the same result since the test portion is materially indistinguishable from the other in each instance. Day 1 Tr.184:18-19. A different result across two portions of the same urine sample indicates either some kind of contamination of the sample or mishandling. As a result, SAMHSA guidelines for urine testing require that a portion of the sample be preserved to verify results via a second laboratory test if questions about the testing of the first sample are raised. Ex.31 at 71860 (document's own numbering) — "the split specimen procedure ensures that the donor will have access to a split specimen that was not opened by the laboratory testing the primary specimen" and 71902-4.

Because urine testing has been in use for several decades now, numerous techniques and even products have been developed for creating substitute samples. SAMHSA guidelines take into account these efforts by spelling out specific chemical requirements for the sample as well a required temperature range in order to verify the sample's authenticity. Ex.32 at 3-5, Day 2 Tr.201 to 202:*passim* (DNA testing is also possible for determining whether the sample is from the tested individual). In light of these requirements as well as numerous others not specifically

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apply to those with commercial driver's licenses.

> The Federal drug testing Guidelines are used by other programs under separate authority and law. For example, the U.S. Department of Transportation (DOT) developed requirements for its regulated industry that incorporate the scientific and technical aspects of the Guidelines into their drug testing program. Here, DOT requires that its regulated employers use only HHS-certified laboratories when testing their employees. The Nuclear Regulatory Commission's (NRC), fitness for duty program also requires the use of HHS-certified laboratories for any drug testing performed under its rules.

Ex.32, p.2 (endnotes removed); *see also* Ex.33, p.18. Accordingly, even if Wisconsin employers could use tests and laboratories not currently certified by SAMHSA for drug testing, certain other employers would still need to maintain compliance with SAMHSA protocols because federal regulations require that compliance.

described here, urine testing that follows SAMHSA requirements produces accurate test results without qualification. In other words, a positive test result for drug use from a SAMHSA-certified laboratory does indeed demonstrate use of the prohibited drug.[6] Day 3 Tr.343:21-5 to 344:1-7 (no doubt that positive reading of BE in urine demonstrates ingestion of cocaine).

SAMHSA certifies drug testing laboratories that meet these criteria and maintains a list of those urine-testing laboratories. Ex.22 (list of certified laboratories effective on 5 September 2012). Because this information is publicly available, other governmental entities, public employers, and private employers use this information to ascertain which laboratories are following SAMHSA guidelines. The Department itself has access to a specific website that lists these certified laboratories.[7] Ex.36, Day 2 Tr.32:7-11 (SAMHSA certified labs), and Day 2 Tr.41:13-18 (CAP certified labs). If the testing laboratory is not on this list (which currently excludes laboratories that utilize hair testing procedures) and the employee denies use of prohibited drugs, then evidence demonstrating that drug use is not established, misconduct is not

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6 Obviously, a positive test result may have arisen from legitimate or unintentional intake of the drug at issue, and a Medical Review Officer is needed after every positive test to determine whether some other factor besides illicit drug use is responsible for the positive test result. For example, a person prescribed painkillers after extensive surgery may well test positive for opiates. In such a circumstance, the positive test result for opiates is explained through legitimate use of prescribed drugs and the reported result of the test to the employer will be negative. This need for a Medical Review Officer to review test results exists in all drug testing, urine or otherwise. SAMHSA has specific protocols for Medical Review Officers to follow in urine testing. Ex.31 at 71899-902 (setting foth criteria, e.g., regarding what to do with insufficient samples, test review criteria, split specimen testing, and the relationship between the testing laboratory and the Medical Review Officer). Comparable protocols for hair testing are not part of the record and apparently do not exist.

7 In addition to SAMHSA, the College of American Pathologists ("CAP") sets forth guidelines and testing criteria for the administration of urine tests, and the Department accepts drug tests from CAP-certfied laboratories in unemployment cases, Ex.36. The CAP guidelines and testing criteria for urine testing are are not part of the record in this proceeding, however. *But see* Day 2 Tr39-42:*passim* (describing in general terms how certain DWD personnel understand the CAP certification requirements to differ from SAMHSA certification requirements). As a result, it cannot be determined how CAP urine-testing protocols compare to the SAMHSA protocols for urine testing. Furthermore, it cannot even be determined from the record whether there are laboratories certified by CAP but not SAMHSA in regards to urine testing to which Wisconsin employers have access.

found, and the claimant is not disqualified from receiving unemployment benefits because of misconduct. *See* Ex.39 (Department rationale for denying a misconduct allegation on this basis).

B. Hair

Hair is a heterogeneous substance, and so the chemical contents of each hair vary from one point to another within each hair as well as vary from hair to hair, even among hairs growing right next to each other. Day 1 Tr.184:16-23. This heterogeneity in hair can lead to as much as a 20% variation in test results from one sample. Day 1 Tr.208:2-5 and 210:8-19 (a 10% figure came after Dr. Cairns' initial testimony about this variation being up to 20%), Day 3 Tr.297:17-25 to 298:1-4 (explaining the source of the 20% figure when Dr. Cairns took three different samples from the same head and saw a 20% variation in the results), Day 3 Tr.354:5-8 (affirming the 20% figure).

Hair in the human body has at its base a follicle through which blood vessels bring the nutrients on which the hair grows. Day 1 Tr.16:7-10 and Ex.64. As new material is added at the follicle, the hair lengthens longitudinally. Day 2 Tr.82:14-15.

The outer coating of a hair is called the cuticle. It consists of layers of flat, thin cells that overlap each other, much like scales. Day 2 Tr.131:19-21; *see also* Ex.59 at 7-8. The body of the hair is called the cortex, and it is this part of the hair that gives the hair its strength and flexibility because of the microfibrils and macrofibrils that run through the cortex. Ex.63. At the center of the hair is a relatively open area called the medulla. Ex.63.

Because hair is permeable, substances are not incorporated strictly into single bands as the hair grows but can diffuse to other bands over time. Day 2 Tr. 105:21-5 to 106:1-2; *see also* Ex.45 at 17 (graph of hairs exposed for various lengths of time to concentrations of a fluorescent dye showing how permeable hair is) and Day 2 Tr.158:1-25 to 159:1-4. Likewise, external substances that enter hair can also move around within the hair's structure. Day 2 Tr.106:7-8. A study of individuals given a single dose of cocaine at a known point of time not only revealed that the timing of when the dosage occurred could not be determined from hair samples but also that an individual who exercised frequently and hence sweated heavily and led to that dose being

diffused throughout the hair sample and made the individual appear as a long-term user of cocaine in his hair test. Day 2 Tr.161:5-23.

Hair can absorb water, and environmental exposure can change the structure of a hair. Day 2 Tr.83:18-23. As Dr. Kidwell explained, "if hair is wet in any form, from sweat or even humidity, these scales [in the cuticle] do open up and allow penetration of things from the external environment." Day 2 Tr.132:5-8; *see also* Ex.59 at 8 (micrograph of a damaged hair showing a gap in the cuticle/scales) and Day 2 Tr.147:15-25 to 148:1-9 (describing the micrograph). It is this permeability in hair that allows dying with henna, for example, to easily change the color of hair and then to have that coloring treatment remain for a considerable amount of time. Day 2 Tr.190:22-5 to 191:1-4.

Phases of hair growth

Hair follows a specific growth cycle with three distinct phases: anagen, catagen, and telogen.[8] The anagen phase is when the hair is actively growing. When the growth subsides, the hair enters the catagen or transitional phase for approximately two weeks. At this point of time, the follicle disconnects from the hair structure, pushing it upwards. So, the hair continues to lengthen to some extent even though new hair cells are not being added. When the growth stops and the hair becomes dormant, the hair has entered the telogen phase, which could last a month or two. *See, generally*, Day 3 Tr.292:24-5 to 293:1-11. These hairs are eventually pushed out and shed when the anagen phase begins again with a new hair emerging from the follicle.

For head hair, the anagen phase can last several years. Day 1 Tr.100:19-20. At any one point in time, 12% of a person's head hair is dormant and will fall out in two weeks. Day 1 Tr.211:13-15; *see also* Day 2 Tr.100:15-17 and Day 3 Tr.293:13-15 (around 10% to 15% is dormant).

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8 The pattern of these growth cycles vary from hair to hair, and so hairs right next to each other can all be in different phases of this growth cycle. Day 2 Tr.175:16-21. These different phases explain in part the heterogeneity in hair samples and why all these different growth tracks make it difficult to conclude that a hair sample can serve as a precise tape recorder of prior drug ingestion Day 2 Tr.175:22-5 (tough to correlate a hair sample to drug use; all you can actually tell is that use occurred sometime before the hair was cut).

Chest hair on men will typically only be in the anagen phase for five months and the growth rate is slightly slower than head hair. Day 1 Tr.101:11-13. The dormant period for chest hair will last about two months before it falls out, and the length at that point will typically be 2 to 2.5 cm long. Day 1 Tr.101:18-22.[9]

Hair is resistant to decay, and substances within hair can remain for some time. Psychemedics has analyzed John Keats' hair and found morphine as well as cocaine in the hair of South American mummies. Day 1 Tr.202:2-18. Psychemedics also examined the hair of Egyptian mummies and found cocaine present in their hair as well. Day 1 Tr.202:19-21. Neither cocaine nor nicotine (which was also found in the hair of the Egyptian mummies) were available in Egypt in ancient times, as both crops originated in South and North America, respectively. Day 2 Tr.209:13-17. These substances found in the hair of these mummies came from external contamination of the hair many decades ago, not ingestion. Day 2 Tr.209:21-5. So, substances from external contamination can also remain within hair for lengthy periods of time.

Growth rate measurements

Human hair grows at various rates because of genetic and external variables, including differences in ethnicity/race, gender, age, climate, health, injury, and physical stress. Ex.52 at 3-4, Ex.29 at 2 (document page numbering), Day 1 Tr.195:22-5 to 196-7: *passim,* Day 2 Tr.174:18-23 (including additional factor of an individual's hormonal cycle). Studies of hair growth based on hair from the top and occipital regions of the head indicate that a great deal of variation in growth rates exists. Ex.52, pp.3-4, While the average growth rate from these studies was 1.06 cm per month (with each month equal to 28 days), Ex.52, p.4, individual growth rates could vary by

9 Dr. Cairns also testified that he expects chest hair to be 1 to 1.5 inches long (2.54 to 3.81 cm) and is suspicious of chest hair that is only 1 to 1.3 cm long. Day 1 Tr.209:13-16. That shorter hair throws his "probative interpretation out." Day 1 Tr.209:11-13. Dr. Kidwell indicated that his own chest hair is around two inches long. Day 2 Tr.197:24-5.

a factor of 0.5 to 2.0 times this average rate, Ex.52, p.6.[10] Average growth rates have no predictive value for determining an individual's own hair growth rate. Day 2 Tr.88:11-12.

