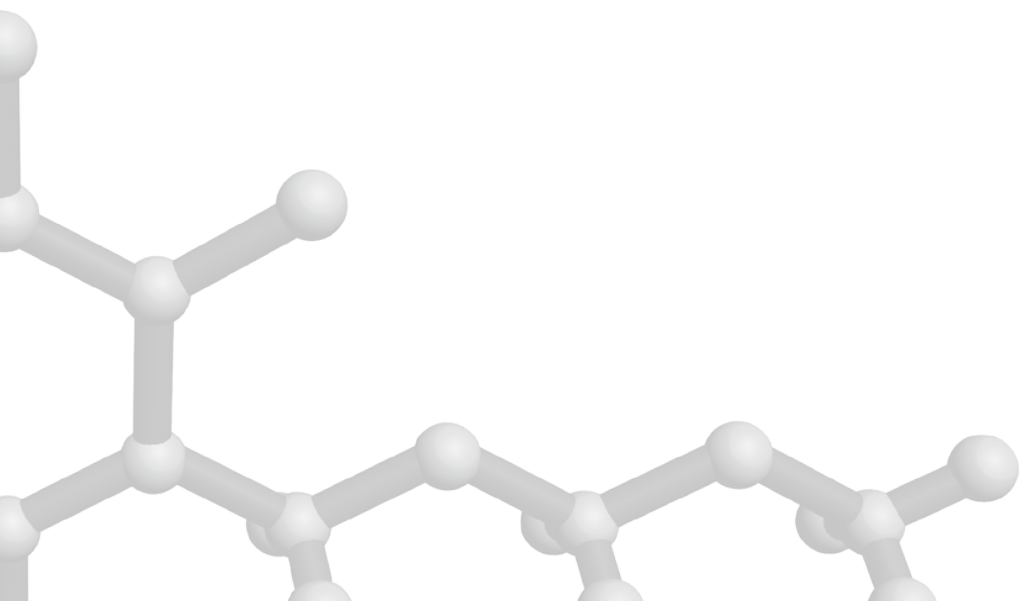
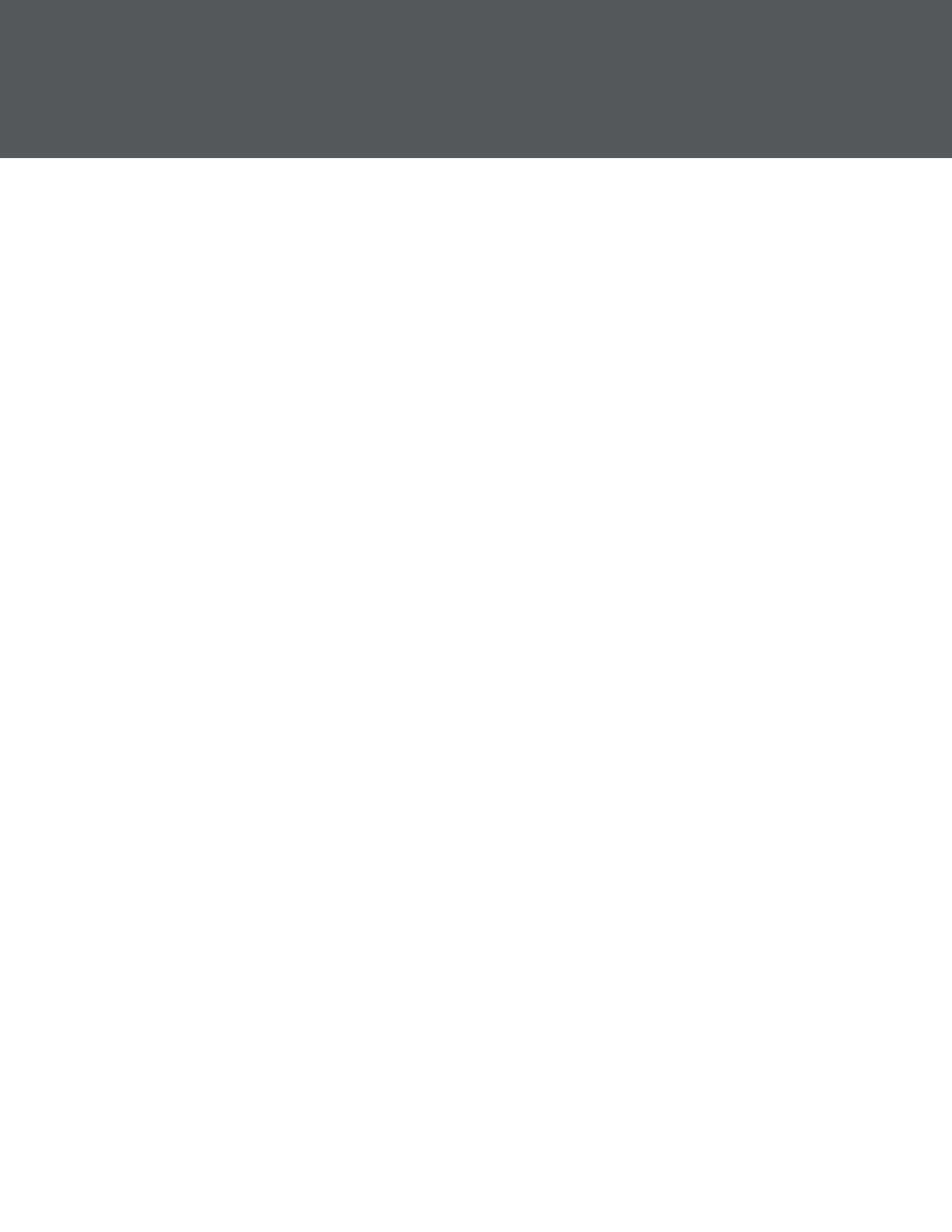




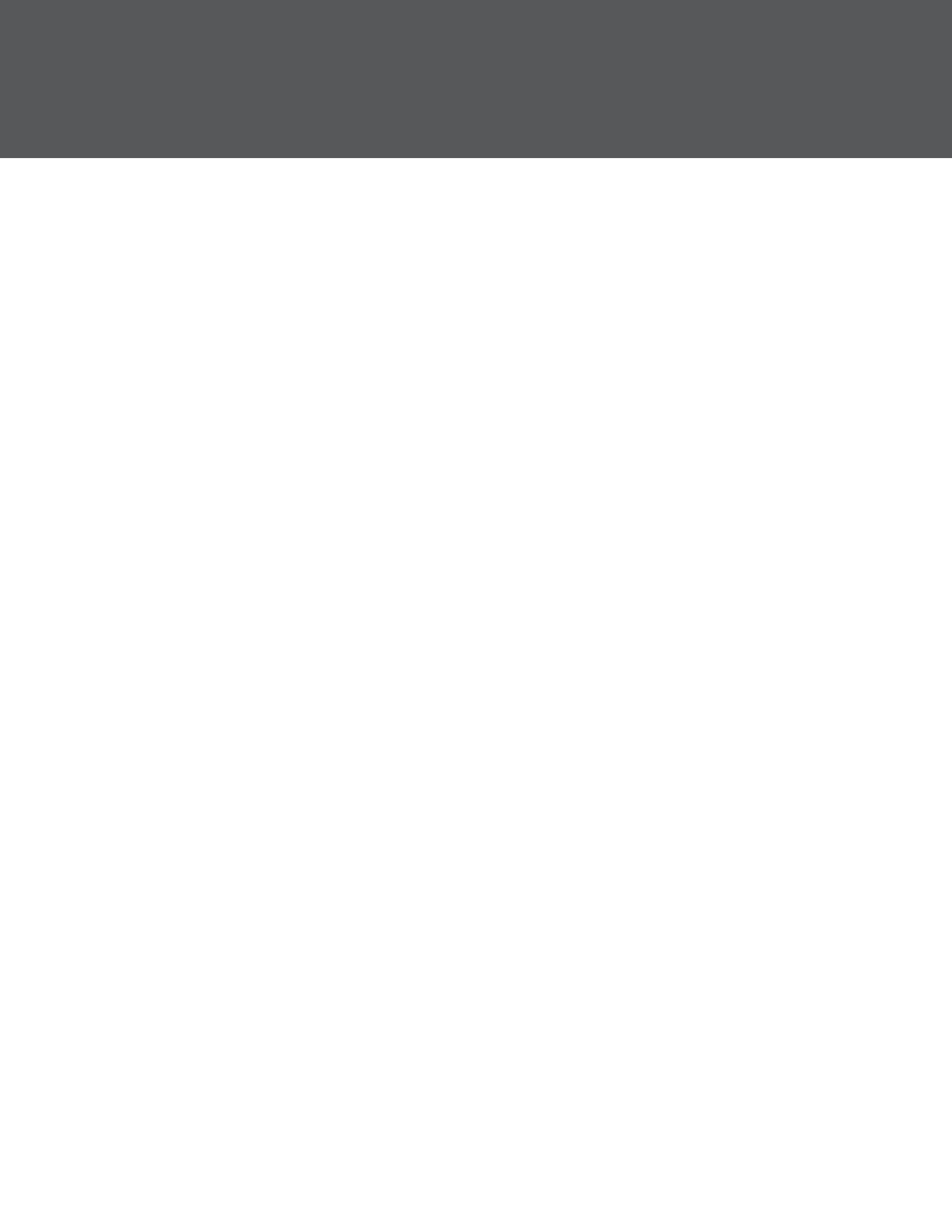
## Laboratory Testing **Reference Guide**





# TABLE OF contents

<b>LABORATORY TESTING SERVICES</b>	<b>5</b>
Drugs of Abuse Testing – Urine . . . . .	6-8
Drugs of Abuse Testing – Oral Fluid . . . . .	9-10
Esoteric/Specialty Testing . . . . .	11
<b>SPECIMEN COLLECTION</b>	<b>13</b>
Collection: Site Preparation . . . . .	14
Collection: Urine/Oral Fluid Collection Protocol . . . . .	15-16
Collection: Specimen Validity . . . . .	17-18
Collection: Problematic Situations . . . . .	19-20
<b>SPECIMEN LABELING &amp; SHIPPING</b>	<b>23</b>
Option 1: ToxAccess™ Labeling Guide . . . . .	24-25
Option 2: Urine Test Request Labeling Guide . . . . .	26-27
Option 3: Oral Fluid Test Request Labeling Guide . . . . .	28-29
Packaging Protocol: Shipping to Lab . . . . .	30-31
<b>RESULT REPORTING &amp; COLLECTION MANAGEMENT</b>	<b>33</b>
ToxAccess™: Web Result Reporting & Collection Management . . . . .	34
Standard Result Reporting . . . . .	35
<b>DRUG INFORMATION</b>	<b>37</b>
Alcohol . . . . .	38
Amphetamines . . . . .	39
Barbiturates . . . . .	40
Benzodiazepines . . . . .	41
Buprenorphine . . . . .	42
Cocaine . . . . .	43
Designer Stimulants . . . . .	44
Diuretics . . . . .	45
Fentanyl . . . . .	46
Gamma-Hydroxybutyric Acid (GHB) . . . . .	47
Marijuana (cannabinoids) . . . . .	48
Methadone . . . . .	49
Opiates . . . . .	50
Oxycodone . . . . .	51
Phencyclidine (PCP) . . . . .	52
Steroids . . . . .	53
Stimulants . . . . .	54
Synthetic Cannabinoids . . . . .	55
Urine Creatinine . . . . .	56
<b>CONTACT INFORMATION</b>	<b>58</b>



## Laboratory services

Redwood Toxicology Laboratory (RTL) performs drug and alcohol testing in accordance with strict forensic standards and scientifically accepted methods. Testing is performed by a highly educated, experienced staff using state-of-the-art equipment under the scrutiny of state and federal agencies. We'll find out.

**Drugs of Abuse Urine Testing** — RTL processes over 85,000 urine specimens each week for thousands of clients.

**Drugs of Abuse Oral Fluid Testing** — Oral fluid testing is gaining popularity with many programs that require easy, gender-neutral specimen collection combined with the accuracy of lab testing.

**Esoteric/Specialty Testing** — RTL also offers a wide range of specialized tests including: EtG/EtS Alcohol testing, Synthetic Cannabinoid testing, Designer Stimulants testing, Comprehensive drug testing, GHB testing, Fentanyl testing and hCG (pregnancy) testing and more.

# Drugs of Abuse Testing — Urine

Routine laboratory urine testing services

## OVERVIEW

The following is an explanation of Redwood Toxicology Laboratory's (RTL) urine screening and confirmation procedures/cutoff levels. The routine cutoff levels listed may periodically change. Note: some cutoff levels may differ for your agency. The analytical methods used by RTL are scientifically accepted and approved by the U.S. Department of Health and Human Services.

## URINE SCREENING METHODOLOGY

In order to determine if a urine specimen is negative or positive for drugs of abuse, all specimens are initially screened by an enzyme immunoassay (EIA) procedure. Specimens that yield an EIA response below the specified cutoff are reported as not detected. Specimens that show an EIA response at or above the specified cutoff are considered "presumptive positive" for a particular drug or drug class. Based on your agency's account, presumptive positive specimens may be confirmed by a second method prior to reporting positive results. (See "urine confirmation methodology").

### Screening Cutoff Levels by Method Cutoff levels updated periodically

DRUG	METHOD	CUTOFF
Amphetamines (Amphetamine/Methamphetamine)	EIA	500/1000 ng/mL
Barbiturates	EIA	200 ng/mL
Benzodiazepines	EIA	200 ng/mL
Buprenorphine	EIA	5 ng/mL
Cocaine Metabolite (Benzoylecgonine)	EIA	150/300 ng/mL
Cotinine	EIA	250 ng/mL
Dextromethorphan (DXM)	ELISA	125 ng/mL
Ecstasy (MDMA)	EIA	500 ng/mL
Ethanol	EA	0.04 gm/dL
EtG	EIA	100/500 ng/mL
LSD (Lysergic Acid Diethylamide)	ELISA	100 pg/mL
6-MAM (Heroin Metabolite)	EIA	10 ng/mL
Methadone	EIA	150 ng/mL
Methadone Metabolite	EIA	150 ng/mL
Methaqualone	EIA	300 ng/mL
Meprobamate	EIA	100 ng/mL
Opiates (Morphine and Codeine)	EIA	300 ng/mL
Oxycodone	EIA	300 ng/mL
Phencyclidine	EIA	25 ng/mL
Propoxyphene	EIA	300 ng/mL
Tramadol	EIA	200 ng/mL
THC (Cannabinoids)	EIA	20/50 ng/mL <sup>1</sup>

## URINE CONFIRMATION METHODOLOGY

Analytical methods of confirmation include, gas chromatography (GC), gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/mass spectrometry/mass spectrometry (LC/MS/MS). The subsequent confirmatory procedures are performed on a second independent portion of the original urine specimen.

### Confirmation Cutoff Levels by Method

Cutoff levels updated periodically

DRUG	GC/MS	LC/MS/MS
Alcohol (ethanol)	.02 gm/dL (GC-FID) <sup>2</sup>	
Amphetamines - Amphetamine / Methamphetamine / MDA / MDEA / MDMA	250 ng/mL	
Barbiturates	200 ng/mL	
Benzodiazepines		50 ng/mL
Buprenorphine/Norbuprenorphine		0.5 ng/mL
Cocaine <sup>1</sup>		50 ng/mL
Dextromethorphan (DXM)		50 ng/mL
EtG		100 ng/mL
EtS		25 ng/mL
Fentanyl	5 ng/mL	
GHB	10 mcg/mL	
Marijuana Metabolite (THC-COOH)		5 ng/mL
Methadone / Methadone Metabolite (EDDP)	100 ng/mL	
Opiates - Total Morphine / Codeine		100 ng/mL
- 6-Monoacetylmorphine	5 ng/mL	
- Hydrocodone / Hydromorphone		100 ng/mL
- Oxycodone / Oxymorphone / Noroxycodone		50 ng/mL
Phencyclidine (PCP)	10 ng/mL	
Propoxyphene	200 ng/mL	
Tricyclic Antidepressants		25 ng/mL
Sedative / Hypnotic Agents - Carisoprodol	100 ng/mL	
- Meprobamate	200 ng/mL	
- Zolpidem		1 ng/mL
- Carboxyzolpidem		10 ng/mL

1. Agency has the ability to choose cutoff levels indicated.

2. Test performed by Gas Chromatography Flame Ionization Detection (GC/FID)

**Urine Drug Testing: Classification Table & Detection Time**

Drug Class	Trade Name	Street Names	Detection Time <sup>1</sup>	DEA†
<b>ANALGESICS (Synthetic)</b>				
Meperidine	Demerol®	Demmies, pain killer	1-3 days	II
Methadone	Methodose®, Dolophine®	Dollies, meth	1-7 days	II
Pentazocine	Talwin®	T's	1-3 days	III
Propoxyphene	Darvocet®, Darvon®	Pain killer	1-7 days	IV
<b>CANNABINOIDS</b>				
Cannabinoids	Marinol®, marijuana, pot, reefer	Mary Jane, Grass, Pot, Smoke, Weed	See below <sup>2</sup>	I
<b>HALLUCINOGENS</b>				
Lysergic acid diethylamide	None	LSD, Acid	1.5-5 Days	I
Methylenedioxyamphetamine	None	MDA, Love Drug	1-3 days	I
Methylenedioxymethamphetamine (MDMA)	Ecstasy	MDMA, Adam, Ecstasy, X	1-3 days	I
Phencyclidine	PCP	PCP, Angel Dust	2-30 days	II
<b>DEPRESSANTS/SEDATIVES/HYPNOTICS</b>				
<b>Barbiturates</b>				
Amobarbital	Amytal®	Yellow jackets, angels, downers	3-10 days	III
Butabarbital	Butisol®, Butibel®	Yellow jackets, angels, downers	1 day–3 weeks	III
Butalbital	Fiorinal®, Fioricet®	Yellow jackets, angels, schoolboys	3-10 Days	III
Pentobarbital	Nembutal®	Yellow jackets, angels, phennies	3-10 Days	III
Phenobarbital	Belladonna®, Luminal®	Yellow jackets, phennies, goofballs	1 day–4 weeks	IV
Secobarbital	Seconal®	Yellow jackets, Barbs, Reds	3-10 days	III
<b>Benzodiazepines</b>				
Alprazolam	Xanax®, Niravam®, Xanor®	Downs, Nerve Pills, Tranks	2-8 days	IV
Chlordiazepoxide	Librium®, Angirex®, Elenium®	"	1-7 Days	IV
Clonazepam	Klonopin®	"	3-14 days	IV
Clorazepate	Tranxene®, Novo-Clopate®	"	1-7 Days	IV
Diazepam	Valium®	"	3-14 days	IV
Flurazepam	Dalmane®, Dalmadorm®	"	1-3 days	IV
Lorazepam	Ativan® Lorax®, Emotavil®	"	2-5 days	IV
Midazolam	Versed, Dormicum, Hypnovel®	"	1-3 days	IV
Oxazepam	Murelax®, Serax®, Serepax®	"	1-3 days, 4-6 weeks Chronic use <sup>3</sup>	IV
<b>Methaqualone</b>	Quaalude	Ludes		IV
<b>Tricyclic Antidepressants</b>				
Amitriptyline	Elavil®, Endep®	None	2-14 days	
Desipramine	Norpramin®	"	3-15 days	
Doxepin	Sinaquan®, Adapin®	"	2-8 days	
Imipramine	Tofranil®, Tofranil-PM	"	1-6 days	
Maprotiline	Ludiomil®, Depilept®, Psymion®	"	7-10 days	
Nortriptyline	Pamelor®, Aventyl®	"	4-21+ days	
<b>Alcohol</b>				
Ethanol	N/A	Booze	Alcohol: 1-2 days blood alcohol decreases ~.02 gm% per hour	
<b>OPIATES/ANALGESICS (Semi-Synthetic)</b>				
Codeine	Tylenol® #3	Schoolboy	1-3 days	II and III
Diacetylmorphine	Heroin	Horse, Smack, "H", Speedball (w/ Cocaine)	6-MAM 6-8 hours 1-3 days	II and III
Hydrocodone	Hycodan®, Vicodin®, Lortab®	Hydros, dones, vics, itchies	1-3 days	II
Hydromorphone	Dilaudid®, Hymorphan®	Juice, dillies, M2s, hospital heroin	1-3 days	II
Morphine	Roxanol®, Avinza®, Kadian®	"M", morph	1-3 days	II
Oxycodone	Oxycontin®, Percodan®, Percocet®	Oxy-coffins, killers, percs	1-3 days	II
Oxymorphone	Opana ER®, Opana IR®, Numorphan®	Blues, nu-blues, biscuits, blue heaven	1-3 days	II
<b>STIMULANTS</b>				
Amphetamine	Adderall®, Benzedrine®, Dexedrine®	Aimies, back dex, bennies	2-4+ days	II
Cocaine	None	Coke, rock, crack, snow, blow, toot	1-7 days	II
Methamphetamine	Desoxyxyn®, Methadrine®	Crystal meth, crystal, meth	1-4+ days	II

1) Average detection times

2) Cannabinoids Detection Time

- Single use: 3 days
- Moderate use: 5-7 days
- Daily use: 10-15 days
- Long term: >30 days
- Oral Ingestion

3) Chronic use over period of months or years; 4-6 weeks

† Explanation of Drug Enforcement Agency (DEA) Classification

- I Illicit drugs with no medical use; high potential for abuse
- II Prescription drugs with high potential for abuse and physical dependency
- III Drugs with less abuse potential than schedule II; have moderate to low physical dependency, but may have high psychological dependence
- IV Prolonged use of these drugs may lead to limited physical or psychological dependency; lower abuse potential than schedule III

## FREQUENTLY ASKED QUESTIONS

### Who should consider urine drug testing?

Redwood Toxicology Laboratory's (RTL) Urine Drug Testing is recommended for a large variety of arenas, including the following: Federal & State Corrections, Clinics & Hospitals, Methadone Clinics, Federal, State & County Probation, Counseling Centers, Physician Offices, Federal Halfway Houses, Drug Courts, Pre-employment, Behavioral Health, Jails & Detention Centers, Rehabilitation & Treatment, Child & Family Services, Mental Health and Schools & Universities.

