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An Evaluation of Innovative Sweat-Based Drug Testing Techniques for Use in Criminal Justice Drug Testing - Final Report

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Coordination by
U.S. DEPARTMENT OF COMMERCE
Office of Law Enforcement Standards
National Institute of Standards
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This report was conducted under the direction of Alim A. Fatah, Program Manager for Chemical Systems and Materials, and Kathleen M. Higgins, Director of OLES.

FOREWORD

The Office of Law Enforcement Standards (OLES) of the National Institute of Standards and Technology (NIST) furnishes technical support to the National Institute of Justice (NIJ) program to strengthen law enforcement and criminal justice in the United States. OLES's function is to develop standards and conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

OLES is: (1) Subjecting existing equipment to laboratory testing and evaluation, and (2) conducting research leading to the development of several series of documents, including national standards, user guides, and technical reports.

This document covers research conducted by OLES under the sponsorship of the NIJ. Additional reports as well as other documents are being issued under the OLES program in the areas of protective clothing and equipment, communications systems, emergency equipment, investigative aids, security systems, vehicles, weapons, and analytical techniques and standard reference materials used by the forensic community.

Technical comments and suggestions concerning this report are invited from all interested parties. They may be addressed to the Office of Law Enforcement Standards, National Institute of Standards and Technology, 100 Bureau Drive, Stop 8102, Gaithersburg, MD 20899–8102.

Kathleen M. Higgins, Director
Office of Law Enforcement Standards

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TABLES

COMMONLY USED SYMBOLS AND ABBREVIATIONS

A	ampere	hf	high frequency	o.d.	outside diameter
ac	alternating current	Hz	hertz	Ω	ohm
AM	amplitude modulation	i.d.	inside diameter	p.	page
cd	candela	in	inch	Pa	pascal
cm	centimeter	IR	infrared	Pe	probable error
CP	chemically pure	J	joule	pp.	pages
c/s	cycle per second	L	lambert	Ppm	parts per million
d	day	L	liter	Qt	quart
dB	decibel	lb	pound	Rad	radian
dc	direct current	lbf	pound-force	Rf	radio frequency
°C	degree Celsius	lbf·in	pound-force inch	Rh	relative humidity
°F	degree Fahrenheit	lm	lumen	S	second
dia	diameter	ln	logarithm (base e)	SD	standard deviation
emf	electromotive force	log	logarithm (base 10)	sec.	section
eq	equation	M	molar	SWR	standing wave ratio
F	farad	m	meter	uhf	ultrahigh frequency
fc	footcandle	μ	micron	UV	ultraviolet
fig.	figure	min	minute	V	volt
FM	frequency modulation	mm	millimeter	vhf	very high frequency
ft	foot	mph	miles per hour	W	watt
ft/s	foot per second	m/s	meter per second	λ	wavelength
g	acceleration	mo	month	wk	week
g	gram	N	newton	wt	weight
gr	grain	N·m	newton meter	yr	year
H	henry	nm	nanometer		
h	hour	No.	number		

area = unit^2 (e.g., ft^2, in^2, etc.); volume = unit^3 (e.g., ft^3, m^3, etc.)

PREFIXES (See ASTM E380)

d	deci (10^{-1})	da	deka (10)
c	centi (10^{-2})	h	hecto (10^{2})
m	milli (10^{-3})	k	kilo (10^{3})
μ	micro (10^{-6})	M	mega (10^{6})
n	nano (10^{-9})	G	giga (10^{9})
p	pico (10^{-12})	T	tera (10^{12})

COMMON CONVERSIONS

0.30480 m = 1 ft	4.448222 N = 1 lbf
25.4 mm = 1 in	1.355818 J = 1 ft·lbf
0.4535924 kg = 1 lb	0.1129848 N m = 1 lbf·in
0.06479891g = 1gr	14.59390 N/m = 1 lbf/ft
0.9463529 L = 1 qt	6894.757 Pa = 1 lbf/in^2
3600000 J = 1 kW·hr	1.609344 km/h = 1 mph

psi = mm of Hg x (1.9339×10^{-2})

mm of Hg = psi x 51.71

Temperature: $T\ °_C = (T\ °_F - 32) \times 5/9$

Temperature: $T\ °_F = (T\ °_C \times 9/5) + 32$

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Introduction

Drug testing is used at all points in the criminal justice system—from pretrial to incarceration. Results are used to help make decisions about pretrial release, probation, and parole. Noninvasive drug detection is one of the priority areas of research established by the Law Enforcement and Corrections Technology Advisory Council (LECTAC). LECTAC reviews and analyzes the present and future technological needs of the criminal justice system. The Council uses this information to recommend research and development priorities to NIJ. Its members are appointed based on their records of distinguished service and include representatives from Federal, State, local, and international criminal justice agencies and organizations.

To improve the practice of drug testing in the criminal justice system, the National Institute of Justice (NIJ) funds research into new methods and evaluates the potential of alternative techniques. Research areas include the use of hair, saliva, and sweat as alternatives to urinalysis for drug testing. Types of investigation include evaluation of available collection devices, possible adaptation of such devices for use in the criminal justice system, development of quality assurance programs and standard reference materials, and improved methods for interpreting test results. This final report presents the results of the project "An Evaluation of Innovative Sweat-Based Drug Testing Techniques for Use in Criminal Justice Drug Testing." This three-year project was a collaborative effort between the Institute for Social Analysis (ISA), the prime contractor, and the University of Utah's Center for Human Toxicology (CHT), the sub-contractor.

This project assessed the feasibility of adapting a device originally designed to collect liquid perspiration from infants to test for cystic fibrosis (the Macroduct®)* for use in criminal justice settings to test for drug use (as an alternative to urinalysis and the sweat patch). The primary focus of this report is a comparison of liquid perspiration test results to urinalysis and sweat patch results, and an assessment of participant's perceptions of the different collection methods. Results from both a pilot study and subsequent field study are reported. Both studies were conducted in collaboration with the Pretrial Services Agency (PSA) in Washington, DC.

The authors would like to acknowledge Wayne Barlow, President; Kent Thomas, Business Manager; Lewis Webster, Senior Scientist; and Dennis Briscoe, Chief Engineer from Wescor, Inc., for their assistance to modify the collector, and the technical assistance provided in this regard. The authors would also like to acknowledge the cooperation and support of Mr. Jerome Robinson and his staff from the PSA. Without the support and cooperation of Wescor and PSA, the pilot and field studies could not have been successfully completed.

*Certain products or materials are identified in this paper to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology (NIST), nor does it imply that the products are necessarily the best available for the purpose.

1. BACKGROUND

1.1 General

After a brief overview of the project, this section describes the rationale for the project and reviews pertinent research on drug testing in criminal justice settings.

1.2 Project Overview

Also discussed in this section are the results of a pilot study. The pilot study gathered data on criminal justice system subjects' perceptions about the use of the Macroduct, developed drug testing methods for liquid perspiration (LP), and compared drug test results from urine, the sweat patch, and LP.

The project began May 1999 and was conducted over a period of three years. Project objectives were as follows:

- Modify and test innovative, less invasive, liquid perspiration (LP) collection devices.
- Adapt drug screening kits for use in analyzing LP specimens and develop drug confirmation methods.
- Assess the validity and utility of the LP collection device as a method of drug testing with criminal justice populations.
- Perform a pilot study to assess the utility of using LP as a testing specimen in a criminal justice population.
- Perform a field study to fully assess the procedures and evaluate the results of the pilot study in a criminal justice population.

The pilot and final projects were conducted in conjunction with the Pretrial Services Agency (PSA) in Washington, DC. This agency, a pioneer in the applications of drug testing to criminal populations, currently drug tests approximately *155 000* urine specimens annually using an in-house, high-speed auto-analyzer. The PSA is an ideal field study site because the agency tests several hundred arrestees *daily*, the majority of whom test positive for one or more drugs; and the agency has previously participated in field test trials of innovative drug tests.

1.3 Drug Testing in the Criminal Justice System

Drug testing is widely used throughout the criminal justice system. Major uses include pretrial drug testing, used to make decisions about probation or pretrial release, and to supervise drug-involved defendants more closely (Visher, 1992); post-adjudication testing of drug offenders by probation and parole departments (Turner, et al., 1994); and testing of law enforcement personnel (Reaves, 1992). In addition to these major programs, drug testing is also a significant element in drug courts (Goldkemp and Weiland, 1993) and programs designed to assess drug use among juvenile detainees (Dembo et al., 1990). Moreover, data on the effectiveness of drug testing is sufficiently supportive that testing is likely to expand throughout the criminal justice system (Mieczkowski and Lersch, 1997).

Currently, most drug testing in criminal justice is based on analysis of urine specimens by immunoassay (screening) and gas chromatography/mass spectrometry (GC/MS) (confirmation). Although recently alternative testing techniques such as hair analysis and on-site kits have become more common (NIJ, 1996), laboratory-based urinalyses remain the "gold standard" by which other methods are assessed. However, despite its advantages, urine testing involves collection methods that are invasive—often discomforting to donor and collector alike—and which typically require burdensome facilities and procedures. It is highly desirable to develop a practical, cost-effective method of drug testing that is as reliable as urine testing, but less invasive.

Among the alternative technologies that are in various stages of development are hair, perspiration, and saliva analyses. Hair analysis is perhaps the most advanced of these technologies with several commercial laboratories currently performing hair testing. Researchers have begun to test its efficacy in criminal justice settings (Mieczkowski, et al., 1993). However, because of potential problems with contamination and hair color bias, the accuracy and utility of hair analyses remain in question (Cook, et al., 1995; and NIJ, 1996). In principle, the analysis of other body fluids, such as perspiration and saliva should offer the most promising noninvasive means of drug testing.

Several devices are now commercially available for saliva testing. However, little is known about the utility of these devices or how drugs and their metabolites are transferred from blood to saliva. In addition, immediately after smoking or orally ingesting a drug, the oral cavity may be contaminated by the drug leading to falsely elevated saliva-drug concentrations. Also, drug concentrations in saliva appear to vary by method of collection (O'Neal, et al., 2000). Therefore, among the less invasive methods, sweat testing appears the most promising, and the new LP collection devices offer a practical and noninvasive means of specimen collection. These devices are discussed below.

1.4 Sweat Testing

Sweat has been extensively studied as a potential clinical diagnostic fluid. Several sweat collection methods are described in the literature such as skin blotting, skin wipes, capillary tubes, sweat patches, and iontophoresis (Kidwell et al., 1998). Techniques such as blotting and skin wipes often rely on occlusive sweat stimulation and collection. The limb or site of collection is placed in an impermeable environment such as a plastic bag. Sweat produced by the limb is trapped in the occlusive bag. The skin can then be blotted with an absorbent material or wiped with a specially designed absorbent skin wipe. The quantity of sweat collected is estimated by comparing the precollection and postcollection weights of the blotter or wipe.

Liquid perspiration also can be harvested from the occlusive bag using a calibrated capillary tube. Nonocclusive LP collection techniques have also used blotters, skin wipes, and capillary tubes. Sweat is harvested from perspiration that accumulates on the skin. Different absorbent materials such as gauze and specially formulated materials have been used for these collections. Blotting and skin wiping have obvious limitations. Physiological materials such as sebum, statium corneum, and drugs or chemicals deposited on the skin may be collected in addition to the LP. The blotters and skin wipes may be inconsistent in texture and weight, making collections time-consuming and problematic. Capillary tube collections also have limitations. The tubes are fragile

and must be graduated by volume. In addition, capillary tube collections rely on having recognizable liquid perspiration on the skin surface.

Sweat collection devices have been cleared for clinical applications and for drugs of abuse testing. Sweat may be collected on tamper-proof absorbent patches. The patches are applied to the subject with a simple adhesive and may be worn for extended periods of time. While the patch is worn, sweat is absorbed and drug(s) and their metabolite(s) are deposited on the sweat patch pad. Several studies have been performed to evaluate the efficacy of detecting drug use with sweat patch testing (Burns and Baselt, 1995; Fogerson, et al., 1997; and Kintz, et al., 1996). These studies have shown that the patches are particularly useful in criminal justice settings where constant surveillance through use of the sweat patch has detected drug use that was not detected by discrete urinalysis tests; and several drugs of abuse such as amphetamine and methamphetamine, heroin, morphine, methadone, marijuana, and phencyclidine have been detected in sweat (Baer and Booher, 1994). The patches are also potentially useful in drug treatment and parole/probation programs where abstinence is used as a measure of treatment compliance and recidivism can be monitored by having the patient continuously wear a patch.

A limitation of sweat testing is that little is known about the deposition of drugs into sweat; therefore, interpreting test results can be difficult. For example, the authors do not know the minimum dose of most drugs that needs to be ingested for the drug(s) to be detected in the patch. Currently, we cannot predict how long after ingestion drugs of abuse can be detected in liquid perspiration. The volume of sweat collected by the patch is unknown. This precludes meaningful (drug/microliter of LP) quantitative analysis of drugs detected and, again, limits the interpretative value of the results. The cost of sweat patch testing is about the same as urinalysis testing. However, since drug concentrations are lower and the entire patch is consumed for a single conformational analysis, repeat testing and confirmation of multiple drugs are precluded.

The Webster Sweat Collection System was introduced in 1978 as one of the first systems designed to collect LP (Webster and Barlow, 1981). It is currently marketed as the Macroduct and used to harvest LP from infants for use in the early diagnosis of cystic fibrosis (Carter, et al., 1984; and Hammond, et al., 1994). The system has been cleared by the Food and Drug Administration (FDA), and has been designed for use with infants and children. Therefore, it is extremely safe for both the collector and the donor. The entire system is compact and portable (9.2 cm x 4.5 cm x 15.5 cm, weighs 0.4 kg) and fits into a carrying case no larger than that used for a laptop computer. The system consists of pilocarpine discs, a portable power supply that provides a micro current to induce "iontophoresis," and the LP collector.

Pilocarpine is a naturally occurring alkaloid that can be extracted from plants. It is used medically to treat glaucoma, but also stimulates salivation and sweat production. In the LP collection process, a small electrical current (microamps) promotes transfer of ionized pilocarpine from the disk through the skin to the sweat glands where it stimulates sweat production. The collector is attached to the donor's forearm, and a capillary tube fills with LP by hydrostatic pressure.

There are several potential advantages to the use of this collector and LP for drug testing in the criminal justice system. First, sensible sweat is collected. This LP is actively produced at the time of collection and, therefore, the drug concentrations may reflect blood drug concentrations. The collection process can be fully witnessed, thereby ensuring the integrity and identity of the

sample. The drug content in liquid samples can be quantified such that drug test results can be reported in concentration/microliter of LP, improving the potential for meaningful interpretation. Due to the compactness of the Macroduct, mobile collections are feasible, and no special facilities are needed in the entire collection process. A significant potential advantage over the sweat patch is that liquid samples could potentially be analyzed at the site of collection by laboratory-based immunoassay tests or by on-site test kits.

