

# FUNDAMENTALS OF TRIAL ADVOCACY COURSE

April 3-7, 2017  
Phoenix, Arizona



## DUI BLOOD ANALYSIS ISSUES

Presented by:

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Distributed by:

ARIZONA PROSECUTING ATTORNEYS' ADVISORY COUNCIL  
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# DUI Blood Analysis

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 AZ 85034-1000

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 602.251.1251  
 eric@bpeaz.gov

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# Blood Alcohol Analysis

## General Alcohol

Absorption, Elimination, and Distribution  
 Impairment/Intoxication  
 Tolerance  
 Officer Tools - Driving Cues and SFSTs

## Blood Alcohol

Blood Draw  
 Property and Evidence  
 Notes  
 Analysis  
 Quality Assurance

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# Alcohol

Common Types

NAME	FORMULA	BOILING POINT	USES	TOXICITY AND METABOLITES
Methanol	CH <sub>3</sub> OH	64.7°C / 148.5°F	Denatured Solvent Fuel Reservoir Fuel	≈ 75ML Formic Acid
Ethanol	C <sub>2</sub> H <sub>5</sub> OH	78.1°C / 172.6°F	Beverage Solvent Medicinal Vehicle Fuel	≈ 400-1000ML Acetic Acid (Acetic Acid)
Isopropyl	C <sub>3</sub> H <sub>7</sub> OH	82.1°C / 180.0°F	Denatured Antiseptic	≈ 250ML Acetic Acid
Ethylene Glycol	C <sub>2</sub> H <sub>4</sub> (OH) <sub>2</sub>	198°C / 388.4°F	Coolant Solvent	≈ 100ML Oxalic Acid

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### Absorption

How does it enter the body?

Oral Consumption

Injection

Inhalation

Through the skin

Enema

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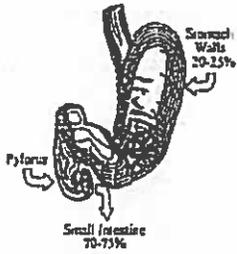
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### Absorption

How does ethanol enter the body?



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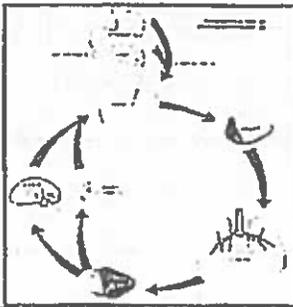
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### Distribution

How does ethanol move around in the body?



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### Distribution

Ethanol Concentration vs. Water Content

70% WATER      60% WATER  
 175 LBS      175 LBS

When ethanol gets spread out over a larger volume of water, the ethanol concentration is lower. When ethanol gets spread out over a smaller volume of water, the ethanol concentration is higher.

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### Distribution

Ethanol Concentration vs. Water Content

70% WATER      60% WATER  
 175 LBS      100 LBS

When ethanol gets spread out over a smaller volume of water, the ethanol concentration is higher. When ethanol gets spread out over a larger volume of water, the ethanol concentration is lower.

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### Per Drink Calculation

Widmark Formula

A = PRC

A = Alcohol (amount and concentration)  
 P = Weight  
 R = Widmark Number (water content)  
 C = BAC

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**Elimination**

How does ethanol leave the body?

Metabolism (liver)

Excretion (urine)

Evaporation (breath)

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**Elimination**

Metabolism

Rate at which ethanol is oxidized varies from one person to another

Elimination rates range from 0.010% to 0.030% per hour

Average rate of elimination is 0.018% per hour

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**Retrograde Calculation**

Used if chemical test is outside two hours from the time of driving

Argument does not apply to (A)(1) or (A)(3)

State may retrograde readings to any time within two hours of driving/APC for per se statutes

*O'Well v. Superior Court, (Konkel/Fitz, RP), 187 Ariz. 443 (App. 1996); State v. Claybrook, 193 Ariz. 588 (App. 1998).*

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### Retrograde Calculation

Practice pointer – be sure to disclose the forensic scientist you will call and his/her opinion re: retrograde.

