# FUNDAMENTALS OF TRIAL ADVOCACY COURSE

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# DUI BLOOD ANALYSIS ISSUES

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Distributed by:


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# DUI Blood Analysis

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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

## Alcohol

Common Types

| NAME | FORMULA | BOILING POINT | USES | TOXICITY AND METABOLITES |
|---|---|---|---|---|
| Methanol | $CH_3$-OH | 64.5°C/ 148.1°F | Denatured Solvent Paint Remover Fuel | ≈75ML Formic Acid |
| Ethanol | $CH_3CH_2$-OH | 78.5°C/ 172.9°F | Beverage Solvent · Medicinal Vehicle Fuel | ≈400-500ML Acetaldehyde (Acetic Acid) |
| Isopropanol | $CH_3CH$-OH \| $CH_3$ | 82.1°C/ 180.1°F | Denatured Antiseptic | ≈250ML Acetone |
| Ethylene Glycol | $CH_2$-OH \| $CH_2$-OH | 198°C/ 388.4°F | Coolant Solvent | ≈100ML Oxalic Acid |

## Absorption

How does it enter the body?

Oral Consumption

Injection

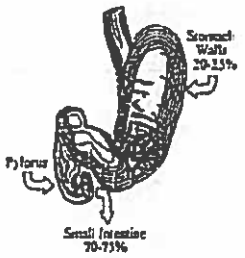
Inhalation

Through the skin

Enema

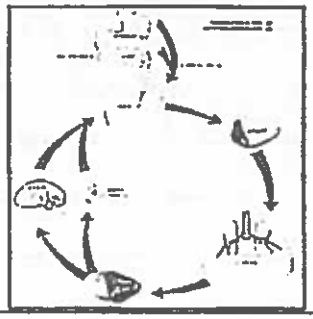
## Absorption

How does ethanol enter the body?



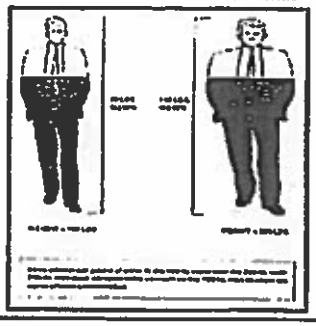

## Distribution

How does ethanol move around in the body?



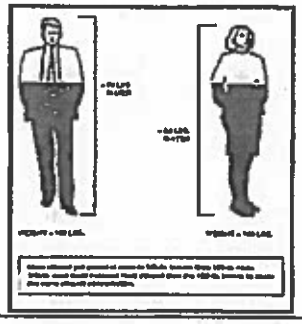
## Distribution

Ethanol Concentration vs. Water Content



## Distribution

Ethanol Concentration vs. Water Content



## Per Drink Calculation

<u>Widmark Formula</u>

A = PRC

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

## Elimination

How does ethanol leave the body?

Metabolism (liver)

Excretion (urine)

Evaporation (breath)

## 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

## 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'Neill v. Superior Court (Konkel/Fritz, RPI)*, 187 Ariz. 443 (App. 1996); *State v. Claybrook*, 193 Ariz. 588 (App. 1998).

## 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).

## Retrograde Calculation

<u>Information Needed</u>

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

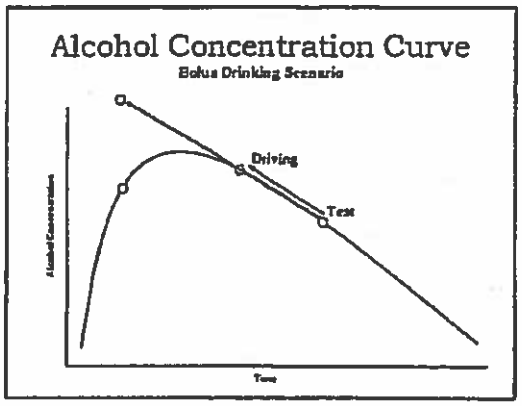
## Retrograde Calculation

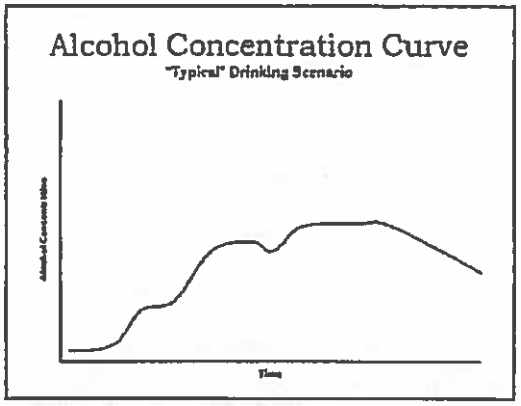
How to Get Your Test Within Two Hours - Retrograde Extrapolation

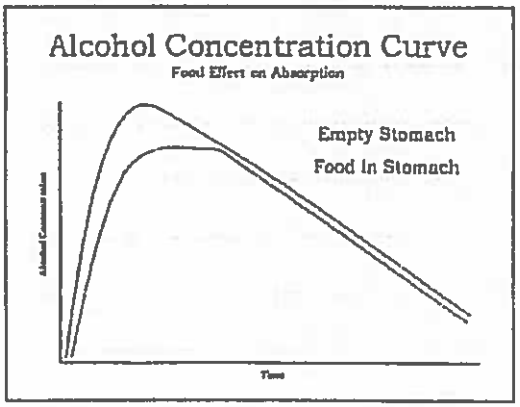
Given certain information, can you calculate the alcohol concentration at a time earlier than the test? (Yes)

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)?