However, there are also disadvantages to the current version of the collection device. The price currently exceeds that of patch testing ($7/sweat collection vs. $5/sweat patch). An initial investment of $1575 is needed for the power supply. A second disadvantage is that collection of 50 μL to 60 μL of LP may take 10 min to 15 min. However, this collection time is not that much in excess of the time required for a urine collection. An additional disadvantage is that the device is designed for micro-collection, and the volume of LP collected may limit the type and number of analyses that can be performed. These potential disadvantages were addressed in this project.

1.5 Pilot Study

1.5.1 Introduction

The first phase of the research was a pilot study designed to gather data on criminal justice system subjects' perceptions about the use of the Macroduct, to develop drug testing methods for LP, and to compare drug test results from urine, the sweat patch, and LP.

1.5.2 Methodology

Subjects were recruited and specimens collected onsite at the pretrial agency's satellite office that serves several hundred clients daily. Data collection occurred during regular office hours over a 3-week period in early 2000 (Crouch, et al., 2001; and Crouch, et al., 2002). All arrestees who were required to report to the satellite site for drug testing were eligible to participate in the project, and a $20 cash stipend was provided at the end of each session. Thirty-two arrestees participated in the pilot study. Written informed consent was obtained from each participant, and researchers emphasized that the drug test results would not be used in the participant's legal proceeding.

The pilot study involved two sessions of data collection that were one week apart. During session one, a sweat patch was applied to each participant, and he or she provided a urine and a LP specimen. After specimen collection and sweat patch application, participants completed a brief questionnaire about their recent drug use and their perceptions of the collection procedures. Participants were scheduled to return approximately one week later for session two during which the sweat patch was harvested, and he or she provided a second urine and an LP specimen, and completed a second questionnaire.

1.5.3 Results

Volunteers rated the urine, sweat patch, and liquid perspiration collections on four dimensions: 1) discomfort, 2) lengthiness of collection, 3) unpleasant sensations, and 4) embarrassment. Analysis of variance revealed that the discomfort ratings for the liquid perspiration and urine collections did not demonstrably differ. Likewise, differences in ratings of lengthiness of the

collection were not significantly different. In addition, the unpleasantness experienced during collection did not differ significantly. However, subjects tended to rate urine as the most embarrassing collection procedure (Crouch, et al., 2002).

LP specimens collected with the commercial Macroduct system typically took about 30 min, and approximately 60 µL was collected. Because it was important to keep the collection time to a minimum for criminal justice practitioners and donors, and to maximize the volume of LP collected, alternative methods were explored to increase the rate of LP collection. Those included increasing the pilocarpine concentration in the induction disks, increasing the induction voltage, using more than one collection device, and modifying the collection device. Under subcontract, the manufacturer developed a modified collector with larger induction and collection surface areas. During the pilot study, LP volumes collected with the standard collector ranged from 0 µL to 85 µL (the maximum capacity) with a mean of 36.4 µL and a median of 33.5 µL. With the modified collector, specimen volumes ranged from 0 µL to 199 µL with an average of 79.3 µL and a median volume of 71.0 µL.

Methods were developed and validated using enzyme immunoassay (EIA) to screen the LP specimens for tetrahydrocannabinol (THC), cocaine, opiates, phenylcyclidene (PCP), amphetamine, and methamphetamine. The cutoff concentrations are shown in table 1 below. Considerable effort went into selecting and validating the methods due to the small volumes of LP available for testing and the very low cutoff concentrations needed for effective testing. In addition to selecting a suitable screening technique for testing the LP, the study developed and validated methods to confirm and quantify drug(s)/metabolite(s) in LP. The most promising MS technologies, such as chemical ionization, gas chromatograph/mass spectrometer (GC/MS), and liquid chromatography/mass spectrometry/mass spectrometry (LC/MS/MS), were evaluated. Summaries of the methods developed for LP confirmation testing are shown in table 2.

Table 1. Summary of LP testing cutoff concentrations*

	Cocaine	PCP	THC/COOH**	Amp/Meth***	Opiates
Screen Cutoff (ng/mL)	5	<5	5	5	<5
Confirmation Cutoff (ng/mL)	0.5	0.25	1	20	1

* The available immunossays were established to determine their limit of sensitivity in sweat in selecting these cutoffs.

** Tetrahydrocannabinol carboxylic acid.

*** Amphetamine and methamphetamine.

Table 2. Summary of LP confirmation methods

Analytes	Cocaine*	PCP	THC/COOH	Amphetamines**	Opiates***
Method	LC/MS/MS	LC/MS/MS	GC/MS	LC/MS/MS	LC/MS/MS
Extraction	Solid Phase	Solid Phase	Solid Phase	Liquid/Liquid	Solid Phase
Calibrators (ng/mL)	0, .5, 1, 5, 10, 25, 50, 100, 125, and 150	0, .25, .5, 1, 5, 10, 25, 50, and 100	0, 1, 2, 4, 10, 25, 100, 150, 200, and 250	0., 20, 50 100, 250, 500, and 1000	0, 1, 5, 10, 25, 50, 200, 250, and 500
Internal Stand	D3	D5	D3	D5/D8	D5
Amount (ng)	50	5	10	100	50

* Cocaine, benzoylecgonine, and ecgonine methyl ester.

** Amphetamine, methamphetamine, phentermine and over-the-counter sympathomimetic amines.

*** Morphine, codeine, 6-acetylmorphine, and heroin.

Drug test results from the pilot urine, sweat patch, and LP specimens showed that 12 urine specimens tested negative when drugs were detected in the corresponding LP specimens. One sweat patch tested negative when the urine or LP specimens tested positive. Only two LP specimens tested negative when the sweat patch was positive.

1.5.4 Conclusions

Several conclusions were reached from the study. LP could be harvested in criminal justice settings. The collection of LP was considered noninvasive, it could be totally observed, and the procedure was well tolerated by the subjects. Subjects found the Macroduct collection no more unpleasant and significantly less embarrassing than a urine collection. Drugs of abuse and their metabolites were excreted in LP. This was suggested by the research that has been reported using the sweat patch, but had not actually been demonstrated until this study was performed.

The volume of LP collected was a limitation. A typical collection was 40 μL to 80 μL. This volume was sufficient to either screen for the drugs of abuse, or to perform a limited screen and confirm no more than one or two drugs. However, LP may be a preferable specimen to urine for the detection of drug use because it appeared to be a good to excellent sample for the detection of opiates and cocaine; and it was consistent with urine and outperformed the sweat patch for the detection of PCP. However, it was outperformed by the urine and the sweat patch for the detection of cannabinoids. Further study of the collection and analysis of LP was needed to fully understand the advantages and limitations of the specimen. This was particularly true because no volunteers tested positive for amphetamine(s), only one tested positive for cannabinoids, and one tested positive for PCP.

2. METHODOLOGY

2.1 Introduction

Several important aspects of the field study methodology are discussed below, including site preparations, selection of the sweat collection device, data collection procedures, and the laboratory analytical methods.

2.2 Site Preparations

ISA staff met with the PSA Laboratory Director in March 2001 for the purpose of making final plans for the full field study. The design and general procedures of the study were discussed with PSA officials with particular attention to specific locations for data collection and the procedures by which subjects would be recruited. Afterward, the PSA Director provided a tour of PSA's various drug-testing and laboratory units, thus providing insight into their procedures and how the field study operations dovetailed into those of PSA. Finally, it was agreed that data collection for the field study would commence in early April 2001.

2.3 Selection of a Collection Device

As discussed from the literature and the pilot study, two sweat collection devices showed promise for use in this project: the sweat patch and the LP collection device. The patch is FDA cleared for drugs of abuse testing, and the LP collection system is FDA cleared for clinical applications such as harvesting sweat for the diagnosis of cystic fibrosis. The sweat patch is a nonocclusive collection device that has been developed specifically to harvest perspiration for testing for drugs of abuse. The patches are approximately 5.1 cm x 7.6 cm (2 in x 3 in) and resemble large band-aids. The patches have an outer hypoallergenic adhesive layer that is permeable to small molecules, such as water vapor, and an absorbent pad. Each sweat patch has a unique identifier for subject tracking, and the patch is tamper-resistant. The patch is attached to the subject's upper arm, chest, or lower back and typically is worn for 7 d to 14 d. While the patch is worn, drug(s) and their metabolite(s) that are in the sweat are deposited on the pad. Several studies have shown that the patches are particularly useful in criminal justice settings (Burns, 1995; Fogerson, et al., 1997; and Kintz, 1996). These findings were validated in the pilot study, and the patch was selected for comparison to LP and urine in the field study (Crouch, et al., 2001, and Crouch, et al., 2002).

There were disadvantages to the commercial version of the LP collection system. The major disadvantages were that it collected <100 μL of sweat, and the collection took up to 30 min. Although the collection time appears protracted, it is not that much longer than the time required for a urine collection when custody and control forms must be completed. The collection volume was a problem given that drug screening usually requires 10 μL to 50 μL of sample/drug and MS confirmations typically require 1 mL of sample/drug. It was important to minimize the collection time and to maximize the volume of LP collected. Therefore, through improved testing methods, discussions with the manufacturer, and the experimentation presented in the pilot study report, we were able to improve the LP collection and the drug detection, and the modified collection device was used in the field study.

2.4 Data Collection Procedures

Data were collected onsite at two PSA offices that served several hundred clients daily. Data collection occurred during regular office hours over a six-month period, beginning in April 2001 and ending in September 2001. All arrestees who were required to report to the two offices for drug testing were eligible to participate in the project, and a $20 cash stipend was provided at the end of each session. Participants were recruited mainly through flyers posted in the offices; a few participants were recruited face-to-face by the analyst.

A total of 204 arrestees participated in the study. There were 89 two-session subjects (group A) and 115 one-session subjects (group B). When a subject volunteered, he or she was randomly assigned as a group A or group B participant. The analyst explained the study and its basic procedures, and a written informed consent was obtained from each participant. The informed consent advised participants that their questionnaire responses and drug test results would be confidential and the test results would not be used against them in any legal proceeding. Additionally, researchers and agency staff emphasized that the test results would not affect participant involvement in their pretrial obligations.

For group A, the two sessions of data collection were approximately one week apart. During session one, each participant provided a urine and an LP specimen, and a sweat patch was applied. While the LP specimen was collected (which required 20 min to 30 min), the drug survey was administered. During session two, the sweat patch was harvested, the subject was provided a second LP and urine specimen, and the subject completed a second drug survey.
Group B subjects had a single session. The participants provided a urine and an LP specimen, and completed a drug survey.

LP collection began with an introduction to the equipment and procedures and an opportunity for participants to have their questions and concerns addressed. Then the electrodes with the gel-disks containing pilocarpine were attached to the participant's lower arm. The inducer was activated and a low-level current established for approximately 2 min to 3 min. After induction, the modified (larger) LP collector was placed over the area where the induction had occurred and it was secured to the subject's arm with a Velcro strap. The LP was collected into the spiral-capillary holding tube portion of the collector. Throughout the process, the research assistant adhered strictly to the manufacturer's instructions for collection. At the conclusion of the LP collection, both the volume collected and the duration of the collection were recorded. The specimens were then transferred via a blunt-needle syringe into glass storage vials, and the vials were labeled with unique study identification numbers. The collection site was cleansed using the manufacturer's recommended procedures to ensure against specimen contamination.

If the participant was assigned to group A, a sweat patch was applied to the lower ribcage or upper arm of each participant. Participants were asked to leave the patch in place for one week and were given instructions for care. Again, the manufacturer's instructions were followed explicitly.

After specimen collection and sweat patch application, participants completed a brief survey about their recent drug use and their perceptions of the collection procedures. This survey asked participants to rate the LP and urinalysis collection procedures on four dimensions: discomfort,

lengthiness of collection, unpleasant sensations, and embarrassment. Ratings were made on a 3-point scale (0 to 2), with 0 being the most negative response. Participants were also asked which procedure they liked most and which they liked least. The final section of the questionnaire asked participants to report how frequently they had used a variety of illicit drugs in the last 30 d, and how recently they had used the drugs. Participants were asked to rate the sweat patch procedure only at session two, when the patch was harvested.

Group A participants were scheduled to return approximately one week later for session 2 specimen collections. Participants were told that they would again receive the incentive ($20) for completing session two.

Urine specimens were collected from most subjects. However, many subjects had just provided a specimen for the PSA. For these subjects, an aliquot was obtained from the agency's specimen. In approximately 1/3 of the subjects, no aliquot was available. Therefore, the PSA provided their drug screening results for these subjects. In group A, 126 urine (screen results were provided for 35 additional specimens), 83 sweat patch, and 177 LP specimens were collected. In group B, 81 urine (screen results were provided for 34 additional specimens) and 115 LP specimens were collected.

2.4.1 Sample Characteristics

The sample was mostly male (73 % male, 27 % female), African American (97.3 % African-American, 1.8 % White, and 0.9 % Hispanic/Latino), with a mean age of 39.1 years. The educational level of the majority of the subjects was high school graduate (38.5 %) or less (38 %). Less than 1/5 (19 %) had attended college, and only 4.5 % were college graduates.

2.4.2 Data and Specimen Handling

All specimens were labeled with study identification numbers to ensure confidentiality and allow matching of the survey and specimen data. Survey data were processed and analyzed at ISA, and the biological specimens were analyzed at CHT.

All specimens were treated as biohazards during collection and handling. For shipping, they were cold-packed and forwarded to CHT via overnight courier. Upon receipt at CHT, the specimens were segregated into group A and group B specimens and encoded with a unique intra-laboratory identifier. Urine specimens from group A were identified by session one (U1) and session two (U2). Similarly, LP specimens from group A were identified by session one (LP1) and session two (LP2), and the sweat patches as SP. Urine specimens from group B were identified by "UX" and LP specimens as "LPX." All specimens were then stored in secure freezers awaiting analysis. For testing, CHT thawed the specimens and removed an aliquot for each analysis.

2.4.3 Analytical Methods

Urine specimens were screened by automated laboratory-based EIA using the standard urine cutoff concentrations: cocaine, 300 ng/mL; opiates, 300 ng/mL; cannabinoids, 50 ng/mL; PCP, 25 ng/mL; and amphetamines, 1000 ng/mL (DHHS, 1993). All presumptive positive specimens (detected at CHT) were confirmed by MS. Some specimens were tested at PSA with similar

screening methods, however, aliquots of those specimens were not always available for confirmation (see above). Urine confirmations were performed by LC/MS. Each confirmation batch contained a drug-free sample and multiple calibrators. One milliliter aliquots of each presumptive positive specimen, calibrator, or quality control samples were processed. Deuterium labeled internal standards were added to each sample for qualitative drug identification by relative retention time and for quantitation of the analyte. Urine confirmation cutoff concentrations were cocaine, 25 ng/mL; opiates, 10 ng/mL; cannabinoids, 50 ng/mL; PCP, 5 ng/mL; and amphetamines, 25 ng/mL. A cocaine confirmation consisted of analyzing for cocaine and benzoylecgonine. An opiate confirmation included morphine, codeine, and 6-acetylmorphine. For cannabinoids, urine specimens were analyzed for the presence of THC-COOH. An amphetamines confirmation included methamphetamine, amphetamine, methylenedioxymethamphetamine (MDMA), methylenedioxyamphetamine (MDA), and methylenedioxyethylamphetamine (MDEA).