### How do I collect the urine and send in a specimen?

Refer to page 13-20 for specimen collection protocols. Instructions for use are also included with your first order of lab supplies. Please read these instructions carefully. RTL offers telephonic training and instructional materials.

### How long can the urine specimen be stored before testing?

Specimens can be stored at room temperature up to 7 days. Urine specimens should be refrigerated if testing is delayed. However, it is strongly recommend that the sample be tested as soon as possible after collection.

### What testing methodology does RTL use to perform initial drug screening?

RTL screens urine specimens by enzyme immunoassay (EIA). An immunoassay is a test that uses antibodies to detect the presence of drugs and other substances in urine. The initial screening process does not measure the specific amount of drug present in urine samples. It provides either a positive or negative result, indicating the presence or absence of detectable drug metabolites above a specific cutoff level.

### What testing methodology does RTL use for confirmations?

Confirmations are available by gas chromatography (GC), gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/mass spectrometry/mass spectrometry (LC/MS/MS). Based on your agency's account settings, specimens may be confirmed by one or more of the aforementioned methods. GC/MS and LC/MS/MS provides identification of the molecule(s) based on characteristic fragmentation patterns at specific retention times.

### Why are screening and confirmation cutoff levels different?

Screening and confirmation testing are performed using different methodologies that necessitate different cutoff levels. The cutoff levels of an immunoassay screen are typically higher than those of a more sensitive GC/MS or LC/MS/MS confirm test, because they screen for a larger group of parent compounds, metabolites and other structurally similar compounds.

If an immunoassay test detects a drug (above the screening cutoff level) the presumptive positive specimen may be sent to GC/MS or LC/MS/MS confirmation testing. Many times, these individual compounds are present in concentrations much lower than the total immunoassay response, thus resulting in the cutoff levels being lower for the GC/MS or LC/MS/MS test.

### What is the importance of checking the urine temperature strip on the collection cup?

Under normal situations fresh urine will display a temperature between 90 and 100 degrees Fahrenheit on the temperature strip, if read within 4 minutes of the collection. Should the temperature strip not register, the specimen should be immediately re-checked using a new cup (or strip) and the results recorded on the requisition. Specimens with a temperature out of range may indicate a substituted or adulterated sample.

### How long does it take for results?

Urine screening results are typically available within 24 hours of receipt of the specimen, while oral fluid screen results take 24-48 hours. Presumptive positive specimens are usually confirmed (unless they are "Screen Only") within 24-72 hours depending on the method. Confirmation of specimens that are presumptive positive by instant/on-site devices take a minimum of 48 hours.

### What does ng/mL mean?

Drug testing cutoff levels are usually expressed in the units of measure ng/mL (nanograms per milliliter). A quantitative positive GC/MS or LC/MS/MS result is commonly expressed in ng/mL.



# Drugs of Abuse Testing — Oral Fluid

Routine laboratory oral fluid testing services

## OVERVIEW

Oral fluid testing is gaining popularity with many programs that require convenient, gender-neutral specimen collection combined with the accuracy of lab testing. Redwood Toxicology Laboratory (RTL) provides an easy and affordable lab-based testing solution for the detection of drugs of abuse in oral fluid. RTL's oral fluid testing utilizes a collection device that has a volume adequacy indicator. This indicator ensures that sufficient saliva (1 mL) is collected to prevent possible false negative results due to insufficient sample size, and to provide a meaningful quantitative result.

The collection device also allows drug concentrations to be reported per mL of oral fluid (GC/MS and LC/MS/MS confirmations only). One (1) mL of oral fluid combined with three (3) mL of buffering agent provides four (4) mL of specimen, allowing a sufficient amount of sample for screening and confirmation procedures.

The following is an explanation of RTL's saliva screening and confirmation procedures/cutoff levels. The routine cutoff levels listed below may periodically change. Note: some cutoff levels may differ for your agency.

## SALIVA SCREENING METHODOLOGY

Specimens collected with the oral fluid collection device are sent to Redwood Toxicology Laboratory for screening by Enzyme Immuno-Assay (EIA) or Enzyme-Linked Immunosorbent Assay (ELISA).

### Screening Cutoff Levels by EIA

*Levels updated periodically*

DRUG	EIA
Alcohol	.025 g/dL
Amphetamine	50 ng/mL
Barbiturates <sup>1</sup>	50 ng/mL
Benzodiazepines	20 ng/mL
Cocaine <sup>2</sup>	20 ng/mL
Methadone	50 ng/mL
Methamphetamine	50 ng/mL
Opiates (codeine, hydrocodone, hydromorphone, morphine, 6-monoacetylmorphine)	40 ng/mL
Oxycodone	40 ng/mL
Phencyclidine	10 ng/mL
THC ( $\Delta$ -9-THC)	4 ng/mL

## SALIVA CONFIRMATION METHODOLOGY

Positive screens are confirmed by gas chromatography/mass spectrometry (GC/MS) or liquid chromatography-tandem mass spectrometry (LC/MS/MS).

### Confirmation Cutoff Levels by Method

*Levels updated periodically*

DRUG	METHODOLOGY	CUTOFF
Alcohol	GC-FID	.025 g/dL
Amphetamine	GC/MS	15 ng/mL
Barbiturates	GC/MS	20 ng/mL
Benzodiazepines	LC/MS/MS	0.5 ng/mL
Buprenorphine	LC/MS/MS	1 ng/mL
Norbuprenorphine	LC/MS/MS	5 ng/mL
Cocaine <sup>2</sup>	GC/MS	8 ng/mL
Methadone	GC/MS	10 ng/mL
Methamphetamine	GC/MS	15 ng/mL
Opiates		
- Codeine, Hydrocodone, Hydromorphone, Morphine	GC/MS	20 ng/mL
- 6-monoacetylmorphine	GC/MS	4 ng/mL
Oxycodone	GC/MS	20 ng/mL
Phencyclidine	GC/MS	5 ng/mL
THC ( $\Delta$ -9-THC)	GC/MS	1 ng/mL

### Oral Fluid Detection Times

DRUG	Detection Time <sup>3</sup>
Alcohol	After absorption (~1 hour) blood alcohol decreases ~.02 gm%/hour
Amphetamine	From minutes up to 48 hours
Barbiturates	From minutes up to 48 hours
Benzodiazepines	From minutes up to 48 hours
Cocaine	From minutes up to 48 hours
Methadone	From minutes up to 48 hours
Methamphetamine	From minutes up to 48 hours
Opiates	From minutes up to 48 hours
Oxycodone	From minutes up to 48 hours
Phencyclidine	From minutes up to 48 hours
THC ( $\Delta$ -9-THC)	From minutes up to 48 hours

1. Detected by Enzyme-Linked Immunosorbent Assay (ELISA)
2. Cocaine Metabolite: Benzoyllecgonine
3. Average detection times

*These oral fluid cutoffs are based upon preliminary guidelines established by the Substance Abuse Mental Health Services Administration (SAMHSA) Drug Advisory Board for drug testing of alternative matrices.*

## FREQUENTLY ASKED QUESTIONS

### How do I know oral fluid testing is right for my agency?

Oral fluid testing is easily used in a variety of testing arenas: Federal & State Corrections, Clinics & Hospitals, Methadone Clinics, Federal, State & County Probation, Counseling Centers, Physician Offices, Federal Halfway Houses, Drug Courts, Pre-employment, Behavioral Health, Jails & Detention Centers, Rehabilitation & Treatment, Child & Family Services, Mental Health and Schools & Universities.

### Why should I implement oral fluid testing at my facility?

Not only does oral fluid testing save your agency time and money in collection fees, it offers the convenience of testing for drugs of abuse anywhere, at any time.

### What are the testing and confirmation methodologies?

Specimens collected with the oral fluid collection device are sent to Redwood Toxicology Laboratory (RTL) for screening by Enzyme Immunoassay (EIA) or Enzyme-Linked Immunosorbent Assay (ELISA). Depending on account setup, positive screens, other than methadone, are confirmed by gas chromatography/mass spectrometry (GC/MS) or liquid chromatography-tandem mass spectrometry (LC/MS/MS).

The analytical methods used by RTL for the detection of drugs of abuse are scientifically accepted and approved by the U.S. Department of Health and Human Services.

### What are the oral fluid drug detection times?

The drug detection times in oral fluid closely parallel those in blood. In general, Amphetamines, Barbiturates, Benzodiazepines, Opiates, Cocaine/Benzoyllecgonine, Methadone, and PCP can be detected for up to 48 hours<sup>1</sup> following use. Parent THC (marijuana) can be detected in oral fluid for up to 24 hours<sup>1</sup>.

### I suspect that my donor just used a substance of abuse, how long should I wait before collecting the specimen?

Depending on the drug and dosage, drugs may be detected in oral fluid in as little as a few minutes or up to approximately 2 hours from the time of use.

### Why are the drug levels in oral fluids lower than those in urine?

Oral fluid drug levels largely correlate with the amount of drug in the blood (dependent on the saliva/plasma ratio for each drug). Higher drug and drug metabolite levels are found in urine because they are concentrated by the kidneys during the excretion process.

<sup>1</sup>. Average detection times

### How do I collect the oral fluid specimen?

Refer to page 13-20 for specimen collection protocols. Instructions for use are also included with your first order of oral fluid collection devices. Please read these instructions carefully. RTL offers telephonic training. If you have questions, please call 800.255.2159, press option 1.

### Can I ship my oral fluid specimens with my urine specimens?

RTL will accept both oral fluid and urine specimens in the same lab pack when sending five or more specimens (e.g. three oral fluid specimens and two urine specimens). The specimens cannot, however, be mixed in the postage-paid mailer boxes due to U.S. Postal Service regulations.

*NOTE: It is important that the test request form is included with the oral fluid specimen. The specimen cannot be processed without the information supplied on the test request form.*

### How long does RTL store the oral fluid specimen?

RTL stores positive oral fluid specimens for three (3) months in frozen storage. Negative specimens are kept for 48 hours.

### How will RTL report the oral fluid results?

RTL offers reporting for the oral fluid specimens via internet, U.S. mail or facsimile. Please indicate your preferred method at the time of account set-up.

### What is the shelf life for the oral fluid collection device?

The oral fluid collection device has a minimum shelf life of 12 months.

### Does OSHA classify oral fluid as hazardous?

OSHA considers oral fluid collections non-hazardous as long as the specimen is not tinged with blood.

### Who do I call to re-order the oral fluid collection devices?

To request labels, collection bottles, and shipping materials, contact our Supplies Department. Lab supply re-ordering is available to existing clients with an account number.

Phone: 800.255.2159, press option 4.

E-mail: [supplies@redwoodtoxicology.com](mailto:supplies@redwoodtoxicology.com)

Web: [https://www.redwoodtoxicology.com/resources/supply\\_form](https://www.redwoodtoxicology.com/resources/supply_form)

## Esoteric/Specialty Testing

Laboratory service

### OVERVIEW

Redwood Toxicology Laboratory (RTL) also offers a wide range of specialized tests including: EtG/EtS Alcohol testing, Synthetic Cannabinoid testing, Designer Stimulants testing, Comprehensive drug testing, GHB testing, Fentanyl testing and hCG (pregnancy) testing and more.

### ETG/ETS ALCOHOL TESTING

EtG is a direct metabolite of alcohol (ethanol). Its presence in urine may be used to detect recent ethanol ingestion, even after ethanol is no longer measurable. The presence of EtG in urine is an indicator that ethanol was ingested and can be detected in urine for up to 80 hours after ingestion.

In addition to EtG, recent scientific studies have identified ethyl sulfate (EtS) as a second specific metabolite or biomarker of ethanol. For this reason, RTL tests and reports EtS, in conjunction with EtG, to confirm recent ethanol ingestion or exposure. The detection of EtG and EtS offers greater sensitivity and accuracy for determination of recent ethanol ingestion, than by detection of either biomarker alone.

### SYNTHETIC CANNABINOID TESTING

Up to four times stronger than marijuana, synthetic cannabinoids are deceptively marketed as herbal smoke or incense products. With high positivity rates, synthetic cannabinoid tests have proven to be an essential tool for a variety of treatment and criminal justice situations.

In July 2012, the DEA banned synthetic cannabinoids based on their structural classification, explicitly naming 15 chemicals, citing numerous calls to poison control centers around the nation. In May 2013, the DEA placed a temporary ban on three additional synthetic cannabinoid substances. However, newer generation compounds continually emerge—making it more vital than ever to target synthetic marijuana.

### DESIGNER STIMULANT TESTING

Designer stimulants are sold online or available at smoke shops; promoted as “bath salts,” “research chemicals,” or “plant food,” product labeling attempts to circumvent regulation by suggesting they are not for human consumption. Additionally, some forms of designer stimulants may be sold as “legal” MDMA (Legal X), or sold and veiled as MDMA tablets.

A new federal ban targets three designer stimulant compounds for so-called bath salt drugs. This ban will help deter abuse and suffering from these dangerous designer drugs. However, drug makers will continue to develop new compounds to circumvent existing drug laws. We are committed to providing timely and relevant tests that enable you to make informed decisions. Now you'll know.

### COMPREHENSIVE DRUG TESTING

Conventional drug test panels will not detect the broad variety of addictive prescription drugs. They pass undetected in standard testing for such drugs as cocaine, marijuana, heroin and amphetamines. RTL's Comprehensive Drug Test solves this problem.

RTL's Comprehensive Drug Test detects prescription drugs within a variety of categories, including:

- Anticonvulsants
- Antidepressants/Analgesics
- Barbiturates
- Benzodiazepines
- Propoxyphene
- Sedatives/Hypnotic Agents
- Stimulants

RTL's Comprehensive Drug Test also tests for alcohol, illicit drugs and specimen validity.

- Alcohol
- Amphetamine
- Cocaine
- Marijuana
- Methadone
- Methamphetamine
- PCP
- Specimen validity (Creatinine)

### GHB TESTING

There are increasing reports of Gamma-Hydroxybutyric acid (GHB) being used recreationally as a euphoriant at “rave” type parties. GHB is typically associated with sexual assault or as a “date rape” drug due to its severe hypnotic and sedative effect at higher dosages. Typical illicit use of GHB involves dissolving 2 - 3 grams of powder in beverages.

### STEROIDS/SPORTS DRUG TESTING

Due to popular demand, Redwood Toxicology Laboratory, Inc. (RTL) developed a comprehensive and affordable steroid panel that is comparable to WADA<sup>1</sup> testing. In addition, RTL also offers a diuretics panel and stimulants panel.

Our tests are ideal for sports organizations, colleges and high schools, certified athletic trainers, coaches, corrections and law enforcement, and occupational health agencies<sup>2</sup>.

1. World Anti-Doping Agency

2. Compliance with RTL non-pretesting policy is required



# Specimen collection

Redwood Toxicology Laboratory provides suggested specimen collection guidelines only. It is the responsibility of individual collection agencies to adopt their own policies and procedures according to their needs in compliance with individual state and federal regulations.

Laboratory drug and alcohol test results are often used in legal proceedings. The manner in which specimens are collected and handled is very important. Specimens must be handled and controlled by collection site personnel throughout the collection process.

Directly observed urine collection is the best means to ensure specimen integrity. However, outside of probation and parole and some drug rehab environments, the question of civil rights arises. A uniform urine and oral fluid collection process, regardless of the testing environment, should be followed.

# Collection: *Site Preparation*

Suggested collection guidelines

## PRINCIPLE

Requirements for specimen collection vary according to the purpose for which the results will be used. However, to meet evidentiary requirements the specimen collection site must be secure in order to eliminate the possibility of specimen tampering or adulteration and to ensure the security of the collected specimens.

## COLLECTION AREA GUIDELINES

1. Storage area for collection supplies and related materials is secure.
2. Collection site facility is secure, well lit, and free of any areas where adulterants or substitute specimens can be hidden.
3. A suitable clean surface for the collector to use as a work area.
4. Eliminate or secure all sources of water in the area where urination occurs. Bluing agent should be placed in the toilet tanks and bowls to prevent sample dilution.
5. Eliminate or secure all soap or detergent dispensers or any other potential adulterants.
6. A secured storage area should be available to ensure specimen security prior to transport to the laboratory.
7. A general log book should be maintained to record collected specimens.



*Collection Area Example*

# Collection: Urine/Oral Fluid Collection Protocol

Urine and oral fluid collection protocol

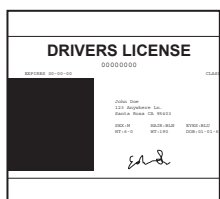
## PRINCIPLE

The validity of urine drug screen results is dependent on specimen integrity. While direct-observation collections provide specimens of the greatest credibility, non-witnessed collections can be effective if safeguards are in place to ensure the donor does not have access to substances which may affect test results (water, chemicals, substitute urine, etc.).

