BLOOD AND URINE DRUG LEVELS
OF CASES SUBMITTED TO THE PHOENIX POLICE DEPARTMENT CRIME LABORATORY FOR TESTING

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Phoenix is 5th largest City

- Has it’s own full service crime laboratory.
- Plenty of drunks; approx 12,000 DUI/Yr.
- Toxicology section mostly staffed
  - one supervisor
  - average four criminalists
  - one laboratory technician
  - one to two volunteers (to crunch data).
Types of Cases Submitted to Toxicology

- DUI Intoxylizer data support~ 10,000 tests/yr.
- DUI alcohol blood samples 840/2003 (Felonies =65%)
- DUI drug/DRE cases; both blood and urine 310 (24%)
- Fatal Accident blood draws 31/2003( 3%)
- Liquor violations (serving after 1:00 A.M.)
- Sexual Assault cases 97/2003( 8%)
- Homicide/Death investigation with Suspect
- Misc internal investigations, Proficiencies, training samples, etc.
We will focus on….

• DRUGS FOUND IN BOTH BLOOD & URINE
• DRUG LEVELS IN DUID/DRE CASES
• DRUG LEVELS IN SEXUAL ASSAULT CASES
• COMPARE WPDT (courtesy of Southwest Laboratories, Inc.) WITH OUR CASES
• STORYTIME (I.E. INTERESTING CASES)
• note: we only test live subjects, dead ones go to medical examiner’s office
BLOOD or URINE

WHY URINE?

- **advantages**
  - Ease of collection, analysis
  - Less of a biohazard
  - Window of Detection (e.g. sex assault, drug stability)
  - “Clever” Laws cover urine
    - **disadvantages**
  - No **quantitative** meaning to results.
  - Cannot be **specific** about dose or time.
BLOOD or URINE

WHY BLOOD?

- Advantages
  - Some quantitative meaning with result.
  - Snapshot of drug level at time of interest.
  - Ideal for Inhalants and Ethanol.
  - Best evidence for seeking the “Truth”.
- disadvantages
  - Collection (invasive)
  - Requires phlebotomist (timing)
  - Limited Window of Detection (SA cases)
Sample Flow-General

- Impound to Property with appropriate packaging/labeling
- Proper request for analysis: BAC or Drugs or both
- DRE opinion or Evaluation Sheet
- If BAC >0.12 no drug analysis on non-felonies
- If BAC < 0.12 and drugs requested, on to Drug screening
- Drug screen on all felonies when requested
- Full ETOH/drug screen on Fatal Accidents
- Full ETOH/drug screen on sex assaults
WHY Quantitate?

• Because we have the capability
• Track/eliminate carryover (urine; range 10-1,000,000ng/ml)
• Gather data for future “per se” laws
• SIM analysis allows for tangible criteria for ASCLD (vs. library match)
• Compare drug levels with therapeutic levels (blood)
• Possibly useful #’s for urine levels (TBD)
Screening Test-EIA

- Antibody test >90% accurate
- Sensitive but not specific (classes of drugs)
- Rapid analysis 10-20 urine samples/hour
- DRE samples are screened for all drug classes
- Threshold levels to differentiate pos/neg
- Very useful tool to direct further, more complex confirmation for specific drug/metabolite
- Limitations- not all drugs are found with this type of testing, even within a class.
SCREENING TEST - EMIT
Confirmation Test - GC/MS

- Gas Chromatography/Mass Spectrometry or separation/identification. 100% accurate.
- Sensitive and specific.
- Can be Quantitative.
- Time and labor intensive analysis. (1.0 hour/sample)
- Identifies individual drug and or metabolite that caused positive screening test. (ex. Morphine)
- Identifies “other” drugs not available in screening tests. (ex. Carisoprodol-SOMA)
# PCL- drugs found in fatal accidents 2002 to 06/2004 n=76

<table>
<thead>
<tr>
<th>Drug</th>
<th>Count</th>
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<tbody>
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<td>ETOH</td>
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<tr>
<td>Cocaine</td>
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<td>PCP</td>
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<tr>
<td>Diazepam</td>
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<tr>
<td>Diphenhydramine</td>
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<tr>
<td>Mirtazapine</td>
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<tr>
<td>Topiramate</td>
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<tr>
<td>valproic acid</td>
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<tr>
<td>Meprobamate</td>
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Drugs found in DUlD 2003-06/2004 (urine) n=?