Sweat patches (SPs) were eluted with 2.5 mL of buffer and screened by EIA to the following cutoff concentrations: cocaine, 5 ng/mL; opiates, 5 ng/mL; cannabinoids, 1 ng/mL; PCP, 5 ng/mL and amphetamines, 10 ng/mL (STC, 1996 and 1997). All presumptive positive SPs were confirmed by LC/MS for all drugs except the cannabinoids (GC/MS). Procedures were analogous to the urine confirmation procedures — each batch contained a drug-free sample and multiple calibrators and 1 mL aliquots of each presumptive positive specimen, calibrator, or quality control samples was extracted. Deuterium labeled internal standards were added to each sample for qualitative identification of the drug or metabolite and for quantitation. The SP confirmation cutoff concentrations were cocaine, 5 ng/mL; opiates, 5 ng/mL; cannabinoids, 1 ng/mL; PCP, 5 ng/mL; and amphetamines, 10 ng/mL. A cocaine confirmation consisted of analyzing for cocaine and benzoylecgonine. An opiate confirmation included morphine, codeine and 6-acetylmorphine. For cannabinoids, the SPs were analyzed for both THC and THC-COOH. An amphetamines confirmation included methamphetamine, amphetamine, MDMA, MDA, and MDEA.

As discussed, specific methods were developed and validated during the pilot study for the analysis of the LP specimens (Crouch, 2002). Two promising laboratory-based immunoassays were selected for evaluation: enzyme immunoassay (EIA) and radioimmunoassay (RIA). (STC, 1996 and 1997; and Fay, et al., 1996). The EIA test kits showed more promise for drug detection in LP than RIA, especially for the detection of THC, THC-COOH, codeine, and morphine. The EIA screening cutoff concentrations and target analytes for LP are shown in the table presented previously.

The LP analyses by MS were especially challenging because the volume of LP collected was typically in microliters and the expected drug concentration (given the pilot study results) were ng/mL. The LP specimen volumes and drug concentrations are in marked contrast to urine collections that are typically in excess of 100 mL and urine-drug concentrations that are usually 10 or more times those of LP. Therefore, we developed chemical ionization GC/MS, LC/MS, and LC/MS/MS methods for the confirmation of the target drugs in LP. Summaries of the methods, drugs tested for, and cutoff concentrations are shown in tables 1 and 2 above.

2.4.4 Laboratory Analysis

Group A subjects attended two sessions and had two urine specimens, two LP specimens, and an SP collected. To assess the potential correlation between LP drug test results and those of urine and SP, the U1, U2, and SP specimens were screened for all drugs, and the presumptive positive specimens were confirmed for the suspected drug by MS. The screening and confirmation methods just discussed were used. The LP specimen volumes were insufficient to screen for all drug classes and to confirm the presumptive positive results by MS. Therefore, we performed MS confirmations on the LP specimens for those cases in which either the U1, U2, or SP specimen screened positive for one or more drugs. In addition, we randomly selected 25 cases where both the urine and SP screening results were negative and performed drug screens on both the LP1 and LP2 specimens. Confirmations were not performed on these specimens due to the limited LP volumes.

Group B subjects attended one session and had one urine and one LP specimen collected. To assess the utility of LP as a screening specimen, the urine and the LP specimens from group B subjects were screened for the target drug classes. In addition to the standard menu of LP screens, the LP specimens were tested by EIA using both an amphetamine targeted EIA and a methamphetamine targeted EIA. The methamphetamine cutoff concentration was 5 ng/mL. No MS confirmations were performed because the LP volume was insufficient to screen and confirm all drugs. However, 10 LP samples that screened positive for cocaine were randomly selected for confirmation of that drug.

3. RESULTS

3.1 Characteristics of Liquid Perspiration Collection

3.1.1 LP Collection Rates and Volume

Based on session one data (first session for group A and only session for group B), LP collections took an average of 24.2 min (median = 25 min) and resulted in a mean collection of 85.5 μL (median = 71 μL) of sweat. The mean rate of LP collection was 3.92 μL/min (median = 3.23 μL/m). For group A, there was no significant difference between the first and second session collection times, volumes of LP collected, or the rates of collection (*t*-tests).

3.1.2 Demographic Differences in Amount of Sweat Collected

In both first and second sessions, there were significant gender differences in the rate of LP collection. In the first session, males produced LP at the rate of 4.23 μL/min and females at the rate of 2.50 μL/min ($t[149.65]=5.51, p < .001$). In the second session, males produced LP at a rate of 4.48 μL/min and females at 2.35 μL/min ($t[65.86] = 4.51, p < .001$). There was a weak correlation between level of education and rate of LP collection (Spearman's rho [209]=0.20, $p < .01$). There were no significant differences in LP collection rates based on age. Ethnicity was not considered independently because there were too few White and Latino subjects.

3.1.3 Participant Attitudes Toward the LP Collection Procedure

Participants were asked to rate the "discomfort," "unpleasantness," "duration," and "embarrassment" of the urine, LP, and sweat patch collection procedures. Unpleasantness was rated on a 0 to 3 scale; the other perceptions were rated on 0 to 2 scales, with "0" being most negative. Data were analyzed separately for first and second session collections.

Repeated measures of the analysis of variance (ANOVA) of first session ratings showed significant differences between the LP and urine collections on all measures. Subjects reported being significantly more comfortable during the LP collection (mean = 2.01) than the urine collection (mean = 1.68), $t[199] = 4.27, p < .001$). Subjects reported fewer unpleasant feelings with the LP (mean = 1.61) compared to the urine collection (mean = 1.39), $t[201] = 3.51$, $p < .001$. Subjects were less embarrassed by the LP collection (mean = 1.90) than by urine collection (mean = 1.51), $t[199] = 7.57, p < .001$. However, the urine collection was perceived to take significantly less time (urine mean = 1.72, LP mean = 1.45), $t[200] = -4.89, p < .001$.

Repeated measures of the ANOVA of the second session perceptions showed significant differences similar to those observed in session one. The subjects rated LP and SP similar to each other for the measures. However, the LP and SP ratings were significantly different from the urine collection ratings. Subjects were significantly more comfortable with the LP (mean = 2.04) and SP (mean = 2.01) procedures than the urine collection procedures (mean = 1.77), $F[2,168] = 6.04, p < .003$. The respondents reported experiencing fewer unpleasant feelings with the LP (mean = 1.72) and SP collections (mean = 1.73) than with the urine collection (mean = 1.46), $F[2,168] = 9.63, p < .001$. In addition, the subjects reported that they were less embarrassed by the LP (mean = 1.91) and SP collection (mean = 1.94) than by urine collection (mean = 1.55), $F[2,168] = 22.83, p < .001$. As with the first session results, the urine collection was perceived to take significantly less time (mean = 1.77) than either the LP (mean = 1.52) or SP collection (mean = 1.42), $F[2,166] = 11.42, p < .001$.

A comparison of the ratings for the LP and urine collections between the first and second sessions demonstrated no significant differences. Therefore, the subject's attitudes about the collection procedures did not change significantly between sessions one and two. (Note: there were no SP collections at the first session).

3.2 Self-Reported Drug Use

The questionnaire included a drug use section that required the subjects to report if they had used marijuana, cocaine, heroin, or hallucinogens during the previous 30 d. The percentages of subjects reporting using/not using the drugs at the first and second sessions are shown in tables 3 and 4.

Table 3. Percentage of subjects reporting using/not using drugs

Drug/Drug Category	% Not Using	% Using
Marijuana	83 %	17 %
Cocaine/Crack	75.5 %	24.5 %
Heroin	88 %	12 %
Hallucinogens	95 %	5 %

Table 4. Percentage of subjects reporting using/not using drugs at session two

Drug/Drug Category	% Not Using	% Using
Marijuana	87 %	13 %
Cocaine/Crack	83 %	17 %
Heroin	94 %	6 %
Hallucinogens	96.5 %	3.5 %

The self-report data in these tables are compared to those from analysis of the biological specimens below.

3.3 Results: Biological Specimens

3.3.1 Group A

Group A subjects attended two sessions and had U1, U2, LP1, and LP2 specimens as well as an SP collected. Both the urine and the SP specimens were screened for all 5 drug classes, and the presumptive-positive screening results were confirmed by MS. MS analyses were then performed on the LP1 and LP2 specimens from all subjects whose urine or SP specimen(s) screened positive. The detailed tables in the group A appendix show the results of the urine screening (U1, U2), a summary of the urine specimens that screened positive, the MS confirmation results, and a list of the samples that were screened positive at PSA. An analogous set of tables in the appendix shows the detailed results of the SP screening, a summary of the screened-positive specimens and the MS confirmation results for the specimens that screened positive. Also included is a table titled "Group A Summary of Urine, Sweat Patch, and LP Results." This table presents the U1, U2, and SP screening results and the MS results for the urine, SP, and LP specimens. Recall that 25 group A subjects were randomly selected in which both the urine and SP specimens screened negative and drug screens were performed on their LP1 and LP2 specimens. Those data are shown in detail in the appendix table titled "Liquid Perspiration Screen Results Group A "Negative" Samples" and discussed below.

Eighty-nine (89) subjects were recruited for group A. Table 5 shows a summary of the urine screening results from CHT and PSA for U1 and U2 for these subjects. The urine, SP, and LP screen positive rates (%) were calculated based on the total number of screening results available for each drug.

For U1, screening data were not available for between 2 and 12 subjects/drug. As shown, the adjusted U1 positive rates varied from 0.0 % for amphetamines, to a high of 9.2 % for cocaine. For U2, screening data were not available for between 3 and 26 subjects/drug. The majority of the missing data were for amphetamines, which is not a priority analysis at PSA. As shown, U2 positive rates varied from 0.0 % for amphetamines to a high of 12.8 % for cocaine. The relative order of the positive rates for U1 and U2 were the same: cocaine>cannabinoids>opiates >PCP>amphetamines. The positive rates for each drug in U1 and U2 were also similar except for cocaine (9.2 % vs. 12.8 %).

Of the 89 group A subjects, six did not provide a SP for analysis. Therefore, 83 SP specimens were analyzed at CHT. As shown, the SP positive rates varied from a low of 0 % for PCP to a high of 38.6 % for cocaine. The rates for cocaine, opiates, and amphetamines exceeded those of U1 and U2. The SP positive rates for cocaine and opiates were approximately 4 times those of U1 or U2. However, the positive rates for PCP and cannabinoids were less than those of U1 and U2.

Table 5. Summary of group A urine and sweat patch specimens received, tested, and % positive by drug

Urine #1	**Cocaine**	**Opiates**	**THC/THC-COOH**	**PCP**	**Amphetamines**
Number of samples	89	89	89	89	89
Number with data lacking	2	2	7	5	12
Number screened	87	87	82	84	77
Number positive	8	5	5	1	0
% Positive	9.2 %	5.7 %	6.1 %	1.1 %	0.0 %
Urine #2					
Number of samples	89	89	89	89	89
Number with data lacking	3	3	9	12	26
Number screened	86	86	80	77	63
Number positive	11	4	6	1	0
% Positive	12.8 %	4.7 %	7.5 %	1.2 %	0.0 %
Sweat Patch					
Number of samples	89	89	89	89	89
Number of patches not received	6	6	6	6	6
Number screened	83	83	83	83	83
Number positive	32	18	1	0	6
% Positive	38.6 %	21.7 %	1.2 %	0.0 %	7.2 %

If drugs were detected in a subject's urine or SP, the LP specimens were analyzed by MS. Table 6 shows that when cocaine was detected in U1 or U2, the corresponding LP contained cocaine. For opiates, there was also 100 % agreement between the U1 and U2 screen positive specimens and the LP positive results (urine positive/LP positive + urine positive/LP negative categories). The results for cannabinoids show that they were confirmed in only a single session one LP specimen, while they were detected in 5 urine specimens. Cannabinoids were not detected in any session two LP specimens, but were detected in 5 session two urine specimens. For PCP, there was 100 % agreement between the U1 and U2 screen positive results and the corresponding LP positive results. No amphetamines were detected in the urine specimens from either session. However, they were detected in a LP specimen from each session (urine negative/LP positive). The striking finding was that drugs were often detected in the LP, but not in the corresponding urine specimen (urine negative/LP positive). For cocaine in session one, the positive rate was more than 3 times greater in LP than urine (23/7). The session two cocaine results show that at least twice as many (25/11) subjects would have been identified as cocaine users from the LP data than from conventional urinalysis. Session one and two opiate results show that nearly twice (9/5) as many subjects would have been identified as opiate users by LP as through urinalysis. Cannabinoid use was more likely to be detected through urinalysis than LP testing. PCP use was detected at equal rates in urine and LP. In both sessions one and two, one LP sample tested positive for amphetamines that tested negative by urinalysis.

Table 6. Group A positive urine vs. positive liquid perspiration results

	Cocaine	Opiates	THC/THCCOOH	PCP	Amphetamines
Urine 1 and LP 1					
Urine positive/LP positive	7	5	1	1	0
Urine negative/LP positive	16	4	0	0	1
Urine positive/LP negative	0	0	4	0	0
Other (No urine data)	1	0	0	0	0
Total cases	24	9	5	1	1
Urine 2 and LP 2					
Urine positive/LP positive	11	4	0	1	0
Urine negative/LP positive	14	3	0	0	1
Urine positive/LP negative	0	0	5	0	0
Other (No urine data)	1	2	1	0	0
Total cases	26	9	6	1	1

SP specimens were screened for drugs and the presumptive positive results were confirmed by MS. Table 7 compares the urine drug screening results with the SP analyses. The results for cocaine are similar to those of LP vs. urine. Cocaine or metabolite was detected in the SPs at a rate approximately 2.4 times (29/12) that of urine. A similar rate (2.5 X) (15/6) was also observed for the detection of opiates in SPs vs. urine. In addition, cocaine and opiate positive samples were rarely missed by SP analysis (urine positive/SP negative). However, cannabinoid use was more likely to be detected through urinalysis than by SP testing. One subject was identified as PCP positive by urinalysis who was not detected by SP testing. No confirmed positive amphetamines were found in the urine or SP.

Table 7. Group A positive urine vs. positive sweat patch results

	Cocaine	Opiates	THC/THCCOOH	PCP	Amphetamines
Urine and Sweat Patch					
Urine positive/SP positive	12	6	0	0	0
Urine negative/SP positive	17	9	1	0	1
Urine positive/SP negative	0	0	8	1	0
Other (No urine or SP data)	1	3*	0	0	5**
Total cases	30	18	9	1	6

* PSA data or sweat patch MS confirmation not available.
** Five specimens screened positive, but did not confirm.