*State v. Roque, 213 Ariz. 193 (2006).*

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### Retrograde Calculation

#### Information Needed

Drinking and eating history over past hour  
Time of test  
Test result  
Time of driving

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### Retrograde Calculation

How to Get Your Test Within Two Hours - Retrograde Extrapolation

Given certain information, can you calculate the alcohol concentration at a time earlier than the test? (Yes)

What information do you need?

Assuming \_\_\_\_\_ (fill in the facts from your case) would you please calculate the defendant's alcohol concentration at \_\_\_\_\_ (time of driving or a point within the 2 hr window)?

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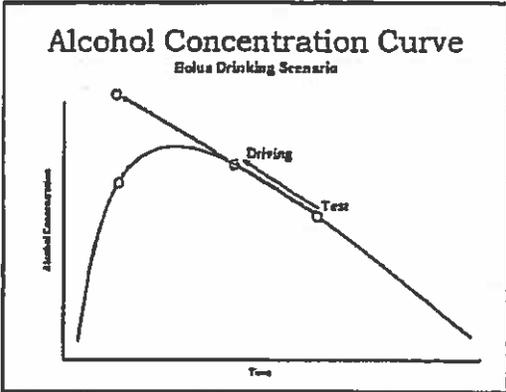
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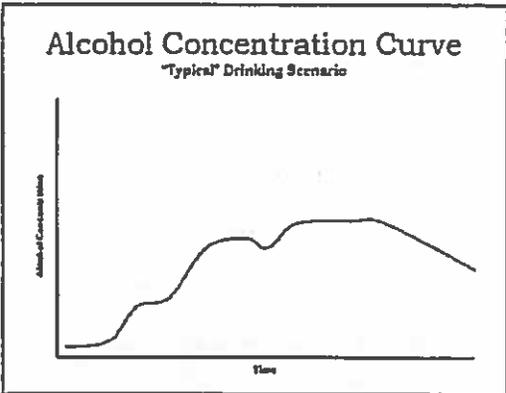
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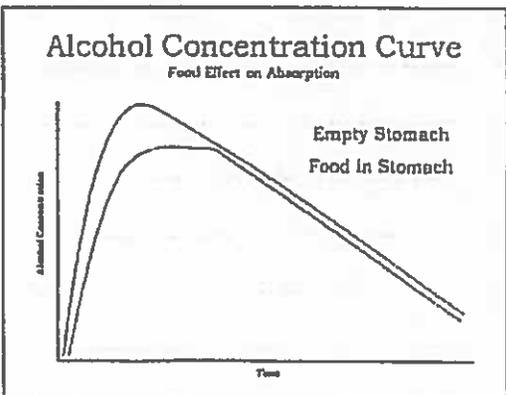
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## Impairment

vs. Intoxication

**Impairment** - based upon measurable changes in an individual's performance of a specific task, such as operating a motor vehicle

**Intoxication** - advanced state of impairment in which gross physical signs of the effects of alcohol are apparent

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## Impairment

COGNITIVE	SENSORY	MOTOR FUNCTION
Impaired judgment	Blurred or double vision	Loss of muscle control
Slowed or erratic driving	Visual acuity	Stagger
Driver's eyes become dry, red, and watery	Color blindness	Balance
Task performance	Slurred speech	Coordination
Ability to remember many details which they do not possess	Slowed vision	Walking
Driver's ability to respond to emergency situations impaired	Abnormal eye to optical and structural sound	Abnormal gait (ataxia) (ICV)
Flanker should	Flanker conditions tests	
Loss of fine point of attention, observation and concentration		
Loss of nerve and response		
Impairment of their own activity		

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## Tolerance

Two Types of Tolerance

Metabolic

Functional

Despite tolerance, all people are still impaired to operate a motor vehicle at 0.08 AC