Alcohol Concentration Curve
Bolus Drinking Scenario
Driving
Test
Time


Alcohol Concentration Curve
"Typical" Drinking Scenario
Time


Alcohol Concentration Curve
Food Effect on Absorption
Empty Stomach
Food In Stomach
Time

## 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

## Impairment

| COGNITIVE | SENSORY | MOTOR FUNCTION |
|---|---|---|
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
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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

## Tolerance
Metabolic

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

Innate – genetics and constitution

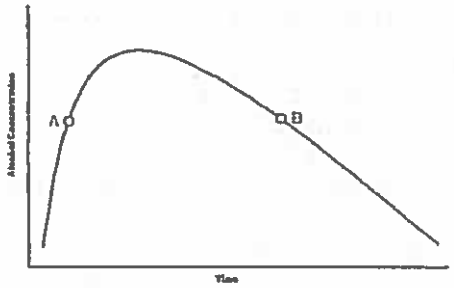
Exposure dependent – Microsomal Ethanol Oxidizing System (MEOS)

## 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

## Tolerance
Acute



## Tolerance

Functional

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

## 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

## 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%

## 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)

## 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%)

## 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

## 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

## 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

## Blood Alcohol Analysis

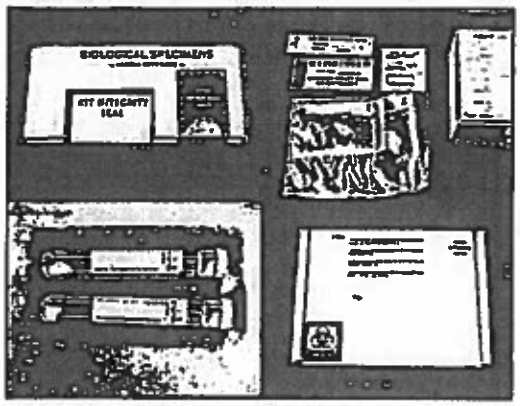
Phlebotomy Blood Draw Kits

NIK, Lynn Peavey, and Tri-Tec

Outer box
Inner box
2 vacuntainer tubes (grey top)
- Preservative - sodium fluoride
- Anticoagulant - potassium oxalate
- Vacuum dated for freshness

1 non-alcoholic swab
- Iodine
- Benzalkonium chloride

Butterfly needle
Evidence seals




## Blood Alcohol Analysis

Property and Evidence

Agency Request For Scientific Examination

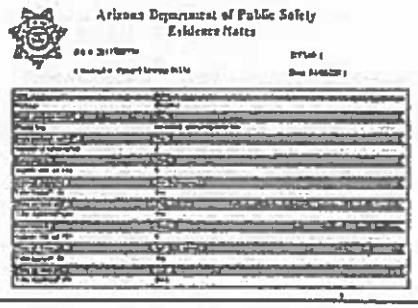
Chain of Custody

Requests disseminated to appropriate unit

Refrigerates blood in walk in cooler

## Blood Alcohol Analysis

Evidence Notes


Arizona Department of Public Safety
Evidence Notes

## Blood Alcohol Analysis
Evidence Opening

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

## Blood Alcohol Analysis
Evidence Opening

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

## Blood Alcohol Analysis
Pipet Samples

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

## Blood Alcohol Analysis

Internal Standard Method

| Peak | RI | Area | g/100 mL |
|---|---|---|---|
| Ethanol | 1.316 | 266100 | 0.2101 |
| n-Propanol | 2.479 | 220407 | |

| Peak | RI | Area | g/100 mL |
|---|---|---|---|
| Ethanol | 1.313 | 257279 | 0.2118 |
| n-Propanol | 2.410 | 211521 | |

## Blood Alcohol Analysis

Internal Standard Method

| Area Counts | Area Counts |
|---|---|
| Ethanol - 266100 | Ethanol - 257279 |
| n-propanol - 220407 | n-propanol - 211521 |
| **Ratio** | **Ratio** |
| 266100/220407 = 1.20 | 257279/211521 = 1.21 |

## Blood Alcohol Analysis

Report

## 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

## Blood Alcohol Analysis
How to Admit Blood Alcohol Results

Sample Collection

Establish: when, where & by whom sample was collected

Defense may stipulate

## 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

## 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)

## 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

## 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

## 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?

## 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

## 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

## *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

## Blood Alcohol Analysis

How to Admit Blood Alcohol Results

*Deason/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?