If an SP specimen tested positive for a drug, one would expect that either LP1, LP2, or both LP specimens would also test positive. Table 8 compares the SP results with those of LP1 and LP2. The results for cocaine show a much better correlation between the positive rates than was observed in the urine vs. LP, or urine vs. SP comparison. Cocaine or metabolite was detected in LP1 and LP2 in 80 % and 84 %, respectively, of the total number of positive case results (LP positive/SP positive + LP positive/SP negative categories). However, for both LP1 and LP2, 44 % (7/16) of the positive opiate cases shown in the table were not detected in the LP. The table shows a limited number of cannabinoid positive results with little difference between the LP and SP findings. PCP was detected in LP1 and LP2 of one case, when not found in the SP. The SP from four cases screened positive for amphetamines, but the results were not confirmed by MS. Therefore, there was little difference between the confirmed LP and SP amphetamines findings.

Table 8. Group A positive liquid perspiration vs. positive sweat patch results

	Cocaine	Opiates	THC/THCCOOH	PCP	Amphetamines
LP 1 and Sweat Patch					
LP positive/SP positive	23	9	0	0	0
LP negative/SP positive	6	7	1	0	1
LP positive/SP negative	1	0	1	1	1
Other (No LP or SP data)	0	0	0	0	4*
Total cases	30	16	2	1	6
LP 2 and Sweat Patch					
LP positive/SP positive	25	9	0	0	1
LP negative/SP positive	5	7	1	0	0
LP positive/SP negative	1	0	0	1	1
Other (No LP or SP data)	0	0	0	0	4*
Total cases	31	16	1	1	6

* Four specimens screened positive, but did not confirm.

As stated in the methods section, LP specimens were selected for screening from 25 group A subjects whose U1, U2, and SP specimens tested negative. The purpose of this screening was to determine if drugs could be found in LP when they were not detected in the urine or SP. The samples were screened using the validated EIA methods and the project's LP cutoff concentrations. As shown in the summary table (9) below, unfortunately, 94 % of the LP specimens were positive for cocaine due to the failure of the EIA assay (discussed below). In total, eight specimens screened positive for opiates in the LP that were not positive by urinalysis 10 %). Two LP specimens screened positive for PCP and THC that were urinalysis negative (4 %). No additional amphetamine positive cases were detected through the LP screening. Data in the table represent potential (because the screening results were not confirmed by MS) false negative results if one were relying on SP or urine screening results.

Table 9. Group A liquid perspiration screen results for a sample of cases with negative urine screens

	Cocaine	**Opiates**	**Cannabinoids**	**Phencyclidine**	**Amphetamine**
First Session	$n = 25$	$n = 25$	$n = 25$	$n = 25$	$n = 25$
Urine Negative/	1	20	23	24	25
LP Screen negative	4 %	80 %	92 %	96 %	100 %
Urine Negative/	24	5	2	1	0
LP Screen Positive	96 %	20 %	8 %	4 %	0 %
Second Session	$n = 25$	$n = 25$	$n = 25$	$n = 25$	$n = 25$
Urine Negative/	2	22	25	24	25
LP Screen Negative	8 %	88 %	100 %	96 %	100 %
Urine Negative/	23	3	0	1	0
LP Screen Positive	92 %	12 %	0 %	4 %	0 %

3.3.2 Group B

Group B subjects attended one session and had one urine and one LP specimen collected. Both the urine and the LP specimens from these subjects were screened for all drugs. No confirmation analyses were performed. However, 10 of the LP specimens that screened positive for cocaine were randomly selected for confirmation testing. The detailed tables in the group B appendix present the results of the urine screening (UX), a summary of the urine specimens that screened positive, the MS confirmation results and a list of the samples that were tested at PSA. Analogous tables present the detailed results of the LP (LPX) screening, a summary of the screened-positive specimens and the MS confirmation results for the selected specimens that screened positive for cocaine and were analyzed by MS.

One hundred and fifteen (115) subjects were recruited into group B. Table 10 shows the combined urine screening results from CHT and the PSA. For each drug, the table also indicates the number of specimens for which screening data were not available. The number varies between drug classes because PSA did not test every specimen for cannabinoids, PCP, and amphetamines. The urine screen positive rates (%) were calculated based on the total number of results available

for each drug. As shown, the urine group B positive rates varied from 1.2 % for amphetamines to 12.1 % for cocaine.

An LP specimen was collected from each of the 115 subjects recruited for group B. Each of those specimens was analyzed at CHT using the validated EIA screening methods described. Unfortunately, the cocaine EIA analysis performed poorly and nearly all (87.8 %) of the LP specimens tested positive. These data should not be considered representative of the prevalence of cocaine in the subjects, but rather a failure of the commercial EIA test kit. As shown, the LP positive rate for opiates was approximately 3 times that of the urine rate. No LP samples screened positive for cannabinoids. The positive rates for PCP were roughly equivalent in urine and LP. However, the LP positive rate for amphetamines was approximately 10 times the urine positive rate. This was partially attributable to screening the LP amphetamines using both amphetamine and methamphetamine specific EIA kits (see methods—urine was screened using only one kit). Five additional LP positive specimens were identified using the additional methamphetamine testing (4.3 %).

Table 10. Summary of group B urine and liquid perspiration specimens received and screened positive

Urine	**Cocaine**	**Opiates**	**THC/THC-COOH**	**PCP**	**Amphetamines**
Number of Samples	115	115	115	115	115
Number, no data from PT	8	8	10	20	29
Number screened at CHT	107	107	105	95	86
Number positive	13	8	6	4	1
% Positive	12.1 %	7.5 %	5.7 %	4.2 %	1.2 %
LP					
Number of Samples	115	115	115	115	115
Number, no data from PSA	NA*	NA	NA	NA	NA
Number screened at CHT	115	115	115	115	115
Number positive	101	27	0	4	16
% Positive	87.8 %	23.5 %	0.0 %	3.5 %	13.9 %

*Not applicable.

An important aspect of this research was to determine if LP was a suitable specimen to use for the detection of drug use by subjects in the criminal justice system. Table 11 shows a comparison of the urine and LP results for the group B subjects. The table shows that when a subject's urine tested positive for cocaine, opiates, or PCP, the LP also tested positive (100 % agreement). However, when a subject's urine tested positive for cannabinoids, they were not detected in his/her LP (0 % agreement). There was also good agreement between the urine testing negative and the associated LP testing negative for all drugs except cocaine (> 80 % agreement). For

cocaine, opiates, and amphetamines, drugs were detected in the LP when they were not detected in the subject's urine as evidenced by the urine negative/LP positive category of results.

Table 11. Group B liquid perspiration screen results vs. urine screen results

	Cocaine	Opiates	Cannabinoids	Phencyclidine	Amphetamine
Positive Urine Screens	$n = 13$	$n = 8$	$n = 6$	$n = 4$	$n = 1$
Urine Positive/ LP Positive	13 100 %	8 100 %	0 0 %	4 100 %	0 0 %
Urine Positive/ LP Negative	0 0 %	0 0 %	6 100 %	0 0 %	1 100 %
Negative Urine Screens	$n = 73$	$n = 77$	$n = 79$	$n = 80$	$n = 81$
Urine Negative/ LP Negative	12 16 %	65 84 %	79 100 %	80 100 %	69 85 %
Urine Negative/ LP Positive	61 84 %	12 16 %	0 0 %	0 0 %	12 15 %

As mentioned above, the EIA test for cocaine performed poorly and nearly all of the group B LP specimens screened positive. Therefore, we selected 10 specimens for confirmation. The specimens were randomly selected from those that screened positive and had an adequate volume for confirmation testing. Cocaine or BZE was detected in 5 of the 10 specimens analyzed by MS.

3.4 Comparison of Results from Self-Reports and Biological Specimens

It was of interest to compare the results of the biological specimen analysis—especially the LP analysis—with the self-reports. The following tables provide comparisons of self-reports (use of any drug in the past 30 days: yes/no) with the results of the analysis of the biological specimens (positive/negative).

Table 12 compares self-reports with urine screens. First session subjects displayed a 70 % agreement rate (70 % of the time, subjects' self-reports agreed with their urine screen results); in the second session, the agreement rate was 88 %. (A 100 % agreement rate would not be expected even if all subjects were truthful and accurate, as the subjects are self-reporting in reference to a time span (30 days) that is beyond the detection range of the biological specimen analysis). Interestingly, in the first session, there were 43 subjects (27 % of the sample) who admitted some kind of illicit drug use, but were found negative by urine screening.

Table 12. Comparison of self-report and urine specimens

		First (or only) Session	
		Positive	Negative
Self-reported	Yes	29	43
30 d use	No	4	81
		Second Session	
		Positive	Negative
Self-reported	Yes	12	4
30 d use	No	3	40

Table 13 compares self-reports with LP results. First session subjects displayed a 43 % agreement rate (43 % of the time, subjects' self-reports agreed with their LP results); in the second session, the agreement rate was 36 %. Again a 100 % agreement rate would not be expected even if all subjects were truthful and accurate, as the subjects are self-reporting in reference to a time span of 30 d that is well beyond the detection range of the LP drug detection time.

Table 13. Comparison of self-report and liquid perspiration specimens

		First (or only) Session	
		Positive	Negative
Self-reported	Yes	71	15
30 d use	No	89	9
		Second Session	
		Positive	Negative
Self-reported	Yes	16	6
30 d use	No	36	8

Note: LP specimen data are screened or MS confirmation data for those who tested positive for at least one drug (in a urine screen) and for a random sub sample of 25 subjects who did not test positive for any drug (in a urine screen).

The following table (14) compares self-reports with SP results. Recall that SP specimens were only collected at session two. Subjects displayed a 71 % agreement rate between detected and admitted use. A higher agreement was expected with the SP results (than the LP) because of the constant monitoring and specimen collection provided by the SP.

Table 14. Comparison of self-report and sweat patch specimens

		Positive	Negative
Self-reported	Yes	17	6
30–d use	No	17	39

Note: SP specimen data are screened or MS confirmation data. The later was used when available.

4. DISCUSSION

This project sought to assess the feasibility of using liquid perspiration (LP) as a specimen for drug testing in the criminal justice system. The collection of LP was seen as a potentially less invasive alternative to the current urine-based drug testing methods that are the principal methods used by virtually all the criminal justice systems in this country. In addition, LP appeared to have several potential advantages compared to sweat patch testing (also commonly used in the criminal justice system). The LP collection could be totally observed by the donor and criminal justice practitioner, concentrations of the drug could be determined, and the specimen was more easily handled in the laboratory than a sweat patch.

The pilot study results were encouraging and supported the use of LP for criminal justice drug testing. It demonstrated that an LP collection device could be used to harvest specimens in a criminal justice setting, that the collection procedure was well tolerated by the subjects, and that drugs of abuse could be detected in LP specimens using available analytic procedures.

In the pilot study, arrestees appeared to have had few (if any) problems with the data collection procedures. The recruitment of subjects and the collection of specimens proceeded without any serious impediments. The management and staff of the PSA were helpful and supportive of the research project, and most arrestees approached to participate in the research volunteered to do so. Subjects' ratings of the different collection procedures indicated that the LP procedures were perceived as no more discomforting or unpleasant than the urine collection and the sweat patch, and that the LP procedures were viewed as significantly less embarrassing than the urine collection. The pilot study identified challenges, both practical and analytic, to the use of the LP method for drug testing. The 25 min to 30 min collection time may be inconvenient in many settings, and the small volume of LP collected posed significant technical difficulties in the analysis; both issues received considerable attention in the study design of the main field study. Because the results indicated that the larger, specially engineered collector was capable of collecting larger volumes at a faster rate than the standard collector, the modified (and similarly modified devices) was used in the field test.

Substantial strides were made in the development and validation of the analytic methods for screening and confirmation of drugs in LP specimens. With a single exception, all of the methods developed in the pilot study performed well when used to test the urine, LP, and SP specimens in the field study. However, pilot study success with the EIA screening LP for cocaine was not duplicated in the field study. About 88 % of the LP specimens in group B screened

positive for cocaine while only 12 % of the urine specimens were positive. Our investigation of this problem led us to conclude that the commercial EIA kit used for the analyses had changed specificity such that it was no longer suitable for the analysis of LP for cocaine. However, the same kit was used successfully to screen the SP specimens from group A. Also, recall that of the 10 LP specimens selected for confirmation (from group B), 1/2 contained cocaine or metabolite by MS. In addition, a 70 % screen positive cocaine rate was found in the pilot study, and a 20 % positive cocaine rate was recently reported in a similar criminal justice population (Yacoubian, et al., 2002). Therefore, despite the apparent failure of the EIA cocaine screening, a high prevalence of cocaine use in the selected population likely accounts for a substantial number of the positive results.

Liquid perspiration proved to be a superior specimen to urine for the screening of opiates. Each case that tested positive for opiates in the urine also tested positive in the LP. However, an additional 19 cases of opiate use were detected by the LP screening.

Conclusions from the cannabinoid and PCP group B screening data should be made cautiously, because positive cases for these drugs were rare in the urine or LP. However, fewer cannabinoid positives were found in LP. These results were consistent with the pilot study. EIA testing for PCP is generally quite specific with high confirmation rates. Therefore, the group B PCP data, that showed consistency between urine and LP positive rates, are likely indicative of LP being a useful specimen for the detection of this drug. These data also demonstrate that lipophilic drugs of abuse (THC and PCP) can be detected in LP. The low prevalence of these drugs in the pilot study (and in saliva studies) have led some authors to suggest that LP and saliva might not be the optimum specimens for detection of lipophilic drugs (Crouch, et al., 2002; and Yacoubian, et al., 2002).

The utility of LP as a screening specimen in the criminal justice system was also demonstrated by the detection of drugs not detected in urine or SP screening in the random selection if 25 group A subjects (whose U1, U2, and SP specimens screened negative). The EIA detection rates of opiates, PCP, and cannabinoids in this subpopulation was 10 %, 4 %, and 4 %, respectively, despite the fact that these drugs were not detected in the corresponding urine or SP specimens.

Study results from group A also demonstrated that LP specimens could be analyzed for the presence of the major drugs of abuse in a criminal justice setting. The data from group A showed that when cocaine or metabolites or opiates were detected in U1 or U2, the corresponding LP specimen contained cocaine; and that cocaine was confirmed by MS in at least twice as many LP as urine specimens. Similar results were observed with opiates. If U1 or U2 tested positive for opiates, they were also detected in the LP specimens; and that opiates were confirmed in nearly twice as many LP specimens. The SP vs. urine results for cocaine and opiates were similar to those of LP. Cocaine or metabolite and opiates were detected in the SPs at a rate approximately 50 % greater than that of urine. LP specimen analysis by MS exhibited fairly high congruence with the sweat patch (SP) results (80 % to 84 % agreement rates) for cocaine, but less for the detection of opiates (44 % agreement rate). The limited use and detection of cannabinoids, PCP, and amphetamines by the group A subjects was anticipated based on the pilot study.