## SUGGESTED PROCEDURE PRIOR TO COLLECTION

Prior to any specimen collection procedure, secure the collection facility (see *Collection Site Preparation page 14*) and if necessary, perform a thorough search for hidden adulterants or substitute urine specimens. Place bluing agent in the toilet bowl or tank, remove or secure all chemicals (soaps, cleaning supplies, etc.) and secure or eliminate all water sources.

1. Check the identity of donor (e.g. social security number or driver's license number and photo I.D.). If using a drug screen test request form, note the identity on the form.



Verify the donor's identity with a photo I.D.

2. Ask the donor to remove any unnecessary outer clothing. All personal belongings (the subject may retain a wallet) should be placed in a secure location outside the stall or partitioned area.
3. Do not ask the donor to empty his/her pockets or to remove articles of clothing such as shirts, pants, dresses, etc. If a collector notices any unusual behavior that indicates a donor may attempt to tamper with or adulterate a specimen (e.g., bulging pockets), the collector may request that the donor empty his/her pockets and explain the need for such items during collection.

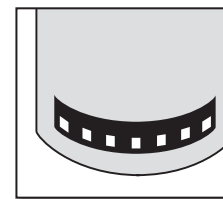
4. Prior to collection, ask the donor to wash his/her hands to eliminate any possible adulterating or contaminating substances from under the donor's fingernails.



Donors should wash hands before donating specimens.

## URINE COLLECTION PROCEDURE

1. Place the following information on the bottle label:
  - Date of collection
  - Donor's name and/or identification numbers
  - Collector's initials
2. Provide the donor with a clean, unused urine specimen collection container and instruct the donor to fill the container at least half full (a minimum of 30 mL's).
3. Unobserved Collection: Allow the donor to enter and maintain privacy within the stall or partitioned area. The collector will wait outside the collection area until the donor is finished urinating. Complete the remainder of the test request form while the donor is collecting the specimen. (See *page 23-31 for detailed labeling instructions*).
4. Observed Collection: Inform the donor that collection will occur under direct observation. Accompany the donor into the collection facility (the collector must be the same gender). Instruct the donor to urinate into the sample container with the witness observing urination. Complete the remainder of the test request form after the donor has completed collecting the specimen. (See *page 23-31 for detailed labeling instructions*).
5. Accept the specimen from the donor. The use of disposable gloves is recommended when handling specimens, so prior to accepting the specimen from the donor, be sure to wear gloves.



Apply temperature strip to sample bottle.

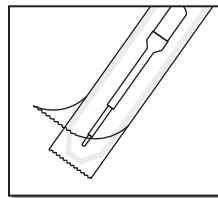
6. Upon receipt of the specimen from the donor, immediately apply the temperature strip (if applicable) to the outside of the bottle. If using a drug screen test request form, record the urine temperature on the form.

NOTE: Urine temperature should be measured within (4) four minutes of collection and should read between 90-100°F.

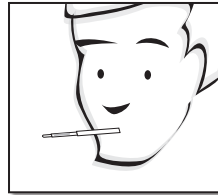


### ORAL FLUID COLLECTION PROCEDURE

1. Remove the kit contents from the packaging. Save the outer packaging because the specimen must be placed in the re-closable outer packaging for shipment to the laboratory.
2. Peel open the collector pad package and remove the collection device. Do not touch the pad.
3. Place the collector pad under the donor's tongue and instruct the donor to close his/her mouth. The donor must not chew or suck on the pad. When the indicator window turns blue, remove the collection device from the donor's mouth. **DO NOT** remove the collection device until the indicator turns blue. If the indicator does not turn blue within 15 minutes, remove the collection device and discard. Re-collection with a new device may begin immediately after saliva has accumulated in the donor's mouth.

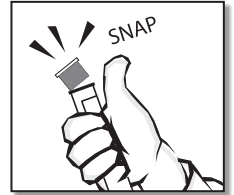


*Peel open package and remove collector.*



*Place collector pad under the donors tongue.*

4. Holding the transport tube in an upright position, remove the cap, and insert the collector device, pad first, into the tube. **DO NOT** set the transport tube on a table. If any of the buffer fluid is spilled, a new transport tube must be used. The amount of liquid in the transport tube is critical to the testing process.
5. Push the cap firmly onto the transport tube until you hear the SNAP. Gently shake the tube to mix the saturated collector pad with the buffer.
6. Complete the labeling procedure by following the instructions on page 28 and 29.



*Open transport tube and insert the collector.*

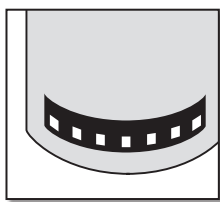


## Collection: Specimen Validity

### Specimen tampering/adulteration

#### PRINCIPLE

Methods to adulterate urine samples for substance abuse testing generally fall into three categories; 1) urine substitution; 2) ingestion of fluids or compounds for flushing out the system, diluting the sample, or interfering with the testing process; or 3) direct addition of adulterants to the urine specimen itself. The substitution of one's own urine sample with one which is clean is a common practice. The best means to combat this practice is to measure urine temperature, as urine specimens even held close to the body for extended periods of time will not produce a physiologically temperature-correct specimen. However, practices of reverse catheterization with clean urine and placement of urine filled balloons in the vaginal cavity can produce urines of correct temperature.



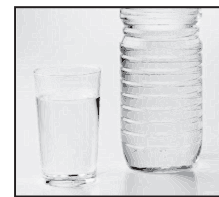
Human urine specimens should range between 90° and 100° F.

Drinking large volumes of liquid, especially cranberry juice or vinegar is common practice. However, studies demonstrate these practices have no effect on testing methodologies and may present unexpected results.

Many of the drugs being tested are pH dependent. When large volumes of cranberry juice or vinegar are consumed, the urine pH is lowered, and the excretion rate of these drugs may increase. If timed correctly, large amounts of a drug may appear sooner in the sample.

Be aware, drinking large volumes of vinegar can be toxic.

One potentially effective method which may negatively impact the testing process is to consume large volumes of water, as short term water loading can increase urine volume up to eight fold. Therefore, if the individual's drug concentration is near the cutoff of an assay, the urine may be diluted enough so that the sample will test below the cutoff level. Other attempted methods of adulteration include ingesting large amounts of vitamin C, vitamin B, niacin, Golden Seal, etc. All of these practices are ineffective.



Consuming too much fluid prior to collection can result in an invalid specimen.

Adulteration of a urine sample with various chemicals is shown (in the literature) to inactivate some of the laboratory testing methodologies, most notably, the enzyme immunoassay's. Addition of compounds such as sodium chloride, sodium bicarbonate, hydrogen peroxide, bleach, alcohols, blood, various soaps, etc. are shown to produce both false negatives and false positives.

The current list of urine adulterants is ever changing as the Internet provides an informational source, as well as a retail outlet for commercial products capable of affecting the outcome of some urine drug testing methodologies. Currently, nitrites (Klear and Whizzies) and chromates (Urine Luck) are two adulterating agents commonly found in the industry. RTL is capable of providing testing for some of these agents.

## ADULTERATION & DILUTION DETECTION

Means to detect adulteration by the collector and/or the laboratory include the following:

1. **Specimen Temperature:** If specimen collection is not witnessed, the most effective means to detect specimen dilution, adulteration, or substitution is to measure the sample's temperature. The collector should measure the temperature utilizing the temperature strip affixed to the specimen container within four minutes of collection; it should read between 90 and 100 degrees Fahrenheit. The urine temperature should be noted on Urine Test Request form.
2. **Urine Appearance and Odor:** Adulterants such as isopropyl alcohol, soaps, bleach and perfumes are readily identified by their odor. Soaps are also identified by excessive bubbling. Use of solid adulterants is detected by the presence of residues in the container.
3. **Creatinine:** In general, creatinine is a metabolic byproduct of muscle metabolism which normally appears in urine in relatively constant quantities over each 24 hour period. Therefore, urine creatinine can be used both as a marker to specifically identify a specimen as urine, and as an indicator of urine water content (dilution). "Normal" random urine specimens will generally have urine creatinine levels of greater than 20 mg/dL, while specimens with creatinine levels between 10 and 20 mg/dL may be due to increased liquid consumption, dietary habits, or liquid ingestion preferences. Urine specimens with creatinine levels between 2 and 10 mg/dL are usually a result of ingestion of large volumes of water (or other liquid), termed short term water loading. This is a very common practice when attempting to dilute a urine so that any drugs in the urine will be diluted below analytical testing cutoff levels. Urine creatinine levels below 2.0 mg/dL are usually a result of "dipping", the direct addition of a liquid to the urine specimen. Creatinine levels of 0.0 mg/dL indicate the specimen is not consistent with human urine.

Urine specimens become dilute as a result of the short term consumption of large amounts of a liquid due to an unknown stimulus such as a response to heat or exercise, herbal flushes, prescription diuretics, intentional dilution, or pathological situations such as diabetes insipidus. The dilution effect from consuming increased volumes of liquid can last from 2 – 5 hours. Therefore, the increased consumption of liquid would have to take place between 2 – 5 hours prior to the collection of the urine specimens.

An important factor to consider when interpreting dilute urine samples is that drug use can never be assumed unless specifically detected, and confirmed in a urine sample. Certainly, a dilute sample can produce false negative results, as drugs in the urine at concentrations near the testing cutoff may be diluted below the testing cutoff level, however, due to the reasons stated above it can be difficult to establish the reason or intent for the sample(s) being dilute. For these reasons, urine creatinine is reported in conjunction with testing for drugs of abuse, as an indicator of specimen validity only, as urine specimens with a creatinine level below 20 mg/dL may have an increased likelihood of producing a false negative drug testing result.

For more information about creatinine, refer to page 46.

4. **Specific Gravity:** Normally, a random urine specimen will have a specific gravity of greater than 1.003<sup>1</sup>. An extremely low specific gravity (<1.003) indicates a dilute specimen, while abnormally high specific gravity (>1.045) may indicate the presence of dissolved solids such as sodium chloride and sodium bicarbonate.
5. **pH:** Normal random urine pH is 4.8-7.8\*. Low pH's indicate possible ingestion of acidic substances such as cranberry juice or vinegar; starvation; diarrhea; or direct adulteration of the specimen itself with acidic compounds. Elevated pH's may indicate the presence of basic compounds such as sodium bicarbonate, bleach, or Drano; vegetarian diet; or prolonged vomiting. pH levels of <3 or ≥11 are consistent with adulteration.
6. **Visible Blood:** Indicates the presence of blood in the urine specimen. The presence of blood in the urine sample may adversely impact the testing process and, in addition, constitutes a biohazard for laboratory employees. Collection of clean catch urine specimens during menstruation should be attempted.

Urine adulteration is a double edged sword as both false negative and false positive results can occur. However, most adulteration attempts can be detected by either trained collection site personnel or by collection procedures as outlined above. Coordination and cooperation between the collection site and the testing laboratory provides effective and reliable drugs of abuse testing.

1. Normal ranges are indicated for freshly voided urines only.

## Collection: *Problematic Situations*

### Donor situations

#### PRINCIPLE

While most donors will cooperate fully if treated with dignity and courtesy, there may be instances when unusual events may occur. For this reason, it is imperative for the collector to have a thorough understanding of the collection process and to have the ability to explain the process clearly to the donor so they will fully understand the directions. During collection of the specimen and completing the forms, it is vital that the collector devote his/her full attention to the procedure without interruptions. Any unusual appearance or behavior is to be noted on the urine chain of custody form.

#### PROCEDURE

While it is not possible to anticipate every type of unusual event, some of the more frequent are:

1. Specimen Temperature Outside Limits: If the specimen temperature is outside normal parameters, i.e., less than 90°F or greater than 100°F then:
  - A. Inform the donor that the temperature of the specimen is outside normal limits (too low or too high) and that the specimen needs to be recollected. If the specimen cannot be recollected or the donor refuses, inform the donor that specimen temperature will be noted on the final report.
 

NOTE: This is important because if the donor has drug in his/her system at the time of collection, collection at a later time may allow the drug to clear. Therefore, if at all possible, make every effort to resolve the situation at the time of the incident.
2. Specimen Contains Visible Blood: Urine specimens may not contain visible blood for drug testing because:
  - Blood may interfere with the testing process (which could result in false negative tests).
  - Urines containing visible blood are considered biohazardous and require special packing procedures in order to be shipped (Federal Bloodborne Pathogens standard).

*Instructions to client to obtain a clean catch urine specimen:*

- A. Wipe area until free of blood.
  - B. Start urinating into the toilet. After a few seconds, place the urine container under the stream of urine until the cup is at least half-full.
3. Uncooperative or Belligerent Donor: Presumably, the donor has agreed to the drug test prior to appearing at the collection site. However, attitudes may change just before, or during the collection process. Remain courteous and do not argue with a donor. It remains the right of the donor to refuse collection at any time, of course at his/her own risk. Remind the donor that you will call the requesting agency with a recount of the pertinent facts.

If physical violence seems imminent, call for assistance and ask the donor to leave the premises. Use the same procedure you would use for any other circumstance in which you fear bodily harm or property damage, including calling 911.

4. Suspicion Donor is Adulterating Sample (Adding water or other substance): Remain courteous and do not argue with the donor. The following statement may be appropriate:

*“We are instructed to tell everyone that the lab tests for water and other materials that may have been added. It will show up on the test report.”*

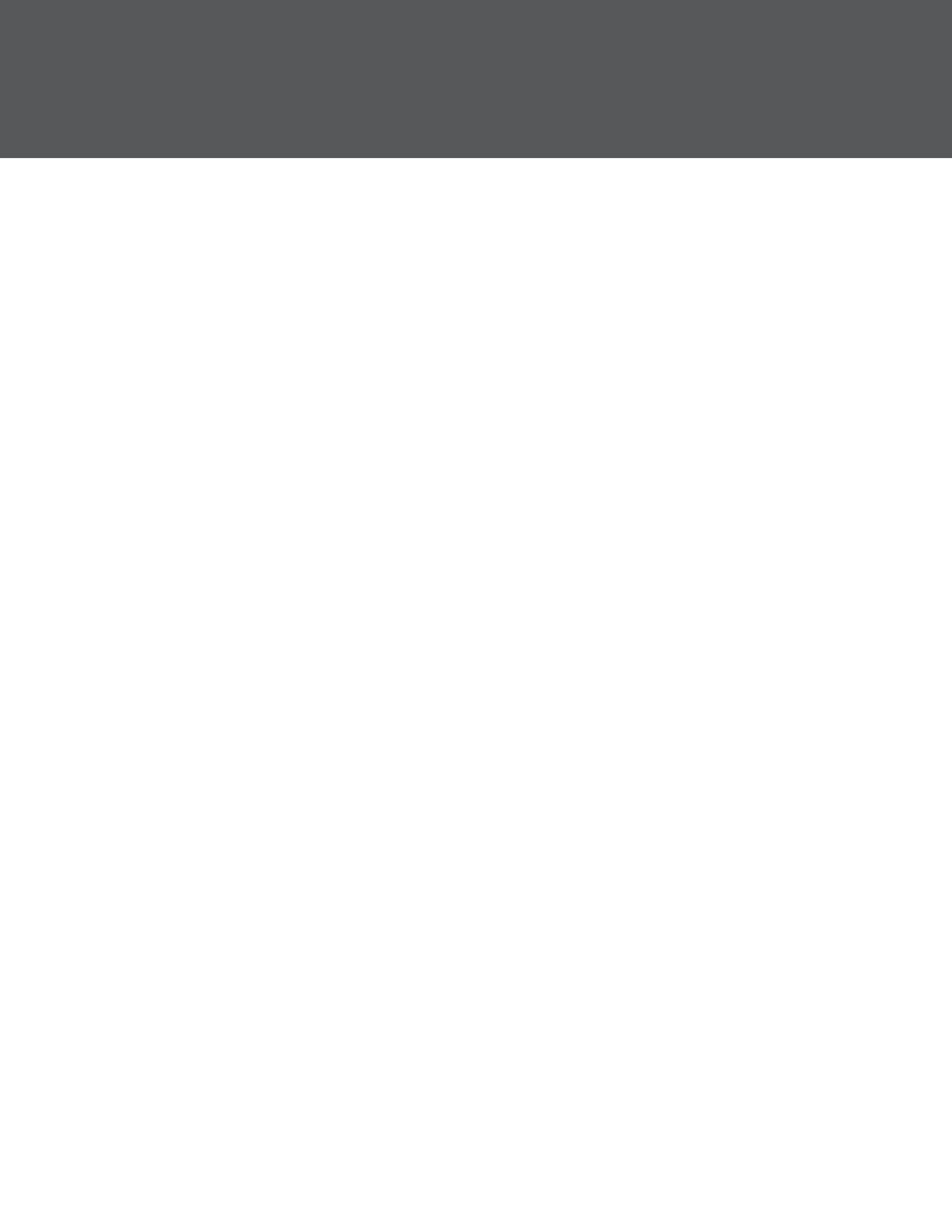
## Donor situations continued

Grounds for these type of suspicions may include out of range specimen temperature, abnormal urine smell or appearance, or unusual sediments.

5. Donor Cannot Urinate or Produces Insufficient Volume: Upon receipt of the specimen, the collector must first determine if there is sufficient urine for testing. Minimum sample volume is twenty (20) mL and is sufficient for retest and confirmatory procedures if required. If there is not sufficient urine volume, then follow the procedures below:
  - A. Ask a supervisor to determine if there is adequate urine volume to perform the requested testing.
  - B. If there is not a sufficient urine volume, the collector shall take possession of the partial specimen and instruct the donor to drink fluids (no more than 8 oz.) and try again in a reasonable amount of time. If possible, the donor should remain on the premises and preferably within visual contact of the collection site person until a complete specimen is provided.
  - C. In the event a donor cannot provide a specimen of adequate volume, the requesting agency should be notified for further instruction. In some cases, it may be acceptable to reschedule the collection. However, it may be necessary to determine whether a valid medical reason exists for the donor's scarce urine output or if the donor is refusing to provide a specimen.
6. Donor Accuses Collector of Carelessness, Personal Misconduct, or Deliberate Mishandling of Specimen: This is unlikely; however it does occur.

Remain calm and professional. Listen carefully. If there is another person at the site, ask that individual to join you and the participant. If you are alone, call your supervisor while in the presence of the participant. It is important to document what took place and what was said. The matter should be treated with the utmost seriousness. It could result in the loss of a client, a civil lawsuit, or even a criminal suit. State fully to the participant and, if possible, to a witness what you did or did not do. Make every reasonable effort to persuade the participant of your good intentions and lack of negligence; however, do not attempt to deny actual error on your part. If it is obvious that a participant is attacking you to perhaps cover the presence of drug use, treat it as a legal matter with documentation and immediate notification to your supervisor.





# Specimen labeling & shipping

Redwood Toxicology Laboratory (RTL) provides specimen collection guides on how to properly label and package specimens being sent to RTL for screening & confirmation testing.

Each test requisition form requires unique labeling and it is important that these guidelines are followed to ensure proper specimen processing at RTL. Mislabeled specimens can delay processing and reporting timelines.

# Option 1: ToxAccess™ Form

## ToxAccess™ test requisition form overview

The ToxAccess™ Collection Management system accelerates donor scheduling, data entry, and the test ordering process.

The online data you input is automatically transferred into RTL's laboratory information system, eliminating both the errors caused by hand-written labels, and laboratory data entry errors.