Chest hair, arm hair, and head hair, for example, all grow at different rates, in large part because the growth phases — anagen, catagen, and telogen — of these types of hair vary. Day 2 Tr.85:21-5.

C. Hair testing of drugs

Protocols and concerns over environmental contamination

Initial research into hair testing showed promise in providing a longer window of detection. Day 2 Tr.128:7-15. Dr. Werner Baumgartner, the founder of Psychemedics, theorized that hair had inaccessible regions in which substances from the follicle were lodged, included prohibited drugs. Day 2 Tr.129:7-13. But, as soon as research into hair testing began in earnest, concerns over environmental contamination appeared. Day 2 Tr.129:17-20. Contamination also appeared to vary by types of hair — large and straight Asian hair versus brown and thin Caucasian hair. for example. Day 2 Tr.132:20-5 to 133:1-2. Dr. Kidwell called this problem a hair testing bias, as some types of hair would tend to be positive whereas others would tend to be negative depending on where the cut-off measure for a positive result was set. Day 2 Tr.133:14-24 *see also* Day 2 Tr.171:3-12 and Ex.45 at 35 and 36 (large variation in hair test results of children exposed to cocaine and methamphetamine and with no blonde haired children testing positive but 43% of black haired children testing positive).

In 2004, SAMHSA proposed possible protocols for using hair samples when testing for prohibited drug usage. Ex.20 and 34. Part of these proposals included measures for determining

10 Psychemedics relies on an average growth rate of 0.5 inches per month (1.27 cm per month) for its hair tests and uses a 30 day per month figure to arrive at its 90 day window. Day 1 Tr.16:17-18. An inch and half sample of hair is 3.81 cm long. One centimeter is 0.39 inches, and 1.06 cm is 0.42 inches. In other words, Psychemedics presumes higher average hair-growth rates and a longer period of time as the baseline for its hair tests. Dr. Kidwell uses a range of 0.8 to 1.3 cm per month. Day 2 Tr.174:24-5. Dr. Cairns' criticism that the growth rate data in Ex.52 is not intended to determine a positive or negative test result, Day 3 Tr.283:3-8, is irrelevant to the question of whether a test of a hair sample can tell with any degree of certainty when ingestion occurred based on presumed or even fictitious growth rates for that hair sample.

when a tested sample would be declared positive for the prohibited drug. Ex20 at 16697 (document's numbering) and Ex.32 at 7 (table setting out these proposed cutoff measures for hair, oral, and sweat testing). Dr. Cairns testified that the proposed cutoff measure for cocaine in hair, for instance,

> was the most appropriate cutoff to clearly separate a user from someone who may be passively or environmentally exposed. And the cutoff is a conservative estimate well above the level of non-use. So it's a highly conservative estimate on a clinical level, that you're protecting the innocent and only in fact targeting those who have done multiple ingestions of Cocaine over the time period.

Day 1 Tr.18:2-10; see also Day 1 Tr.112:8-13.[11] The proposed cutoffs for cocaine ("COC") were 500 pg/1 mg of hair as well as additional measures of 50 pg/1 measures for Benzoylecgonine ("BZE" or "BE"), Cocaethylene ("CE") (a common by-product when cocaine and alcohol are consumed together), and Norcaine ("NCOC") along with a BZE/cocaine ratio ≥ 0.05. Ex.32 at 7, Ex.29 at 4 (document's own numbering), and Day 1 Tr.33:1-13. These additional measures were included (at the time) because they allegedly would only show up in test results when ingestion occurred. Day 1 Tr.104:23-5 to 105:1-6 (Dr. Cairns describing Mr. EMPLOYEE's 6/18/09 chest hair sample results).

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11 Dr. Cairns also asserts that this cut-off level represents someone snorting several lines of cocaine per month, Day 1 Tr.18:14-22, or about 160 mg of cocaine in a month, Day 1 Tr.24: 9-10. As a result, Dr. Cairns explains that the cutoff will *not* catch the occasional or accidental user of cocaine. Day 1 Tr.112:14-25. This explanation of the cutoff contradicts the explicit reason for drug testing in the first place: namely to prevent all drug use, not just heavy or consistent drug use. *Cf* Ex.32 at 2 ("The focus of this Federal drug testing program is to deter and detect the use of illicit drugs."). Furthermore, in making these conclusions about the level of cocaine use that will trigger a positive test result, Dr. Cairns does not explain how the lines of cocaine needed will vary for a 120 lb person versus a 220 lb person. *Cf*. Day 2 Tr.240:17-22 (study of cocaine ingestion administered doses of cocaine per unit weight of body mass), Day 3 Tr.353:4-25 (metabolism, age, sex, and weight are factors that affect concentrations of a drug in a person); *see also* Day 3 Tr.288:1-9 (discounting finding of cocaine in children's hair because they could ingest much less and still test positive in light of their lower body mass). Third, Dr. Cairns is juxtaposing two very different criteria in explaining these cutoff measures. On one hand, he is accepting the measure as a way to avoid a false positive for environmental or passive contamination. On the other hand, he is indicating the cutoff measure is only intended to capture regular use of a prohibited drug, not infrequent or one-time use of a drug. This latter concern presumes that testing results accurately show all drug ingestion and that passive or environmental contamination does not exist. As Dr. Kidwell notes in his testimony, if that fact was actually true, Psychemedics should have a significantly lower cutoff measure set at the limit of detection available for its lab equipment and testing procedures. Day 2 Tr.214:7-15. Instead, it appears that Psychemedics is simply picking a compromise cutoff measure between misclassifying too many and misclassifying too few. Day 2 Tr.214:20-4. Finally, according to Dr. Kidwell, Dr. Cairns' estimate of ingesting 160 mg of cocaine as the minimum amount for a positive test result is likely too low by a factor of three. Day 2 Tr.170:7-13. Ingestion of 160 mg of cocaine is most likely four lines, Day 2 Tr.199:12-13, not three or two as Dr. Cairns says at various points of his testimony. *Cf.* US v. Fuller, USAF Ct. of Crim. App., Case No. ACM 35058 (23 June 2004), *slip op*. at 2-3 (Dr. Selavka testimony that a positive hair test result at more than 300 pg/1 mg requires 15 cocaine dosages in a three month period). When Dr. Cairns revised his testimony to state that his reference to 160 mg was to pure cocaine, not street cocaine, he uncharacteristically demurred from providing any information about how many lines of cocaine this amount represented. Day 3 Tr.321:10-17.

Numerous comments on the proposed hair testing guidelines were received, including comments from Dr. Kidwell. Ex.59, Day 2 Tr.145:21-2. In these comments, Dr. Kidwell raised concerns about: environmental contamination through damage to hair, Ex.59 at 8 and Day 2 Tr.146-7: *passim;* decontamination failures, Ex.59 at 10-11 and Day 2 Tr.148:11-25 to 149:1-18; problems of hair/cultural bias in testing, Ex.59 at 13 and Day 2 Tr.151:3-22;[12] a lowering of cutoff measures from the originally developed 1000 pg/1 mg and a BE/COC ratio of 10% or higher that would lead to many false positives, Ex.59 at 3-4 and 11;[13] and the use of NCOC and

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12 Dr. Cairns testified about several documents that allegedly show no cultural or testing bias exists in hair testing. Day 3 Tr.266-8:*passim*. Ex.53 is a one page press release about a 1999 study done by Mieczkowski and Newel on drug testing technology. A press release hardly qualifies as representative of a significant and important scientific opinion. Furthermore, the study presumes that a positive correlation for positive test results across urine and hair tests for being African-American rather than white shows no racial bias. A correlation is not causation, however. The differences in sample sizes for each kind of test and race (only 201 African-Americans were hair tested while 491were subject to urine testing) means that 187 tested positive with urine and only 125 tested positive with their hair. As a result, the basic finding could well be from some kind of peculiarity unique to how the African-American subjects became part of the study. Ex.54 is a three page academic paper that seeks to show a similar result as Ex.53 among police cadets. The statistical method used, Mantel-Haenszel, will show a significant result if there is *any* differential in the categorical data, however. Such a result, at best, only indicates that additional research is needed to examine what exactly may or may not be going on with the data. In this case, a basic separation of hair into just two classifications may obscure actual differences in hair color, growth, structure, and size that make some kinds of hair more susceptible to a positive hair test. Ex.55 is a 2007 study that re-cycles the 1999 data and dresses up the findings through use of Bayes theorem probability ratios. As already noted. concerns with the variation in positive test results for African-Americans raise concerns about some kind of selection bias. The probability ratios magnify that problem, and the Chi-Square analysis only makes it worse, as Chi-Square analysis will almost always produce statistically significant results with large sample sizes. Ex.56 is a paper that Mierczkowski, a criminologist (not an epidemiologist as Dr. Cairns asserted, Day 3 Tr.289:14), presented at the annual American Society of Criminology academic conference in 1999 and then self-published in an on-line journal for which he was the editor and for which only three volumes were published (see attached printouts of the relevant volumes, available at http://www.criminology.fsu.edu/journal/volume1.html [links are dead, so to see additional volumes substitute volume1.html with volume2.html and volume3.html] as well as a printout of the journal's current status available at http://www.criminology.fsu.edu/journal/). Accordingly, these arguments should receive little to any weight. Indeed, the fact that SAMHSA continues to fund research into the issues these articles allegedly resolve suggests that the conclusions reached in these documents have resolved nothing.