Due to PSA's need to process the arrestees for adjudication purposes, subject urine specimens were sometimes difficult to obtain as explained in the results section. As a result, we arranged to

obtain their drug screening results for those subjects. However, PSA did not screen all urine specimens for cannabinoids, PCP, and amphetamines. Therefore, the comparisons made between urine, SP, and LP test results for group A were based upon urine screening data, MS confirmed SP, and LP data. Although this should be considered, immunoassay screens have a high rate of confirmation for most drugs of abuse; the exceptions in urine being opiates and amphetamines.

Amphetamines screens often have a low rate of confirmation due to reactivity with drugs over-the-counter such as, cold and diet preparations. However, few amphetamines were detected in the field study. Opiate screens often have a low rate of confirmation due to immunoassay reactivity to prescription opioid drugs such as hydromorphone and hydrocodone that are quite prevalent in the general population. This was not a problem in our study because in arrestee populations, heroin, 6–AM, or morphine are the most commonly detected opiates (Crouch, et al., 2002; and Yacoubian, et al., 2002). Therefore, the U1 and U2 screening results are likely to reflect illicit opiate use. This is supported by the data that showed that 89 % of screen positive SP opiates were confirmed by MS, and 100 % of the cases in which urine was available for MS analysis confirmed positive for opiates.

From the beginning of this research, limitations were identified for the use of LP for drug testing in the criminal justice system. The price of the current commercial Macroduct exceeds that of patch testing ($7/sweat collection vs. $5/sweat patch). An initial investment of $1575 is needed for the power supply. The cost of a collection using the modified collector was $28.56 for materials. This limits its potential use when compared to the cost of conventional criminal justice system collections of SP or urinalysis. A second limitation was that the original collection procedure and device harvested 50 μL to 60 μL of LP in what sometimes approached 30 min. Through the cooperation of the manufacturer we were able to increase the collection volume to 80 μL to 100 μL (mean 85.5) in approximately 20 min (mean 24), making LP and LP collection more viable for use in the criminal justice system. The modified LP collection device appeared to meet an additional central criteria of an alternative, less invasive method as demonstrated by the subjects rating the device and its procedures more comfortable, less embarrassing, and less unpleasant than a urine collection.

5. CONCLUSIONS

Several conclusions can be reached from this research.

- Liquid perspiration can be harvested in criminal justice settings using the modified or standard collector. Minimal training was required for the project staff to use the collection apparatus effectively, and the device was readily accepted by both agency staff and arrestees.

- The modified collector can be used in criminal justice settings to collect LP specimens in a noninvasive, totally observed process, and the procedure was well tolerated by the subjects. Subjects found the modified collector to be more comfortable, less embarrassing, and less unpleasant than a urine collection.

- The cost of an LP collection is a limitation. The cost of an LP collection using the modified collector greatly exceeded that of a urinalysis or SP.

- The volume of LP collected remains a limitation to its use. The volume is sufficient to screen for the drugs of abuse or to perform a limited screen and a confirmation of no more than 1 or 2 drugs. However, the specially engineered collector harvested larger volumes at a faster rate than the standard collector.

- Existing, commercially available, EIA drug screening technologies can be used effectively to screen for drugs of abuse in LP specimens. However, the EIA kit selected for use showed a variation in the antibody specificity between the pilot and field studies for cocaine. However, the confirmed positive rate for a randomly selected set of EIA specimens that screened positive for cocaine was 50 %.

- MS procedures were developed and validated for confirmation of drugs of abuse in LP.

- LP may be a preferable specimen to urine for the detection of drug use by arrestees in the criminal justice system, specifically, for the detection of cocaine and opiates. Results show that 2 to 3 times the number of cocaine users and nearly 2 times the number of opiate users were identified using LP testing. These MS results identified incidences in which the LP tested drug positive and the corresponding urine specimen tested negative. Also in a selected number of subjects whose U1, U2, and SP specimens screened negative, the detection rates of opiate, PCP, and cannabinoids were 10 %, 4 %, and 4 % respectively, using the LP screening.

- LP positive rates for drugs of abuse were similar to the SP. However, LP offers several advantages as a specimen for testing in the criminal justice system. One does not have to wait a week between application and harvesting. Therefore, only one visit is needed to obtain a specimen. The entire LP collection process may be observed by the donor and the collector—eliminating questions of specimen identity and integrity such as environmental exposure of the patch to drugs.
- The detection rates of cannabinoids, PCP, and amphetamines were too low in the population to draw conclusions about the detection rates in LP vs. urine or LP vs. the SP. However, detection rates compared to urine were encouraging.

- Further study of LP is needed to fully understand the advantages and limitations of the specimen and the collection technique. For example, more positive cases for amphetamine(s), cannabinoids, and PCP are needed to evaluate usefulness of LP for the detection of these drugs. It is not known whether LP drug concentrations correlate with blood drug concentrations. This should be examined, because if a correlation exists, LP would be a very useful specimen in the criminal justice system and criminal investigations.

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Appendix Group A

Group A Urine Drug Screen Results

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 101 U1	neg	neg	neg	neg	neg
NIST 105 U1	neg	neg	neg	neg	neg
NIST 105 U2	neg	neg	neg	neg	neg
NIST 107 U1	neg	neg	neg	neg	neg
NIST 107 U2	neg	neg	neg	neg	neg
NIST 111 U1	neg	neg	neg	neg	neg
NIST 111 U2	neg	neg	neg	neg	neg
NIST 112 U1	neg	neg	neg	neg	neg
NIST 112 U2	neg	neg	neg	neg	neg
NIST 113 U1	POSITIVE	neg	neg	neg	neg
NIST 113 U2	POSITIVE	neg	neg	neg	neg
NIST 114 U1	neg	neg	neg	neg	neg
NIST 114 U2	neg	neg	neg	neg	neg
NIST 115 U1	neg	neg	neg	neg	neg
NIST 115 U2	neg	neg	neg	neg	neg
NIST 116 U1	neg	neg	neg	neg	neg
NIST 116 U2	neg	neg	neg	neg	neg
NIST 119 U2	POSITIVE	neg	neg	neg	neg
NIST 120 U1	neg	neg	neg	neg	neg
NIST 120 U2	neg	neg	neg	neg	neg
NIST 121 U1	neg	neg	neg	neg	neg
NIST 121 U2	neg	neg	neg	neg	neg
NIST 124 U1	neg	neg	neg	neg	neg
NIST 125 U1	POSITIVE	POSITIVE	POSITIVE	neg	neg
NIST 125 U2	neg	neg	neg	neg	neg
NIST 129 U1	neg	neg	neg	neg	neg
NIST 129 U2	neg	neg	neg	neg	neg
NIST 130 U1	neg	neg	neg	neg	neg
NIST 130 U2	neg	neg	neg	neg	neg
NIST 131 U1	neg	neg	neg	neg	neg
NIST 131 U2	neg	neg	neg	neg	neg
NIST 136 U1	neg	neg	POSITIVE	POSITIVE	neg
NIST 136 U2	neg	neg	POSITIVE	POSITIVE	neg
NIST 138 U1	neg	POSITIVE	neg	neg	neg
NIST 139 U1	neg	neg	neg	neg	neg
NIST 141 U1	neg	neg	neg	neg	neg
NIST 141 U2	neg	neg	neg	neg	neg
NIST 143 U1	neg	neg	neg	neg	neg
NIST 152 U1	neg	neg	neg	neg	neg
NIST 155 U1	neg	neg	neg	neg	neg
NIST 155 U2	neg	neg	neg	neg	neg
NIST 165 U1	neg	neg	neg	neg	neg
NIST 165 U2	neg	neg	neg	neg	neg
NIST 169 U1	neg	neg	neg	neg	neg
NIST 169 U2	neg	neg	neg	neg	neg
NIST 171 U1	neg	neg	neg	neg	neg
NIST 175 U1	neg	neg	neg	neg	neg
NIST 175 U2	neg	neg	neg	neg	neg
NIST 176 U1	neg	neg	neg	neg	neg

Group A Urine Drug Screen Results

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 176 U2	neg	neg	neg	neg	neg
NIST 178 U1	neg	neg	neg	neg	neg
NIST 178 U2	neg	neg	neg	neg	neg
NIST 183 U1	neg	neg	neg	neg	neg
NIST 186 U1	neg	neg	neg	neg	neg
NIST 192 U1	neg	neg	neg	neg	neg
NIST 198 U1	neg	neg	neg	neg	neg
NIST 198 U2	neg	neg	neg	neg	neg
NIST 205 U1	neg	neg	neg	neg	neg
NIST 208 U2	neg	neg	neg	neg	neg
NIST 209 U1	neg	neg	neg	neg	neg
NIST 212 U2	neg	neg	neg	neg	neg
NIST 224 U1	neg	neg	neg	neg	neg
NIST 225 U1	neg	neg	neg	neg	neg
NIST 232 U1	neg	neg	neg	neg	neg
NIST 232 U2	neg	neg	neg	neg	neg
NIST 233 U1	neg	neg	POSITIVE	neg	neg
NIST 233 U2	neg	neg	POSITIVE	neg	neg
NIST 235 U1	neg	neg	neg	neg	neg
NIST 235 U2	neg	neg	neg	neg	neg
NIST 241 U1	neg	neg	neg	neg	neg
NIST 242 U1	POSITIVE	neg	POSITIVE	neg	neg
NIST 242 U2	POSITIVE	neg	POSITIVE	neg	neg
NIST 246 U1	neg	neg	neg	neg	neg
NIST 246 U2	neg	neg	neg	neg	neg
NIST 255 U2	POSITIVE	POSITIVE	neg	neg	neg
NIST 256 U2	neg	neg	neg	neg	neg
NIST 261 U1	neg	neg	neg	neg	neg
NIST 261 U2	neg	neg	neg	neg	neg
NIST 264 U1	neg	neg	neg	neg	neg
NIST 265 U1	neg	neg	neg	neg	neg
NIST 266 U1	neg	neg	neg	neg	neg
NIST 269 U1	neg	neg	neg	neg	neg
NIST 275 U1	neg	neg	neg	neg	neg
NIST 275 U2	neg	neg	neg	neg	neg
NIST 277 U1	neg	neg	neg	neg	neg
NIST 277 U2	neg	neg	neg	neg	neg
NIST 278 U1	neg	neg	neg	neg	neg
NIST 278 U2	neg	neg	neg	neg	neg
NIST 280 U1	neg	neg	neg	neg	neg
NIST 280 U2	neg	neg	neg	neg	neg
NIST 281 U1	neg	neg	neg	neg	neg
NIST 281 U2	neg	neg	neg	neg	neg
NIST 282 U1	neg	neg	neg	neg	neg
NIST 282 U2	POSITIVE	neg	neg	neg	neg
NIST 284 U1	neg	neg	neg	neg	neg
NIST 284 U2	neg	neg	neg	neg	neg
NIST 285 U1	neg	neg	neg	neg	neg
NIST 285 U2	neg	neg	POSITIVE	neg	neg

Group A Urine Drug Screen Results

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 293 U1	neg	neg	neg	neg	neg
NIST 294 U1	neg	neg	neg	neg	neg
NIST 294 U2	neg	POSITIVE	neg	neg	neg
NIST 296 U1	neg	POSITIVE	POSITIVE	neg	neg
NIST 299 U1	neg	neg	neg	neg	neg
NIST 299 U2	neg	neg	neg	neg	neg
NIST 300 U1	neg	neg	neg	neg	neg
NIST 300 U2	POSITIVE	neg	neg	neg	neg
NIST 301 U2	neg	neg	neg	neg	neg
NIST 307 U1	POSITIVE	neg	neg	neg	neg
NIST 309 U1	neg	neg	neg	neg	neg
NIST 309 U2	neg	neg	neg	neg	neg
NIST 312 U2	POSITIVE	POSITIVE	neg	neg	neg
NIST 314 U1	neg	neg	neg	neg	neg
NIST 314 U2	neg	neg	neg	neg	neg
NIST 315 U1	neg	neg	neg	neg	neg
NIST 315 U2	neg	neg	neg	neg	neg
NIST 319 U1	neg	neg	neg	neg	neg
NIST 320 U2	neg	neg	neg	neg	neg
NIST 321 U1	neg	neg	neg	neg	neg
NIST 321 U2	neg	neg	neg	neg	neg
NIST 322 U1	neg	neg	neg	neg	neg
NIST 322 U2	neg	neg	neg	neg	neg
NIST 323 U1	neg	neg	neg	neg	neg
NIST 323 U2	neg	neg	neg	neg	neg
n=125					

Group A Urine Drug Screen Positive Summary

Sample ID #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 113 U1	POSITIVE	neg	neg	neg	neg
NIST 113 U2	POSITIVE	neg	neg	neg	neg
NIST 119 U2	POSITIVE	neg	neg	neg	neg
NIST 125 U1	POSITIVE	POSITIVE	POSITIVE	neg	neg
NIST 136 U1	neg	neg	POSITIVE	POSITIVE	neg
NIST 136 U2	neg	neg	POSITIVE	POSITIVE	neg
NIST 138 U1	neg	POSITIVE	neg	neg	neg
NIST 138 U2	neg	POSITIVE*	neg	NT	NT
NIST 143 U2	POSITIVE*	neg	neg	neg	neg
NIST 163 U2	neg	neg	POSITIVE	neg	neg
NIST 171 U2	neg	neg	POSITIVE*	NT	NT
NIST 205 U2	POSITIVE*	neg	neg	NT	NT
NIST 214 U1	POSITIVE*	neg	neg	NT	NT
NIST 233 U1	neg	neg	POSITIVE	neg	neg
NIST 233 U2	neg	neg	POSITIVE	neg	neg
NIST 242 U1	POSITIVE	neg	POSITIVE	neg	neg
NIST 242 U2	POSITIVE	neg	POSITIVE	neg	neg
NIST 255 U1	POSITIVE*	POSITIVE*	neg	NT	NT
NIST 255 U2	POSITIVE	POSITIVE	neg	neg	neg
NIST 282 U2	POSITIVE	neg	neg	neg	neg
NIST 285 U2	neg	neg	POSITIVE	neg	neg
NIST 294 U2	neg	POSITIVE	neg	neg	neg
NIST 296 U1	neg	POSITIVE	POSITIVE	neg	neg
NIST 298 U1	POSITIVE*	neg	NT	neg	NT
NIST 298 U2	POSITIVE*	neg	neg	NT	NT
NIST 300 U2	POSITIVE	neg	neg	neg	neg
NIST 307 U1	POSITIVE	neg	neg	neg	neg
NIST 307 U2	POSITIVE*	neg	neg	neg	NT
NIST 312 U1	POSITIVE*	POSITIVE*	NT	neg	NT
NIST 312 U2	POSITIVE	POSITIVE	neg	neg	neg