Following the data input process; administrators print ToxAccess chain of custody forms using special paper supplied by RTL. Each printed form features a unique test request label and specimen security seal.


The printed form will be signed with a water-resistant marker, such as a blue or black ball-point pen (red color is not recommended since it tends to rub off).

### TOXACCESS™ TEST REQUISITION FORMS

- 1) **Agency Information**—Contains the agency's account information including: account number, name, address, phone and fax numbers.
- 2) **Donor Information & Test(s) Requested**—Donor information will be located in this section. You will also see the tests requested to the right of the donor's information.
- 3) **Specimen Verification**—Signature area for Donor and Collector, verifying specimen collected and labeled correctly.
- 4) **Security Seal**—Peel off label secures specimen container.
- 5) **Specimen Label**—This label will contain all required information for the laboratory to process your specimen. Ensure the label is placed horizontally across the specimen bottle.
- 6) **Receiving (lab only)**—To be filled out by RTL personnel only.
- 7) **Donor Receipt**—The tear off section of the chain of custody form is to be provided to the donor for their records.



Print your own test request forms with paper provided by RTL. *Only available with ToxAccess.*



### Laboratory Drug Test

Test Requisition Form

---

**1** Agency Number: 600000

Agency Name: Web Demo Agency  
Address: 3650 Westwind Blvd.

City, State and Zip: Santa Rosa, CA 95403  
Agency Phone: (800)255-2159  
Agency Fax:

00000000

**2** Donor Name: John J. Doe      Tests Requested: 647 - Ethylglucuronide (ERG)  
Donor Unique ID: 54321      URSING      P08 - Screen P with Creatinine  
Specimen Type: 97F  
Specimen Temperature: 97F  
Test Reason: RANDOM - 3

---

**3** DONOR CERTIFICATION

I certify that I provided my specimen to the collector and that I have not adulterated it in any manner. The specimen was sealed in my presence with a tamper-evident seal. The information provided on this form and on the label affixed to the specimen container is correct. I authorize Redwood Toxicology Laboratory to perform the tests listed and to release the results of this test to **WEB DEMO AGENCY**

Donor's Signature: John J. Doe      Donor's Name:      Date: 6/29/2011

---

**4** COLLECTOR VERIFICATION

I certify that this specimen was collected from the above person following established protocols, and the specimen has been properly sealed and labeled.

Collector's Signature: Jim J. Smith      Collector's Name:      Date: 6/29/2011      Collection Time: 10:00 AM

---

**4** Security Seal

Donor's Initials: \_\_\_\_\_  
Date: 6/29/2011

**5** Reg #: 000000000

Agency: 600000—Web Demo Agency  
ID: 54321 John J. Doe  
Collector: Jim J. Smith  
Collected: 6/29/2010 10:00 AM  
Tests: 647, P08

Redwood Toxicology Laboratory | 3650 Westwind Blvd, Santa Rosa, CA 95403 | (800) 255-2159

---

**6** LABORATORY STAFF ONLY

RECEIVED AT LAB:       Received By (Initials): \_\_\_\_\_      Date: \_\_\_\_\_      Seal Intact?  Yes  No      Labels Match?  Yes  No

Tear off and provide to donor

---

**7** AGENCY INFO:

Web Demo Agency  
3650 Westwind Blvd  
Santa Rosa, CA 95403  
Phone: (800)255-2159  
Fax:

COLLECTION INFORMATION:

Donor Name: John J. Doe  
Requisition #: 000000000  
Test Reason: RANDOM  
Collection Date: 6/29/2011  
Collection Time: 10:00 AM

For training or questions, please contact:  
 Toxicology Support Services  
 Phone: 800.255.2159, press option 5.  
 Fax: 707.577.0365  
 Email: [clientservices@redwoodtoxicology.com](mailto:clientservices@redwoodtoxicology.com)  
 Web: [https://www.redwoodtoxicology.com/services/online\\_reporting](https://www.redwoodtoxicology.com/services/online_reporting)

ToxAccess™ Test Request Form



# ToxAccess™: Labeling Protocol

How to label specimens using the ToxAccess™ forms

## LABELING OVERVIEW

For customers taking advantage of the web-based ToxAccess™ Collection Management solution. Please follow these labeling instructions. Correctly labeled specimens will allow the laboratory to process your specimens accurately and quickly.

## LABELING PROCEDURE

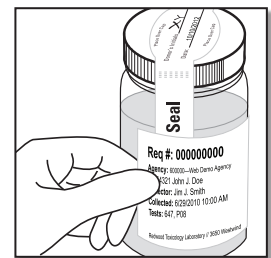
- 1) **Seal container**—After the collection process is complete, ensure the specimen container is tightly sealed.
- 2) **Sign and date the form**—The donor will certify that the specimen was collected following the appropriate procedures by signing under the “Donor’s Signature” area. The collector will also sign the form verifying that the specimen was collected appropriately in the “Collector Verification” area.
- 3) **Place security seal on the specimen bottle**—Once the specimen has been verified by the donor and collector, the collector will remove the security seal from the form and place it across the top of the bottle. The donor will then initial security seal.
- 4) **Place specimen label on the specimen bottle**—Place the specimen label around the body of the specimen bottle. The label should lay over the ends of the security seal as represented in the images to the right. Do not hand write any tests on the label. Tests may only be ordered through the ToxAccess program.
- 5) **Package for shipping**—After labeling and sealing the specimen tightly, place it into a RTL branded plastic baggie with absorbent material. Ensure baggie is sealed. Store in a secure area until the specimen is ready to be shipped to the laboratory.

DONOR CERTIFICATION			
I certify that I provided my specimen to the collector and that I have not adulterated it in any manner. The specimen was sealed in my presence with a tamper-evident seal. The information provided on this form and on the label affixed to the specimen container is correct. I authorize Redwood Toxicology Laboratory to perform the tests listed and to release the results of this test to WEB DEMO AGENCY			
<input checked="" type="checkbox"/>	Donor's Signature	John J. Doe	Donor's Name
			Date
		6/29/2011	
COLLECTOR VERIFICATION			
I certify that this specimen was collected from the above person following established protocols, and the specimen has been properly sealed and labeled.			
<input checked="" type="checkbox"/>	Collector's Signature	Jim J. Smith	Collector's Name
			Date
		6/29/2011	10:00 AM
			Collector's ID

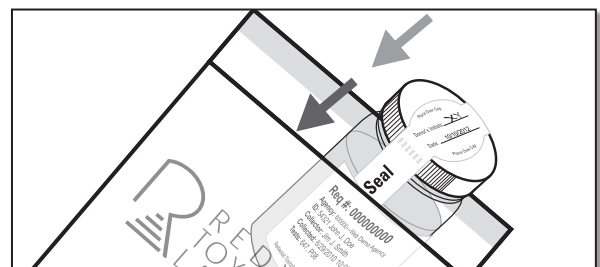
Donor signature and collector signature lines.



Security seal placed across the specimen cap.



Place specimen label over the security seal.



Place urine specimen into the plastic baggie.

# Option 2: Urine Test Request Form

Multi-part urine test requisition form overview

Urine Test Requisition forms will be provided when ordering urine tests through the lab. The Urine Test Requisition Forms (RF2 and RF3) are chain of custody labels with either 2 or 3 part carbon copies.

The forms should be completed with a water-resistant marker, such as a blue or black ball point pen (red color is not recommended since it tends to rub off).

## URINE TEST REQUISITIONS FORMS (RF2/RF3)

- 1) **Agency Information**—Contains the agency's account information including: account number, name, address, phone and fax numbers.
- 2) **Urine Drug Screen Type**—Indicates multiple boxes with corresponding reasons for testing the donor\*. Specimen temperature is also noted in this area.
- 3) **Security Seal**—Peel off label secures specimen container.
- 4) **Specimen Label**—The collector will select the a laboratory test from the available options or specify the desired test in the "other" field. Collector will then enter the donor's ID, collector initials and collection date onto the label. Ensure the label is placed horizontally across the specimen bottle.
- 5) **Donor Information & Collector Verification**—Donor information will be located in this section. Signature area for Donor and Collector, verifying specimen collected and labeled correctly.
- 6) **Receiving (lab only)**—This section is to be filled out by Redwood Toxicology Laboratory personnel only.

\* Donor identification (Name, ID Number, Etc.) will appear on the final report. Donor ID must be written on the Patient ID line of the label. It is recommended that the donor's Social Security Number not be written on the Patient ID line.

Urine Test Request Form

For training or questions, please contact:

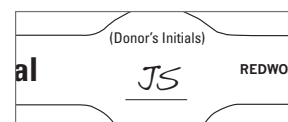
Toxicology Support Services

Phone: 800.255.2159, press option 5.

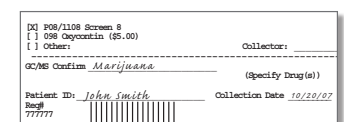
Fax: 707.577.0365

Email: [clientservices@redwoodtoxicology.com](mailto:clientservices@redwoodtoxicology.com)

Web: [https://www.redwoodtoxicology.com/services/online\\_reporting](https://www.redwoodtoxicology.com/services/online_reporting)



An initialed security seal



A completed chain of custody label

# Urine Test Request Form (RF2/RF3): Labeling Guide

How to label specimens using the RF2/RF3 multi-part forms

## LABELING OVERVIEW

The following procedure gives you an easy to follow guide to ensure your specimens are labeled correctly using the RF2/RF3 test request forms. Correctly labeled specimens will allow the laboratory to process your specimens accurately and quickly.

## LABELING PROCEDURE

- 1) **Seal container**—After the collection process is complete, ensure the specimen container is tightly sealed.
- 2) **Sign and date the form**—The donor will certify that the specimen was collected following the appropriate procedures by signing under the “Donor’s Signature” area. The collector will also sign the form verifying that the specimen was collected appropriately in the “Collector Verification” area.
- 3) **Place security seal on the specimen bottle**—Once the specimen has been verified by the donor and collector, the collector will remove the security seal from the form and place it across the top of the bottle. The donor will then initial security seal.
- 4) **Indicate the test(s) to be performed**—Indicate the following information in the appropriate area of the specimen label:
  - Please indicate which test(s) or panel is to be ordered by placing a check mark in the appropriate box or by writing the test on the “other” line. Tests to be run by GC/MS or LC/MS/MS must be written on the GC/MS request line.
  - Donor identification, collection date, and collector.
- 5) **Place specimen label on the specimen bottle**—Place the specimen label around the body of the specimen bottle. The label should lay over the ends of the security seal as representable in the images to the right.
- 6) **Package for shipping**—After labeling and sealing the specimen tightly, place it into a RTL branded plastic baggie with absorbent material. Ensure baggie is sealed. Store in a secure area until the specimen is ready to be shipped to the laboratory. The test request form (chain of custody form) must be placed in the same shipping bag as the specimen. If the form is sent in a separate bag, it will not be matched to the specimen.

Donor's signature: \_\_\_\_\_

Donor's name as listed above (please print): \_\_\_\_\_ Donor's ID (SSN or DL nr): \_\_\_\_\_

**COLLECTOR VERIFICATION** (To be completed by collection station personnel)  
I certify, that this specimen was collected from the above person following established protocols, and the specimen has been properly sealed and labeled.

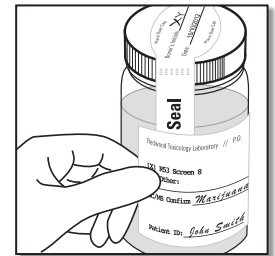
Collector's signature: \_\_\_\_\_ Date and time of collection: \_\_\_\_/\_\_\_\_/\_\_\_\_ : \_\_\_\_ : \_\_\_\_  AM  PM

Collector's name as listed above (please print): \_\_\_\_\_ Collection site phone: \_\_\_\_\_

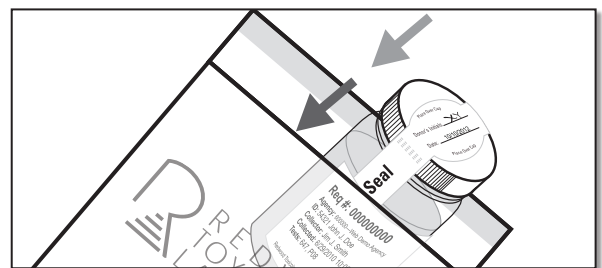
Donor signature and Collector Signature lines.



Security seal placed across the specimen cap.



Place specimen label over the security seal.



Place urine specimen into the plastic baggie.

# Option 3: Oral Fluid Specimens

## Multi-part oral fluid test requisition form overview

Oral Fluid Test Requisition forms will be provided when ordering oral fluid tests through the lab. These forms are different from the Urine Test Requisition forms and are therefore not interchangeable. Please send the appropriate form with the specimen. If the laboratory copy of this form is not sent with the specimen, the lab will be unable to process the specimen. This form is a two-part carbon copy.

Ensure that the security seal, dates and appropriate signatures are completed by the donor and the collector.

The forms should be completed with a water-resistant marker, such as a blue or black ball point pen (red color is not recommended since it tends to rub off).

### ORAL FLUID SPECIMEN TEST REQUISITIONS

**1) Lab Test Request Information**—Lists agency specific test panel information. Test(s) to be performed will be printed on the top of the form. Indicate the panel and/or additional test to be run by placing a check mark next to the panel or test description. (Diagram 1A)

**On-site Device Test Request Information**—Use the “GC/MS Confirm” line to list the presumptive positive drug(s) you want to confirm through the lab. Please note: panel cannot be run on on-site devices. (Diagram 1B)

Check one of the boxes for why the donor is being tested in the green box below the test request information.

- 2) Security Seal with barcode**—Peel off label secures specimen container.
- 3) Donor Information & Collector Verification**—Donor information will be located in this section. Signature area for Donor and Collector, verifying specimen collected and labeled correctly.
- 4) Receiving (lab only)**—This section is to be filled out by Redwood Toxicology Laboratory personnel only.

For training or questions, please contact:  
 Toxicology Support Services  
 Phone: 800.255.2159, press option 5.  
 Fax: 707.577.0365  
 Email: [clientservices@redwoodtoxicology.com](mailto:clientservices@redwoodtoxicology.com)  
 Web: [https://www.redwoodtoxicology.com/services/online\\_reporting](https://www.redwoodtoxicology.com/services/online_reporting)

1A: Lab Tests—Agency specific drug test panel listed

1B: On-site Devices—List drug(s) to be confirmed for your on-site screening device

Oral Fluid Test Request Form

Security Seal & Barcode—A completed oral fluid label

# Oral Fluid Test Request Form: *Labeling Protocol*

How to label your specimens using the oral fluid multi-part forms

## LABELING OVERVIEW

The following procedure gives you an easy to follow guide to ensure your specimens are labeled correctly using the oral fluid test request forms. Correctly labeled specimens will allow the laboratory to process your specimens accurately and quickly.

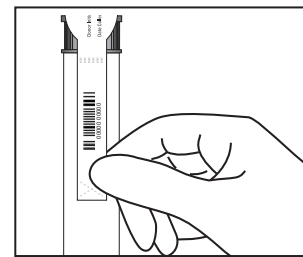
## LABELING PROCEDURE

- 1) **Seal container**—After the collection process is complete, ensure the specimen container is tightly sealed.
- 2) **Indicate the test to be performed**— Indicate the test to be performed at the top of the form. For on-site devices, indicate the drug to be confirmed on the “GC/MS Confirm” line.
- 3) **Sign and date the form**— The donor will enter his/her signature, printed name, date collected and donor ID (SSN or DL# if required by agency). The collector will verify the information provided by the donor and validate that the specimen was collected correctly.
- 4) **Place security seal on the collection tube**—Once the specimen has been verified by the donor and collector, the collector will remove the security seal from the form and place it across the top of the collection tube. NOTE: The barcode and number are required for processing the oral fluid specimen. Ensure that the barcode and number are unobscured and clearly visible on the side of the collection tube.
- 5) **Package for shipping**—After labeling and sealing the specimen tightly, place it into a RTL branded plastic baggie with absorbent material. Ensure baggie is sealed. Store in a secure area until the specimen is ready to be shipped to the laboratory.

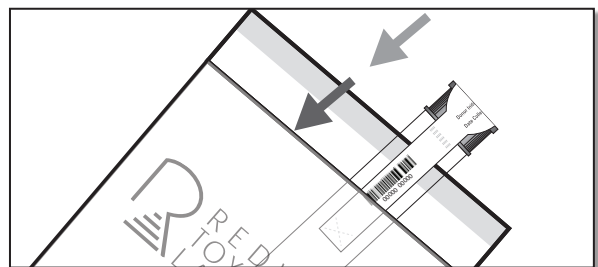
## IMPORTANT LABELING INFORMATION

The oral fluid sample cannot be processed without the information supplied on the test request form. If the test request form does not accompany the specimen, testing will be delayed.

Donor signature and collector signature lines.



Security seal placed across the collection tubes cap. Ensure barcode is clearly visible from side of tube.



Place oral fluid specimen into the plastic baggie.

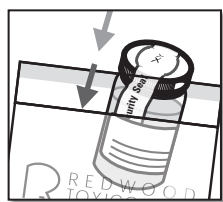
# Packaging Protocol: *Shipping to Lab*

Urine & oral fluid specimen shipping instructions

## URINE & SALIVA SHIPPING PRINCIPLES

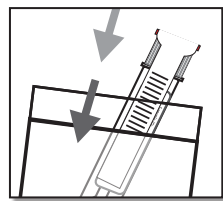
The following is a brief description of how to label and send your urine specimen in to the laboratory for testing:

All on-site device samples & lab urine samples: After labeling and sealing the specimen tightly, place it into a RTL branded plastic baggie with absorbent material. Ensure baggie is sealed. Store in a secure area until the specimen is ready to be shipped to the laboratory.



Place urine specimen into the plastic baggie.

Lab oral fluid samples: After labeling and sealing the specimen tightly, place the transport tube into the original outer packaging provided with the collector device. Ensure baggie is sealed. Store in a secure area until the specimen is ready to be shipped to the laboratory.



Place saliva specimen into the plastic baggie.

Oral fluid samples must be received by the lab within 7 days of collection. Specimens should be refrigerated until shipped. The test request form (chain of custody form) must be placed in the same shipping bag as the specimen. If the form is sent in a separate bag, it will not be matched to the specimen.

## SPECIMEN SHIPPING

Your account has been set up with one of the following specimen shipping methods:

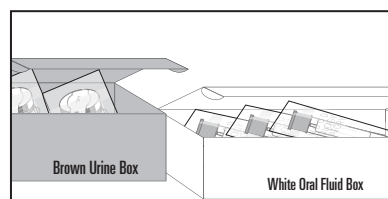
### EXPRESS DELIVERY SERVICE—5 OR MORE SPECIMENS



5 or more specimens: Use express delivery package

Please use the packaging materials and labels that are included with your lab supplies. Instructions for packing and shipping specimens will be enclosed with your supply shipment.

### U.S. POSTAL SERVICE—LESS THAN 5 SPECIMENS



Fewer than 5 specimens: Use USPS Pre-paid Mailer Box

Please use the pre-paid U.S. mailer boxes. Do not mix oral fluid and urine specimens in the same postage-paid mailer box! Per U.S. Postal Service regulations, use the box provided specifically for each type of test as indicated on the pre-paid label.

### SHIPPING/PICKUP

If you need help with scheduling an express delivery pick-up, please call Toxicology Support Services at 800.255.2159. (See page 57 for additional information.)