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### Tolerance

Metabolic

Tolerance that results in a more rapid elimination of alcohol from the body

Innate – genetics and constitution

Exposure dependent – Microsomal Ethanol Oxidizing System (MEOS)

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### Tolerance

Functional

Tolerance that develops when brain functions adapt to compensate for the disruption in both behavior and bodily functions

Acute – impairment is greater when measured soon after alcohol is consumed than when measured later in the drinking session

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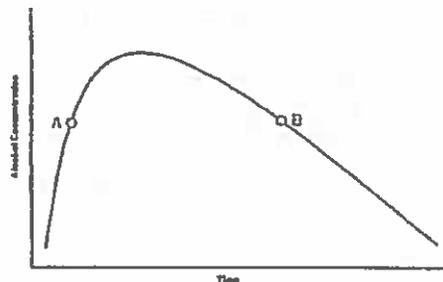
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### Tolerance

Acute



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## Tolerance

Functional

Chronic - some impairing factors of alcohol are lessened by the central nervous system's response to many drinking sessions

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## Officer Tools

Driving Cues

### Failure to maintain lane position

weaving, straddling lane line, turning to wide, drifting in lane

### Speed / Braking problems

stops short at intersection, not maintaining constant speed, driving ten or more miles below speed limit

### Vigilance

slow to respond to respond to traffic signal, driving without headlights on, wrong way on street, failure to signal

### Judgment

tailgating, unsafe lane change, jerky to fast turn, odd behavior in car

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## Officer Tools

Driving Cues

Validation - NHTSA performed three field studies that encompassed more than 12,000 stops

Any one cue = 35% likelihood over 0.08%  
Any two cues = 50% likelihood over 0.08%

Weaving = 65% likelihood over 0.08%  
Driving on wrong side of road =  
70% likelihood over 0.08%

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### Officer Tools

Standardized Field Sobriety Tests (SFSTs)

#### History

NHTSA sponsored three studies to arrive at the current battery of three SFSTs

Psychophysical Tests For DWI Arrest, California (1977)

Development and Field Test Of Psychophysical Tests For DWI Arrest, California (1981)

Field Evaluation Of A Behavioral Battery For DWI, Maryland, D.C., V.A. N.C. (1983)

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### Officer Tools

Standardized Field Sobriety Tests (SFSTs)

#### History

Three additional studies standardized the tests, finalized grading, and proved correlation to BAC

Colorado, 1995 (234 acceptable subjects) SCRI  
163 arrests out of 175 arrests were correct (93%)

Florida 1997 (256 acceptable Subjects) SCRI  
197 arrests out of 206 arrests were correct (95%)

San Diego, 1998 (234 acceptable subjects) Anacapa  
210 arrests out of 234 arrests were correct (90%)

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### Officer Tools

Standardized Field Sobriety Tests (SFSTs)

#### Horizontal Gaze Nystagmus (HGN)

Involuntary jerking of the eyes

4 of 6 clues = 88% total accuracy (average)  
(Your officer is likely better)

#### 6 Clues (3 in each eye)

Lack of smooth pursuit  
Nystagmus at maximum deviation  
Onset of nystagmus before 45 degrees

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### Officer Tools

Standardized Field Sobriety Tests (SFSTs)

#### Walk and Turn

2 of 8 clues = 79% total accuracy (average)

#### 8 Clues

- Loses balance during instructions
- Starts before the instructions are finished
- Stops while walking
- Does not touch heel to toe
- Steps out of line
- Uses arms to balance
- Improper turn
- Incorrect number of steps

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### Officer Tools

Standardized Field Sobriety Tests (SFSTs)

#### One Leg Stand

2 of 4 clues = 83% total accuracy (average)

#### 4 Clues

- The suspect sways while balancing
- Subject uses his arms to balance
- Subject hops while balancing
- Subject puts foot down

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### Blood Alcohol Analysis

Phlebotomy Blood Draw Kits

NIK, Lynn Peavey, and Tri-Tec

Outer box

Inner box

2 vacutainer tubes (grey top)