* = Washington Pretrial Service NT=Not Tested

Group A Urine Confirmation Summary

Sample ID #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH	Comments
NIST 113 U1	POSITIVE	neg	neg	neg	neg	COC=75/BZE>1000
NIST 113 U2	POSITIVE	neg	neg	neg	neg	COC=31/BZE>1000
NIST 119 U2	POSITIVE	neg	neg	neg	neg	COC=13/BZE>1000
NIST 125 U1	POSITIVE	POSITIVE	POSITIVE	neg	neg	COC=847/BZE>1000 THC-COOH=12 MOR=426 COD=16 6MAM=11
NIST 136 U1	neg	neg	POSITIVE	POSITIVE	neg	PCP=88 THC-COOH=315
NIST 136 U2	neg	neg	POSITIVE	POSITIVE	neg	PCP>100 THC-COOH=85
NIST 138 U1	neg	POSITIVE	neg	neg	neg	MOR=127 6MAM=7
NIST 163 U2	neg	neg	POSITIVE	neg	neg	THC-COOH=16
NIST 233 U1	neg	neg	POSITIVE	neg	neg	THC-COOH=108
NIST 233 U2	neg	neg	POSITIVE	neg	neg	THC-COOH=170
NIST 242 U1	POSITIVE	neg	POSITIVE	neg	neg	COC>1000/BZE>1000 THC-COOH=27
NIST 242 U2	POSITIVE	neg	POSITIVE	neg	neg	COC>1000/BZE>1000 THC-COOH=34
NIST 255 U2	POSITIVE	POSITIVE	neg	neg	neg	COC>1000/BZE>1000 MOR=265 COD=46 6MAM=53
NIST 282 U2	POSITIVE	neg	neg	neg	neg	COC=244/BZE>1000
NIST 294 U2	neg	POSITIVE	neg	neg	neg	MOR=28 COD=13
NIST 296 U1	neg	POSITIVE	POSITIVE	neg	neg	THC-COOH=14 MOR=415 COD=15
NIST 300 U2	POSITIVE	neg	neg	neg	neg	COC=neg/BZE=127
NIST 307 U1	POSITIVE	neg	neg	neg	neg	COC>1000/BZE>1000
NIST 312 U2	POSITIVE	POSITIVE	neg	neg	neg	COC=551/BZE>1000 MOR=2595 COD=117

Group A Urine Pretrial Services Unconfirmed Positive Results

Washington Pretrial Services Screen Only Positive Results					
Sample ID #	PCP	THC-COOH	COC/BZE	Opiates	AMP/METH
NIST 138U2	NT	neg	neg	POSITIVE	NT
NIST 143 U2	neg	neg	POSITIVE	neg	neg
NIST 171 U2	NT	POSITIVE	neg	neg	NT
NIST 205 U2	NT	neg	POSITIVE	neg	NT
NIST 214 U1	NT	neg	POSITIVE	neg	NT
NIST 255 U1	NT	neg	POSITIVE	POSITIVE	NT
NIST 285 U2	neg	POSITIVE	neg	neg	neg
NIST 292 U2	NT	POSITIVE	neg	neg	NT
NIST 298 U1	neg	NT	POSITIVE	neg	NT
NIST 298 U2	NT	neg	POSITIVE	neg	NT
NIST 307 U2	neg	neg	POSITIVE	neg	NT
*Not Tested					

Sweat Patch Screen Results (Group A)

CHT Sample #	COC/BZE	Opiates	THC	PCP	AMP/METH
NIST 101 SP	neg	neg	neg	neg	neg
NIST 105 SP	POSITIVE	neg	neg	neg	neg
NIST 107 SP	neg	neg	neg	neg	neg
NIST 111 SP	neg	neg	neg	neg	neg
NIST 112 SP	neg	neg	neg	neg	neg
NIST 113 SP	POSITIVE	neg	neg	neg	neg
NIST 114 SP	neg	neg	neg	neg	neg
NIST 115 SP	neg	neg	neg	neg	neg
NIST 116 SP	NT	NT	NT	NT	NT
NIST 119 SP	POSITIVE	neg	neg	neg	neg
NIST 120 SP	neg	neg	neg	neg	neg
NIST 121 SP	neg	neg	neg	neg	neg
NIST 124 SP	neg	neg	neg	neg	neg
NIST 125 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 129 SP	neg	neg	neg	neg	neg
NIST 130 SP	NT	NT	NT	NT	NT
NIST 131 SP	POSITIVE	neg	neg	neg	POSITIVE
NIST 135 SP	NT	NT	NT	NT	NT
NIST 136 SP	neg	neg	neg	neg	neg
NIST 138 SP	neg	POSITIVE	neg	neg	POSITIVE
NIST 139 SP	neg	neg	neg	neg	neg
NIST 141 SP	neg	neg	neg	neg	neg
NIST 143 SP	POSITIVE	neg	neg	neg	neg
NIST 152 SP	POSITIVE	neg	neg	neg	neg
NIST 155 SP	neg	neg	neg	neg	neg
NIST 160 SP	POSITIVE	neg	neg	neg	neg
NIST 163 SP	NT	NT	NT	NT	NT
NIST 165 SP	neg	neg	neg	neg	neg
NIST 169 SP	neg	neg	neg	neg	neg
NIST 171 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 175 SP	neg	neg	neg	neg	neg
NIST 176 SP	neg	neg	neg	neg	neg
NIST 178 SP	neg	neg	neg	neg	neg
NIST 183 SP	neg	neg	neg	neg	POSITIVE
NIST 186 SP	neg	neg	neg	neg	POSITIVE
NIST 192 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 198 SP	neg	neg	neg	neg	neg
NIST 199 SP	neg	neg	neg	neg	neg
NIST 205 SP	POSITIVE	neg	neg	neg	neg
NIST 208 SP	neg	neg	neg	neg	neg
NIST 209 SP	POSITIVE	neg	neg	neg	neg
NIST 212 SP	POSITIVE	neg	neg	neg	neg
NIST 214 SP	NT	NT	NT	NT	NT
NIST 224 SP	neg	neg	neg	neg	neg
NIST 225 SP	POSITIVE	neg	neg	neg	neg
NIST 232 SP	neg	neg	neg	neg	neg
NIST 233 SP	neg	neg	neg	neg	neg
NIST 235 SP	neg	neg	neg	neg	neg

Sweat Patch Screen Results (Group A)

CHT Sample #	COC/BZE	Opiates	THC	PCP	AMP/METH
NIST 241 SP	neg	neg	neg	neg	neg
NIST 242 SP	POSITIVE	neg	neg	neg	POSITIVE
NIST 246 SP	neg	neg	neg	neg	neg
NIST 255 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 256 SP	neg	neg	neg	neg	neg
NIST 261 SP	POSITIVE	neg	neg	neg	neg
NIST 264 SP	POSITIVE	POSITIVE	neg	neg	POSITIVE
NIST 265 SP	neg	neg	neg	neg	neg
NIST 267 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 269 SP	neg	POSITIVE	neg	neg	neg
NIST 275 SP	neg	POSITIVE	neg	neg	neg
NIST 276 SP	neg	neg	neg	neg	neg
NIST 277 SP	neg	neg	neg	neg	neg
NIST 278 SP	neg	neg	neg	neg	neg
NIST 279 SP	neg	neg	POSITIVE	POSITIVE	neg
NIST 280 SP	POSITIVE	neg	neg	neg	neg
NIST 281 SP	neg	neg	neg	neg	neg
NIST 282 SP	POSITIVE	neg	POSITIVE	neg	neg
NIST 284 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 285 SP	neg	neg	neg	neg	neg
NIST 291 SP	POSITIVE	neg	neg	neg	neg
NIST 293 SP	POSITIVE	neg	neg	neg	neg
NIST 294 SP	neg	POSITIVE	neg	neg	neg
NIST 296 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 297 SP	neg	neg	neg	neg	neg
NIST 298 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 299 SP	neg	neg	neg	neg	neg
NIST 300 SP	POSITIVE	neg	neg	neg	neg
NIST 301 SP	neg	neg	neg	neg	neg
NIST 306 SP	neg	POSITIVE	neg	neg	neg
NIST 307 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 308 SP	neg	POSITIVE	neg	neg	neg
NIST 309 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 310 SP	neg	neg	neg	neg	neg
NIST 312 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 314 SP	neg	neg	neg	neg	neg
NIST 315 SP	neg	neg	neg	neg	neg
NIST 319 SP	neg	neg	neg	neg	neg
NIST 320 SP	neg	neg	neg	neg	neg
NIST 321 SP	neg	neg	neg	neg	neg
NIST 322 SP	neg	neg	neg	neg	neg
NIST 323 SP	POSITIVE	neg	neg	neg	neg
n=83					

Group A Summary of Urine, Sweat Patch and LP Results

CHT Sample #	Cocaine			Opiates			Cannabinoids			Phencyclidine			Amphetamine			LP - Confirmations	Urine Confirmations	Sweat Patch Confirmations
	U1	U2	SP	U1	U2	SP	U1	U2	SP	U1	U2	SP	U1	U2	SP			
105	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC LP2 COC		COC=13/BZE=8
113	POS	POS	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC BZE LP2 COC BZE	U1 COC=75/BZE>1000 U2 COC=31/BZE>1000	COC>200/BZE>200
119	neg	POS	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC BZE LP2 COC BZE	U2 COC=13/BZE>1000	COC>200/BZE=33
125	POS	neg	POS	POS	neg	POS	POS	neg	neg	neg	neg	neg	neg	neg	neg	LP1 THC=neg 6MAM COC BZE LP2 THC=neg 6MAM COC BZE	U1 COC=847/BZE>1000 THC-COOH=12 U2 MOR=426 COD=16 6MAM=11	COC>200/BZE=88 Cod=5,Mor=23, 6-AM=39
131	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	POS	LP1 AMP COC/BZE=neg LP2 AMP COC		AMP&METH=neg COC=6/BZE=neg
136	neg	neg	neg	neg	neg	neg	POS	POS	neg	POS	POS	neg	neg	neg	neg	LP1 PCP=POSITIVE, THC=neg LP2 PCP=POSITIVE, THC=neg	U1 PCP=88 THC-COOH=315 U2 PCP>100 THC-COOH=85	
138	neg	neg	neg	POS	POS	POS	neg	neg	neg	neg	NT	neg	neg	NT	POS	LP1 6MAM AMPS=neg LP2 MOR 6MAM METH AMP=neg	U1 MOR=127 6MAM=7	AMP=18/Meth=neg Cod=18,Mor=37, 6-AM=48
143	neg	POS	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC LP2 COC BZE		COC>200/BZE=45
152	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	NT	neg	LP1 COC LP2 COC/BZE=neg		COC=14/BZE=neg
160	PTS	neg	POS	PTS	neg	neg	PTS	neg	neg	PTS	neg	neg	PTS	neg	neg	LP1 COC BZE LP2 COC BZE		COC=84/BZE=12
163	neg	neg	neg	neg	neg	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	LP1 THC=neg LP2 THC=neg	U2 THC-COOH=16	
171	neg	neg	POS	neg	neg	POS	neg	POS	neg	neg	NT	neg	neg	NT	neg	LP1 Opiates=neg COC/BZE=neg THC=QNS LP2 Opiates=neg COC/BZE=neg THC=QNS		COC=neg/BZE=8 6-AM=1
183	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	NT	POS	LP1 AMPS=neg LP 2 AMPS=neg		AMP&METH=neg
186	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	NT	neg	neg	NT	POS	LP1 AMP=neg LP 2 AMPS=neg		AMP&METH=neg
192	neg	neg	POS	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	NT	neg	LP1 MOR COC LP2 Opiates=neg COC BZE		COC=17/BZE>200 Mor=5
205	neg	POS	POS	neg	neg	neg	neg	neg	neg	neg	NT	neg	neg	NT	neg	LP1 COC BZE LP2 COC BZE		COC>200/BZE=73
209	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC LP2 COC		COC=6/BZE=5
212	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	NT	neg	neg	LP1 COC BZE LP2 COC BZE		COC=41/BZE=7
225	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	NT	neg	LP1 COC LP2 COC BZE		COC=86/BZE=7

Group A Summary of Urine, Sweat Patch and LP Results

CHT	Cocaine			Opiates			Cannabinoids			Phencyclidine			Amphetamine			LP - Confirmations	Urine Confirmations	Sweat Patch Confirmations
Sample #	U1	U2	SP	U1	U2	SP	U1	U2	SP	U1	U2	SP	U1	U2	SP			
264	neg	neg	POS	neg	neg	POS	neg	NT	neg	neg	neg	neg	neg	NT	POS	LP1 Opiates=neg AMPS=neg COC BZE LP2 Opiates=neg AMPS=neg COC		AMP&METH=neg COC=160/BZE=9 Opiates=neg
267	PTS	PTS	POS	PTS	PTS	POS	PTS	PTS	neg	PTS	PTS	neg	PTS	PTS	neg	LP1 Opiates=neg COC/BZE=neg LP2 MOR 6MAM COC/BZE=neg		COC=148/BZE=6 Cod=1,Mor=2, 6-AM=2
269	neg	neg	neg	neg	PTS	POS	neg	neg	neg	neg	neg	neg	neg	NT	neg	LP1 Opiates=neg LP2 Opiates=neg		Cod=3, 6-AM=3
275	neg	neg	neg	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 6MAM HEROIN LP2 6MAM		6-AM=2
280	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC/BZE=neg LP2 COC BZE		COC>200/BZE=26
282	neg	POS	POS	neg	neg	neg	neg	neg	POS	neg	neg	neg	neg	neg	neg	LP1 THC=neg COC BZE LP2 THC=neg BZE	U2 COC=244/BZE>1000	COC>200/BZE=104 THC=13.6
284	neg	neg	POS	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 Opiates=neg COC/BZE=neg LP2 Opiates=neg COC/BZE=neg		COC=5/BZE=neg Opiates=neg
285	neg	neg	neg	neg	neg	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	LP1 THC=neg LP2 THC=neg		
291	neg	neg	POS	neg	neg	neg	NT	NT	neg	neg	neg	neg	NT	NT	neg	LP1 COC/BZE=neg LP2 COC/BZE=neg		COC&BZE=neg
293	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC/BZE=neg LP2 COC/BZE=neg		COC=neg/BZE=8
294	neg	neg	neg	neg	POS	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 Opiates=neg LP2 MOR 6MAM	U2 MOR=28 COD=13	Cod=5,Mor=1, 6-AM=2.5
296	neg	PTS	POS	POS	PTS	POS	POS	PTS	neg	neg	PTS	neg	neg	PTS	neg	LP1 THC MOR 6MAM COC BZE LP2 THC=neg MOR 6MAM COC BZE	U1 THC-COOH=14 MOR=415 COD=15	COC=28/BZE=9 Cod=3,Mor=14, 6-AM=18
298	POS	POS	POS	neg	neg	POS	NT	neg	neg	neg	NT	neg	NT	NT	neg	LP1 6MAM COC BZE LP2 Opiates=neg COC BZE		COC>200/BZE=145 6-AM=3
300	neg	POS	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 COC BZE LP2 COC BZE	U2 COC=neg/BZE=127	COC>200/BZE=14
301	neg	neg	POS	neg	neg	neg	neg	neg	neg	NT	neg	neg	NT	neg	neg	LP1 COC LP2 COC		COC&BZE=neg
306	neg	neg	neg	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 Opiates=neg LP2 Opiates=neg		Cod=1&Mor=1
307	POS	POS	POS	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	NT	neg	LP1 Opiates=neg COC BZE LP2 Opiates=neg COC BZE	U1 COC>1000/BZE>1000	COC>200/BZE>200 Cod=3 & 6-AM=5
308	neg	neg	neg	neg	neg	POS	neg	neg	neg	NT	PTS	neg	NT	NT	neg	LP1 Opiates=neg LP2 Opiates=neg		6-AM=3
309	neg	neg	POS	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP1 6MAM COC LP2 MOR 6MAM HEROIN COC BZE		COC>200/BZE=69 Cod=7,Mor=11, 6-AM=48
312	POS	POS	POS	POS	POS	POS	NT	neg	neg	neg	neg	neg	NT	neg	neg	LP1 MOR 6MAM HEROIN COC BZE LP2 MOR 6MAM HEROIN COC BZE	U2 COC=551/BZE>1000/ MOR=2595 COD=117	COC>200/BZE=116 Cod=27,Mor=28, 6-AM=131
323	neg	neg	POS	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	neg	LP2 COC BZE		COC=21/BZE=neg