**Supplies Re-ordering:** Lab supply re-ordering is available to existing clients with an account number. RTL offers two convenient methods for re-ordering drug testing supplies:

Email: [supplies@redwoodtoxicology.com](mailto:supplies@redwoodtoxicology.com)

Web: [https://www.redwoodtoxicology.com/resources/supply\\_form](https://www.redwoodtoxicology.com/resources/supply_form)

Please order supplies through RTL ONLY. Do not ask drivers for labels or bags since RTL provides its clients with custom supplies. The supplies have specialized routing information that drivers do not have access to. This information is also important for billing purposes.

## IMPORTANT PACKAGING NOTICE

FEDERAL LAW REQUIRES THAT SPECIMENS BE PACKAGED IN BAGS WITH ABSORBENT MATERIAL.

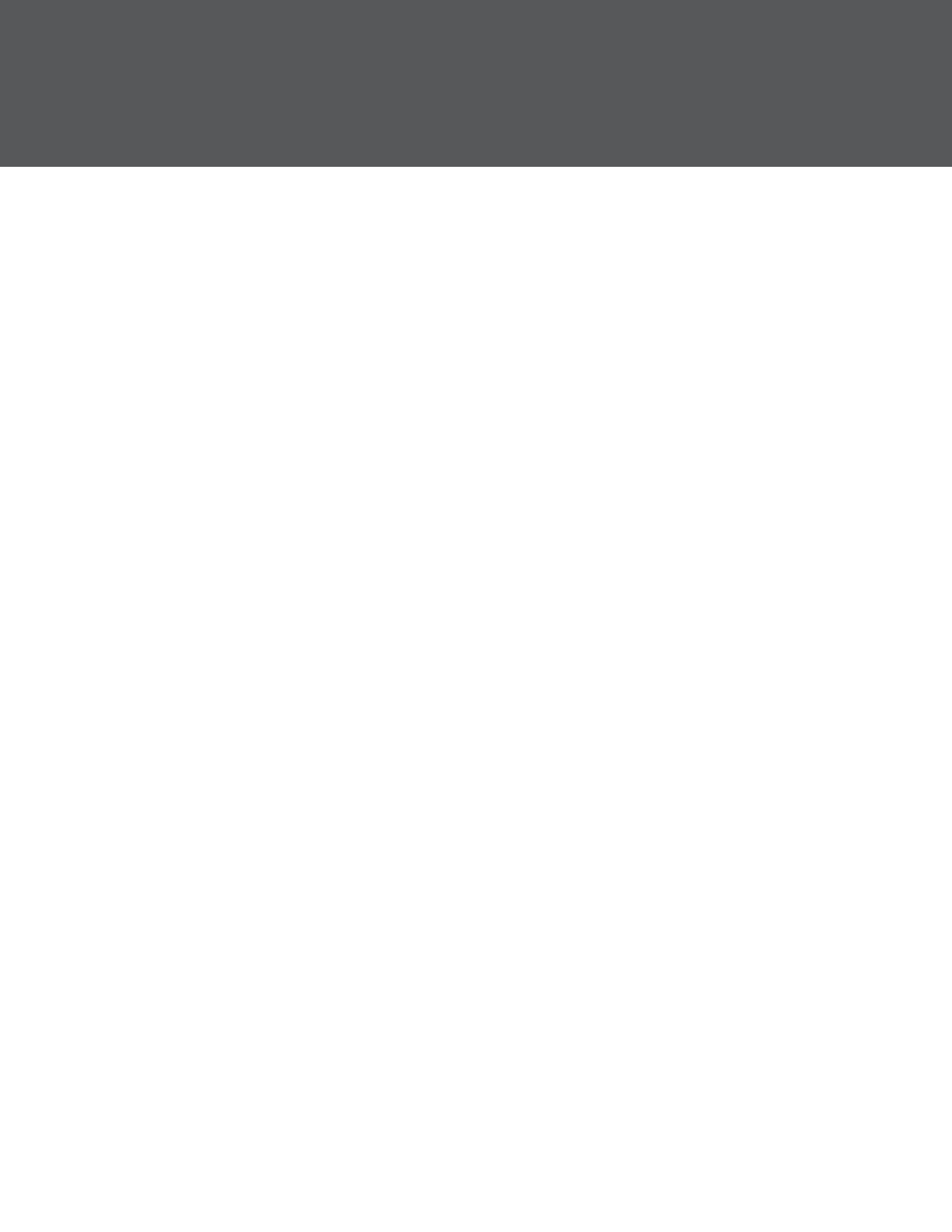
PLEASE BE SURE TO FASTEN THE LID OF THE BOTTLE TIGHTLY. LEAVE THE ABSORBENT MATERIAL IN THE BAG WITH THE SPECIMEN BOTTLE.

LEAKY SPECIMENS MAY BE RETURNED TO YOUR AGENCY BY YOUR SHIPPING PROVIDER.

IF YOU REQUIRE TRAINING ON SPECIMEN COLLECTION PROCEDURES, PLEASE CONTACT RTL'S CLIENT SERVICES DEPARTMENT:

Phone: 800.255.2159  
Fax: 707.577.0365  
Email: [clientservices@redwoodtoxicology.com](mailto:clientservices@redwoodtoxicology.com)

THANK YOU.





## Result reporting & collection management

Redwood Toxicology Laboratory's objective is to provide its clients with all the tools possible to help deter and prevent drug abuse. Reliable and useful toxicology reports are essential to this objective. Toxicology results are delivered in the following formats:

**Web-Result Reporting & Collection Management**—RTL's ToxAccess™ site provides a secure and complete solution for tracking, managing and printing your drug test reports and chain of custody forms.

- Fast collections—print chain of custody forms using a simple, step by step process on a single screen
- Accurate data—no more hand-written labels and laboratory data entry errors
- Real-time tracking—track specimens from collection to reporting; includes COC scans with donor, collector and lab receiving signatures
- Program management—schedule tests, generate collection rosters and view no-shows
- Powerful reporting—pending specimens, drug statistics, donor summaries and more

**Mail/Fax Reports**—RTL offers reporting solutions via U.S. mail or facsimile. Please indicate your preferred method at the time of account set-up.



# Standard Result Reporting

Toxicology results

## FINAL REPORT


Standard reporting from Redwood Toxicology Laboratory includes toxicology reports which are delivered via fax, mail or the internet (ToxAccess™). The combination of RTL's leading testing methods and chain of custody documentation guarantees legal defensibility.

For more information on specific drugs, including; classifications, metabolism, general abuse information and methods of analysis, please refer to the Drug Information section, beginning on page 37.

For more information on how to read creatinine levels, please see page 56 within the Drug Information section.

## FINAL REPORT OVERVIEW

- 1) **Donor and agency information**—Contains client, donor/patient and collection information.
- 2) **Final result summary**—Features immediate result status, including a list of any detected analytes or if “None detected.”
- 3) **Test ordered**—Lists the tests that were ordered by the client, and features test panel code information.
- 4) **Drug test overview**—Shows test results for each drug, test methodology and cutoff.
- 5) **Specimen comments**—Comments may accompany laboratory results and findings.



Redwood Toxicology Laboratory  
120729-00002 O1  
Laboratory Directors: Mark J. DeMeo, M.D.; Richard R. Wilber, M.D.  
CLIA License # 05020707988

Identification: IT TEST - NO SUCH SPECIMEN      **Client:** Test Agency (Standard Confirms)

**DOB:**      **Account #:** 500010      3650 Westwind Blvd

**Sex:**      **Requisition #:** 999999999      Santa Rosa, CA 95403

**Collected by:**      **Accession #:** 120729-00002      Phone: (999)999-9999

**Collected:**      **Specimen Type:** URINE

**Received:** 07/29/2012 4:29 PM

**Reported:** 07/29/2012 5:41 PM

**1** Identification: IT TEST - NO SUCH SPECIMEN      **Client:** Test Agency (Standard Confirms)

**DOB:**      **Account #:** 500010      3650 Westwind Blvd

**Sex:**      **Requisition #:** 999999999      Santa Rosa, CA 95403

**Collected by:**      **Accession #:** 120729-00002      Phone: (999)999-9999

**Collected:**      **Specimen Type:** URINE

**Received:** 07/29/2012 4:29 PM

**Reported:** 07/29/2012 5:41 PM

**2** **Final Result Summary**

- Codeine detected by TLC
- THC (Marijuana) detected by RIA
- Total Morphine detected by TLC

**3** **Tests Ordered**

- P08 - Screen 7 with Creatinine

**4** **Drug Tests**

Drug	Result	Screen		Confirmation	
		Method	Cutoff	Method	Cutoff
Alcohol (Ethanol)	Not detected	EA	0.04 g/dL		
Amphetamines	Not detected	EIA	1000 ng/mL		
Barbiturates	Not detected	EIA	200 ng/mL		
Benzodiazepines	Not detected	EIA	200 ng/mL		
Cocaine (Benzoylcegonine)	Not detected	EIA	300 ng/mL		
<b>Opiates</b>					
Opiates	DETECTED	EIA	300 ng/mL		
Codeine	DETECTED			LC/MS/MS	Qualitative
Total Morphine	DETECTED			LC/MS/MS	Qualitative
<b>THC (Marijuana)</b>					
THC (Marijuana)	DETECTED	EIA	50 ng/mL		
THC (Marijuana)	DETECTED			LC/MS/MS	20 ng/mL
THC/Creatinine Ratio (RIA)	NA			LC/MS/MS	

**5** **Specimen Validity Tests**

Test	Result	Method	Reference Range
Creatinine	55.0 mg/dL	Colorimetric	≥20 mg/dL

**Comments:**

Analytical testing has been performed in accordance to all Redwood Toxicology Laboratory standard operating procedures and final results have been reviewed by laboratory certifying scientists.

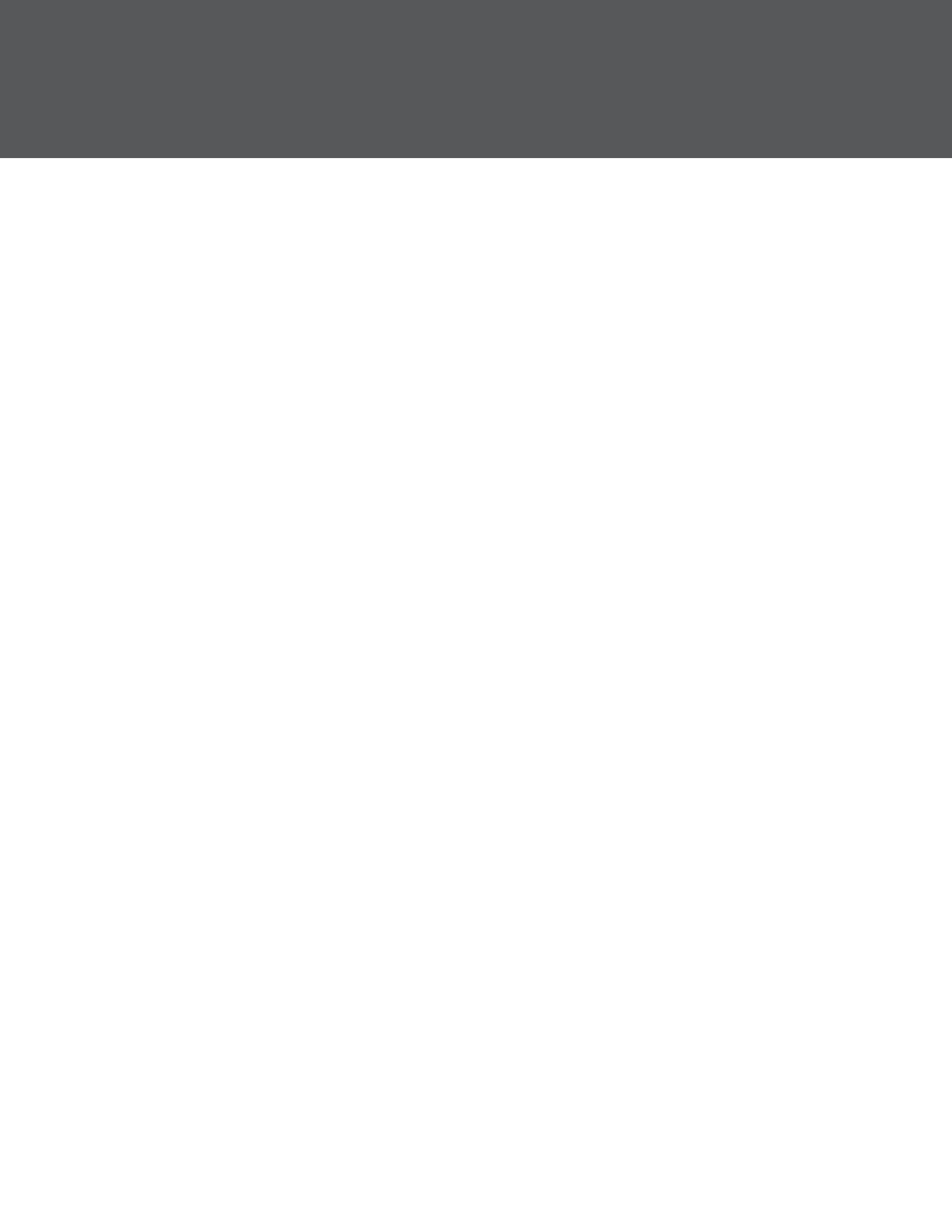
Chief Toxicologist: Wayne Ross, M.C.L.S. / MT(AAB)

**Method Index**  
 EA - Enzyme Assay      GC-FID - Gas Chromatography - Flame Ionization Detector  
 EIA - Enzyme-Immunoassay      GC/MS - Gas Chromatography / Mass Spectrometry  
 ELISA - Enzyme-Linked Immunosorbent Assay      LC/MS/MS - Liquid Chromatography Tandem Mass Spectrometry

**Specimens are disposed of as follows:** Negatives - after 2 days; Positives - after 6 months; Methadone Maintenance - after 2 months

Page 1 of 1      IT TEST - NO SUCH SPECIMEN  
 \* Printed 10/9/2012 9:20 AM      120729-00002 O1

Sample Final Toxicology Report



## Drug information

Included herein is specific drug information including classifications, metabolism, general abuse information and methods of analysis.

This section will assist you in understanding specific drugs of abuse and how Redwood Toxicology Laboratory's wide range of urine and oral fluid screening programs test for each drug.

# Alcohol

## Drug information

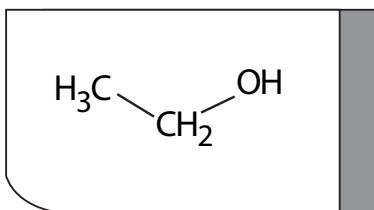
### CLASSIFICATION

Common alcohols are a group of compounds whose structures include a hydroxyl group attached to a carbon chain of varying length. The number of carbons determine both the name and individual properties. The common alcohols are designated as primary, secondary, or tertiary depending on the number of carbons that are attached to the carbon bearing the hydroxyl group. Examples of primary alcohols include methanol and ethanol, which contain one and two carbons respectively. Secondary alcohols include isopropanol, a three carbon alcohol. Tertiary or four carbon alcohols include N-butanol. The information contained herein will deal primarily with ethanol, or beverage alcohol.

### METABOLISM

Ethanol is a small molecule which is readily soluble in water and penetrates membranes throughout the GI tract, including the mouth, stomach and small intestine. Rate of absorption varies greatly due to factors such as type of beverage ingested, quantity of food in the stomach, frequency of gastric emptying, drinking pattern, etc. The average time to peak absorption is usually 30 to 60 minutes, but may range from 15 minutes to 3 hours. Approximately 95% of an ingested dose of ethanol is metabolized by liver enzymes, principally alcohol dehydrogenase, with the remainder eliminated unchanged in the urine, breath, sweat, and feces.

Ethanol is metabolized to acetaldehyde and then to a final end product of acetic acid. Distribution of alcohol throughout the body occurs via the blood supply and since ethanol is hydrophilic (strong affinity for water), it will diffuse into body tissue or fluid compartments such as urine, saliva, plasma, etc. Since plasma or serum have a higher percentage of water by unit volume, it will have a higher ethanol concentration than whole blood. A wide range of elimination rates exists, however, ethanol is typically metabolized at approximately .015-.018 gm/dL per hour in healthy individuals. Therefore, the detection time of ethanol in body fluids is dose dependent.



### ABUSE

Ethanol is the most widely consumed drug in society and is generally consumed socially. Ethanol is predominantly consumed as fermented or distilled beverages and is also a component of mouthwashes, medicinal, and industrial products. Fermented beverages such as beers and ales contain 3-6% ethanol by volume, wines contain 10-12%, and distilled spirits contain 20-60% ethanol. Acute ingestion of ethanol typically leads to progressive stages of effects depending upon the amount consumed. With low to moderate consumption, a person may initially experience mild euphoria, sociability, decreased inhibitions and the beginning of sensory-motor impairment. With increased consumption the effects can progress to emotional instability, loss of perception, memory and comprehension in addition to decreased response time and slurred speech, staggered gait and loss of muscular coordination. Finally, excessive acute ethanol consumption can lead to impaired consciousness, respiratory depression, coma and death. Chronic ethanol abuse can result in multi-organ pathological effects. These can include cirrhosis of the liver, acute and chronic gastritis, pancreatitis, cardiomyopathy and various neurological and metabolic disorders.

### METHODS OF ANALYSIS

One of the most widely used techniques for detecting alcohols in urine include enzyme assay utilizing alcohol dehydrogenase. The method is very sensitive and specific in that methanol and acetone are not detected. However, longer chain alcohols such as isopropanol may be detected. This is appropriate for clinical settings, however, for forensic purposes, a secondary more definitive confirmation method is required. Gas chromatographic methods, either direct injection or headspace sampling, with the incorporation of an internal standard offer very accurate and precise quantitation of ethyl alcohol, in addition to identifying other volatile compounds such as methanol, acetone, isopropanol. Definitive identification of ethanol and accurate quantitation are required when relating a blood alcohol concentration to a particular level of impairment. This is especially critical when the blood alcohol concentration is to be used as evidence to determine whether grounds exist for presumption of impairment.

# Amphetamines

## Drug information

### CLASSIFICATION

Amphetamine and methamphetamine are Schedule II drugs included in a group of chemicals called sympathomimetic amines, which contain a phenethylamine chemical nucleus. Sympathomimetic amines mimic the effects of the endogenous neurotransmitters such as epinephrine (adrenaline), norepinephrine (noradrenaline) and dopamine. Also included in this group are various over-the-counter drugs such as phenylpropanolamine, pseudoephedrine, ephedrine as well as the Schedule I drug methylenedioxymethamphetamine (MDMA or Ecstasy). The amphetamines are powerful central nervous system stimulants and can be taken orally, intravenously, snorted or smoked. Methamphetamine is one of the most commonly abused drugs in the Western United States. It is readily synthesized, with ephedrine being used as the primary precursor.