## Blood Alcohol Analysis

How to Admit Blood Alcohol Results

*Deason/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)

## Blood Alcohol Analysis

Headspace Gas Chromatography

Measures alcohol content in the air above the blood

Standard in the scientific community for blood alcohol analysis

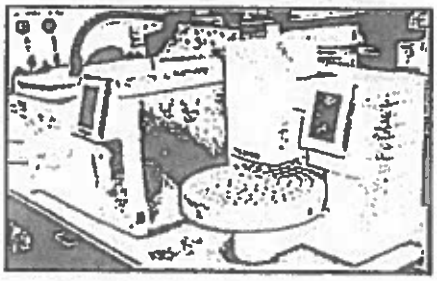
## Blood Alcohol Analysis

Henry's Law

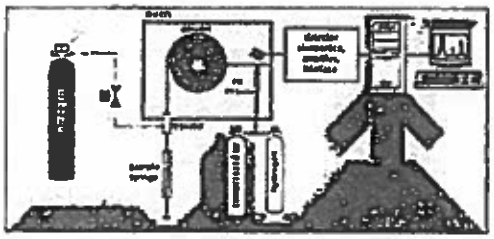
In a closed system, the concentration of a volatile substance above a fluid is proportional to the concentration of that substance in the fluid at equilibrium

## Blood Alcohol Analysis

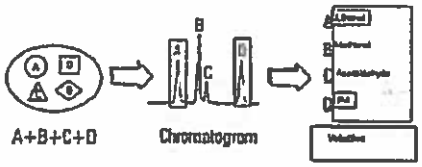
PerkinElmer Clarus 500 w/ Turbomatrix HS110



## Blood Alcohol Analysis
Chromatography



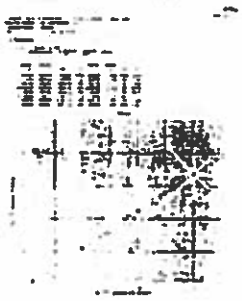
## Blood Alcohol Analysis
Chromatography




## Blood Alcohol Analysis
Quality Assurance

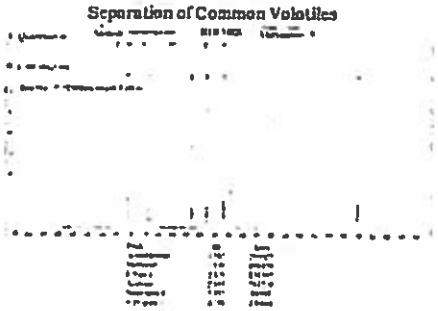
## Calibration Curve

NIST Traceable Calibration - .01 .10 .20 .30



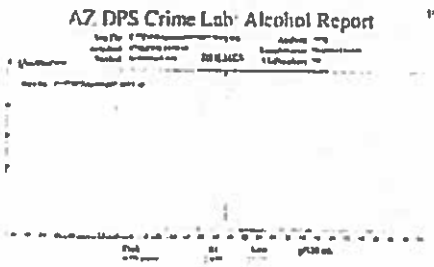
## Mix Standard

Separation of Common Volatiles



## Negative

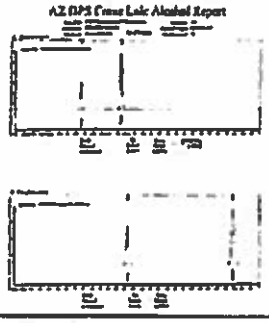
AZ DPS Crime Lab Alcohol Report



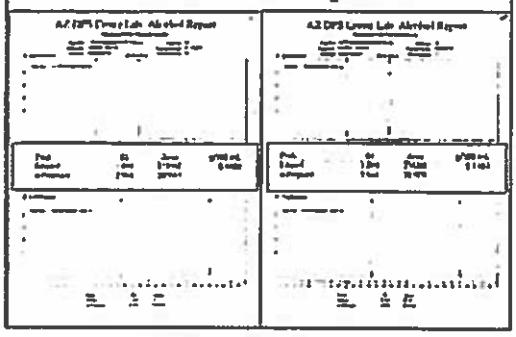
## Controls

Aqueous and Whole Blood

AZ DPS Crime Lab Alcohol Report



## Cases Run in Duplicate



## Verification Standards

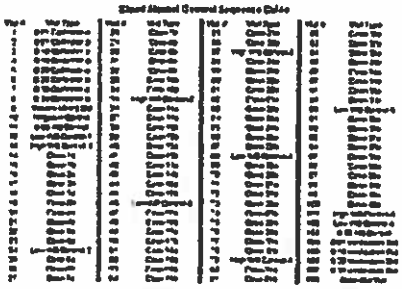
Same as Calibration Standards

Analyzed at the end of run

Verifies pipettor and calibration stability

## Blood Alcohol Analysis

Batch



## Quality Assurance

Review

Technical Review

Administrative Review

## Responding to Defense Foundational Objections

If in Doubt
Weight not admissibility

All the State is required to do is lay the basic foundation. Any remaining issues go to the weight, not the admissibility, of the evidence.

*State v. Plew*, 155 Ariz. 44 (1987); *State v. Superior Court (Weant, RPI)*, 172 Ariz. 153 (App. 1992)

## 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).

## 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

## Questions?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