CE markers for ingestion when those substances were already being found in the environment and in street cocaine, Ex.59 at 11-12.[14]

Scientist like Dr. Kidwell also raised concerns about how sweat might facilitate passive infusion of cocaine into hair. Day 2 Tr.155:21-5 to 156:1-10. A study of children in households with cocaine users, for example, revealed some of the the children's' hair to be positive for cocaine. Day 2 Tr.156:13-19; see also Ex.45 at 24. Indeed, within the same household some children tested higher than their parents. Ex.45 at 26 and Day 2 Tr.167:17-19. Indeed, Psychemedics tested some of these children and declared them positive for cocaine. Day 2 Tr.168:3-7. Furthermore, several studies have revealed that cocaine is present in small quantities throughout some environments, such as children's' school desks, Day 2 Tr.169:1-9, and even US

13 Dr. Cairns asserts that the 5% BE threshold was more appropriate for the proposed SAMHSA hair testing guidelines than the 10% threshold that Dr. Kidwell supported because the 5% cutoff better matched Psychemedics' previous test results under its own testing procedures. Day 3 Tr.439:4-13. Dr. Cairns offers no indication that the 5% threshold was based on anything other than what Psychemedics itself and its own testing requirements determined was appropriate. As such, this testimony indicates that this standard did nothing more than confirm Psychemedics' lab testing practices at that time and had nothing to do with what might be best for the field or the other hair testing companies.

14 Dr. Cairns contends in his testimony that Dr. Kidwell's criticisms in Ex.59 were unfounded and not supported by others. He points to Ex.62 as evidence that supports this criticism. Day 3 Tr.276-7:*passim*. Dr. Cairns, however, was not a member of the Hair Testing Working Group and did not attend its meetings, Day 3 Tr.362:23-5 to 363:1-4, while Dr. Kidwell was, Day 2 Tr.138:5-22. So, Dr. Cairns has no direct knowledge of what that group did or did not do. Additionally, one of the authors of Ex.62 was the lab director of Psychemedics at the time. As a result, Dr. Kidwell's concerns about Psychemedics having undue influence on the Hair Testing Working Group appear to have some support, especially when Ex.62 specifically touts the validity of Psychemedics hair test results and its aggressive wash techniques. For example: "Any study performed without aggressive washing of the hair samples cannot be interpreted to represent ingestion, much less to assess the presence of a color effect." Ex.62 at 5. Finally, it should be noted that Ex.62 at 5 does indeed support Dr. Kidwell's concerns about hair testing bias.

> For example, there could be extraction methodologies that may be more effective with thicker, porous hair and less effective with thinner, nonporous hair. The washing mechanisms may be non-existent or fail to remove externally-deposited or sweat-deposited drugs or metabolites. It is extremely important that the Department weigh the information in the studies based upon the particular laboratory methodology used by the researchers and the laboratory's results in the Department's proficiency surveys.

currency in amounts that drug sniffing dogs can detect, Ex.45 at 42-3; *see also* Day 2 Tr.171:17-25 to 172:1-8 (Baltimore study of cocaine on dollar bills shows rates of 0.5 to 1 micrograms on almost every bill in circulation). As a result, this widespread environmental presence of cocaine can easily lead to hair contamination when liquids, such as sweat from hands, are added to this environmentally present cocaine and those hands are then rubbed on hair.

Dr. Kidwell was not alone in raising these concerns, and, in 2008, the protocols for hair testing were dropped, as only urine test protocols were put forward for adoption. Ex.31 and 33.[15]

Peter Stout and other researchers at the Center for Forensic Sciences at RTI International are funded by SAMHSA to conduct additional research into the efficacy of hair testing for drug use.[16] Day 3 Tr.333:1-4, Tr.423:10-13, Ex.23 at 1, n.*. In 2006, Stout *et al*. published results of an initial study into whether hair testing procedures could adequately account for external contaminates across different hair colors, exposure to sweat, and washing. Ex.23. The authors explained that the mechanisms by which drugs are incorporated into hair are not fully understood. Ex.23 at 1 [490].[17]

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15 There is scant evidence in the record about CAP protocols for hair testing. Ex.60 only presents a table of contents regarding a laboratory checklist used by inspectors for checking Psychemedics' laboratory procedures. Day 3 Tr.272:19-25 to 273:1-19; Tr.341:15-16 (checklist applies to both urine and hair testing). There is nothing in the record comparable to SAMHSA's protocols for urine testing, such as Ex.31-33, or the 2004 proposals, Ex.20 and 34. And, the record is lacking regarding whether CAP certification addresses the Department's concerns about external contamination, hair treatments, hair sampling protocols, and other matters. Day 2 Tr.56-57: *passim*. As the Department witness explained, CAP allows "labs to pretty much oversee themselves and they [CAP] check externally to see if the labs are following their own protocols." Day 2 Tr.64:2-5. Finally, CAP, unlike SAMHSA, does not set cutoff measures. Day 3 Tr.342:11-12. Moreover, CAP does not require any particular decontamination procedure. Day 3 Tr.342:19-24.

16 Dr. Cairns labels Dr. Stout as belonging "to what I call the urine lobbyist group" who want "to see hair testing denied in favor of urine testing so they can keep their business." Day 1 Tr.152:15-16 and 19-20. The only evidence on the record is that Dr. Stout and Dr. Ropero-Miller have done hair testing research with RTI at the behest of SAMHSA. Dr. Cairns, on the other hand, sees no problem with himself being a lobbyist for hair testing. Day 1 Tr.185:3-4. Furthermore, he admits to having an exclusive financial arrangement with Psychemedics to testify on its behalf in legal proceedings. Day 3 Tr.369:4-7.

17 *Cf*. to Dr. Cairns' testimony that ingested drugs are permanently lodged in microfilbrils and macrofibrils and that contaminants are easily removed via aggressive wash. Day 3 Tr.278:18-

> Drug incorporation into hair can occur through blood exchange at the hair follicle; exposure to sweat and sebaceous secretions; transdermal diffusion of drug from the skin; and also from exposure to the external environment, including drug residues, contaminated surfaces, and vaporized drug. Each of these mechanisms is affected by the chemical and physiological composition of the hair matrix.

Ex.23 at 1-2 [490-1] (references removed). After contaminating the hair samples, treatments of synthetic sweat, and shampooing were applied along with various kinds of decontamination techniques. Ex.23 at 3-5 [492-5]. The samples were then analyzed at various points in time after no decontamination efforts, labs did their own decontamination, and RTI itself applied the buffer wash technique (usually referred to as the Cairns wash technique, *see* Day 3 Tr.274:*passim*, Ex.61, Ex.23 at 5 [494]). Ex.23 at 5-7 [495-8]. The results were troubling, as they found that BE/COC ratios significantly increased during the ten weeks of the study even though there was not any additional exposure to cocaine, that the BE/COC ratio was presumptively positive after 21 days based on the proposed federal guidelines for hair testing, the largest variability in results were from the samples decontaminated by individual laboratories, and some of the contaminated samples would have been reported as positive under the proposed hair testing guidelines. Ex.23 at 1 [490]. In regards to the efficacy of the Cairns wash technique, 65 contaminated samples were put through that wash method. Stout *et al*. reported:

> Ten samples were positive by the [SAMHSA]-proposed COC and BE cutoffs prior to the application of the wash criterion. After the application of the wash criterion, none of the samples were positive by the COC and BE cutoffs because the ratio of BE/COC was less than 0.05. By the COC and CE cutoffs, 29 were positive by the COC and CE criterion. Twenty-eight of the samples still were positive based on COC and CE criterion after the application of the wash criterion. Even though the wash criterion performed better, samples still would have been reported positive using the proposed federal cutoffs.

Ex.23 at 10 [499].[18]

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25 to 279:1-14.

18 *Cf.* with Dr. Cairns testimony: "Now, if you use the SAMHSA guidelines you're going to make false positives. It's not to till you add the aggressive wash procedure that you got the 65 right out of the 65. And that was openly admitted by Stout in his manuscript." Day 1 Tr.157:12-17; *see also* Day 1 Tr.177:20-5. The conflict is that the proposed SAMHSA hair test criteria were originally a set of possible alternatives for declaring a result positive. As a result, a positive result existed if any of the criteria were met. *See* Ex.29 at 4 (document page

In 2007, Psychemedics wrote a response to these findings. Ex.24. Schaffer *et al*. questioned whether the contamination procedures used in the study did not realistically describe how contamination occurred in practice,[19] that the contamination procedure used would also likely lead to absorption through the skin and a false positive in a urine test,[20] that examination of hair structure for damage with an electron microscope would not reveal hair porosity in the same way that methylene blue staining would and show that certain hair samples were significantly

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numbering). Psychemedics now seems to require all of the criteria to be present for a positive test result. Day 3 Tr.400:2-19. As noted below, the efficacy of all of these measures have come into doubt because BE, CE, and NCOC are becoming more prevalent in street cocaine and BE is appearing with cocaine in numerous circumstances outside of the body.

19 Specifically, Schaffer *et al*. were concerned about the extended drying time after contamination, as the findings in Stout *et al*. indicated that external contaminants were resistant to removal without any further treatment of that hair. This result revealed that certain circumstances made external contaminants extremely difficult to remove:

> Only hair samples that were decontaminated at RTI almost immediately after sampling at the 1 h post-contamination time point (prior to sweat application) had no detectable COC, BE, CE, or NCOC. This was consistent with the findings of Romano *et al*. and other authors who appear to have decontaminated the hair very soon after contaminating the hair . This result is of particular note when compared to hair samples from the same time point (1 h post- contamination prior to sweat application or hygienic washing) submitted to the laboratories. These samples were analyzed by all three laboratories. All laboratories reported significant quantities of COC and some reported small quantities of BE, CE, and NCOC after the individual laboratories had decontaminated these 1 h post-contamination samples.
>
> These hair samples were decontaminated between 5 and 30 days after the contamination event. Thus, in the period between 1 h and 5 days after the contamination event, the analytes became resistant to removal from the hair. This hair was not exposed to either artificial sweat or shampoo.
>
> Hair is a dynamic material of which water is an integral part. In light of the results obtained for the hair samples before they were wet with artificial sweat, it is possible that changes in humidity throughout shipping and storage aided the migration of COC from the surface into the hair matrix with the resulting incorporation being resistant to removal. This phenomenon merits further study and, if confirmed, would further confound discriminating drug positives due to ingestion from those due to environmental contamination.

