

# ETG

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## OUTLINE

- BRIEF REVIEW OF ETHANOL TESTING
- BRIEF REVIEW OF ETG
- TESTING FOR ETG
- LITIGATION
- RESEARCH

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## Introduction



- Alcohol is the most frequently performed analysis in forensic labs, and the most commonly used lab result in court. Alcohol is the only drug for which states and the federal government have established levels of intoxication or under the influence. Alcohol can be detected in all body fluids and also in breath.

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### ALCOHOL SOCIALLY ACCEPTABLE DRUG ADDICTION



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### ALCOHOLISM VS ALCOHOL ABUSE

- Alcoholism is characterized by an addiction to alcohol that is out of the drinker's control. An alcoholic cannot stop using alcohol despite the severe physical, mental and emotional consequences. Alcoholism is a chronic, progressive disease that can be fatal if left untreated. Alcoholism can be treated but never cured.
- Alcohol abuse is a pattern of excessive drinking that results in adverse health and/or social consequences to the drinker and often his family and friends. Alcohol abuse can be treated and cured.

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### Why screen for alcohol?

- Cost the economy over 150 billion annually
- 80% of child abuse, domestic assaults and violent crimes are committed under the influence of alcohol
- > 1 million Americans have an alcohol addiction or abuse problem

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## How Much Can I drink

- Women – 1 drink per day
- Men – 2 drinks
- Pregnant women – None

A drink has been defined as follows:

12 oz beer – 4 - 4.5% alcohol

5 oz wine – 12 – 20% alcohol

1.25 oz 80 proof liquor – 30 - 50% alcohol



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## Cough Syrup

- Make sure the donor is not taking cough syrup that contains alcohol
- 5% -25% alcohol content
- Combined with the drugs included in the cough syrup the effects could look like alcohol intoxication.
- People have a tendency to drink from the bottle and not measure the suggested amount.



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## Cough Syrup - OTC

• <u>Product</u>	• <u>Alcohol</u> content
- Robitussin Liquid	- 0%
- Nyquil Nighttime	- 25% (30 mL 4/day)
- Dayquil Syrup	- 0%
- Vicks Formula 44	- 10%
- Triaminic DM	- 0%
- Dimetapp Elixir	- 0%
- Tylenol Nighttime Severe Cold	- 0%
- Chloraseptic Sore Throat Gargle	- 0%

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## WHAT MATRIX CAN BE TESTED?

- BREATH – PERFERED BY LAW INFORCEMENT
- BLOOD – ALTERNATE TO BREATH AND PERFERED IN POST MORTUM ANALYSIS
- URINE – NOT A GOOD CHOICE BUT USED OFTEN IN WORKPLACE AND CRIMINAL JUSTICE TESTING
- SALIVA – APPROVED BY DOT AND USED OFTEN IN WORKPLACE TESTING
- VITEROUS – DEFINITELY A CHOICE IN POST MORTUM ANALYSIS
- GASTRIC – A POST MORTUM OPTION

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## WHY IS URINE A POOR CHOICE

- Glucose + yeast = production of ethanol
- Loss of ethanol due to evaporation
- Short detection window – 8 – 12 hours
- Does not indicate impairment
- Negative does not indicate the donor did not use only that the use was not recent.

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## IS IT DIABETIS OR ALCOHOL INTOXICATION

	ALCOHOL	HYPOGLYCEMIA	KETOACIDOSIS
Dizziness	YES	YES	NO
Blurred vision	YES	YES	YES
Confusion	YES	YES	NO
Flushed face	YES	NO	YES
Combative	YES	YES	NO
Vomiting	YES	NO	YES
Pass Out/Coma	YES	YES	YES

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## WHAT IS THE ALTERNATIVE

# ETG

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## FORMATION

- ETG is broken down or metabolized nonoxidatively creating analytes that can be measured for a longer period

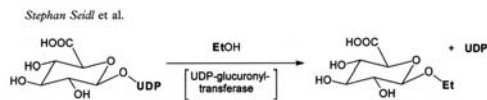


Figure 1. Formation of ethyl glucuronide (EtG) by conjugation of UDP-glucuronic acid and ethanol.