PTS = Tested at PTS and no data

NT= Not tested

Concentrations are ng/mL

Sweat Patch Screen Positive Summary (Group A)

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 105 SP	POSITIVE	neg	neg	neg	neg
NIST 113 SP	POSITIVE	neg	neg	neg	neg
NIST 119 SP	POSITIVE	neg	neg	neg	neg
NIST 125 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 131 SP	POSITIVE	neg	neg	neg	POSITIVE
NIST 138 SP	neg	POSITIVE	neg	neg	pos (1)/neg (2)
NIST 143 SP	POSITIVE	neg	neg	neg	neg
NIST 152 SP	POSITIVE	neg	neg	neg	neg
NIST 160 SP	POSITIVE	neg	neg	neg	neg
NIST 171 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 183 SP	neg	neg	neg	neg	POSITIVE
NIST 186 SP	neg	neg	neg	neg	POSITIVE
NIST 192 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 205 SP	POSITIVE	neg	neg	neg	neg
NIST 209 SP	POSITIVE	neg	neg	neg	neg
NIST 212 SP	POSITIVE	neg	neg	neg	neg
NIST 225 SP	POSITIVE	neg	neg	neg	neg
NIST 242 SP	POSITIVE	neg	neg	neg	POSITIVE
NIST 255 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 261 SP	POSITIVE	neg	neg	neg	neg
NIST 264 SP	POSITIVE	POSITIVE	neg	neg	POSITIVE
NIST 267 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 269 SP	neg	POSITIVE	neg	neg	neg
NIST 275 SP	neg	POSITIVE	neg	neg	neg
NIST 279 SP	neg	neg	POSITIVE	POSITIVE	neg
NIST 280 SP	POSITIVE	neg	neg	neg	neg
NIST 282 SP	POSITIVE	neg	POSITIVE	neg	neg
NIST 284 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 291 SP	POSITIVE	neg	neg	neg	neg
NIST 293 SP	POSITIVE	neg	neg	neg	neg
NIST 294 SP	neg	POSITIVE	neg	neg	neg
NIST 296 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 298 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 300 SP	POSITIVE	neg	neg	neg	neg
NIST 301 SP	POSITIVE	neg	neg	neg	neg
NIST 306 SP	neg	POSITIVE	neg	neg	neg
NIST 307 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 308 SP	neg	POSITIVE	neg	neg	neg
NIST 309 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 312 SP	POSITIVE	POSITIVE	neg	neg	neg
NIST 323 SP	POSITIVE	neg	neg	neg	neg

Sweat Patch Confirmation Summary (Group A)

Results = ng/patch

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH	Comments
NIST 105 SP	POSITIVE	neg	neg	neg	neg	COC=13/BZE=8
NIST 113 SP	POSITIVE	neg	neg	neg	neg	COC>200/BZE>200
NIST 119 SP	POSITIVE	neg	neg	neg	neg	COC>200/BZE=33
NIST 125 SP	POSITIVE	POSITIVE	neg	neg	neg	COC>200/BZE=88 Cod=5,Mor=23, 6-AM=39
NIST 131 SP	POSITIVE	neg	neg	neg	POSITIVE	AMP&METH=neg COC=6/BZE=neg
NIST 138 SP	neg	POSITIVE	neg	neg	pos (1)/neg (2)	AMP=18/Meth? neg Cod=18,Mor=37, 6-AM=48
NIST 143 SP	POSITIVE	neg	neg	neg	neg	COC>200/BZE=45
NIST 152 SP	POSITIVE	neg	neg	neg	neg	COC=14/BZE=neg
NIST 160 SP	POSITIVE	neg	neg	neg	neg	COC=84/BZE=12
NIST 171 SP	POSITIVE	POSITIVE	neg	neg	neg	COC=neg/BZE=8 6-AM=1
NIST 183 SP	neg	neg	neg	neg	POSITIVE	AMP&METH=neg
NIST 186 SP	neg	neg	neg	neg	POSITIVE	AMP&METH=neg
NIST 192 SP	POSITIVE	POSITIVE	neg	neg	neg	COC=17/BZE>200 Mor=5
NIST 205 SP	POSITIVE	neg	neg	neg	neg	COC>200/BZE=73
NIST 209 SP	POSITIVE	neg	neg	neg	neg	COC=6/BZE=5
NIST 212 SP	POSITIVE	neg	neg	neg	neg	COC=41/BZE=7
NIST 225 SP	POSITIVE	neg	neg	neg	neg	COC=86/BZE=7
NIST 242 SP	POSITIVE	neg	neg	neg	POSITIVE	AMP&METH=neg COC>200/BZE>200
NIST 255 SP	POSITIVE	POSITIVE	neg	neg	neg	COC>200/BZE>200
						Cod=137,Mor=1.5, 6-AM=7
NIST 261 SP	POSITIVE	neg	neg	neg	neg	COC=96/BZE=5
NIST 264 SP	POSITIVE	POSITIVE	neg	neg	POSITIVE	AMP&METH=neg COC=160/BZE=9
NIST 267 SP	POSITIVE	POSITIVE	neg	neg	neg	COC=148/BZE=6 Cod=1,Mor=2, 6-AM=2
NIST 269 SP	POSITIVE	POSITIVE	neg	neg	neg	Cod=3, 6-AM=3
NIST 275 SP	neg	POSITIVE	neg	neg	neg	6-AM=2
NIST 280 SP	POSITIVE	neg	neg	neg	neg	COC>200/BZE=26
NIST 282 SP	POSITIVE	neg	POSITIVE	neg	neg	COC>200/BZE=104 THC=13.6
NIST 284 SP	neg	POSITIVE	neg	neg	neg	COC=5/BZE=neg Opiates=neg
NIST 291 SP	POSITIVE	neg	neg	neg	neg	COC&BZE=neg
NIST 293 SP	POSITIVE	neg	neg	neg	neg	COC=neg/BZE=8
NIST 294 SP	neg	POSITIVE	neg	neg	neg	Cod=5,Mor=1, 6-AM=2.5
NIST 296 SP	POSITIVE	POSITIVE	neg	neg	neg	COC=28/BZE=9 Cod=3,Mor=14, 6-AM=18
NIST 298 SP	POSITIVE	POSITIVE	neg	neg	neg	COC>200/BZE=145 6-AM=3
NIST 300 SP	POSITIVE	neg	neg	neg	neg	COC>200/BZE=14
NIST 301 SP	neg	neg	neg	neg	neg	COC&BZE=neg
NIST 306 SP	neg	POSITIVE	neg	neg	neg	Cod=1&Mor=1
NIST 307 SP	POSITIVE	POSITIVE	neg	neg	neg	COC>200/BZE>200 Cod=3 & 6-AM=5
NIST 308 SP	neg	POSITIVE	neg	neg	neg	6-AM=3
NIST 309 SP	POSITIVE	POSITIVE	neg	neg	neg	COC>200/BZE=69 Cod=7,Mor=11, 6-AM=48
NIST 312 SP	POSITIVE	POSITIVE	neg	neg	neg	COC>200/BZE=116 Cod=27,Mor=28, 6-AM=131
NIST 323 SP	POSITIVE	neg	neg	neg	neg	COC=21/BZE=neg

Liquid Perspiration Screen Results Group A "Negative" Samples

CHT Sample #	COC/BZE	Opiates	THC	PCP	AMPS
NIST 101 LP1	POSITIVE	neg	neg	neg	neg
NIST 101 LP2	POSITIVE	neg	neg	neg	neg
NIST 107 LP1	POSITIVE	neg	neg	neg	neg
NIST 107 LP2	POSITIVE	neg	neg	neg	neg
NIST 111 LP1	POSITIVE	neg	POSITIVE	neg	neg
NIST 111 LP2	POSITIVE	neg	neg	neg	neg
NIST 112 LP1	POSITIVE	neg	neg	neg	neg
NIST 112 LP2	POSITIVE	neg	neg	neg	neg
NIST 114 LP1	POSITIVE	neg	neg	neg	neg
NIST 114 LP2	POSITIVE	neg	neg	neg	neg
NIST 115 LP1	neg	neg	neg	neg	neg
NIST 115 LP2	POSITIVE	neg	neg	neg	neg
NIST 116 LP1	POSITIVE	neg	neg	neg	neg
NIST 116 LP2	POSITIVE	neg	neg	neg	neg
NIST 120 LP1	POSITIVE	neg	neg	neg	neg
NIST 120 LP2	POSITIVE	neg	neg	neg	neg
NIST 121 LP1	POSITIVE	POSITIVE	neg	neg	neg
NIST 121 LP2	POSITIVE	neg	neg	neg	neg
NIST 129 LP1	POSITIVE	neg	neg	neg	neg
NIST 129 LP2	POSITIVE	neg	neg	neg	neg
NIST 155 LP1	POSITIVE	neg	neg	neg	neg
NIST 155 LP2	POSITIVE	neg	neg	neg	neg
NIST 165 LP1	POSITIVE	neg	neg	neg	neg
NIST 165 LP2	POSITIVE	neg	neg	neg	neg
NIST 169 LP1	POSITIVE	POSITIVE	neg	neg	neg
NIST 169 LP2	POSITIVE	POSITIVE	neg	neg	neg
NIST 175 LP1	POSITIVE	neg	neg	neg	neg
NIST 175 LP2	neg	neg	neg	neg	neg
NIST 176 LP1	POSITIVE	neg	neg	neg	neg
NIST 176 LP2	POSITIVE	neg	neg	neg	neg
NIST 178 LP1	POSITIVE	neg	neg	POSITIVE	neg
NIST 178 LP2	POSITIVE	neg	neg	neg	neg
NIST 198 LP1	POSITIVE	POSITIVE	neg	neg	neg
NIST 198 LP2	POSITIVE	POSITIVE	neg	neg	neg

Liquid Perspiration Screen Results Group A "Negative" Samples

CHT Sample #	COC/BZE	Opiates	THC	PCP	AMPS
NIST 232 LP1	POSITIVE	neg	neg	neg	neg
NIST 232 LP2	POSITIVE	neg	neg	neg	neg
NIST 235 LP1	POSITIVE	POSITIVE	neg	neg	neg
NIST 235 LP2	POSITIVE	neg	neg	neg	neg
NIST 246 LP1	POSITIVE	POSITIVE	neg	neg	neg
NIST 246 LP2	neg	neg	neg	neg	neg
NIST 277 LP1	POSITIVE	neg	neg	neg	neg
NIST 277 LP2	POSITIVE	neg	neg	neg	neg
NIST 278 LP1	POSITIVE	neg	POSITIVE	neg	neg
NIST 278 LP2	POSITIVE	neg	neg	neg	neg
NIST 299 LP1	POSITIVE	neg	neg	neg	neg
NIST 299 LP2	POSITIVE	neg	neg	neg	neg
NIST 314 LP1	POSITIVE	neg	neg	neg	neg
NIST 314 LP2	POSITIVE	neg	neg	POSITIVE	neg
NIST 315 LP1	POSITIVE	neg	neg	neg	neg
NIST 315 LP2	POSITIVE	POSITIVE	neg	neg	neg

Appendix Group B

Group B Urine Drug Screen Results

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 102 UX	neg	neg	neg	neg	neg
NIST 108 UX	neg	POSITIVE	neg	POSITIVE	neg
NIST 109 UX	neg	neg	neg	neg	neg
NIST 110 UX	POSITIVE	POSITIVE	neg	neg	POSITIVE
NIST 117 UX	neg	POSITIVE	neg	neg	neg
NIST 118 UX	neg	neg	neg	neg	neg
NIST 122 UX	neg	POSITIVE	neg	neg	neg
NIST 126 UX	POSITIVE	neg	neg	neg	neg
NIST 127 UX	neg	neg	neg	neg	neg
NIST 132 UX	neg	neg	neg	neg	neg
NIST 133 UX	neg	neg	neg	neg	neg
NIST 137 UX	neg	neg	neg	neg	neg
NIST 140 UX	neg	neg	neg	neg	neg
NIST 142 UX	neg	neg	neg	neg	neg
NIST 145 UX	neg	neg	neg	neg	neg
NIST 146 UX	neg	neg	neg	neg	neg
NIST 147 UX	neg	neg	neg	neg	neg
NIST 148 UX	neg	neg	neg	neg	neg
NIST 149 UX	neg	neg	POSITIVE	POSITIVE	neg
NIST 150 UX	neg	neg	neg	neg	neg
NIST 151 UX	neg	neg	neg	neg	neg
NIST 153 UX	neg	neg	neg	neg	neg
NIST 154 UX	neg	neg	neg	neg	neg
NIST 157 UX	neg	neg	neg	neg	neg
NIST 161 UX	neg	neg	neg	neg	neg
NIST 164 UX	neg	neg	neg	neg	neg
NIST 166 UX	neg	neg	neg	neg	neg
NIST 168 UX	neg	neg	neg	neg	neg
NIST 173 UX	POSITIVE	neg	POSITIVE	neg	neg
NIST 177 UX	POSITIVE	neg	neg	neg	neg
NIST 179 UX	neg	neg	neg	neg	neg
NIST 182 UX	neg	neg	neg	neg	neg
NIST 185 UX	neg	neg	neg	neg	neg
NIST 187 UX	POSITIVE	neg	neg	neg	neg
NIST 188 UX	neg	neg	neg	neg	neg
NIST 189 UX	neg	neg	neg	neg	neg
NIST 190 UX	neg	neg	neg	neg	neg
NIST 191 UX	neg	neg	neg	neg	neg
NIST 193 UX	POSITIVE	neg	neg	neg	neg
NIST 194 UX	neg	neg	neg	neg	neg
NIST 196 UX	neg	neg	POSITIVE	neg	neg
NIST 206 UX	POSITIVE	neg	neg	neg	neg
NIST 220 UX	neg	neg	neg	neg	neg
NIST 221 UX	neg	neg	neg	neg	neg
NIST 222 UX	neg	neg	neg	neg	neg
NIST 223 UX	neg	neg	neg	neg	neg
NIST 231 UX	neg	neg	neg	neg	neg
NIST 234 UX	POSITIVE	neg	neg	neg	neg