Ex.23 at 9 [498] (references removed). In other words, Stout *et al*. here directly contradict Dr. Cairns' testimony, Day 3 Tr.286:12-19, that contaminants in hair are easily washed out.

more porous than others (the two light-haired samples in the Ex.23 study had the highest levels of cocaine after contamination and the lowest levels of cocaine after decontamination),[21] and that it was improper to use CE, COC, and BE rather than just COC and BE as contaminants. Ex.24 at 1 [172]. Schaffer *et al*. also objected to how their results were grouped in with other lab results that used methanol cleansing rather than the Cairns wash method and that Psychemedics, unlike the other labs, had correctly identified all the contaminated samples through its testing procedures. Ex.24 at 2 [173].

Stout *et al*. responded to this criticism by explaining: that the study was intended to develop a contamination model for creating performance testing samples that could evaluate the effectiveness of lab decontamination procedures;[22] that criticism of the contamination amount was little more than rhetoric as no known references exist regarding environmental contamination amounts; that, because of numerous reports of CE present in cocaine being sold, the use of CE as a marker of consumption in hair test results was becoming problematic; that, while some samples decontaminated by RTI using the Cairns wash method would have been reported negative under the proposed SAMSHA guidelines, this result was no validation of the wash method because the samples and contamination mixture offered only a small window into the kind of variation that exist among hair types and cocaine mixtures available on the street; that the mere fact that shampooing and hygiene led to 54 of 65 contaminated samples being negative says nothing about eleven samples tested by Psychemedics that would have been reported as positive and that more samples probably would have been reported as positive if BE had been

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20 This argument is essentially the micro-ingestion claim that Dr. Cairns in his testimony impugns as unrealistic in hair testing: the amount of cocaine being absorbed is too small of an amount to register on any test. Day 1 Tr.20:8-20. In other words, Dr. Cairns holds that models of external contamination are not possible because the amounts at issue are both too large and too small.

21 This criticism implies that hair color and porosity does indeed effect test results.

22 The need for a methodology for creating performance testing samples was one of the factors that led SAMHSA to not adopt the 2004 proposed hair testing guidelines. *See* Ex.31 at 71858 (document's own numbering). Dr. Cairns acknowledges this concern as well. Day 1 Tr.249:23-5 to 250:1

included in the contamination mixture. Ex.25 at 1-3 [174-6]; *see also* Boston Police Cases at 56-63, ¶¶111-17 (describing research and use of metabolic criteria and ratios to determine positive or negative hair test results).

In 2009, Ropero-Miller and Stout published the final report of their hair testing studies. Ex.29. This final report took as a starting point that BE tended to increase in hair samples over time and that there is no simple relationship between amounts of COC, BE, CE, and NCOC in hair. Ex.29 at 9 (document's own numbering).[23] After examining numerous cocaine samples to determine their chemical composition, Ex.29 at 13-21, Ropero-Miller and Stout had hair samples of known cocaine users decontaminated with the Cairns wash method and then tested to assess various criteria for determining whether a test result was positive or not. Ex.29 at 22-6. The percentage declared positive among street users and clinical users varied dramatically by the criteria used. Ex.29 at 32 and 34-5 (Tables 15 and 16). Indeed, among street users 100% of the subjects tested positive for BE but only 97% of the subjects tested positive for COC. Ex.29 at 32. In any case, the most effective criteria was the first: COC ≥ 500 pg/mg and BE ≥ 50 pg/mg and BE/COC ≥ 0.05. And, data from a previous study of cocaine levels and cocaine metabolites by Cairns et al. as well as another researcher confirmed this conclusion. Ex.29 at 36-8. Ropero-Miller and Stout then expanded on the contamination study previously done (Ex.23) with slight changes in the contamination amounts (roughly half from what was used previously) and kinds of cocaine. Ex.29 at 44-5 (one contaminant of pharmaceutical grade COC and minimal CE, BE, and NCOC, one contaminant of illicit/street cocaine with high NCOC and minimal CE and BE, and one contaminant of illicit/street cocaine with high CE and BE but minimal NCOC).[24] The

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23 The tendency of BE to increase in hair over time indicates that BE has limited usefulness as a marker of ingestion. Ex.29 at 52 (document page numbering): "This study was also consistent with previous findings because the BE/COC ratio increased significantly over the course of the study period." *Cf.* with Dr. Cairns' testimony that Psychemedics only sees the BE in its test results because of ingested cocaine trapped inside the hair structure. Day 3 Tr.311:15-19.

24 *Cf.* to Dr. Cairns' testimony that street cocaine contains no or only trace amounts of CE. Day 3 Tr.312:8-9 and 403:9-11.

results show a great deal of variation of concentration levels among hair types for the different kinds of cocaine, Ex.29 at 46-51, as well as a great many false positives:

> a substantial number of analyzed specimens would have been determined as positive by most of the criteria applied. For the specimens exposed to COC that contained more CE, there were more specimens that would have resulted in positive calls. For these specimens, only the criteria, including a ≥0.05 CE/COC ratio, would have resulted in no positive results. Using the ≥0.02 CE/COC criteria, there were 44% of the dark hair specimens and 33% of the light hair specimens that would have had tested positive. For those specimens exposed to the high NCOC that contained COC, 33% of the light hair specimens and 92% of the dark hair specimens would have been determined as positive by all of the criteria using NCOC. A more complex pattern was observed with BE criteria because BE appeared in the hair from all sources; therefore, varied amounts of NCOC, CE, and BE in the contaminating COC can substantially confound the use of ratios to discriminate contaminated hair specimens, even after using a laboratory's decontamination procedure.

Ex.29 at 53; *see also* Table A-7 in the Appendix (pp.A-12 to A-22) (listing each sample and its positive or negative status during the stages of the study).

In light of these findings and others, LeBeau and Montgomery announced later in 2009 that the FBI laboratory was suspending analysis of hair for cocaine. Ex.26 at 1 [343]. The Ropero-Miller and Stout study demonstrated, LeBeau and Montgomery explained, that external contamination of hair could lead to false positives under the proposed SAMSHA guidelines for hair testing and that all hair tests for cocaine showed was that exposure had occurred. Ex.26 at 1 [343].[25] In 2010, Pagst *et al*. asked the FBI laboratory to reconsider this decision. Ex.27. They admitted that "until now there has been no unambiguous analytical proof for cocaine consumption as the reason of a cocaine positive hair sample," but they urged that the use of holistic examination of factors along with statistical probability measures to assess how likely the cocaine appearing in the test results was ingested or from external contamination. Ex.27 at 1

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25 Dr. Cairns explains that LeBeau, in particular, was concerned about learning proper wash techniques, like the Cairns wash method. Day 1 Tr.226:1-11. As both Stout *et al*. (Ex.23) and Ropero-Miller and Stout (Ex.29) used the Cairns wash method and still had grave concerns about contamination and LeBeau and Montgomery expressly said that the FBI lab was stopping hair tests because of those concerns, this testimony from Dr. Cairns is disingenuous at best and reflects a consistent pattern in his testimony of pushing results and analyses that always favor adoption of hair testing.

[354]. LeBeau and Montgomery responded by explaining that the majority of the testing at the FBI laboratory usually concerned that very question of external contamination versus ingestion and that, if the lab could not make that distinction in its testing, then there was no logical reason to do the tests in the first place. Ex.28. As Dr. Kidwell explained in his testimony, hair testing when properly carried out only offers "a reliable indication of exposure." Day 2 Tr.218:6-7.

Collection of samples

While any body hair can be used for testing purposes,[26] the preferred locations for taking hair samples are the vertex posterior (more commonly described as the rear bald spot on men balding in that fashion) and occipital (just below the vertex posterior and just above the nape of the neck) regions on the human head. Ex.52; *see also* Day 1 Tr.238:23-5 to 239:1-5. These body regions have demonstrated the most consistent linear growth rates. Ex.52. "Collection is usually achieved by twisting a small bundle of hair (about the thickness of a pencil or larger, securing it with a rubber band, twist tie, or foil and cutting as close to the scalp as possible with scissors" Ex.52 (endnotes and figure reference removed); *see also* Day 1 Tr.78:10-13 (testimony regarding hair sample of Mr. EMPLOYEE taken on 22 September 2009).

Because of differences in experience and particularly the angle of the scissors when the hair is cut, there is significant variation in the length of hair left on the scalp when a sample is collected. Ex.52 at 4-5 (the range left on the scalp is 0.8 cm +/- 0.2 cm).[27] As a result, it is likely that the resulting samples used for hair tests do not immediately begin with new growth but

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26 Typically, only head hair is collected from women while chest, arm pit, and head hair can be collected from men. Day 1 Tr.221:16-25 to 222:1-5.

27 It should be noted that this study did not consider the impact different kinds of hair (curly, thick, thin) had only the cutting of samples, as only the length of hair — short or long — on the doll from which hair samples were collected varied. Accordingly, different hair types may lead to additional variation in the length of hair being collected. Dr. Cairns would make the donors responsible for making sure the cuts were not angled and actually leaving no hair on the scalp. Day 3 Tr.350:13-18. This requirement is akin to making donors of urine samples responsible for verifying that the sample meets the necessary temperature and chemical composition to be considered valid. There is nothing in the record to indicate that individuals subject to hair testing have any understanding of why or how hair samples are cut as close to the skin as possible.

represent hair that is (presuming a growth rate of 1.06 cm per month) at least three weeks old. Ex.52 at 5.[28] In light of the variation in individual hair growth rates and sample collection practices, LeBeau *et al*. recommend a minimum eight-week delay between suspected drug ingestion and hair collection. Ex.52 at 6.

Hair tests by Omega Laboratories

Omega currently is certified by a host of agencies and groups, including FQS as a forensic test laboratory for drug testing of hair, the College of American Pathologists as a forensic drug testing laboratory, and the New York State Department of Public Health for the forensic toxicology testing of hair. Ex.46. Testimony during the hearing indicates that Omega's laboratory procedures for hair testing have received clearance from the Federal Food and Drug Administration. Day 1 Tr.144:1-4 (though it is unclear when Omega obtained that clearance, including whether the clearance had been granted in 2009).