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## WHAT IS ETG?

- Ethyl glucuronide is a direct, non-volatile, water soluble, stable metabolite of ethanol.
- 1<sup>st</sup> isolated in humans in 1967
- Highly sensitive and specific biomarker
- Detection 4 -5 days
- <0.02% of ethanol is converted to ETG
- Can be detected in urine, plasma, hair and body tissue

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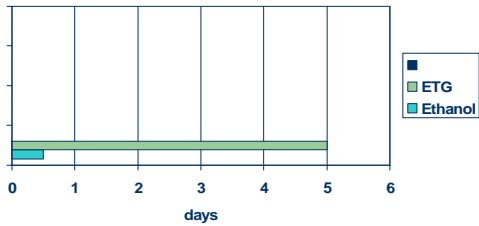
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## DETECTION WINDOW



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## HOW IS ETG TESTED

- Lab based screening
- On-site not available
- Confirmation by LC/MS/MS
- Can test with either GC/MS or LC/MS but the methods are not as sensitive

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## WHY IS ETG TESTING A GOOD CHOICE

- ETG is a scientifically accepted biomarker to show exposure to ethanol
- Non-volatile – it is stable in urine
- Much longer detection window
- No false positives due to fermentation
- It is not in the urine of donors not exposed to ethanol

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### DOES ETG TESTING HAVE ANY DISADVANTAGES?

- The number of labs testing ETG is small
- Can be costly for confirmation
- Incidental exposure is a concern
- False Negative/False Positive results due to bacterial contamination

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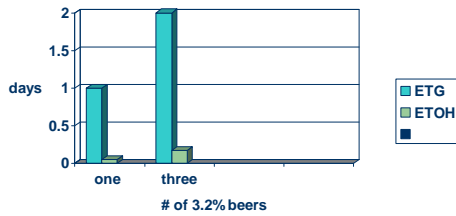
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### Detection of ETG after social drinking



Research presented by Dr. Carry 2006\*

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### What happens to the ETG after binge drinking

- Research has shown that after binge drinking the ETG levels in urine can reach levels in the range of 10,000 ng/ml – 100,000 ng/ml

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### THE BIG QUESTION

- Is the positive ETG due to a relapse or prohibited drinking?

OR

- Is the ETG due to incidental exposure

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### Common Sources of Alcohol

- Cough syrup – Nyquil and Vicks formula 44
- Insect repellents – Off, Skin-so-Soft
- Waterless hand soap – GermX and Purell
- Non-alcoholic beer – contains ethanol
- Lipton's canned/bottled tea with lemon
- Perfumes, cologne, and body sprays
- Food products – desserts and main courses

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### ALCOHOLIC BEVERAGES

- Non-alcoholic beer – Actually contains 0.3% ethanol
- Communion wine – 0.5 teaspoon resulted in an ETG of 75 ng/ml at 9 hours

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## ALCOHOL FROM FOOD

Preparation Method	% Alcohol Retained
Alcohol added to boiling liquid & removed from heat	85%
Alcohol flamed	75%
No Heat & stored overnight	70%
Baked 25 min/not stirred	45%
Baked/simmered & stirred	15 min=40% 2.5hrs = 5%

SOURCE USFDA

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## TRANSULATION

- Lasagna – made with 8 oz red wine in the sauce = 0.033oz alcohol per serving – like drinking less than an ounce of beer
- Bourbon ball – 4 oz bourbon to make 30 bourbon balls = 4 mls per serving – So if you ate 10 of my bourbon balls it would be an ounce of bourbon

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## ALCOHOL BASED HAND SANITIZERS

- Very popular
- Travel size
- Use at work and or home
- Many brands available
- Contain 60 – 85% alcohol
- Apply small amount to hands and rub together