### METABOLISM

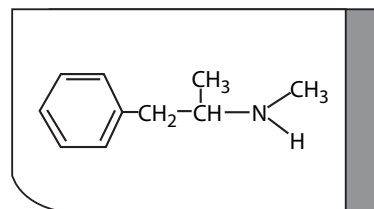
Amphetamines are rapidly absorbed from the gastrointestinal tract and are either deactivated by the liver or excreted unchanged into the urine. Methamphetamine is excreted primarily unchanged (44%) and some of the drug (6%) is metabolized and excreted as amphetamine. Amphetamine is also excreted largely unchanged (30%) with 20-25% being metabolized to deaminated (hippuric and benzoic acids) and hydroxylated metabolites. The elimination rate of amphetamines varies with the pH of the urine, as at low pH the excretion of unchanged drug increases, while at high pH the excretion of unchanged drug decreases. Within a few hours after any type of administration, amphetamines appear in the urine and can typically be detected for up to 72-96 hours.

### ABUSE

Amphetamines, particularly methamphetamine, are among the most popular drugs of abuse. Common street names include speed, crank, crystal, meth, and ice. Ice and crystal meth are crystals of methamphetamine HCL. Snot and glue are oils formed from methamphetamine free base and baking soda. Methamphetamine is frequently smoked in a glass pipe as it is easily volatilized into a gas that is inhaled. Although the ice form is primarily found in Hawaii and the western United States, it has gained the most notoriety mainly due to the fact that it is >90% pure methamphetamine HCL and its effects are rapid, intense, and of longer duration than other forms of methamphetamine.

The signs and symptoms associated with the abuse of methamphetamine depend upon the amount used and the duration of use. With infrequent or low dose use, a person may experience euphoria,

lowered anxiety, talkativeness, decreased appetite, increased sexual arousal, increased alertness, and decreased fatigue. Physiologically there can be increased heart rate and blood pressure. With increased dose or prolonged abuse (either binge or chronic), an individual may experience a set of secondary effects that can include increased anxiety, irritability, aggressiveness, paranoia and hypersexuality. Physiological effects can include dilated pupils, dry mouth, hippus, increased body temperature and tachycardia. In overdose situations, a person may experience hallucinations, coma or death. Crash symptoms typically follow binge abuse of methamphetamine. This phase is marked by extreme fatigue, depression, mental exhaustion and prolonged periods of sleep.



### METHODS OF ANALYSIS

Immunoassays are common methods for detecting amphetamines in urine. Enzyme immunoassay (EIA) is the most commonly used immunoassay that detects both methamphetamine and amphetamine to varying degrees of sensitivity and specificity. However, it will cross-react with several over-the-counter cold and diet preparations which indicates the importance of confirmatory testing for samples screened presumptively positive by immunoassay tests. Gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/tandem mass spectrometry (LC/MS/MS) provides reliably sensitive and specific solutions as confirmatory methods.

# Barbiturates

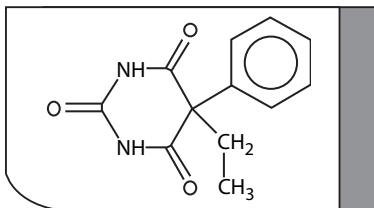
## Drug information

### CLASSIFICATION

Barbiturates are a class of drugs capable of producing CNS depression, and depending upon the drug and dosage, may produce varying states of sedation or hypnosis and are thus classified as sedative/hypnotics. They are further categorized according to the duration of their effects, ranging from ultra-short acting, short acting, intermediate acting, and long acting. Duration of effects lasts anywhere from 15 minutes for the ultra-short acting barbiturates to a day or more for the long acting drugs. Short and intermediate acting barbiturates include amobarbital, butalbital, pentobarbital, and secobarbital, while the long acting barbiturates include phenobarbital. Other common therapeutic indications for use are as anticonvulsants and for migraine headaches.

### METABOLISM

Barbiturates are distributed throughout the body with highest concentrations occurring in the brain, liver and kidneys. In general, duration of action is dependent upon lipid solubility and extent of protein binding with the short acting barbiturates showing the most lipid solubility and percentage of protein binding. The short and intermediate acting barbiturates are nearly entirely metabolized by the liver and excreted in the urine, while 25-50% of a dose of a long acting barbiturate is excreted as unchanged drug. The half-life is variable with short acting barbiturates being detectable in urine for 24 hours and the long acting drugs detectable for 2-3 weeks following ingestion.



### ABUSE

The most common detected barbiturates are butalbital and phenobarbital. Butalbital is routinely prescribed for migraine and muscle relaxation while phenobarbital is primarily prescribed for seizure disorders. Trade and street names of some common barbiturates are as indicated below.

Chemical Name	Trade Name	Street Name
Amobarbital	Amytal	Yellow Jackets
Butalbital	Fiorinal	Blue Devils
Secobarbital	Seconal	Reds
Phenobarbital	Luminal	Downers, Goofballs

Chronic abuse leads to tolerance, and abrupt discontinuance of use can induce a life-threatening withdrawal syndrome that can result in seizures.

### METHODS OF ANALYSIS

Immunoassays readily detect barbiturates as a class of drugs. Specific barbiturate identification can be accomplished by utilizing confirmatory methods such as gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/tandem mass spectrometry (LC/MS/MS).



# Benzodiazepines

## Drug information

### CLASSIFICATION

The benzodiazepines are a class of drugs primarily classified as anti-anxiety, sedatives, or hypnotics. All contain a benzene ring fused to a 7-membered diazepine ring, hence the term benzodiazepine. Various modifications and substitutions of the ring structure yield compounds of similar activities. The clinical effects of these drugs result from actions on the central nervous system and these effects include sedation, hypnosis, muscle relaxation, and anticonvulsant activity.

### METABOLISM

The benzodiazepines are well absorbed after oral administration and are rapidly distributed throughout the body. They are extensively metabolized by the liver, and in general, slowly excreted in the urine as pharmacologically inactive conjugated metabolites. Some metabolites may possess some pharmacological activity of their own, thus displaying the “next day” effects of some benzodiazepines. Oxazepam is a common urinary metabolite of several benzodiazepines such as diazepam and temazepam. Duration of detectability in urine is varied. Ingestion of therapeutic dosages may be detectable for 1-3 days while extended usage over a period of months or years can extend excretion times up to 4-6 weeks after cessation of use (depends on dosage & benzodiazepine).

### ABUSE

The benzodiazepines are considered one of the most widely prescribed drugs in the United States, thus leading to its widespread abuse. Diazepam (Valium®) and alprazolam (Xanax®) are two of the most widely abused of the benzodiazepines. Many abusers will attempt to accentuate the effects of benzodiazepines by the

Chemical and trade names are as follows:

Chemical Name	Trade Name
Alprazolam	Xanax®
Chlordiazepoxide	Librium®
Clonazepam	Klonopin®
Clorazepate	Tranxene
Diazepam	Valium®
Flunitrazepam	Rohypnol®
Flurazepam	Dalmane®
Lorazepam	Ativan®
Midazolam	Versed®
Oxazepam	Serax®
Prazepam	Centrax®
Temazepam	Restoril®
Triazolam	Halcion®

concomitant use of alcohol or other CNS depressant drugs. As a result, benzodiazepines are involved in approximately one third of all drug self induced poisonings. Other commonly abused benzodiazepines are chlordiazepoxide, flurazepam, clonazepam, and lorazepam. Prolonged high doses of benzodiazepines can cause dependency and a withdrawal syndrome may occur following abrupt cessation of use.

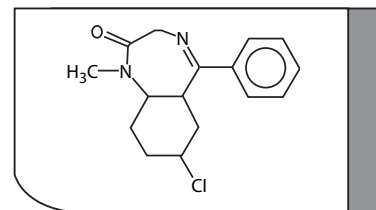
### METHODS OF ANALYSIS

There are many problems associated with a comprehensive approach to the analysis of the benzodiazepines. The benzodiazepines are a very diverse and complex group of compounds which are extensively metabolized in urine. For this reason, it is not always possible to determine the parent drug with urine testing. In addition, dosage levels and half-life varies substantially between the benzodiazepines affecting the ability to detect therapeutic use of some benzodiazepines. Therefore, the analytical detection limits may preclude the detection of therapeutic use.

The most common analytical methods to screen for the presence of benzodiazepines in urine are the immunoas-

say methods such as enzyme immunoassay (EIA). The immunoassay methods are class specific in that they detect oxazepam, a common metabolite of many benzodiazepines. However, many other structurally similar benzodiazepines may also be detected.

While immunoassay cross-reactivity to non-benzodiazepine compounds is extremely rare, most immunoassay manufacturers recommend that positive results be confirmed by alternate specific analytical method such as gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS). Most routine confirmation methods are targeted to detect the group of benzodiazepines which share a common metabolic pathway and metabolize to nordiazepam and oxazepam thus making these methods class specific. However, common benzodiazepines such as alprazolam (Xanax®), lorazepam (Ativan®), and clonazepam (Klonopin®) do not share this metabolic pathway and must be confirmed by specific techniques, such as GC/MS or LC/MS/MS. It is essential to understand the advantages and limitations of the various laboratory analytical methods to ensure proper detection of benzodiazepines. If a case history indicates the use of a particular benzodiazepine, then a method must be chosen which will have the necessary sensitivity and specificity to identify the drug of interest.



# Buprenorphine

## Drug information

### CLASSIFICATION

Buprenorphine (Suboxone, Subutex) is a semi-synthetic thebaine derivative that has both analgesic and opioid antagonist properties. As an analgesic, buprenorphine is approximately 25 to 40 times more potent than morphine and as an opioid antagonist it is roughly equivalent to naltrexone. Buprenorphine is prescribed in the hydrochloride form and therapeutic dosages range from 0.3 - 0.6 mg when given parenterally, or 0.2 - 0.4 mg sublingually, every 6 - 8 hours. The use of larger daily doses (2 - 16 mg daily) have been used successfully for the treatment of opiate withdrawal or maintenance. Overdose symptoms include confusion, dizziness, pinpoint pupils, hallucinations, hypotension, respiratory difficulty, seizures and coma. Fatalities due to buprenorphine overdosage alone and by poly-drug use have been reported.

### METABOLISM

Buprenorphine is rapidly metabolized in the liver by the cytochrome P450 system to form a pharmacologically active N-dealkylated metabolite, norbuprenorphine and glucuronide conjugates.

Buprenorphine and norbuprenorphine are excreted in urine almost exclusively as glucuronides with very little free drug being detected. Studies indicate that concentration of free buprenorphine and norbuprenorphine in urine can be less than 1 ng/mL following therapeutic administration, but can range up to 20 ng/mL in abuse situations. Total buprenorphine and norbuprenorphine concentrations in urine, ranging from 0.5 - 2936 ng/mL and 4.0 - 4462 ng/mL respectively, have been reported following daily doses between 0.2 - 24 mg. The corresponding median norbuprenorphine to buprenorphine ratio was 0.23. However, there is significant inter- and intra-individual variability in the ratio because the elimination kinetics of norbuprenorphine are slower; therefore, the ratio is greatly influenced by dosage and sample time. Approximately 95% of a labeled dose is excreted within 144 hours, 68% in the feces and 27% in the urine.

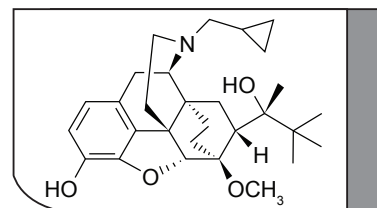
### ABUSE

Like methadone when buprenorphine is taken by an individual who is addicted to heroin or other opioid, buprenorphine reduces craving and helps the person remain drug-free. Because of its opioid effects, buprenorphine can also be abused, particularly by individuals who are not physically dependent on opioids.

Compared with methadone, buprenorphine has a relatively lower risk of abuse, dependence, and side effects, and it has a longer duration of action. Because buprenorphine is a partial opioid agonist, its opioid effects, such as euphoria and respiratory depression, as well as its side effects, reach a ceiling of maximum effect, unlike with methadone or heroin. For this reason, buprenorphine may be safer than methadone, as long as it is not combined with sedatives such as tranquilizers or alcohol. The side effects of buprenorphine are similar to those of other opioids and may include nausea, vomiting, and constipation. Both buprenorphine and buprenorphine with naloxone can result in the opioid withdrawal syndrome if used by people on high doses of other opioids. Symptoms of opioid withdrawal can include: dysphoria, nausea and vomiting, muscle aches and cramps, sweating, tearing, diarrhea, mild fever, running nose, insomnia, and irritability.

### METHODS OF ANALYSIS

Enzyme immunoassay (EIA) is used as a screening method for the detection of buprenorphine. The assay has equal cross reactivity to norbuprenorphine, the primary urinary metabolite of buprenorphine. Confirmation of screened positive urines should be performed by a specific method such as gas chromatography-mass spectrometry (GC/MS) or liquid chromatography-tandem mass spectrometry (LC/MS/MS).



# Cocaine

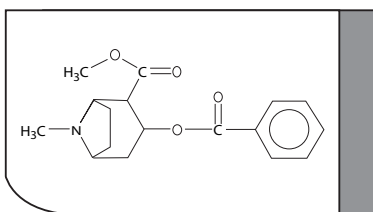
## Drug information

### CLASSIFICATION

Cocaine (benzoylmethylecgonine) is a central nervous system stimulant derived from the leaves of the coca plant. Cocaine has two major pharmacological actions; one is a local anesthetic, and the other is an indirect acting sympathomimetic having many of the properties of an amphetamine. The drug is either in the salt/powder form (cocaine HCL) which can be administered by snorting or intravenous injection or in the free base "crack" form which is smoked.

### METABOLISM

After smoking, cocaine is rapidly absorbed with peak plasma concentrations occurring at about 5 minutes, versus 30-40 minutes following intranasal ingestion. Cocaine is extensively metabolized by the liver and blood enzymes with approximately one percent of the dose excreted in the urine unchanged. The major metabolite found in the urine is benzoylecgonine (25-40% of the dose), followed by ecgonine methyl ester (18-22%). Depending upon the dosage ingested, frequency of use, and metabolic variation, benzoylecgonine can remain detectable in the urine for as long as 48-96 hours post ingestion.



### ABUSE

Cocaine produces a short-lived, intense high which is extremely addictive. The signs and symptoms associated with the abuse of cocaine depend upon the amount used and the duration of use. With infrequent or low dose use a person may experience euphoria, lowered anxiety, talkativeness, decreased appetite, increased sexual arousal, increased alertness, and decreased fatigue. Physiologically there can be increased heart rate and blood pressure.

With increased dose or prolonged abuse (either binge or chronic) an individual may experience a set of secondary effects that can include increased anxiety, irritability, aggressiveness, paranoia and hypersexuality. Physiological effects can include dilated pupils, dry mouth, hippus, increased body temperature and tachycardia. In overdose situations, a person may experience hallucinations, coma or death. Crash symptoms typically follow binge abuse of cocaine. This phase is marked by extreme fatigue, depression, mental exhaustion and prolonged periods of sleep.

### METHODS OF ANALYSIS

Enzyme immunoassay (EIA) is a widely used screening method designed to specifically detect benzoylecgonine and to a lesser extent, cocaine and ecgonine methyl ester (secondary cocaine metabolite). Redwood Toxicology Laboratory utilizes liquid chromatography/tandem mass spectrometry (LC/MS/MS) for confirmation. This method offers excellent sensitivity and specificity and is the method of choice for the confirmation of the immunoassay positive screens.

# Designer Stimulants

## Drug information

### CLASSIFICATION

Recreational drugs produced in the laboratory have been around since at least the middle of the 20th century, when LSD was first studied. But over the past few years, a new wave of synthesized chemicals, so-called “designer drugs” and “designer stimulants” have had a significant impact on the drug culture.

The term “designer stimulants” is used for chemicals that produce similar subjective effects to illegal recreational drugs. Development of synthesized drugs may involve altering the molecular structure of existing drugs, or identifying different chemical structures that generate the same effects that illegal drugs produce.

A group of synthetic compounds consisting of  $\beta$ -keto- and methylenedioxy- derivatives of amphetamines and derivatives of piperazine have been recently developed as recreational (“party”) drugs with psychoactive properties. They gained popularity as legal alternative to amphetamines and cocaine and have been abused worldwide, prompting investigation into their safety. These drugs were proven to possess central stimulation effects similar to those of other illicit drugs.

Due to their high potential for abuse and addiction, most designer stimulants have been recently banned in many European countries, Australia and New Zealand. A federal ban enacted in July 2012 targets MDPV and Mephedrone, two designer drug compounds found in so-called bath salts. This important measure will prove critical in deterring abuse from these dangerous designer drugs. Nevertheless, they are still readily available via the Internet and in many “headshops” around the country.

### METABOLISM

Designer stimulants are excreted in urine unchanged and as conjugated hydroxy-metabolites. Cathinone is known to metabolize extensively by reduction of  $\beta$ -keto group into free norephedrine and nor- $\psi$ -ephedrine. Similar metabolic path is expected for other synthetic stimulants possessing  $\beta$ -keto structure.

### ABUSE

Synthetic designer stimulants are produced in clandestine laboratories and are commonly sold as “bath salts” at smoke shops or available online. They are sold under a variety of names that include Ivory Wave, Cloud Nine, Bliss, Red Dove, Vanilla Sky and Hurricane Charlie.

These “bath salts” are in reality potent crystallized chemicals that may be snorted, swallowed or smoked. They contain powerful stimulants such as methylone, methylenedioxypyrovalerone (MDPV) and mephedrone, which mimic the stimulating effects of cocaine, methamphetamine or MDMA. Additionally, some forms of designer stimulants may be sold and veiled as MDMA (ecstasy) tablets.

Effects sought by users include feelings of physical and mental well-being, exhilaration, euphoria, increased alertness, elevated motor activity, and postponement of hunger or fatigue. Young adults in the United States and other countries have reportedly died from using these products. While synthetic stimulants appear to affect users in ways similar to amphetamines and cocaine, reports concerning aggression, tachycardia, paranoia and suicide suggest that they may be more acutely toxic. There are no known medical uses for synthetic stimulants, and long-term effects are unknown, although experts have stated that cardiovascular effects can last for days after ingestion.

Several agencies have issued alerts about synthetic stimulants, noting ease-of-access concerns and the number of nationwide emergency-room visits related to these drugs.

In 2011, poison centers nationwide responded to over 6,000 calls related to bath salts. In 2012, that number dropped to over 2,500 and in 2013 the number of calls was over 900 showing that the true extent of the public health threat is still prevalent.

### METHODS OF ANALYSIS

RTL's test utilizes gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS) for screening and confirmation of designer amphetamines, cathinones and designer piperazines. All presumptive positive specimens are confirmed using a second aliquot prior to reporting positive results. The analytical methods used by RTL are scientifically accepted.

Two test panel variations are available: an expanded designer stimulant panel covering 21 drugs or the limited panel covering MDPV, Methylone and Mephedrone.

# Diuretics

## Drug information

### CLASSIFICATION

Diuretics elevate the rate of bodily urine excretion (diuresis). All diuretics increase the excretion of water from the body, although each class of diuretics does so in a distinct way employing different mechanisms of action. In medicine, diuretics are used to treat heart failure, liver cirrhosis, hypertension and certain kidney diseases. Side effects include dehydration, hypotension, disturbed electrolyte balance, muscle cramps and weakness.