Group B Urine Drug Screen Results

CHT Sample #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 236 UX	neg	neg	neg	neg	neg
NIST 237 UX	neg	neg	neg	neg	neg
NIST 238 UX	neg	neg	neg	neg	neg
NIST 239 UX	neg	neg	neg	neg	neg
NIST 240 UX	neg	neg	neg	neg	neg
NIST 243 UX	neg	POSITIVE	neg	neg	neg
NIST 245 UX	neg	neg	neg	neg	neg
NIST 247 UX	neg	neg	neg	neg	neg
NIST 248 UX	neg	neg	neg	neg	neg
NIST 249 UX	neg	neg	neg	neg	neg
NIST 250 UX	neg	neg	neg	neg	neg
NIST 251 UX	neg	neg	POSITIVE	POSITIVE	neg
NIST 252 UX	neg	neg	neg	neg	neg
NIST 253 UX	neg	neg	neg	neg	neg
NIST 254 UX	neg	neg	neg	neg	neg
NIST 257 UX	neg	neg	neg	neg	neg
NIST 259 UX	neg	neg	neg	neg	neg
NIST 260 UX	neg	neg	neg	neg	neg
NIST 262 UX	neg	POSITIVE	neg	neg	neg
NIST 263 UX	neg	neg	POSITIVE	neg	neg
NIST 268 UX	neg	neg	neg	neg	neg
NIST 270 UX	neg	neg	neg	neg	neg
NIST 273 UX	neg	neg	neg	neg	neg
NIST 274 UX	POSITIVE	neg	neg	neg	neg
NIST 283 UX	neg	neg	neg	neg	neg
NIST 286 UX	neg	neg	neg	neg	neg
NIST 287 UX	neg	neg	neg	neg	neg
NIST 288 UX	neg	neg	neg	neg	neg
NIST 289 UX	neg	neg	neg	neg	neg
NIST 295 UX	POSITIVE	neg	neg	neg	neg
NIST 303 UX	neg	neg	neg	neg	neg
NIST 304 UX	neg	neg	neg	neg	neg
NIST 305 UX	neg	neg	neg	neg	neg
n=81					

Group B Urine Drug Screen Positive Summary

Sample ID #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 108 UX	neg	POSITIVE	neg	POSITIVE	neg
NIST 110 UX	POSITIVE	POSITIVE	neg	neg	POSITIVE
NIST 117 UX	neg	POSITIVE	neg	neg	neg
NIST 122 UX	neg	POSITIVE	neg	neg	neg
NIST 123 UX	POSITIVE*	neg	neg	neg	NT
NIST 149 UX	neg	neg	POSITIVE	POSITIVE	neg
NIST 173 UX	POSITIVE	neg	POSITIVE	neg	neg
NIST 177 UX	POSITIVE	neg	neg	neg	neg
NIST 187 UX	POSITIVE	neg	neg	neg	neg
NIST 193 UX	POSITIVE	neg	neg	neg	neg
NIST 195 UX	POSITIVE*	POSITIVE*	neg	neg	NT
NIST 196 UX	neg	neg	POSITIVE	neg	neg
NIST 206 UX	POSITIVE	neg	neg	neg	neg
NIST 219 UX	POSITIVE*	POSITIVE*	neg	NT	NT
NIST 234 UX	POSITIVE	neg	neg	neg	neg
NIST 243 UX	neg	POSITIVE	neg	neg	neg
NIST 251 UX	neg	neg	POSITIVE	POSITIVE	neg
NIST 262 UX	neg	POSITIVE	neg	neg	neg
NIST 263 UX	neg	neg	POSITIVE	neg	neg
NIST 274 UX	POSITIVE	neg	neg	neg	neg
NIST 292 UX	neg	neg	POSITIVE*	NT	NT
NIST 295 UX	POSITIVE	neg	neg	neg	neg
NIST 302 UX	neg	neg	POSITIVE*	POSITIVE*	NT

* = Washington Pretrial Services NT=Not Tested

Group B Urine Confirmation Summary

Urine Confirmations MS (ng/mL)

Sample ID #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH	Comments
NIST 108 UX	neg	POSITIVE	neg	POSITIVE	neg	PCP=33 MOR=102 COD=25
NIST 110 UX	POSITIVE	POSITIVE	neg	neg	POSITIVE	AMP/METH=neg COC=454? /BZE>1000 MOR=2290 COD=1020 6MAM=1277
NIST 117 UX	neg	POSITIVE	neg	neg	neg	MOR=583 COD=42 6MAM=38
NIST 122 UX	neg	POSITIVE	neg	neg	neg	MOR=70 COD=4938
NIST 126 UX	POSITIVE	neg	neg	neg	neg	COC=neg/BZE=167
NIST 149 UX	neg	neg	POSITIVE	POSITIVE	neg	PCP>100 THC-COOH=5
NIST 173 UX	POSITIVE	neg	POSITIVE	neg	neg	COC=88/BZE>1000 THC-COOH=27
NIST 177 UX	POSITIVE	neg	neg	neg	neg	COC=10/BZE=221
NIST 187 UX	POSITIVE	neg	neg	neg	neg	COC=73/BZE>1000
NIST 193 UX	POSITIVE	neg	neg	neg	neg	COC=9/BZE=178
NIST 196 UX	neg	neg	POSITIVE	neg	neg	THC-COOH=17
NIST 206 UX	POSITIVE	neg	neg	neg	neg	COC=401/BZE>1000
NIST 234 UX	POSITIVE	neg	neg	neg	neg	COC>1000/BZE>1000
NIST 243 UX	neg	POSITIVE	neg	neg	neg	MOR=78
NIST 251 UX	neg	neg	POSITIVE	POSITIVE	neg	PCP=25 THC-COOH=30
NIST 262 UX	neg	POSITIVE	neg	neg	neg	MOR=389 COD=26
NIST 263 UX	neg	neg	neg	neg	neg	THC-COOH=neg
NIST 274 UX	POSITIVE	neg	neg	neg	neg	COC=14/BZE=838
NIST 285 UX	neg	neg	neg	neg	neg	THC-COOH=neg
NIST 295 UX	POSITIVE	neg	neg	neg	neg	COC=20/BZE=536 MOR=2595 COD=117

Group B Urine Pretrial Services Unconfirmed Positive Resutls

Washington Pretrial Services Screen Only Positive Results

Sample ID #	COC/BZE	Opiates	THC-COOH	PCP	AMP/METH
NIST 123 UX	POSITIVE	neg	neg	neg	NT
NIST 195 UX	POSITIVE	POSITIVE	neg	neg	NT
NIST 219 UX	POSITIVE	POSITIVE	neg	NT	NT
NIST 263 UX	neg	neg	POSITIVE	neg	neg
NIST 302 UX	neg	neg	POSITIVE	POSITIVE	NT
NIST 312 UX	POSITIVE	POSITIVE	NT	neg	NT

NT=Not Tested

Group B Liquid Perspiration Screen Results

CHT Sample #	COC/BZE	Opiates	PCP	THC	AMP	METH
NIST 102 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 108 LPX	POSITIVE	POSITIVE	POSITIVE	neg	neg	neg
NIST 109 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 110 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 117 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 118 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 122 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 123 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 126 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 127 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 132 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 133 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 134 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 137 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 140 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 142 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 144 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 145 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 146 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 147 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 148 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 149 LPX	POSITIVE	neg	POSITIVE	neg	neg	neg
NIST 150 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 151 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE
NIST 153 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 154 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 156 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 157 LPX	neg	neg	neg	neg	neg	neg
NIST 158 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 159 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE
NIST 161 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 164 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 166 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 167 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 168 LPX	neg	neg	neg	neg	neg	neg
NIST 172 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 173 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 177 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 179 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 180 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 182 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 185 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 187 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 188 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 189 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 190 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 191 LPX	POSITIVE	POSITIVE	neg	neg	neg	POSITIVE
NIST 193 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 194 LPX	POSITIVE	neg	neg	neg	POSITIVE	neg
NIST 195 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 196 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 197 LPX	POSITIVE	neg	neg	neg	POSITIVE	neg
NIST 200 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 201 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 202 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 203 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 206 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 207 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE

Group B Liquid Perspiration Screen Results

CHT Sample #	COC/BZE	Opiates	PCP	THC	AMP	METH
NIST 210 LPX	neg	neg	neg	neg	neg	neg
NIST 211 LPX	POSITIVE	neg	neg	neg	POSITIVE	neg
NIST 213 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 215 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 216 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 218 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 219 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 220 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 221 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 222 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 223 LPX	neg	neg	neg	neg	neg	neg
NIST 226 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 228 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 230 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 231 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 234 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 236 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 237 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 238 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 239 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 240 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 243 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 245 LPX	neg	neg	neg	neg	neg	neg
NIST 247 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 248 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 249 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 250 LPX	neg	neg	neg	neg	POSITIVE	neg
NIST 251 LPX	POSITIVE	neg	POSITIVE	neg	POSITIVE	neg
NIST 252 LPX	POSITIVE	POSITIVE	neg	neg	POSITIVE	neg
NIST 253 LPX	POSITIVE	POSITIVE	neg	neg	POSITIVE	POSITIVE
NIST 254 LPX	neg	neg	neg	neg	neg	neg
NIST 257 LPX	neg	neg	neg	neg	POSITIVE	neg
NIST 259 LPX	neg	neg	neg	neg	POSITIVE	POSITIVE
NIST 260 LPX	neg	neg	neg	neg	POSITIVE	neg
NIST 262 LPX	POSITIVE	POSITIVE	neg	neg	POSITIVE	neg
NIST 263 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 268 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 270 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 273 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 274 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 283 LPX	neg	neg	neg	neg	neg	neg
NIST 286 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 287 LPX	neg	neg	neg	neg	neg	neg
NIST 288 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE
NIST 289 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 292 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 295 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 302 LPX	neg	neg	POSITIVE	neg	neg	neg
NIST 303 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 304 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 305 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 311 LPX	neg	POSITIVE	neg	neg	neg	neg
NIST 313 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 324 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 325 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
NIST 326 LPX	POSITIVE	neg	neg	neg	neg	neg
NIST 327 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg
n=115						

Group B Liquid Perspiration Screen Positive Summary and Selected Cocaine Confirmations

CHT Sample #	COC	Opiates	PCP	THC	AMP	Meth	Selected COC Confirmations
NIST 102 LPX	POSITIVE	neg	neg	neg	neg	neg	neg-MS
NIST 108 LPX	POSITIVE	POSITIVE	POSITIVE	neg	neg	neg	
NIST 109 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 110 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 117 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 118 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 122 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 123 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 126 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 127 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 132 LPX	POSITIVE	neg	neg	neg	neg	neg	neg-MS
NIST 133 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 134 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 137 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 140 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 142 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 144 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 145 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 146 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	neg-MS
NIST 147 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 148 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 149 LPX	POSITIVE	neg	POSITIVE	neg	neg	neg	
NIST 150 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 151 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE	
NIST 153 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 154 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 156 LPX	POSITIVE	neg	neg	neg	neg	neg	COC=Positive - MS
NIST 158 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 159 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE	
NIST 161 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 164 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 166 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 167 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 172 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 173 LPX	POSITIVE	neg	neg	neg	neg	neg	COC=Positive - MS
NIST 177 LPX	POSITIVE	neg	neg	neg	neg	neg	

Group B Liquid Perspiration Screen Positive Summary and Selected Cocaine Confirmations

CHT Sample #	COC	Opiates	PCP	THC	AMP	Meth	Selected COC Confirmations
NIST 179 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 180 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 182 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 185 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 187 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 188 LPX	POSITIVE	neg	neg	neg	neg	neg	COC=Positive - MS
NIST 189 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 190 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 191 LPX	POSITIVE	POSITIVE	neg	neg	neg	POSITIVE	
NIST 193 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 194 LPX	POSITIVE	neg	neg	neg	POSITIVE	neg	
NIST 195 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 196 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 197 LPX	POSITIVE	neg	neg	neg	POSITIVE	neg	
NIST 200 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 201 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 202 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 203 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 206 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 207 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE	
NIST 211 LPX	POSITIVE	neg	neg	neg	POSITIVE	neg	neg-MS
NIST 213 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 215 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 216 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 218 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 219 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 220 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 221 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 222 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 226 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 228 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 230 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 231 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 234 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 236 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 237 LPX	POSITIVE	neg	neg	neg	neg	neg	

Group B Liquid Perspiration Screen Positive Summary and Selected Cocaine Confirmations

CHT Sample #	COC	Opiates	PCP	THC	AMP	Meth	Selected COC Confirmations
NIST 238 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 239 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 240 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 243 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 247 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 248 LPX	POSITIVE	neg	neg	neg	neg	neg	COC=Positive - MS
NIST 249 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 250 LPX	neg	neg	neg	neg	POSITIVE	neg	
NIST 251 LPX	POSITIVE	neg	POSITIVE	neg	POSITIVE	neg	
NIST 252 LPX	POSITIVE	POSITIVE	neg	neg	POSITIVE	neg	
NIST 253 LPX	POSITIVE	POSITIVE	neg	neg	POSITIVE	POSITIVE	
NIST 257 LPX	neg	neg	neg	neg	POSITIVE	neg	
NIST 259 LPX	neg	neg	neg	neg	POSITIVE	POSITIVE	
NIST 260 LPX	neg	neg	neg	neg	POSITIVE	neg	
NIST 262 LPX	POSITIVE	POSITIVE	neg	neg	POSITIVE	neg	
NIST 263 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 268 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 270 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 273 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 274 LPX	POSITIVE	neg	neg	neg	neg	neg	COC=Positive - MS
NIST 286 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 288 LPX	POSITIVE	neg	neg	neg	neg	POSITIVE	
NIST 289 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 292 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 295 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 302 LPX	neg	neg	POSITIVE	neg	neg	neg	
NIST 303 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 304 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 305 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 311 LPX	neg	POSITIVE	neg	neg	neg	neg	
NIST 313 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 324 LPX	POSITIVE	neg	neg	neg	neg	neg	neg-MS
NIST 325 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
NIST 326 LPX	POSITIVE	neg	neg	neg	neg	neg	
NIST 327 LPX	POSITIVE	POSITIVE	neg	neg	neg	neg	
n=107							