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## STUDIES ON HAND SANITIZERS

GROUP	APPLICATION TIME	ETG DETECTED
ONE	EVERY 60 MIN FOR 8 HRS	NONE DETECTED
TWO	EVERY 30 MIN FOR 8 HRS	NONE DETECTED
THREE	EVERY 15 MIN FOR 8 HOURS	1 PERSON AT 62 NG/ML

JAT Nov/Dec 2006

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## UNPUBLISHED STUDY(Carey 2006)

- 24 college students applied hand sanitizer every 4 minutes for 1 hour. A total of 15 applications
- Group 1 – no application
- Group 2 – vented environment
- Group 3 – closed environment
- Group 4 – bystanders in the closed environment – no application

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## RESULTS

GROUP	RESULTS
GROUP 1	NEGATIVE FOR ETG
GROUP 2	NEGATIVE FOR ETG
GROUP 3	ALL >100 NG/ML
GROUP 4	ALL > 100 NG/ML

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## CONCLUSION

- The positive results for the bystanders in the closed environment is an indication that the alcohol was transmitted via inhalation as well as trans-dermal

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## MOUTHWASH STUDY # 1

- 9 test subjects
- 4oz of 12% alcohol mouthwash
- Gargle all 4 oz over 15 minutes
- 39 urine specimens collected
- All positive >50 ng/ml <500 ng/ml

JAT Nov/Dec 2006

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## MOUTHWASH STUDY # 2

- 11 test subjects
- 12% alcohol mouthwash
- Gargled 3 times daily for 5 days
- 55 urine specimens collected
- 16 positive > 50 ng/ml <150 ng/ml

JAT Nov/Dec 2006

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## BACTERIAL CONTAMINATION

- Helander – Reported a risk factor for false negative ETG results due to bacterial contamination. The bacteria did not destroy the ETS.
- Production of ETG in samples spiked with glucose and yeast to simulate the urine of a diabetic
- Production of ETG and ETS in samples spiked with E Coli and ethanol

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## THE BAD NEWS THE SAMHSA ADVISORY

- Should not be the sole source to determine drinking
- Legal or disciplinary action should not be based solely on the results of an ETG positive test result
- Advised caution on low levels due to incidental exposure

Sept 2006

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## THE GOOD NEWS - LEGAL

- Jan 2008
- Class action lawsuit filed in US District Court for the District of New Jersey against LabCorp was **dismissed**
- Charge was the plaintiffs did not consume alcoholic beverages

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## THE GOOD NEWS - SAMHSA

- EtG AND EtS WHEN USED TOGETHER SEEM TO OFFER GREATER SENSITIVITY TO ALCOHOL USE THAN EITHER BIOMARKER ALONE

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## INTERPERTATION OF TEST RESULTS

- WHAT SHOULD I CONSIDER?
  - CUT OFF LEVEL
  - NORMALIZATION
  - USE OF EtG and EtS confirmation results

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## HOW DO YOU INTERPERT THE RESULT OF AN ETG TEST

- A result of >500 ng/ml is consistent with recent ingestion of products containing alcohol
- Published and peer reviewed scientific research has shown the incidental exposure will result in concentrations <500 ng/ml

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## WHAT IS NORMALIZATION

- This is the consideration of how dilution or concentration of a urine specimen impacts the results of a drug screen test. Drugs are measured in ng/ml, the more dilute the urine the lower the drug concentration.
- The process of normalization is routinely used by the US Federal Courts to determine new or residual use.

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## WHY DOES DILUTION WORK?