Diuretics are prescription drugs with relatively low potential for abuse among the general population. They are not classified as Controlled Substances in the United States. There are several categories of diuretics:

- High ceiling loop diuretics such as furosemide, bumethanide and ethacrynic acid may cause substantial diuresis. They inhibit the body's ability to reabsorb sodium in the kidney which leads to retention of water in the urine as water normally follows sodium back into the extracellular fluid.
- Thiazides such as hydrochlorothiazide, cause moderate diuresis. They act as carbonic anhydrase inhibitors with the major site of action in the renal distal tube. They enhance excretion of sodium, potassium, calcium and chlorine ions.
- Potassium sparing diuretics such as amiloride, triamterene and spironolactone do not promote the secretion of potassium into the urine; thus potassium is spared and not lost as much as in other diuretics.
- Osmotic diuretics like mannitol, glucose and other sugars are filtered in the kidneys, but cannot be reabsorbed leading to elevated water elimination with urine.
- Low ceiling diuretics—the term is used to indicate a pharmacological profile with rapidly flattening dose effect curve (in contrast to “high ceiling”, where the relationship is close to linear). The thiazides usually fall into this category.

### METABOLISM

Most diuretics are excreted in urine with minimal metabolites. A few exceptions include spironolactone metabolizing into canrenone and canrenoic acid; and triamterene, which in the body undergoes conversion to hydroxytriamterene sulfate.

### ABUSE

Diuretics are sometimes abused by people with eating disorders for weight loss. Use of diuretics in sports is prohibited. Increased urine flow would reduce concentrations of banned performance enhancing substances in urine such as anabolic steroids, thus complicating their detection in doping control (masking). In sports where weight categories are involved diuretics are abused as weight reducing agents. Diuretic abuse in sports is unethical and dangerous for athlete health (dehydration). Diuretic testing is a part of routine doping control in sports.

### METHODS OF ANALYSIS

RTL utilizes Methylation and gas chromatography/mass spectrometry (GC/MS), which has been traditionally used for diuretic screening and confirmation in athletic doping control.

# Fentanyl

## Drug information

### CLASSIFICATION

Fentanyl (Duragesic, Sublimaze, "China White") is an extremely fast-acting synthetic narcotic analgesic, of high potency (approximately 100 – 200 times that of morphine) and short duration of action. There are several analogues and derivatives of fentanyl which are also abused, and may have higher potencies. Pharmaceutical fentanyl has been available since 1963 as an anaesthetic supplement, and is available as a citrate salt for I.V or I.M injection. Transdermal patches are also available for management of chronic pain or for breakthrough cancer pain. Fentanyl abuse among healthcare workers has become popular due to the drugs euphoric effects and easy availability. Due to the lipophilicity of the drug, fentanyl rapidly crosses the blood-brain barrier, producing fast and pronounced CNS effect, such as a heightened euphoria and respiratory depression, and possible toxic effects which include muscle rigidity, seizures, coma, and hypotension. Fentanyl also has similar tolerance and physical dependence properties to those of morphine.

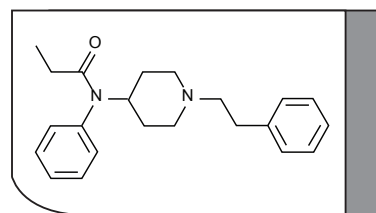
### METABOLISM

Fentanyl is rapidly metabolized by the liver to the inactive metabolites, norfentanyl, hydroxyfentanyl, and hydroxynorfentanyl. Approximately 85% of an intravenous dose is excreted in urine over a 3 – 4 day period, with 0.4 – 6% of the drug excreted unchanged, 26 – 55% excreted as norfentanyl, and unknown amounts of hydroxyfentanyl, and hydroxynorfentanyl excreted.

Fentanyl is administered I.V. or I.M. at single dosage levels of 25 – 100 µg as needed, transdermally at dosages of 25 – 100 µg/hr for 72 hours for chronic pain management, or by oral transmucosal dosages of 200 – 1600 µg for breakthrough cancer pain. Following a single 50 – 100 µg fentanyl dose, fentanyl was detected in the urine of 3 of 7 patients for 24 hours. Urine fentanyl concentrations ranged from 89 – 449 ng/mL in 4 adults who died following the excessive use of transdermal fentanyl. In another series of 7 adult deaths, fentanyl concentrations ranging from 5.0 – 93 ng/mL were found following self-administered intravenous injections.

### ABUSE

Illicit fentanyl which appears on the street in the U.S., is principally in the form of the transdermal patches, which can be cut up and eaten, or the gel can be extracted from the patches and smoked or injected by addicts. Illicitly synthesized fentanyl powder manufactured in Mexico has appeared in the U.S. recently, and may be abused by itself or mixed with heroin or cocaine, which have resulted in several deaths.



### METHOD OF ANALYSIS

Immunoassay screens are commercially available for detecting fentanyl in urine specimens. Confirmation of the presumptive positives is generally performed using a specific technique such as gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS). Redwood Toxicology Laboratory utilizes a direct method for the detection of fentanyl in urine using liquid-liquid extraction, deuterated internal standards, and GC/MS detection.

# Gamma-hydroxybutyric Acid (GHB)

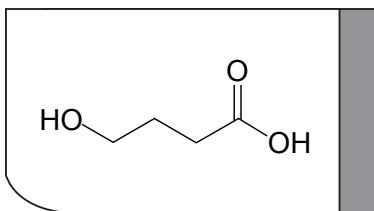
## Drug information

### CLASSIFICATION

GHB was first developed as an anesthetic, but was discontinued for this use due to its adverse and unpredictable effects. However, GHB is readily available and used in Europe as a sedative. The salt form of GHB has been marketed in gymnasiums and health food stores for the past few years as a steroid alternative for body-building and as a tryptophan replacement for sedation. There have also been increasing reports of GHB being used recreationally as a euphoriant at “rave” type parties. As typically follows, there have also been reports of GHB being associated with sexual assault or as a “date rape” drug due to its severe hypnotic and sedative effect at higher dosages.

### METABOLISM

GHB is thought to be extensively metabolized by alcohol dehydrogenase and/or succinic semialdehyde dehydrogenase. Metabolic precursors to GHB, gamma-butyrolactone (GBL) and 1,4 butanediol are also readily available as substances of abuse. Endogenous GHB is also a product of GABA metabolism, and concentrations of 0 – 6.6 mg/L have been reported. Oral doses of approximately 2.5 g (1 teaspoon of GHB powder) dissolved in water, produced urine GHB concentrations of 29 mg/L in a 100 kg man. Studies also indicate peak urine GHB concentrations of 100 mg/L following a 100 mg/kg oral dose, and no detectable drug in the urine by 12 hours. Less than 5% of an oral dose is eliminated unchanged in urine. To distinguish between endogenous and exogenous GHB, a reporting cutoff of 10 µg/mL is suggested.



### ABUSE

Typical illicit use of GHB involves dissolving 2 – 3 grams of powder in water or other beverages. Onset of effects occur within 10 – 30 minutes of ingestion and include euphoria, increased libido, drowsiness, reduced inhibitions, dizziness, nausea and may persist for 2 – 5 hours. Toxic effects include hypotension, respiratory depression, seizure, unconsciousness, and coma. Deaths have been reported when GHB is used alone or in conjunction with ethanol, heroin, or ketamine. The California Department of Health Services and the Food and Drug Administration (FDA) banned over-the-counter sales of GHB in 1990 and GHB is currently classified as Schedule I by the federal Controlled Substances Act.

### METHOD OF ANALYSIS

Determination of gamma-hydroxybutyric acid (GHB), also known as liquid Ecstasy, in human samples is challenging. Due to the small size of GHB, immunological testing is very difficult and limited immunoassays are available for screening. GHB detection in urine relies on specific chromatographic methods such as gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS). RTL's test utilizes GC/MS for the direct analysis of GHB from urine after liquid-liquid extraction and silyl-derivatization. Compared to existing methods, this method is superior because it is specific to GHB without conversion to gamma-butyrolactone (GBL).



# Marijuana (THC)

## Drug information

### CLASSIFICATION

Marijuana is a preparation derived from the leaves and flowering tops of cannabis plants (*Cannabis sativa*) that is capable of producing psychoactive effects when ingested. One of the primary classes of compounds found in marijuana is called cannabinoids. There are up to 60 cannabinoids in marijuana with delta-9-tetrahydrocannabinol (THC) being the primary psychoactive constituent.

### METABOLISM

When marijuana is smoked, THC is rapidly absorbed through the lungs and enters the bloodstream in minutes. Following oral ingestion, THC does not reach the bloodstream for approximately 1.5-3 hours. Once in the blood, THC is bound to blood proteins and carried throughout the body where it is either absorbed into body tissues (including the brain, heart, and fat) or transformed by the liver into the water soluble metabolites 11-hydroxy-THC and carboxy-THC. These water soluble metabolites, are readily excreted into the urine, with the inactive metabolite carboxy-THC being the predominant metabolite detected. Initially, THC is quickly absorbed into the body tissues and then is slowly released back into the blood stream where it is carried to the liver and metabolized. Because THC tends to be stored in fatty tissues, it accumulates faster than it can be eliminated in chronic repetitive smokers. This leads to extended retention of THC which is then eliminated from the body at a relatively constant rate with an average elimination half-life being estimated at 2-4 days. Urinary concentrations of THC are very difficult to interpret due to variables such as dosage of THC ingested, frequency of use, timing of urine collection relative to last exposure to marijuana, rate of release of stored cannabinoids in adipose tissue, and an individual's hydration state. Therefore, the detection of THC metabolites in the urine is only an indication of past marijuana use and is not related to the degree of intoxication or impairment.

### ABUSE

The psychological effects of THC include an increased sense of well being or euphoria, relaxation, slowed psycho-motor response, an altered sense of time, short term memory impairment and impairment of multi-tasking performance.

### THC Retention Time

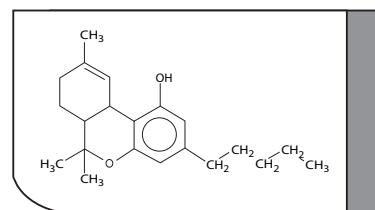
- Infrequent (less than twice/week) Smoking: When screening assays of 50 ng/mL or greater are used, urine samples will generally be positive for 1-3 days.
- Regular (several times per week) Smoking: May result in urine specimens testing positive for 7-21 days.

- Chronic (daily) Smoking: An individual who smokes marijuana daily for prolonged periods of time can test positive for 30 days or longer.
- Oral Ingestion: Metabolic profiles in urine samples cannot generally differentiate between marijuana ingested orally versus marijuana ingested by smoking. However, oral ingestion requires approximately three times more THC than smoking to produce similar effects or "highs"; therefore, visual detection of the marijuana in the ingested item would seem reasonable, thus ruling out unknown consumption. Retention time of orally ingested marijuana ranges from 1-5 days.
- Passive Inhalation: In general, routine passive exposure to marijuana smoke will not result in a positive result for cannabinoids in excess of a 50 ng/mL screening cutoff.

### METHODS OF ANALYSIS

The most common screening methods used to detect cannabinoids in urine include enzyme immunoassay (EIA). Urine cannabinoid immunoassays are usually optimized for the detection of carboxy-THC, but also react with other cannabinoids present in the urine. Because of this cross-reactivity, immunoassay results are expressed in terms of "total cannabinoids" and not specifically in terms of carboxy-THC concentration as is detected by specific confirmation methods such as gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS). Therefore, when interpreting THC concentrations, it is important to realize that GC/MS or LC/MS/MS, which measures only carboxy-THC, generally yields quantitative results which may represent only 10-50% of the "total cannabinoid" value as detected by immunoassays. While immunoassay cross-reactivity to non-cannabinoid compounds is extremely rare, most immunoassay manufacturers recommend that positive

results be confirmed by alternate specific analytical methods. The chromatographic methods; GC/MS and LC/MS/MS meet this requirement while providing most reliable test results.





# Methadone

## Drug information

### CLASSIFICATION

Methadone is a narcotic analgesic which is approximately equipotent to that of morphine. Methadone has been utilized to treat opioid dependency and prescribed as a heroin substitute in methadone maintenance programs since the 1960's. Typically, daily oral dosing with doses up to 180 mg/day, is prescribed with efficacy measured by the absence of withdrawal symptoms. Dosing is then gradually decreased until opiate dependency is eliminated.

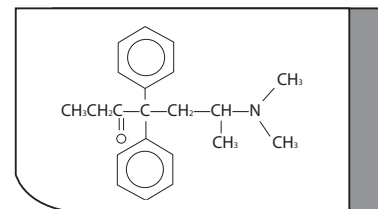
### METHODS OF ANALYSIS

Immunoassays, such as enzyme immunoassay (EIA) are common methods for detecting methadone and methadone metabolite (EDDP) in urine. Independent EIA methods are used to specifically detect methadone or methadone metabolite. Confirmation of presumptive positive urines should be performed by specific methods such as gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS).

### METABOLISM

Methadone is metabolized primarily to two pharmacologically inactive metabolites, EDDP and EMDP. Monitoring

for the presence of EDDP (methadone metabolite) is a means to determine compliance to methadone treatment. The elimination half-life of methadone is approximately 15-55 hours with about 5-50% of a dose eliminated as methadone and 3-25% as EDDP. Large individual variations in elimination do occur due to urine pH, urine volume, dose, rate of metabolism, drug interaction, etc.



# Opiates

## Drug information

### CLASSIFICATION

The term "opioid" refers to all drugs, natural or synthetic, with morphine-like properties. Both morphine and codeine are naturally occurring alkaloids derived from the seed pod of the opium poppy. Semi-synthetic opiates include heroin, a diacetyl derivative of morphine; hydromorphone, hydrocodone, and oxycodone derived by a simple modification of the morphine molecule. Synthetic opiates such as methadone and meperidine, mimic opiate effects but are not prepared from the poppy. The drugs may be administered by snorting, subcutaneous or intravenous injection, or smoking. Opioid compounds have analgesic and antitussive properties.

### METABOLISM

Morphine is rapidly absorbed. Plasma peak levels following an oral dose occur after 15-60 minutes, and following IV injection occur after 15 minutes. Extensively metabolized by the liver, only 2-12% is excreted as unchanged drug, while 60-80% is excreted as morphine-3-glucuronide. The half-life of morphine is 1.7-4.5 hours. Heroin is rapidly metabolized (plasma half-life is 3 minutes), first to 6-monoacetylmorphine (6-MAM) and further to morphine. The urinary excretion profile is similar to morphine, in that 7% is excreted as unchanged morphine and 50-60% as glucuronides. Trace amounts of 6-MAM, a specific metabolite of heroin, are also excreted for approximately 6-8 hours following heroin use. Following an oral dose, codeine is also rapidly absorbed and metabolized, principally to codeine-6-glucuronide, with 10-15% metabolized to morphine and norcodeine. Opiates may be detected in urine for 2-4 days following ingestion.

The interpretation of results for urines positive for opiates merit special consideration. Since codeine is metabolized to morphine, both substances may appear in the urine following codeine ingestion. However, the codeine concentration is generally greater than that of morphine. Street heroin also contains acetylcodeine, which metabolizes to codeine, therefore, both codeine and morphine may be present in the urine of some heroin users, although morphine generally predominates. In cases of low morphine and codeine concentrations in urine, it is not possible to determine whether codeine, morphine, or heroin were ingested. The presence of morphine alone would generally indicate either clinical morphine use or illicit morphine or heroin use. A specific metabolite of heroin, 6-monoacetylmorphine,

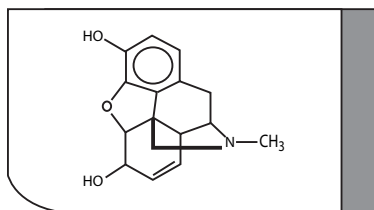
is also at times detected and would definitely confirm illicit drug (heroin) use. Poppy seeds, which have not been effectively washed, contain trace amounts of codeine and morphine. When consumed in sufficient amounts, poppy seeds may produce urines which test positive for opiates.

### ABUSE

Opioid compounds have effects on the CNS and usually on the bowel. They produce analgesia, respiratory depression, euphoria, mood changes, confusion, and constipation. Tolerance and dependence develop with repeated use, with overdose being characterized by coma, respiratory depression, and pinpoint pupils. Discontinuing the drug in a dependent individual will precipitate a withdrawal syndrome. Heroin and morphine are the most commonly abused opioid compounds; however codeine, propoxyphene, oxycodone, hydrocodone, etc. are also extensively abused, as they are more readily available. Most heroin and morphine abusers inject or "mainline" the drugs intravenously, as this produces the most immediate and intense effects. The heroin or morphine "rush" is the most desired sensation which is characterized by an intense orgasmic sensation centered in the abdomen.

### METHODS OF ANALYSIS

The immunoassay methods such as enzyme immunoassay (EIA) detect codeine and morphine in free and conjugated forms at cutoff levels of approximately 300/2000ng/mL or less. Other opioids detected by immunoassay at higher cutoff levels are hydrocodone, hydromorphone, while the routine detection of oxycodone requires a more sensitive and specific immunoassay screen. Since the immunoassays do not distinguish between the various narcotics, a confirmation method is required that can specifically identify these compounds. Methods commonly used include gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS). These methods determine the total morphine and codeine content in the urine specimens. Since 90% of these compounds are conjugated in the urine, acid or enzyme hydrolysis is required to convert the conjugated form into the free form.



# Oxycodone

## Drug information

### CLASSIFICATION

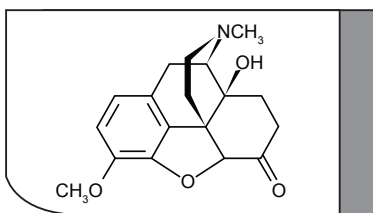
Oxycontin® is the trade name of one of numerous Schedule II prescription drugs that contain the opioid oxycodone as the active ingredient. Opioids refer to a class of drugs, natural and synthetic, with morphine-like actions. Oxycodone is reported to have equivalent potency to that of morphine. Other prescription drugs that contain oxycodone include Percodan® and Percocet®. Schedule II drugs are those which are approved for medical use and have a high potential for abuse and may lead to severe physical and psychological dependence. Oxycontin® was first introduced by Purdue Pharma in 1996 as a controlled sustained release formulation for pain relief. It was estimated that almost 6 million prescriptions for Oxycontin® were filled in the year 2000 and sales reached 1 billion dollars. It is legitimately prescribed for moderate to severe chronic or long-lasting pain. Oxycontin® is available in tablet forms containing 10, 20, 40, and 80 mg. A 160 mg oxycodone tablet was available which was discontinued in May 2001. By comparison, Percocet® typically contains 5 mg of oxycodone. Thus, one 160 mg tablet of Oxycontin® contained the equivalent amount of oxycodone as 32 Percocet® (5 mg) tablets.

One of the primary benefits of Oxycontin® is that because it is controlled release, it only needs to be taken orally every 12 hours. In contrast, short acting oxycodone tablets like Percocet® require the dosage be taken every 4-6 hours to maintain pain relief. Thus, the controlled release formulation allows for continuous pain relief for a substantial period of time when compared to traditional Percodan® or Percocet® tablets.

### METABOLISM

A large portion of oxycodone is N-dealkylated to noroxycodone during first-pass metabolism. Oxymorphone, is formed by the O-demethylation of oxycodone. The metabolism of oxycodone to oxymorphone is catalyzed by CYP2D6. Free and conjugated noroxycodone, free and conjugated oxycodone, and oxymorphone are excreted in human urine following a single oral dose of oxycodone.

Approximately 8% to 14% of the dose is excreted as free oxycodone over 24 hours after administration. Following a single, oral dose of oxycodone, the mean  $\pm$  SD elimination half-life is  $3.51 \pm 1.43$  hours.