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28 Psychemedics trains individuals in hair collection techniques. Day 1 Tr.87:9-19 (explaining the hair sampling training differed between Omega and Psychemedics only in the paperwork to be completed and kit contents) . The substance of that training is not part of the record in this matter, however, and it is not known whether the collectors trained by Psychemedics provide the exact and consistent samples which include all the hairs emerging from the subject's skin that Psychemedics presumes for its testing. Day 1 Tr.78:10-11 ("cutting [the hair sample] using scissors as close to the scalp as I could"). Indeed, the available evidence suggests otherwise. In this case, the same collection agency — TOWN Occupational Health Center — procured all of Mr. EMPLOYEE's hair samples. Day 1 Tr.289:9-10 and Tr.84-6:*passim* (indicating that other hair sample collectors in this case all work for TOWN Occupational Health Center and that they send the hair samples to the employer's lab of choice or the in-house lab, Omega). Ex.8, the only evidence of hair length taken in the record, shows that the hair length in that sample taken on 12 October 2009 ranged from 0.25 to 1.5 inches long. Psychemedics' reports, on the other hand, only list a start — 0 — and end point — usually 3.9 cm — for the hair sample. *See, e.g*., Ex.42. Dr. Cairns' testimony that Psychemedics only takes 1.5 inches from the root end of the sample, Day 1 Tr.28:1-15, reveals why measures of actual hair length are not part of Psychemedics' reports. The concern LeBeau *et al*. express about how the process of aligning the strands from an angled cut can lead to gross time-line errors is obviously material in these circumstances, Ex.52 at 5 [114]. Indeed, Dr. Cairns testified that he does not know the length of any one sample and that the 6/29/09 head hair sample from Mr. EMPLOYEE could have been as short as half an inch. Day 1 Tr.207:2-5. Dr. Cairns apparently did not realize that Ex.42 and 50 report 0 to 3.9 cm as the hair length sample that was tested.

Omega uses a methanol rinse, Day 3 Tr.420:13-15, rather than the Cairns wash method that Psychemedics uses in its hair testing, Day 1 Tr.157:25 to 158:1-3; *see also* Tr144:8-25 to 145:1-3. Omega is only certified for testing head hair, not body, hair, Day 1 Tr.178:22-5 to 179:1.

Hair tests by Psychemedics Laboratories

Psychemedics is certified by a host of agencies and groups, including FQS as a forensic test laboratory for drug testing of hair, the College of American Pathologists as a forensic drug testing laboratory, the Florida Agency for Health Care Administration as forensic toxicology laboratory for hair testing, and the New York State Department of Public Health for the forensic toxicology testing of hair.[29] Ex.13. Since the early 2000s, Psychemedics' laboratory procedures for hair testing have received clearance from the Federal Food and Drug Administration ("FDA"). Day 1 Tr.114:14-25 to 115:1-5; *see also* Ex.13 at 17. The actual contents of the FDA clearances and the history of those clearances are not part of the record.[30] The data in the clearance document are generated internally by Psychemedics and reviewed by the FDA. Day 3 Tr.358:10-16. These FDA clearances allegedly establish that the cutoff measures for Psychemedics are appropriate for distinguishing between real positives and real negative test results. Day 3 Tr.326:15-25 to 327:1-3.[31]

Psychemedics asserts that, because human hair grows on average 0.5 inch per month across all demographics, a 1.5 inch sample of hair provides a 90-day look-back window into an

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29 Psychemedics only received the certification from the College of American Pathologists for forensic hair testing in February or March of 2010, though the procedures were the same from 2009. Day 1 Tr.163:20-25 to 164:1-2; Day 3 Tr.271:2-16. Still, Psychemedics had NO certification from CAP for Mr. EMPLOYEE's 2009 hair tests. Psychemedics has been certified by the College of American Pathologists for urine testing since late 1996. Ex.58.

30 Dr. Kidwell raises doubts about the veracity of this FDA clearance when he points out that the samples Psychemedics prepares for testing its own decontamination procedures do not use enough cocaine on the test samples to get a positive result in the first place. Day 2 Tr.150:2-13.

31 Because these cutoff measures are lab specific, the cutoffs vary from lab to lab. Day 3 Tr.327:14-20. Dr. Cairns is mistaken when he asserts that FDA clearance controls for urine testing. Day 3 Tr.327:9-13. There is nothing in the record to indicate that the urine cutoff measures in Ex.31 vary from lab to lab or that SAMHSA protocols allow for different cutoff measures for urine testing from one lab to the next.

individual's prior drug use. Day 1 Tr.16:17-22. Even when accounting for the slight variation that exists among individual growth rates, Psychemedics believes that the look back window for a 1.5 inch sample of hair can only vary from 82 to 98 or 99 days. Day 1 Tr.31:24-5 to 32:1.[32] This growth traps in the structure of the hair whatever drugs are present in the individual's bloodstream. Day 1 Tr.16:12-13.

For cocaine, Psychemedics employs a cutoff of 5 ng/10 mg of hair. Day 1 Tr.17:17-19. This cutoff measure is equivalent to the proposed cutoff for cocaine in hair of 500 pg/1 mg hair. *See* Ex.32 at 7.[33] Once Psychemedics receives a sample for testing, it takes a portion of that sample, splits that portion into five sub-portions, and does a preliminary analysis to see if that portion has any prohibited drugs higher than the cutoff threshold. Day 1 Tr.218:16-25. If there is an initial positive, that portion is discarded and another portion of the sample is taken for a second round of testing. Day 1 Tr.24:15-19, 219:1-2; Day 2 Tr.105:2-3 (digestion destroys the sample). Psychemedics uses an aggressive wash technique that, Dr. Cairns asserts, removes ALL external contaminates. Day 1 Tr.20:16-20, 22:17-19, 24:20-25 to 25:1-8, 216:16-25 to 217:1-22, Day 3 Tr.274: *passim*, 278-9: *passim*, Ex.61. The contents of the fifth wash are analyzed, the second portion of the sample is then digested/liquefied, the drugs allegedly still trapped in the hair are released, and measurements taken of what and how much prohibited drugs are present in that portion. Day 1 Tr.25:10-24 and 217:1-22, Day 3 Tr.29511-22 and 296:4-10 (comparing split sample requirement in urine testing in which the sample if simply divided and so a confirmation test does not use a cut-off to taking a second portion of a hair sample for a retest and expecting "a result pretty well close to the original). From the 1.5 inch long sample used for the testing — weighing about 25 mg or 120 strands — 8 mg (30 strands) is the portion needed for the first

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32 Psychemedics also acknowledges that it takes five to seven days for hair growth to emerge above the skin. Day 1 Tr.41:8-10 and 42:3-8. When this factor is included, Psychemedics' look back window (including the acknowledged variation in growth rates) shifts later in time an additional five to seven days: 87 or 89 days to 103 or 106 days.

33 Psychemedics has adopted the additional ratios and criteria that were originally included in the proposed guidelines for hair testing. Day 1 Tr.148:23.

analysis and 14 mg (40 strands) is used for the wash and second analysis. Day 1 Tr.28:21-4 and 29:21-5.[34]

Psychemedics markets hair tests as providing a longer look back window than urine testing into individual use of prohibited drugs. Ex.19 (comparing the 90 day window of Psychemedics' hair test to the few days available through urine, blood, and saliva testing). According to Psychemedics, hair tests also lead to an increase in positive test results as compared to urine testing. Ex.19 (e.g., hair tests for cocaine are almost 15x more likely to produce a positive test result than urine tests); Ex.2 at 6 (hair tests 4x to 6x more likely than urine tests to be positive). Dr. Cairns explains this result because hair tests are more difficult to sabotage or "trick" than urine tests. Day 1 Tr.162:6-25. In contrast, EMPLOYER reports that positive test results declined from 13% with urine tests to only 10 or 12 positives out or over 1,500 hair tests. Day 1 Tr.276:4-24. It is not known why EMPLOYER has such a dramatically different result with its hair testing than the "typical" hair testing experience Psychemedics itself presents.[35] In any case, this evidence is inconclusive at best for the contention that hair testing might lead to fewer unemployment adjudications. Day 2 Tr.23:13-25 to 24:1-5. What is evident from the record is that an increase in the factors and protocols of drug testing that need to be examined, the longer initial investigations will take. Day 2 Tr.13:17-25 to 14:1-4. And, those delays could well lead to penalties, including an increase in the federal unemployment taxes that cover the administrative costs of running the unemployment system. Day 2 Tr.17:14-25 to 18:1 and 25:1-13.

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34 Dr. Cairns is not being precise in this part of his testimony, as the ratio of 8/14 (0.57) does not equal 30/40 (0.75). Either the weight of the hair in each portion is incorrect or the number of strands being used for each portion is incorrect.

35 Nothing in the record, for instance, indicates that Psychemedics markets its hair testing as a way to change attitudes towards drug use and convince people to stop drug use altogether. The other option is that hair testing is actually much less effective than urine testing in spotting drug use. Day 2 Tr.213:2-9.

Hair testing in unemployment cases in other states[36]

Psychemedics frequently cites Nevada Employment Security Department v. Holmes, 914 P.2d 611 (Nev. 1996) in its supporting documentation. *See also* Ex.12. In this *per curium* decision, the Supreme Court of Nevada held that there was substantial evidence in the record to support the unemployment board's conclusion that Psychemedics' hair testing methods were acceptable for determining whether prohibited drug use had occurred. Id. While not as cited as often, New York has also held that hair tests results are admissible in unemployment proceedings to determine whether use of prohibited drugs has occurred. *See* New York State Department of Labor, Unemployment Insurance Division, Adjudication Services Office, A-750-2109 (November 1999) (available at http://www.labor.state.ny.us/ui/aso/21.htm) and New York State Department of Labor, Unemployment Insurance Division, Review Letter 2-2000 (May 2000) (available at http://www.labor.ny.gov/ui/aso/rl.htm#2-2000).

On the other hand, Massachusetts has held that hair tests results are not admissible in unemployment cases. In City of Boston v. Downing, 73 Mass.App.Ct. 78, 83 (2008), an appeals court affirmed a decision of that state's unemployment board that there was substantial evidence in the record supporting the conclusion that that claimant's denial of drug use and several other negative hair test results trumped Psychemedics' positive hair test result.[37]

The only other published unemployment court case regarding hair testing for drug use is Broadus v. Unemployment Compensation Board of Review, 721 A.2d 70 (Pa. Commonwealth Ct. 1998). In this case, a Pennsylvania court of appeals overturned a board decision finding misconduct based on a positive hair test by Psychemedics showing drug use. The appeals court

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36 A more extensive review of cases concerning hair testing for drugs, including the unemployment cases described here, can be found in Boston Police Cases at 104-6. Ex.21, Fla. Stat. §§ 440.101 and 102 concern the implementation of drug testing by employers in order to secure a discount in workers' compensation coverage. *See* § 440.102(2). There is nothing in this statutory provision about the use of hair tests to determine eligibility for unemployment benefits.