- Normal urine production is 1 ml/min
- Drink 1 liter of water and the urine production goes to 7.5 – 8.5 ml/min from 30 – 150 min post consumption
- Drink 2 liters of water and urine production peaks at 1 hr at 16ml/min and stays as high as 6 ml/min for 4.5 hrs
- Creatinine range on a random void – 100 – 200mg/ml
- Specific Gravity is the weight or mass of a given volume of a substance compared to water.  
Normal range = 1.010 – 1.025

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## Calculation

$$\frac{\text{ng Drug}}{\text{mg Creatinine}} \times 100 = \text{ng Drug/mg}$$

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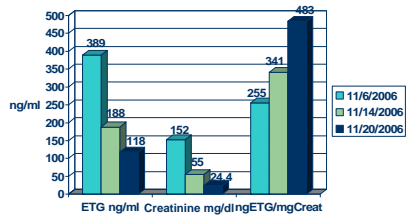
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## NEW OR RESIDUAL




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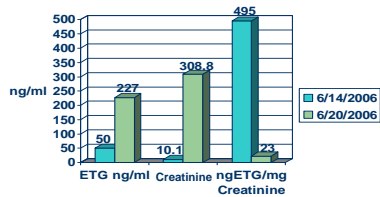
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## NEW OR RESIDUAL




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## HOW DO YOU INTERPERT THE RESULT OF AN ETG TEST

- A negative can have multiple implication
  - No exposure to products containing alcohol
  - Exposure beyond the detection window of the assay
  - Exposure resulting in levels below the detection limit of the assay

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### WHAT ARE YOUR OPTIONS IN A CRIMINAL JUSTICE SETTING

- Use the ETG positive in conjunction with another indicator

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### OTHER INDICATORS

- Admission of use
- Presence of EtG and EtS on confirmation test
- Alcohol related incident – DUI, observed signs of alcohol intoxication
- Report of client in bar or observed drinking
- Violation of a contract specifying possible sources of incidental alcohol exposure

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### WHY INCLUDE EtS

- EtS is a recognized biomarker for the ingestion of alcohol
- EtS is routinely detected in the confirmation techniques
- EtS is not produced when urine is spiked with glucose and yeast to simulate the urine of a diabetic

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### WHAT TO INCLUDE IN AN ETG CONTRACT

- Specifics on the requirements to meet your local compliance standards for drug court probation
- Education of the client on the possibility of incidental exposure
- List of products that contain alcohol (remember to notify the client this is a partial listing)

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### WHERE TO OBTAIN A LIST

- [www.householdproducts.nlm.nih.gov/cgi-bin/household/brands?tbl=chem&id=26](http://www.householdproducts.nlm.nih.gov/cgi-bin/household/brands?tbl=chem&id=26)
- [www.ethylglucronide.homestead.com](http://www.ethylglucronide.homestead.com)

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### Where to Get More Information

- **Web sites**
  - [www.rti.org/forensiced](http://www.rti.org/forensiced)
  - [www.erowid.org](http://www.erowid.org)
  - [www.dot.gov/ost/dapc](http://www.dot.gov/ost/dapc)
  - [www.drugfreeworkplace.gov](http://www.drugfreeworkplace.gov)
- **E-mail**
  - Pat Pizzo – [ppizzo@kroll.com](mailto:ppizzo@kroll.com)

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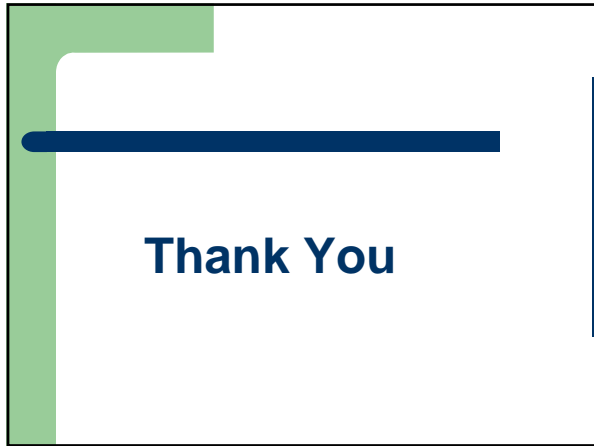
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