### ABUSE

The attraction of Oxycontin® as a preferred drug of abuse over other oxycodone containing products has several reasons. The large amounts of oxycodone per tablet versus Percodan® or Percocet® are one of the primary reasons, while a second factor is that Percodan® and Percocet® additionally contain 325 mg of aspirin or up to 650 mg of acetaminophen, respectively while Oxycontin® has neither. Thus, the oxycodone high will not be associated with any toxic side effects that may result from either excessive aspirin or acetaminophen. Oxycontin® tablets are to be taken whole to allow for the controlled release of oxycodone. Abusers will destroy the controlled release capabilities of Oxycontin® by either chewing the tablets prior to swallowing, crushing the tablets and snorting the powder or they may be crushed, dissolved in water and injected. This allows for a rapid and large absorption of oxycodone into the blood stream producing a powerful euphoric high. This rapid, bolus absorption is also thought to be responsible for an apparent increase in oxycodone related overdoses in the east. Several Oxycontin® street slang's include "OC", "OXY", "Oxy-Coffins", Hillbilly Heroin, Poor-Mans Heroin and Killers. Diversion of the prescription has also been a problem associated with Oxycontin®. It has been reported that while a single 160 mg tablet may retail for up to \$14, it can fetch up to \$1 per mg on the street. Thus, a 160 mg tablet, known as a "blue bomber", may sell for up to \$160 with its illicit sale. Interestingly, Oxycontin® is sometimes referred to as poorman's heroin. We recently encountered a case in California in which a parolee who was being prescribed Oxycontin® was suspected of diverting his prescription to purchase heroin. Specific analysis of his urine determined no detectable level of oxycodone but the primary heroin metabolite, morphine, was present in his urine in excess of 2,000 ng/mL, thus offering scientific support to the diversion suspicion.

### METHODS OF ANALYSIS

Typically oxycodone does not produce a positive response to routine immunoassay screens for opiates, which generally target morphine and/or codeine; therefore, Redwood Toxicology Laboratory utilizes an enzyme immunoassay (EIA) screening method which specifically targets oxycodone at a cutoff of 300 ng/mL. Confirmation of presumptive positive urines should be performed by specific methods such as gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS).

# Phencyclidine (PCP)

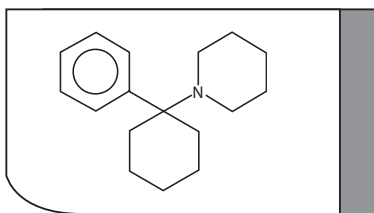
## Drug information

### CLASSIFICATION

Phencyclidine (1-phenyclohexylpiperidine, PCP) is prepared from 1-piperidinocyclohexane-carbonitrile in a Grignard reaction, as first performed in 1956 for use as an intravenous anesthetic. Pharmacologically PCP is classified as a dissociative anesthetic. PCP is currently a popular drug of abuse and was once used as a veterinary tranquilizer. A structural analog, ketamine, is currently used as a veterinary tranquilizer. PCP is self-administered either by smoking (drug-laced tobacco, marijuana, or parsley), by nasal insufflation and intravenous injection, or by oral ingestion.

### METABOLISM

PCP is a lipophilic drug with a large volume of distribution. It undergoes extensive hepatic oxidative metabolism with about 10-15% of a dose excreted unchanged in urine, and about 65% excreted as hydroxylated metabolites and other polar metabolites. Renal excretion of PCP (pKa 8.5) is enhanced when urine is acidic, and it is reduced when urine is alkaline. Frequent or chronic PCP users may excrete PCP for 2-10+ days following last use. Urine concentrations may range from <0.1 mcg/mL to 340 mcg/mL.



### ABUSE

Phencyclidine's pharmacological actions are complex, since it interacts with several neurotransmitter systems (i.e., GABAergic, dopaminergic, cholinergic, and adrenergic). As a result, PCP has stimulant, depressant, hallucinogenic, and analgesic properties. Adverse effects are unpredictable and include agitation, delusions of grandeur, anxiety, hostility, stupor, paranoia, and coma. Death has been known to result following the ingestion of 120 mg of PCP (toxic dose 10-20 mg).

### METHODS OF ANALYSIS

The immunoassay methods (EIA) are widely used screening methods designed to specifically detect phencyclidine and its inactive metabolites. Commonly used confirmation methods include gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/tandem mass spectrometry (LC/MS/MS). These methods offer excellent sensitivity and specificity and are the methods of choice for most forensic applications. False positive immunoassays have been reported following the use of thioridazine (Mellaril), chlorpromazine (Thorazine), dextromethorphan, or diphenhydramine (Benadryl), therefore indicating the necessity for specific secondary confirmation testing.

# Steroids

## Drug information

### CLASSIFICATION

A steroid is a terpenoid lipid characterized by a carbon skeleton with four fused rings, generally arranged in a 6-6-6-5 fashion.

Steroids vary by the functional groups attached to these rings and the oxidation state of the rings. Hundreds of distinct steroids are found in plants, animals, and fungi. Many more have been produced as synthetic drugs.

Three steroid classes found in human body belong to a subset of the sex hormones that produce sex differences and control reproduction. They include androgens, estrogens, and progestagens.

- Androgens (androgenic-anabolic steroids) are a class of steroids responsible for the development and maintenance of male sexual characteristics. Androgens interact with androgen receptors to increase muscle and bone synthesis exhibiting their anabolic performance enhancing effect. There are natural and synthetic anabolic steroids available. Testosterone is a principal androgenic-anabolic steroid in the body. In popular language the word “steroids” usually refers to anabolic steroids.
- Estrogens are involved in female reproductive function.
- Progestagens serve as protectors of pregnancy.
- Corticosteroids include glucocorticoids and mineralocorticoids. Glucocorticoids regulate many aspects of metabolism and immune function, whereas mineralocorticoids help maintain blood volume and control renal excretion of electrolytes.
- Cholesterol is a major source for the synthesis all other steroid hormones in the body.

### METABOLISM

In the body testosterone and its synthetic analogs are bio-transformed into more polar compounds, metabolites. Enzymatically catalyzed reduction, oxidation, hydroxylation and isomerization are the major metabolic reactions. Consequent conjugation with glucuronic acid or sulfate facilitates ultimate elimination of steroid metabolites from the body with urine.

### ABUSE

Androgenic-anabolic steroids (AAS) have limited medical use, but are abused as performance enhancing drugs in sports and more recently in some professional areas, where strong muscular appearance is important. In the general population, especially among adolescents and young adults, AAS are abused as a cosmetic tool helping to improve physique.

AAS have been classified as Schedule III Controlled Substances in the United States since 1991. Side effects include suppression of endogenous hormone production, gynecomastia (female type breast growth in males), acne, liver toxicity, mood swings, aggression, infertility and masculinization in females: deepening of the voice and male type hair growth.

### T/E RATIO

Testosterone and its precursors may be endogenous (produced in the body naturally) or exogenous (ingested as drugs or supplements). The T/E ratio is used to distinguish between the two. This ratio is a urine concentration ratio of two steroids, testosterone (T) and its natural isomer, epitestosterone (E). The normal average ratio is approximately 1, with individual variation on both sides, either higher or lower.

Ingestion of exogenous testosterone or its precursors suppresses internal steroid production in the body. Both endogenous T and E would be suppressed. However, total testosterone concentration in urine will rise above normal due to ingested drug. Low E and high T cause the T/E ratio to rise above 6 (cutoff), indicating testosterone abuse.

### METHODS OF ANALYSIS

RTL utilizes the most sophisticated, sensitive, and specific equipment and technology available. RTL performs a fast, efficient and sensitive GC/MS steroid screen, capable of detecting 85 endogenous and exogenous compounds providing information about naturally occurring and synthetic steroids and metabolites. The RTL Steroid Test includes specific GC/MS confirmation methods for each individual drug.

Accurate quantification is performed for nandrolone and testosterone with cut-off levels of 2 ng/mL (nandrolone metabolite) and testosterone to epitestosterone ratio above 6 (T/E > 6).

# Stimulants

## Drug information

### CLASSIFICATION

Stimulants are psychoactive drugs that induce temporary improvements in mental and/or physical function. The effects of stimulants include enhanced alertness, wakefulness, endurance, productivity and motivation; increased arousal, locomotion, heart rate/blood pressure; and a perception of a diminished requirement for sleep. Symptoms of excessive stimulation of the central nervous system (CNS) include restlessness, difficulty sleeping, tremor, headaches and even psychotic episodes. Loss of appetite (anorexia) and weight loss also occur with CNS.

Most stimulants are classified as Controlled Substances (CS) in the United States. Designer drugs like MDMA (ecstasy), which have no medical use, are classified as Schedule I CS; the others belong to Schedule II – IV substances. There are several categories of stimulants possessing different chemical structures and employing different pharmacological mechanisms:

- Amphetamine, Methamphetamine, their precursors and structurally related designer drugs represent a broad range of classic stimulant agents.
- Cocaine is the most potent of naturally-occurring stimulants. It is commonly abused and a highly addictive drug.
- Piperazines, such as benzylpiperazine and trifluoromethylpiperazine, possess stimulant and hallucinogenic activity. They became especially popular worldwide as party drugs in the recent years.
- Eugeroids, like adrafinil and modafinil, are prescribed for the treatment of narcolepsy (excessive daytime sleepiness). They were abused as “wakefulness promoting agents” and as CNS stimulants in sports.
- Methylxanthines, such as caffeine, are found in tea, coffee and “energy” drinks. They are also potent stimulants. However, their use is widely accepted in the society.
- Nicotine in tobacco products is also a stimulant, which is not currently banned.
- Other Stimulants—this is a broad group of Controlled Substances with different chemical structures and common CNS pharmacological effects. Many of them, like fenfluramine and phentermine, were originally designed as weight loss drugs. They are no longer used due to severe side effects.

### METABOLISM

Most stimulants are excreted in urine unchanged with only minor metabolites. Numerous precursor drugs metabolize extensively into active amphetamine and methamphetamine. Cocaine is rapidly inactivated in the body and excreted with urine fully metabolized.

### ABUSE

Stimulants may cause extreme psychological dependence. As drugs of abuse, stimulants are frequently taken to produce a sense of exhilaration, enhance self esteem, improve mental performance, increase activity, produce prolonged wakefulness, and to “get high”. Stimulants are also popular as appetite suppressants. Ability to improve short-term physical performance made stimulants one of the most abused drug classes in sports.

### METHODS OF ANALYSIS

Immunoassay screens with gas chromatography/mass spectrometry (GC/MS) or liquid chromatography/tandem mass spectrometry (LC/MS/MS) for confirmation is a classic approach for amphetamines and cocaine analysis in urine. RTL's comprehensive stimulant test for athletic doping control employs gas chromatography/mass spectrometry (GC/MS).



# Synthetic Cannabinoids

## Drug information

### CLASSIFICATION

Synthetic Cannabinoids are chemicals that act as cannabinoid receptor agonists. Chemically they are not similar to cannabinoids but the term “Synthetic Cannabinoids” or “Cannabinomimetics” is widely used to refer to them as they’re cannabinoid-like in their activity.

The synthetic cannabinoid receptor agonists fall into seven major structural groups:

- Naphthoylindoles (e.g. JWH-018, JWH-073)
- Naphthylmethylindoles\* (JWH-185, JWH-199)
- Naphthoylpyrroles\* (JWH-369, JWH-370)
- Naphthylmethylindenes\* (JWH-176)
- Phenylacetylindoles (JWH-250)
- Cyclohexylphenols (e.g. CP 47,497 and homologues of CP 47,497)
- Classical cannabinoids (e.g. HU-210)

*\*Compounds in these groups have not been detected in herbal blends so far.*

### METABOLISM

Little is known about the detailed pharmacology and toxicology of the synthetic cannabinoids and few formal human studies have been published.

Synthetic Cannabinoids metabolize extensively in humans via oxidation and glucuronide conjugation. Following a single low dose, the hydroxylated synthetic cannabinoids and the carboxylated synthetic cannabinoids metabolites can be detected up to 72 hours in urine. Very little parent drug excreted in human urine has been reported. In case of chronic use the detection window could be longer.

Presence of parent drug in saliva confirms ingestion; average detection window up to 24-48 hours.

It is possible that, apart from high potency, some other synthetic cannabinoids could have particularly long half-lives, potentially leading to a prolonged psychoactive effect. In addition, there is considerable inter- and intra-batch variability in smoking mixtures, both in terms of substances present and their quantity. Thus, there is a higher potential for overdose than with cannabis.

### ABUSE

Initially, JWH-018 and JWH-073 were the two most common synthetic cannabinoid chemicals found in a variety of herbal smoking blends. Others like AM-1248, AKB-48, UR-144, and XLR-11 have started appearing in newer synthetic cannabinoid products

and preparations. Reportedly offering a high 4 times stronger than marijuana, these compounds are commonly associated with herbal smoke and incense products sold under names such as K2, K3 Legal, Spice, Syn, Haze, Cloud Nine, Serenity and many others.

Synthetic cannabinoid chemicals are often laced in the herbal smoking products that are readily available via the Internet and in many “head-shops” around the country.

Users looking for a “high” often turn to these herbal smoking or incense products because they do not show up on a standard urine drug test. Users smoke the product by wrapping joints, smoking it in pipes, or inhaling fumes via vaporizers. Users also report that herbal blends or pure chemical concoctions can be ingested with an infusion or solvent process; purportedly allowing them to manage the potency and dose of the active ingredient(s).

Users indicate the high comes on slow at first, then with surprising potency. There have been many reports about the adverse effects including agitation, rapid heart rate, confusion, dizziness and nausea.

According to the American Association of Poison Control Centers, the number of human exposure calls relating to synthetic cannabinoids was 6,968 and decreased over the following years. As of August 2014, the total volume of calls regarding synthetic cannabinoid exposures is still over 2,000 showing that the true extent of the public health threat is still prevalent.

Long-term effects from these research chemicals are unknown.

In July 2012, the DEA banned synthetic cannabinoids based on their structural classification, explicitly naming 15 chemicals, citing numerous calls to poison control centers around the nation. In May 2013, the DEA placed a temporary ban on three additional synthetic cannabinoid substances. However, newer generation compounds continually emerge—making it more vital than ever to target synthetic marijuana.

### METHODS OF ANALYSIS

Immunoassay screens are now available for synthetic cannabinoid testing. RTL’s test utilizes the most sophisticated, sensitive and specific equipment and technology available, liquid chromatography/tandem mass spectrometry (LC/MS/MS) to confirm presumptive positive specimens for synthetic cannabinoid metabolites in urine. The method relies on monitoring multiple metabolites for each drug. RTL’s test methodology provides the most definitive synthetic cannabinoid biomarker test results.

For oral fluid testing, LC/MS/MS is utilized to confirm parent synthetic cannabinoid drugs.

# Urine Creatinine

## Drug information

### CLASSIFICATION

Creatinine is a metabolic by-product of muscle metabolism, and normally appears in urine in relatively constant quantities over a 24 hour period with “normal” liquid intake. Therefore, urine creatinine can be used as an indicator of urine water content (dilution) or as a marker identifying a specimen as urine. Greater than normal intake of water will increase the urine water content (lowering the creatinine level) consequently diluting any drug which may be present in urine. Conversely, a limited intake of water can lead to an abnormally concentrated urine specimen (as occurs with dehydration) resulting in elevated creatinine levels.

### INTERPRETATION OF RESULTS

Creatinine Conc.: Interpretation:

<20 mg/dL	Dilute urine specimen: Most likely due to increased water or liquid intake. Can be a result of short-term water loading (flushing) in an attempt to dilute any drug below testing cutoff concentrations.
<2.0 mg/dL	Abnormally dilute: Specimen showing an excessively low creatinine value. May be an indication that the specimen is not consistent with normal human urine.

**NOTE:** The above values are based on the critical points that the Federal Department of Health and Human Services, Substance Abuse Mental Health Services Administration (SAMHSA) has set as decision points for interpreting dilute or substituted urine specimens.

The above interpretations are general guidelines only. Redwood Toxicology Laboratory recommends consulting with a certified toxicologist regarding proper interpretation prior to taking administrative action based solely on the creatinine concentrations. Other physiological conditions may account for low creatinine concentrations such as diabetes or use of prescription diuretics.





# Get in touch with us.

To contact Redwood Toxicology Laboratory (RTL), please select from the departments listed below. All requests made during non-business hours will be responded to as early as possible the next business day.

---

## SALES AND GENERAL INQUIRIES

RTL offers toll-free sales and customer support services during regular business hours. RTL hours are 7:30 AM to 4:00 PM PST.

**Phone:** Laboratory Services – 800.255.2159, press option 1 or 707.577.7959  
Screening Devices – 877.444.0049 or 707.571.1157

**Fax:** 707-577-8102

**E-mail:** sales@redwoodtoxicology.com

**Address:** P.O. Box 5680, Santa Rosa, CA 95402 or  
3650 Westwind Blvd., Santa Rosa, CA 95403

---

## TOXICOLOGY SUPPORT SERVICES

Trained customer support representatives are available to assist you in a prompt and courteous manner. We'll get you up and running on specimen collection, results interpretation and technical inquiries.

**Phone:** 800.255.2159, press option 5 or 707.577.7959

**Fax:** 707.577.0365

**E-mail:** clientservices@redwoodtoxicology.com

---

## INFORMATION TECHNOLOGY

IT is available during regular business hours to answer client inquiries about internet ([www.RedwoodToxicology.com](http://www.RedwoodToxicology.com)) and statistical reporting. Contact IT to request your ToxAccess™ username and password for convenient results retrieval.

**Phone:** 800.255.2159, ext. 34311 or 707.577.7959

**Fax:** 707.577.0471

**E-mail:** helpdesk@redwoodtoxicology.com

---

## TESTING SUPPLIES

To request labels, bottles and shipping materials, contact our Supplies Department. Lab supply re-ordering is available to existing clients with an account number.

**Phone:** 800.255.2159, press option 4 or 707.577.7959

**E-mail:** supplies@redwoodtoxicology.com

**Web:** [https://www.redwoodtoxicology.com/resources/supply\\_form](https://www.redwoodtoxicology.com/resources/supply_form)

---

## SCHEDULING A SPECIMEN PICKUP

**MORE THAN 3 PICKUPS A WEEK**—RTL will arrange for daily FedEx pickups. A FedEx courier will stop at your location daily (M-F) and pick up your specimen boxes. Please do not arrange pickups directly as this may result in your agency being billed for these services.

**LESS THAN 3 PICKUPS A WEEK**—To schedule a pickup, change a previously scheduled pickup or cancel/suspend a pickup, please call FedEx directly at 1-800-GoFedEx (1-800-463-3339). For assistance finding a drop-off location visit [fedex.com](http://fedex.com).





## CONFIDENCE IN TESTING

Redwood Toxicology Laboratory, Inc. (RTL) is the preferred choice in drug testing providers. RTL provides accurate laboratory testing services for drugs of abuse in urine and oral fluid, synthetic cannabinoids, designer stimulants, EtG/EtS, steroids, GHB, fentanyl and more. We also sell instant, on-site drug and alcohol screening devices. Our reputation for experience, accuracy and excellence in customer service speaks for itself.

## CONTACT US TODAY!

Address: 3650 Westwind Blvd.,  
Santa Rosa, CA 95403

Laboratory Services: (800) 255-2159  
Screening Devices: (877) 444-0049  
Fax: (707) 577-0365  
Email: [sales@redwoodtoxicology.com](mailto:sales@redwoodtoxicology.com)  
Website: [www.redwoodtoxicology.com](http://www.redwoodtoxicology.com)