37 The claimant in Downing is also one of the police officers in Boston Police Cases at 125-6 (discharge because of positive hair test result for cocaine overturned and reinstatement ordered).

held that the unemployment board relied on "non-substantiated and non-qualified expert testimony" from Dr. Donald Kippenberger that human hair "grows roughly one-half inch per month" when there was also detailed testimony from the claimant's beautician that her hair grew only half an inch per year. Id. at 73-4. Because of this slower hair growth rate, the appeals court reasoned, there was no factual basis for concluding that the positive test result from the last third of the claimant's hair represented drug use after the employer implemented its new hair testing for prohibited drugs policy. Id. In addition, the appeals court found, the record was lacking to show that Psychemedics had maintained a proper chain of custody for the hair sample. Id. at 73.

D. Mr. EMPLOYEE's drug tests[38]

In 2006, Mr. EMPLOYEE began work at EMPLOYER as a saw operator and was subject to drug tests via urine sample pursuant to the employer's drug testing policy in effect then. In January 2009, EMPLOYER adopted a new policy for testing for drug use based on hair tests performed by Psychemedics. As part of this new drug testing policy, those who admitted prior use of drugs would be given a second chance if a positive test occurred. Day 1 Tr.268:3-12 and 287:11-18. On 29 January 2009, Mr. EMPLOYEE admitted to prior use of a prohibited drug. Ex.3.[39] Accordingly, he was eligible for a second-chance program of quarterly testing for the two years. Ex.2 at 9-10. The first test would occur 120 days after disclosure to ensure that a subsequent test would not pick up any prior drug use covered under this disclosure, and so a second positive test would mean termination. Ex.2 at 9-10; Day 1 Tr.268-9:*passim* and Tr.285:16-25.

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38 Mr. EMPLOYEE continues to deny drug use in 2009 and contends that any positive test result after the 6/18/09 chest hair sample arose from external contamination. The 6/18/09 positive test result itself reflects a mixture of prior drug use that he disclosed to EMPLOYER and external contamination of his hair.

39 At the remand hearing, Mr. EMPLOYEE explained that he had begun using cocaine in October 2008 and stopped around Christmas 2008 because of a divorce and the death of his father. Day 1 Tr.300:18-22. This use was only a couple of lines of cocaine, Day 1 Tr.301:10, and was connected to a girlfriend at the time who used cocaine herself and who he continued to see occasionally through the summer and into early fall of 2009, Day 1 Tr.301-2:*passim*.

18 June 2009 chest hair test

On 18 June 2009 — 140 days after his disclosure — Mr. EMPLOYEE underwent his first hair test, using a sample of his chest hair collected that day that was 4 cm long. Ex.4 at 2. It is unknown why a chest hair sample was taken rather than a sample of head hair.[40] It is also unknown the rate of growth of Mr. EMPLOYEE's chest hair. Day 1 Tr.55:23-5.[41] That test result from Psychemedics was positive for cocaine at more than 3x the cutoff measure (Ex.4) and reported to EMPLOYER on or around 25 June 2009.

According to Dr. Cairns, the test result could not have occurred if the cocaine usage had only taken place in December 2012. Day 1 Tr.103:1-11. Dr. Cairns also testified that this hair test took place at the end of June, and, with a look back period of six months, the cocaine had to have been ingested since January 1st of 2009. Day 3 Tr.299:8-15 and 303:15-16. These conclusions are all based on assumptions about chest hair growth and hair that may or may not apply to the actual chest hair from Mr. EMPLOYEE used in this test. Nor does Dr. Cairns or EMPLOYER offer any explanation of why a chest hair sample that Psychemedics itself assumes would reach back in time more than 120 days (four months) was used in this test.

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40 Psychemedics directs collectors to turn to other hair sources when there is less than 1/2 inch of hear hair available. Day 1 Tr.100:11-13. Mr. EMPLOYEE had sufficient head hair for a sample on June 18th, Day 1 Tr.305:24-5 to 306:1. Moreover, Mr. EMPLOYEE had approximately a couple of inches of head hair at the first day of the remand hearing, Day 1 Tr.311:12-13, and his hair in June 2009 was slightly thicker, Day 1 Tr.305:22-3. Furthermore, a sample of his head hair was taken eleven days later on 29 June 2009 that was 3.9 cm long. Ex.43.

41 Indeed, the Medical Review Officer for this test indicated in his testimony that he believes hair in general grows 1/2 cm to 1 cm a month, roughly. Day 1 Tr.66:2-4. This growth rate would mean that a 1.5 inch hair sample could represent 7.62 months of growth, not factoring how close to the skin the sample was taken, how long it took for the hairs in the sample to emerge from the skin, and whether the sample was head or chest hair. Dr. Cairns, on the other hand, testified that the growth rate for chest hair was only slightly slower than head hair. Day 1 Tr.101:11-17. The look back window with chest hair is longer — six to seven months across demographics, plus or minus five to ten percent — according to Dr. Cairns, not because of the slightly slower growth rate of chest hair but because of the different pattern of anagen, categen, and telgen phases in chest hair. Day 1 Tr.101:6-25 to 102:1-13. So, if the Psychemedics' hair growth assumption + 30 day window set forth in EMPLOYER's second chance program applied to chest hair samples, then Mr. EMPLOYEE should not have had his chest hair tested until approximately eight months later, 210 + 30 days, or early September 2009.

29 June 2009 urine and head hair tests

As per the new drug testing policy, a last-chance agreement was instituted on Monday, 29 June 2009. Ex.3 and Day 1 Tr.272:13-25 to 273:1. That same day, Mr. EMPLOYEE submitted a second hair sample (from his head) and also took a urine test. The immediate result from the urine test done at EMPLOYER was negative (Ex.5, Day 1 Tr.273:9-11, 279:11-15, 288:19-25 to 289:1-4), and EMPLOYER learned on Wednesday, 1 July 2009, that this second hair test — performed by Psychemedics — was negative (Ex.43 and 50; Day 1 Tr.273:12-14). Subsequently, Mr. EMPLOYEE continued to work for EMPLOYER.

For the remand hearing, Psychemedics presented additional testing documentation for the 6/29/09 sample. Ex.42 and 57. Dr. Cairns explained that the portion of hair initially tested returned a presumptively positive result for cocaine. Day 1 Tr.204:9-13 and 236:2-14. After wash with the Cairns method, the test result was now below the cutoff for cocaine and reported as negative. Day 1 Tr.204:18-25 and 236:18-25. This negative result did not undercut the positive 6/18/09 test result, Dr. Cairns explained at the hearing, because the chest hair sample went back six to seven months but the head hair sample was limited to, at most, three months and so would not pick up ingestion from January, February, March, and April. Day 1 Tr.206:20-25 to 207:1-17. But, Dr. Cairns then revised his testimony to explain with "scientific certainty" that the 6/29/09 sample showed cocaine use by Mr. EMPLOYEE from February through June of 2009. Day 3 Tr.304:12-18. The result also indicated to Dr. Cairns that Mr. EMPLOYEE's use of cocaine in regards to the 6/29/09 test sample was for cocaine ingested in April, May, and March at levels that were "close to recreational use which is a couple of lines a month over the three months." Day 1 Tr.239:16-22 as well as 242:7-9 (Cairns: high degree of probability that EMPLOYEE used cocaine from March to June 29th). The positive 6/18/09 chest hair sample also reflected that cocaine use in April, May, and March. Day 1 Tr.239:22-5. Finally, Dr. Cairns maintained that even though the 6/29/09 test was reported as negative for being below the cutoff measure for cocaine of 5 ng/10 mg of hair and that this cutoff measure is "established by clinical analysis to clearly differentiate between a user and someone who's passively or environmentally exposed

with a wide margin of conservatism," there still was cocaine trapped in Mr. EMPLOYEE's hair from his ingestion of cocaine. Day 1 Tr.240:9-24.

In other words, this testimony when combined with Psychemedics' presumptions of a 90 day window for head hair and a six month window for chest hair (when discussing Mr. EMPLOYEE's specific tests, Dr. Cairns often shortened the chest hair window to five or six months), Dr. Cairns is saying that the negative 6/29/09 hair test still showed ingestion from February, March, April, May, and June but not January, February, March. and April. Moreover, the high positive on the 6/18/09 test could not be based on usage in just one month but it also included all of the months that allegedly did not trigger a positive test result from the 6/29/09 sample. Not surprisingly, Psychemedics offers no analysis of the segments from the 6/18/09 sample to support these contradictory statements. Day 1 Tr.114:3-7 (positive hair samples are retained for five years).

22 September 2009 hear hair test

On 3 September 2009, Mr. EMPLOYEE underwent surgery for the removal of a cyst on his tail bone. Mr. EMPLOYEE returned to work on Monday, 22 September 2009. As Mr. EMPLOYEE knew that he would soon need to take another drug test, on his own initiative he voluntarily presented himself for collection of a hair sample (taken from his head) that same day. From its testing, Psychemedics concluded that this hair sample was positive for cocaine Ex.7 at 4. According to Dr. Cairns, this test result of 7.3 ng/10mg represents cocaine usage of a "little more than a few lines per month." Day 1 Tr.132:13.[42]

A Medical Review Officer contacted Mr. EMPLOYEE about that positive test result and asked about any recent surgeries or medical treatments Mr. EMPLOYEE had recently undergone. Day 1 Tr.310:10-15. Mr. EMPLOYEE submitted documentation to the Medical

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42 *Cf*. with Dr. Cairns' conclusion that a test result of 16.8 ng/10mg for a chest hair sample represents cocaine use of "several lines per month." Day 1 Tr.103:10-11. As noted for the 6/29/09 sample that was negative, Dr. Cairns inferred that Mr. EMPLOYEE was still doing a couple of lines of cocaine a month. It appears that Psychemedics is doing nothing more than making an *ad hominin* attack of Mr. EMPLOYEE by labeling him a cocaine user rather than developing any kind of reasoned analysis based on actual and consistent data.