Preservative - sodium fluoride

Anticoagulant - potassium oxalate

Vacuum dated for freshness

1 non-alcoholic swab

Iodine

Benzalkonium chloride

Butterfly needle

Evidence seals

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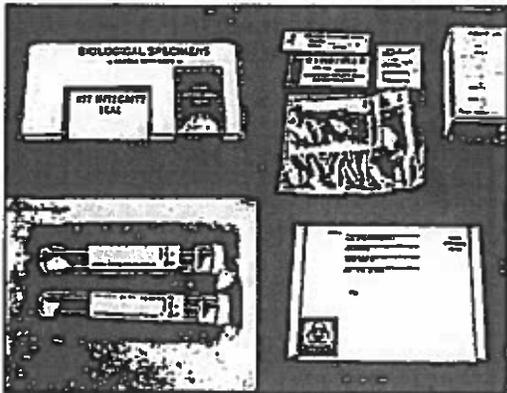
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**Blood Alcohol Analysis**  
Property and Evidence

**Agency Request For Scientific Examination**

**Chain of Custody**

**Requests disseminated to appropriate unit**

**Refrigerates blood in walk in cooler**

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**Blood Alcohol Analysis**  
Evidence Notes

Arizona Department of Public Safety  
Evidence Notes


 ADPS 201708070  
 4000 North Central Avenue, Suite 1000  
 Phoenix, Arizona 85018-1000  
 (602) 974-1000  
 www.azdps.gov

Case No.	
Officer No.	
Officer Name	
Agency	
Offense	
Location	
Date/Time	
Vehicle	
Driver	
Witness	
Notes	
Signature	
Date	

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**Blood Alcohol Analysis**

*Evidence Opening*

**Notes**

One sample open at a time  
Seals – evidence tape (not air tight)  
Number of tubes  
Name  
Anything else

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**Blood Alcohol Analysis**

*Evidence Opening*

Ensure homogeneity of sample  
Rock the blood baby  
Vortex  
Tissue Grinder  
Ensures homogeneity of sample

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**Blood Alcohol Analysis**

*Pipet Samples*

One open at a time  
Conical cup  
250 Microliters  
2 mls of internal standard  
Crimp

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**Blood Alcohol Analysis**  
Internal Standard Method

AP MP5 Crown Lab Alcohol Report				AL MP5 Lower Lab Alcohol Report			
Peak	Rt	Area	g/100 mL	Peak	Rt	Area	g/100 mL
Ethanol	1.318	266100	0.2101	Ethanol	1.311	257279	0.2118
n-Propanol	2.479	220407		n-Propanol	2.480	211521	

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**Blood Alcohol Analysis**  
Internal Standard Method

<u>Area Counts</u>	<u>Area Counts</u>
Ethanol - 266100	Ethanol - 257279
n-propanol - 220407	n-propanol - 211521
<u>Ratio</u>	<u>Ratio</u>
266100/220407 =	257279/211521 =
1.20	1.21

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**Blood Alcohol Analysis**  
Report

**MEMPHIS POLICE DEPARTMENT**  
LABORATORY

Case No. \_\_\_\_\_  
 Date \_\_\_\_\_  
 Officer \_\_\_\_\_  
 Station \_\_\_\_\_  
 Substation \_\_\_\_\_  
 Unit \_\_\_\_\_  
 Name \_\_\_\_\_  
 Sex \_\_\_\_\_  
 Race \_\_\_\_\_  
 Age \_\_\_\_\_  
 Height \_\_\_\_\_  
 Weight \_\_\_\_\_  
 Blood \_\_\_\_\_  
 Urine \_\_\_\_\_  
 Other \_\_\_\_\_

AP MP5 Crown Lab  
AL MP5 Lower Lab

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**Blood Alcohol Analysis**

Discovery

**"Standard Disclosure"**

Scientific Analysis Report

Analyst Notes

Chromatograms for subject's sample

Chain-of-custody

Run summary of Quality Assurance

**"Control Packet"**

Everything included in Standard Disclosure

Chromatograms for Quality Assurance

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**Blood Alcohol Analysis**

How to Admit Blood Alcohol Results

**Sample Collection**

Establish: when, where & by whom sample  
was collected

Defense may stipulate

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**Blood Alcohol Analysis**

How to Admit Blood Alcohol Results

**Chain of Custody**

Prove sample tested at the lab is the  
defendant's sample

What was sample collected in

How was it labeled

Protocols

Photo

Defense may stipulate to part or all of  
chain

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## Blood Alcohol Analysis

How to Admit Blood Alcohol Results

### Chain of Custody

Challenges to the chain of custody go to the weight, not the admissibility of evidence

The defendant must make some showing that the evidence has been tampered with

*State v. Morales*, 170 Ariz 360 (App 1991)

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## Rule 702

### 5 Portions of the Rule

- "A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:"

➤ #1 must qualify witness as an expert

➤ Thoroughly qualify your witness

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### 5 Portions of Rule 702 #2

- "a) The expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue"

- Blood testing embraces scientific, technical & other specialized knowledge

- So just relevance

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### 5 Portions of Rule 702 #3

- b) The testimony is based on sufficient facts or data
  - Factual basis for opinion
    - Have expert explain basis for opinion
  - Can the opinion, reasoning or method be properly applied to the facts in issue?
  - What did they do? How did they do it?

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### 5 Portions of Rule 702 #4

- c) The testimony is the product of reliable principles and methods
  - This is similar to *Frye* (accepted in relevant scientific community) – Lay the *Daubert* foundation +
  - Quality assurance
  - Method - Gas Chromatography is reliable & has been tested
    - Studies
    - By manufacturer
    - Lab validation

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### 5 Portions of Rule 702 #5

- d) the expert has reliably applied the principles and methods to the facts of the case.
  - Case specific
  - Did this witness do it correctly
    - Focus is on principles & methodology
  - The accepted technique was properly applied and the results accurately recorded

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## *Daubert !*

(Rule 702)

- Qualify witness as an expert
- Chain of custody (prove it was defendant's blood)
- What method was used
- Establish scientific reliability
- What did he/she do?
- Emphasize quality assurance/reliability

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## **Blood Alcohol Analysis**

How to Admit Blood Alcohol Results

### Daubert/Daubert

Establish general acceptance of underlying science (i.e. Infrared Spectrophotometry, Gas Chromatography or Mass Spectrometry).

Is the method used accepted in the relevant scientific community as a valid method for breath/blood/urine testing?

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## **Blood Alcohol Analysis**

How to Admit Blood Alcohol Results

### Daubert/Daubert

Based on a review of the procedure used in analyzing the sample, the test results, and records:

- The accepted technique was properly used
- The readings are an accurate measurement and recording of the defendant's alcohol concentration (or the presence of drugs)
- The test results would be accepted in the relevant scientific community as valid test results (legally not required but judge may)

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## Blood Alcohol Analysis

Headspace Gas Chromatography

Measures alcohol content in the  
air above the blood

Standard in the scientific  
community for blood alcohol  
analysis



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## Blood Alcohol Analysis

Henry's Law

In a closed system, the  
concentration of a volatile  
substance above a fluid is  
proportional to the concentration  
of that substance in the fluid at  
equilibrium



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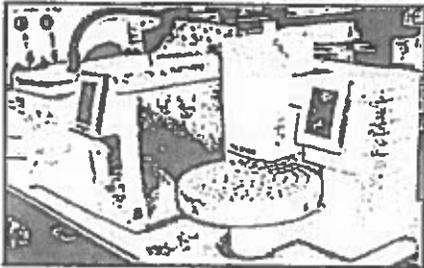
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## Blood Alcohol Analysis