Review Officer about his September surgery and subsequent treatment. Day 1 Tr.310:15-17. For an unknown reason, the Medical Review Officer concluded that the test result was not a false positive.[43] On Friday, 9 October 2009, EMPLOYER learned about this positive test result for cocaine. Ex.7 at 4A. That same day, EMPLOYER discharged Mr. EMPLOYEE.

In preparation for an appeal to circuit court, Psychemedics performed additional testing on the 9/22/09 hair sample, called segmental analysis in which the 1.5 inch sample is cut into half inch portions, with each portion representing a 30-day period of growth. Segmental analysis is usually done for someone in a treatment program to indicate whether drug use has stopped via a decline in reported levels from the tests of the hair segments. Day 1 Tr.183:1-11 and 184:1-4. According to Psychemedics, analysis of each hair segment from the 9/22/09 sample demonstrates that Mr. EMPLOYEE used cocaine in the three months prior to the 9/22/09 but that his usage slowly declined over this time period. Day 1 Tr.135-9:*passim*. Others disclaim any scientific ability currently available to make such findings. *Cf*. Ex.52 at 1-2 ("While gross

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43 The Medical Review Officer for this hair test was Dr. ONE. She did not testify, however. Rather, Dr. TWO testified about what Dr. ONE did as a Medical Review Officer based on his review of her notes in this matter. Accordingly, that testimony does not provide a substantial or credible basis for making any factual conclusions. First, Dr. TWO has no first-hand knowledge of what Dr. ONE did as a Medical Review Officer. Ex.41 at 7 and 8 have notes that indicate that Dr. ONE took advice from Dr. Schaffer, identified as Psychemedics' lab director, that there could be no false positive from Fentanyl, that hair grows at 1 cm/month or 0.4 mm/day, that 1.5 inches of hair represents 90 days of the most recent growth, that darker hair is more likely to absorb cocaine, that environmental wash can have an effect, there is no study correlating dosage to concentration in hair, that the drug diffuses into hair passively at the follicle via the blood stream, and that the drug can also enter the hair from sweat produced by sebaceous glands (small subcutaneous glands, usually connected with hair follicles that secrete an semi-fluid matter, composed in great part of fat, which softens and lubricates the hair and skin) during and after formation of the hair. All of this contradictory and unexplained information raises a host of questions about why and on what basis Dr. ONE concluded that there was no false positive for Mr. EMPLOYEE. Second, the medical review documentation in this case is incomplete and even conflicting at points. *Cf*. Ex41 at 2 with Ex.7 at 4b (note dated 10/2/09 about surgery medical records being received listed on former document but missing from the latter document). No explanation is available in the record about this discrepancy. Dr. TWO proposed that the note was written after the document was sent to the company. Day 1 Tr.61:16-25. But, this document was sent to the company on 10/8/09 according to the document itself, six days after the 10/2/09 notation was apparently written. Ex.41 at 2.

qualitative determination of drugs and poisons in hair has generally provided minimal interpretational challenges, the same cannot be said about quantitative or segmental analysis. Presently, drug and poison concentrations cannot be correlated with dose."). The analysis presented here shows why this criticism is valid.

As the basis for his segmental analysis, Dr. Cairns assumes Mr. EMPLOYEE's hair grows a 1/2 inch per month, Day 3 Tr.352:9-10, and that each half inch segment represents a 30 day window of drug use, Day 3 Tr.351:13-25 to 352:1-2. Furthermore, he does not know how close to the scalp the hair was cut. Day 3 Tr.352:3-6. As already noted, there is no information in the record about Mr. EMPLOYEE's own hair growth rates or that Psychemedics' presumed 1/2 inch per 30 days hair growth rate applies to him. That lack of information is fatal.

> Another important assumption for segmental analysis is the use of 1-cm segments to represent a 1-month period of growth. These data show that while the use of 1-cm/month is quite close to our calculated average growth rate of 1.06 cm/month, the significant range of growth rates reported in the literature (0.65–2.2 cm/month) must also be acknowledged. Not knowing the actual growth rate of hair from a random individual could result in conclusions based on the 1-cm/month growth rate to be significantly skewed.

Ex.52 at 5.

These results in Ex.10 also show why BE is useless as a marker for showing ingestion.[44] Here, Psychemedics' first tests of the 9/22/09 sample produced a 7.3 ng/10 mg result for COC and a 7.3 ng/10 mg result for BE. The subsequent tests of the three half-inch segments in late August 2010 produced the following results (ng/10mg):

COC	BE
4.4	4.3
6.6	8.9
9.3	14.0
6.77 mean	9.07 mean

44 As Dr. Kidwell explains, BE is both a metabolite of cocaine and a decomposition by-product. Day 2 Tr.179:3-4. In hair contaminated with cocaine, the cocaine degrades into BE over time and particularly after washings. The resulting increase in BE changes the ratio of BE to COC. Day 2 Tr.179:22-5 to 180:1-6.

So, in a hair sample allegedly sealed inside a laboratory the amount of COC declined by 0.53 ng and the amount of BE increased by 1.77 ng.[45] *See also* Day 2 Tr.180:8-14. Indeed, the high initial BE result from the September 2009 test suggests that external contamination during intimate contact took place when sweat and hand contact with hair occurs. Day 2 Tr.183:11-17, 185:9-15, and 185:17-25 to 186:1-5 (contamination of hair by cocaine on hands showed that, as the individual washed his or her contaminated hair, the cocaine became indistinguishable from that of a drug user). Given the infinitesimal thresholds for a positive test result with hair, contamination with only a small amount of cocaine can easily lead to a positive hair test. Day 2 Tr.215:7-16.

12 October 2009 head hair test

On Monday, 12 October 2009, Mr. EMPLOYEE presented himself for collection of another hair sample for testing and a valid collection of a hair sample occurred. Ex.49. Mr. EMPLOYEE did not know that he could ask for a second test of the 9/22/09 head hair sample. Day 1 Tr.306:20-5 to 308:1-3. Omega Laboratories tested this new hair sample and reported a negative result to Mr. EMPLOYEE on October 15th. Ex.8 and 48.

Dr. Cairns explains this negative test result with a presumption of abstinence from cocaine by Mr. EMPLOYEE (after consistently labeling him a habitual user of cocaine) for a period of one month after the 9/22/09 test (even though only twenty days separate the two sampling dates and Mr. EMPLOYEE had no idea about a possible positive test result until 9/28/09 at the earliest if Dr. ONE's notes on Ex.4 at 1, Ex.7 at 4B, and Ex.41 at 8 are accurate). Day 1 Tr.143:1-12. He also posits that Omega's use of solvent extraction on the hair sample is not as accurate as Psychemedics' digesting of the hair. As a result, Omega is more likely to miss or understate drug use by the individuals being tested. Day 1 Tr.144:5-25 to 145:1-14. What is probably more likely is that opportunities for external contamination that arose when Mr. EMPLOYEE saw his occasional girlfriend (who continued to use cocaine herself and was why

45 The decline in the COC measure is within a 10% testing variation that Dr. Cairns admits can occur because of the heterogeneity of hair. The increase in BE by 1.77, however, is well outside even a 20% (1.46 of the original BE measure of 7.3) variation possibility.

he raised the issue of possibly receiving cocaine with her through sex) had been markedly reduced because of his hospitalization. Because the external contamination had been reduced, Mr. EMPLOYEE's hair now tested negative.

Dr. Cairns also asserts, Day 3 Tr.396:7-19, that Mr. EMPLOYEE initially tested positive with this 10/12/09 hair sample and that additional testing was needed before the sample was declared negative. As the basis for this inference, Dr. Cairns looks to Ex.48, which lists the testing procedure used by Omega as: "Enzyme-linked immunosorbent assay followed by gas chromatography/mass spectrometry confirmation." Dr. Cairns has no basis for such an inference. For additional analysis of the 6/29/09 sample that Dr. Cairns did in December 2012, Dr. Cairns himself submitted the following explanation for Psychemedics' testing procedure on a DWD Drug Test Report form: "Clearance from FDA under 510(K) of FDCA." *See* Ex.57. That reference encompasses Psychemedics' complete testing protocol. Day 3 Tr.339:17-25 to 340:1. Ex. 57 at 3 (stamp) shows that Psychemedics only used the screening portion of its testing methodology on the 6/29/09 sample and not its complete FDA cleared testing protocol. Day 3 Tr.340:3-8. Accordingly, a basic description of laboratory's testing protocols provides no basis for concluding what specific steps and tests within those protocols were used to ascertain how the sample was declared negative. Such an inference also runs afoul of Dr. Cairns' repeated admonishment that cutoff measures are conservatively set above the level of non-use so as to avoid problems of passive or environmental exposure and false positives.

Conclusion

Mr. EMPLOYEE submits that hair testing for prohibited drug use is currently not a valid procedure for determining actual use of a drug. Unlike urine, hair is a heterogeneous substance, and so test results can vary by as much as 20% from one sample to the next. While numerous factors such as gender, metabolism, age, sex, and weight are acknowledged as affecting the concentration of drugs in a person and the resulting amounts that end up being deposited in hair, there is no consideration of how individual hair growth rates might affect the conclusions being reached about the drugs allegedly found in that hair. Furthermore, whereas hair testing

companies presume a half inch per month growth rate for hair, actual studies of head hair growth show an average rate of 1.06 cm per month. As a result, this average by itself indicates that the analysis of companies like Psychemedics are off by a third or more. These errors are compounded by problematic issues in hair collection in that cuts may not be perfectly parallel to the skin or which leave a great deal of hair on the head.

The criteria for cutoff measures for determining a positive test result appear, in the case of cocaine (little to no evidence is available about other drugs), to simply reflect the practices of one company (in regards as to the use of BE) and to offer little in the way of distinguishing ingested cocaine from cocaine in the environment generally. As the discussion above illustrates, it has become clear that the use of BE, CE, and NCOC as markers for ingestion are either already in cocaine being sold or appearing as the cocaine decomposes on its own. There simply is at present a basic lack of data to show how a certain amount of ingested cocaine will lead to a certain amount of readily identifiable cocaine in hair.

Finally, there is obviously external contamination of hair occurring in tests for cocaine. Different hair colors and hair treatments, presence of swear, physical damage of the hair, and even just plan shampooing of hair significantly affect the amount of cocaine in the environment that can enter hair and remain there for a considerable amount of time despite aggressive efforts to remove those contaminants. These concerns have led numerous authorities to declare that hair testing does nothing more than show exposure. And, that is all that the tests of Mr. EMPLOYEE's hair have shown.