PerkinElmer Clarus 500 w/ Turbomatrix HS110



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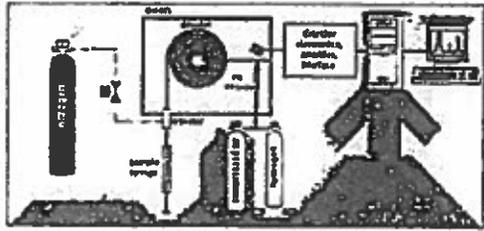
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### Blood Alcohol Analysis Chromatography



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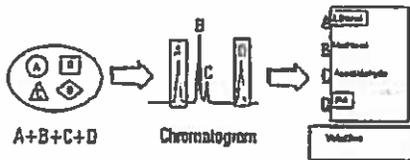
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### Blood Alcohol Analysis Chromatography



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### Blood Alcohol Analysis Quality Assurance

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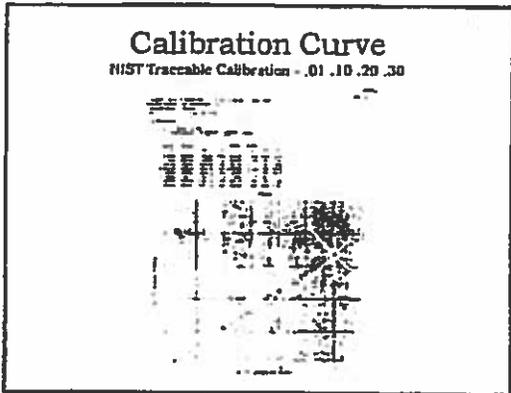
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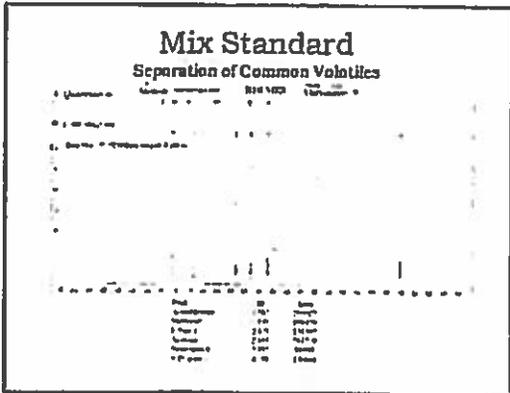
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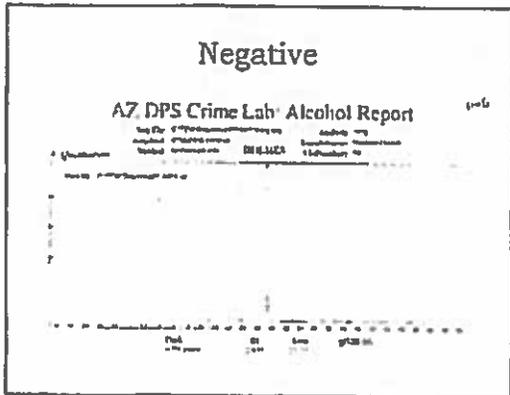
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## Battle of the Experts

Disagreements between expert witnesses go to weight, not the admissibility. *State v. Velasco*, (Alday, RPI), 165 Ariz. 480, 486, (1990).

Where there is a lack of unanimity in scientific community on accuracy of a breath test, "the scientific disagreement affects only the weight and not the admissibility of evidence." *State v. Olivas*, 77 Ariz. 118 (1954).

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## Your Criminalist and You

Can do drink calculations

"One beer" How big would that be?

Retrogrades

Effect of alcohol on humans

Explain issues with the Intox

Rebut defense expert's testimony

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## Questions?

Jon Tew, DPS Crime Lab

Supervising Criminalist

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Erin Hooser, DPS Crime Lab

Technical Leader

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Beth Barnes, Phoenix Police Officer

AZ GONIS Traffic Safety Resource Prosecutor

[beth.barnes@phoenix.gov](mailto:beth.barnes@phoenix.gov)

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