Respectfully submitted
on behalf of EMPLOYEE,

Victor Forberger

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Victor Forberger
WI State Bar No. 1070634
2509 Van Hise Avenue
Madison WI 53705
Telephone: 608-352-0138

E-mail: vforberger@fastmail.fm

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Appendix A: Exhibits

A. Table: List of exhibits by sample date and type

Sample date	Test used	Ex. #	pp	Ex. Description
06/18/09	hair/chest	4	2	MRO checklist and Psychemedics results report
06/29/09	urine	5	1	EMPLOYER in-house urine test result
06/29/09	hair/head	50	1	Psychemedics results report
06/29/09	hair/head	57	19	DWD Drug Test Report and Psychemedics data packet
06/29/09	hair/head	42	5	Psychemedics results reports for each panel/drug
06/29/09	hair/head	43	2	Psychemedics custody form and medical release
09/22/09	hair/head	6	1	DWD Obtain Specimen Report
09/22/09	hair/head	7	37	DWD Drug Test Report, custody form, Psychemedics results report, MRO checklist, lab data, Psychemedics certifications, and Cairns CV
09/22/09	hair/head	10	105	Psychemedics results reports, segment analyses, and lab data
09/22/09	hair/head	14-17	4	Psychemedics results report and segment analysis reports
09/22/09	hair/head	41	23	MRO documents RE: test results
10/12/09	hair/head	8	1	Omega results report
10/12/09	hair/head	48	1	DWD Drug Test Report
10/12/09	hair/head	49	3	DWD Obtain Specimen Report and custody form

B. Table: List of exhibits

Ex.#	Date	pp.	Name
1	01/30/09	1	new EMPLOYER Drug Free Workplace Policy EE acknowledgement
2	01/21/09	11	PPT of EMPLOYER Drug-Free Workplace Policy
3	06/29/09	1	Last chance agreement
4	06/18/09	2	Positive drug test result (chest hair)
5	06/29/09	1	Negative test result (urine)
6	09/22/09	1	DWD drug specimen report (head hair)
7	09/22/09	37	Positive DWD drug test report (head hair), p.1; lab results, p.4
8	10/12/09	1	Negative lab report (head hair)
9	09/26/06	5	ER drug policy and EE acknowledgment
10	09/26/12	105	Laboratory Data Package RE: additional testing of 9/22/09 head hair sample
11		12	Cairns CV
12		8	Legal Track Record: Judicial Acceptance of Psychemedics Hair Analysis
13		17	Psychemedics certifications
14	09/22/09	1	Positive DWD drug test report (head hair)

Ex.#	Date	pp.	Name
15	08/25/10	1	Additional testing of 9/22/09 1/2 inch hair sample (duplicate of Ex.10,p.5)
16	08/25/10	1	Additional testing of 9/22/09 1/2 inch hair sample (duplicate of Ex.10,p.6)
17	08/25/10	1	Additional testing of 9/22/09 1/2 inch hair sample (duplicate of Ex.10,p.7)
18		2	Psychemedics drug panel testing information
19		1	Comparison graph of hair testing to urine testing
20	04/13/04	59	FR-SAMHSA Proposed Revisions to Mandatory Guidelines for Federal Workplace Drug Testing Programs
21		12	West Fla Stat. § 440.101 and 102
22	09/05/12	2	FR-SAMHSA Current List of Laboratories and Instrumented Initial Testing Facilities Which Meet Minimum Standards To Engage in Urine Drug Testing for Federal Agencies
23	Oct. 2006	9	Stout et al., External Contamination of Hair with Cocaine: Evaluation of External Cocaine Contamination and Development of Performance-Testing Materials, Journal of Analytical Toxicology, Vol. 30 (Oct. 2006)
24	April 2007	3	Schaffer et al., Identification of Cocaine-Contaminated Hair: Perspectives on a Paper, Journal of Analytical Toxicology, Vol. 31 (April 2007)
25	April 2007	3	Stout et al., Authors' Reply, Journal of Analytical Toxicology, Vol. 31 (April 2007)
26	Aug. 2009	2	LeBeau and Montgomery, Considerations on the Utility of Hair Analysis for Cocaine, Journal of Analytical Toxicology, Vol. 33 (July/August 2009)
27	Aug. 2010	2	Pragst et al., Hair Analysis for Cocaine Continues to be a Valuable Tool in Forensic and Clinical Toxicology, Journal of Analytical Toxicology, Vol. 33 (July/August 2010)
28	Aug. 2010	2	LeBeau and Montgomery, Authors' Reply, Journal of Analytical Toxicology, Vol. 33 (July/August 2010)
29	Jan. 2009	106	Ropero-Miller and Stout, Analysis of Cocaine Analytes in Human Hair: Evaluation of Concentration Ratios in Different Hair Types, Cocaine Sources, Drug-User Populations, and Surface-Contaminated Specimens, Final Report to US Dep't of Justice, National Institute of Justice (Nov. 2008).
30	09/03/09	12	TOWN Memorial Hospital medical records RE: medications EMPLOYEE received during stay
31	11/25/08	50	FR-SAMHSA Mandatory Guidelines for Federal Workplace Drug Testing Programs
32	04/16/07	9	Bush, The US Mandatory Guidelines for Federal Workplace Drug Testing Programs: Current Status and Future Considerations, Forensic Science International 174 (2008), 111-19.
33	05/01/10	25	PPT of Bush, Review of Significant Changes in the Revised Mandatory Guidelines for Federal Workplace Drug Testing Programs

Ex.#	Date	pp.	Name
34	04/13/04	31	FR-SAMHSA Mandatory Guidelines and Proposed Revisions to Mandatory Guidelines for Federal Workplace Drug Testing Programs; Notices
35	10/05/12	1	SAMHSA letter to DWD
36		3	Excerpt from DWD/UI Disputed Claims Manual RE: Drug Testing
37	10/08/12	3	Chart of Commonly Abused Drugs and Period of detection by urine testing
38		1	Blank DWD Discharge questionnaire (Form UCB-15197)
39	11/05/09	1	DWD UI Claim Investigation -- Determination Rationale
40		3	Blank DWD Drug Test Request Letter, Drug Test Report, and Obtain Specimen Report Forms
41		23	Documents EMPLOYER supplied in response to subpoena for documents relating to EMPLOYEE's drug testing
42	10/09/12	5	Additional testing of 6/29/09 hair sample
43	06/29/09	2	Hair sample taken form (head hair)
44		23	Kidwell CV
45	11/15/04	54	Kidwell PPT
46		12	Omega Lab certifications
47		16	Rollins CV
48	10/02/12	1	10/12/09 DWD Drug Test Report (head hair sample)
49	01/06/10	3	10/12/09 DWD Specimen Report (head hair sample)
50	07/01/09	1	Negative lab report (6/29/09 head hair)
51		1	Hair graphic
52	03/06/11	7	LeBeau et al., The Role of Variations in Growth Rate and Sample Collection on Interpreting Results of Segmental Analysis of Hair, Forensic Science International 210 (2011), 110-116
53		1	Cesar Fax, Review Concludes No Racial Bias in Hair Assays, vol. 8, Issue 48 (29 November 1999).
54		3	Benjamin H. Hoffman, Analysis of Race Effects on Drug-Test Results, Journal of Occupational and Environmental Medicine, vol. 41 (July 1999), 612-14.
55		12	Mieczkowski et al., The Use of Bayes-Coefficients to Assess the Racial Bias-Hair Analysis Conjecture for Detection of Cocaine in Hair Samples, Forensic Science Communications, 9 (April 2007), __-__.
56		20	Tom Mieczkowski, The Further Mismeasure: The Curious Use of Racial Categorizations in the Interpretation of Hair Analyses, International Journal of Drug Testing, 2 (__), __-__.
57	12/19/12	20	DWD Drug Test Report and additional Psychemedics lab results for 6/29/09 testing (6/29/09 head hair)
58	01/25/13	3	Psychemedics College of American Pathologists certification

Ex.#	Date	pp.	Name
59		22	Kidwell comments on FR Doc 04-7984
60	01/04/12	3	Excerpt of College of American Pathologists forensic drug testing checklist
61	06/26/04	11	Cairns et al., Removing and Identifying Drug Caontamination in the Analysis of Human Hair., Forensic Science International 145 (2004), 97-108.
62	06/17/04	14	Selavka and Kippenberger comments on FR Doc 04-7984
63		1	Hair graphic
64		1	Hair graphic
65	04/04/02	1	Fax cover sheet from Bob Stephenson to Ray Kubacki

Appendix B: Additional cases and documents

1. Boston Police Department Drug Testing Appeals ("D" Cases), Mass. Civil Service Comm'n, (28 February 2013) (hereafter Boston Police Cases), *slip op*. (available at http://www.mass.gov/anf/docs/csc/decisions/discipline/boston-police-drug-testing-appeals-022813.pdf).

2. LeBron v. Fla. Dep't Children and Families, No. 11-15258 *slip op*. (11th Cir., 26 February 2013).

3. Nevada Employment Security Department v. Holmes, 914 P.2d 611 (Nev. 1996).

4. New York State Department of Labor, Unemployment Insurance Division, Adjudication Services Office, A-750-2109 (November 1999) (available at http://www.labor.state.ny.us/ui/aso/21.htm).

5. New York State Department of Labor, Unemployment Insurance Division, Review Letter 2-2000 (May 2000) (available at http://www.labor.ny.gov/ui/aso/rl.htm#2-2000)

6. City of Boston v. Downing, 73 Mass.App.Ct. 78, 83 (2008).

7. Broadus v. Unemployment Compensation Board of Review, 721 A.2d 70 (Pa. Commonwealth Ct. 1998).

8. US v. Fuller, USAF Ct of Crim. App., Case No. ACM 35058 (23 June 2004), *slip op*. (available at __).

9. International Journal of Drug Testing, vol.1 (available at http://www.criminology.fsu.edu/journal/volume1.html).

10. International Journal of Drug Testing, vol.2 (available at http://www.criminology.fsu.edu/journal/volume2.html).

11. International Journal of Drug Testing, vol.3 (available at http://www.criminology.fsu.edu/journal/volume3.html).

12. International Journal of Drug Testing, current status (available at http://www.criminology.fsu.edu/journal/).