<table>
<thead>
<tr>
<th>Drug Type</th>
<th>Count</th>
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<tbody>
<tr>
<td>Marijuana</td>
<td>184</td>
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<tr>
<td>Amph/Methamp</td>
<td>124</td>
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<tr>
<td>Cocaine/BE</td>
<td>99</td>
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<tr>
<td>Benzodiazepines</td>
<td>87</td>
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<tr>
<td>Opiates</td>
<td>83</td>
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<tr>
<td>Phencyclidine</td>
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<tr>
<td>SOMA</td>
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<tr>
<td>OTC</td>
<td>22</td>
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<tr>
<td>SSRI</td>
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<tr>
<td>TCA</td>
<td>11</td>
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<tr>
<td>Phenothiazines</td>
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<tr>
<td>Barbiturates</td>
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<tr>
<td>Bupropion</td>
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<tr>
<td>Zolpidem</td>
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<tr>
<td>Inhalants</td>
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<td>Olanzapine</td>
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<td>Ketamine</td>
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<tr>
<td>Metaxalone</td>
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</tr>
<tr>
<td>Isopropyl alcohol</td>
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</tbody>
</table>
Drugs found in Sex Assaults 2002-06/2004 n=250

- ETOH 47 19%
- Methamp 47 19%
- Cannabis 39 15%
- Cocaine 39 15%
- Benzos 17 7%
- Opiates 8 3%
- GHB/FN 0
ETHANOL

• Still # 1 depressant
• for 2003 9,283 breath tests ave brac=0.15%
  • .0-.09  1156 12.4%
  • .10-.15  3126 33.6%
  • .16-.20  2495 26.8%
  • .21-.25  1181 12.7%
  • .26-.30  319  3.4%
  • .31-.35  57  0.6%
  • over .35  9  0.1%
Gender differences

- Males arrested 7,819 or 84% of the time!
- Females arrested 1464 or 16%
## Days and times

- **Mon-Thurs**: 3244, 35%
- **Friday-Sunday**: 6039, 65%
- **00:00-04:00**: 3989, 41%
- **04:00-16:00**: 610, 6.5%
- **16:00-20:00**: 805, 8.6%
- **20:00-24:00**: 3879, 42%
Blood Amp/Meth 2003-6/2004

- Conc (n=67) amp range 11-160ng/ml; mean 42ng/ml
  - meth range 38-1700ng/ml; mean 290ng/ml
  - Meth/Amp ratio ~7:1 in blood (*acetone)

- With ETOH n=12
- With THC n=10
- With Coca n=6
- With Benzo n=6
- DUI n=35
- Methamphetamine and violence
  - Homicide 3 agg assault 5
  - Sex assault 4 stolen veh 1
  - Fatal 2
  - Injury acc 9

• Conc (n=31) coca range 10-380 ng/ml mean 100 ng/ml
• BE (n=70) be range 29-3600 ng/ml mean 780 ng/ml
• CE (n=6) ce range 13-98 ng/ml mean 35 ng/ml
  – **BE/Coca ratio ~13:1** (when cocaine found > 10 ng/ml)
  – **Cocaine not found when BE conc < 130 ng/ml**
  – **Cocaine always detected when BE conc > 1000 ng/ml**
  – **Incomplete data on CE (added Mar/04)**
  – With ETOH 34 48%
  – Meth 11 16%
  – THC 7 10%
  – Benzo 5 7%
  – Opia 5 7%
Blood Cocaine Con’t

• DUID n=36
• Cocaine and violence
  – Hom 4 agg assault 7
  – Sex assault 4 Inj acc 12
  – Fatal 4 fel pursuit 1
• Concentration independent
• DUI at low levels ½ of cases had BE<300ng/ml - Downside?
Storytime-Downside

• 24 y/o WM DUI
  • Vitals pulse=60(low) BP 110/68(low) Temp=95.9(low)
  • Pupils 3.0\textit{Rm}-6.5\textit{Dk}-2.5\textit{Dir}, No HGN, droopy eyelids
  • slurred speech, “tremors”
  • Poor FST’s, arms on wall for balance.
  • Admit “sick in head”, speed 1 gram.
  • DRE opinion Stimulant.

• What we found;
  • Blood Amph 44\text{ng/ml}, Methamp 475\text{ng/ml}
  • Blood Benzoylecgonine 470\text{ng/ml}
Blood PCP 2003-06/2004

- Conc (n=10) range 25-84 ng/ml; mean= 43 ng/ml
- With THC n=5.
- With ETOH n=3
- With Stimulants n=2 meth, coca one each
- One PCP only; 30 ng/ml
  - type
- DUID n=9
- Homicide suspect n=1
storytime

• 36 y/o M Hispanic DUI
• Vitals pulse 96(high) BP 130/95(norm/hi) Temp 98.7
• Time est 10/19 of 30sec, rigid, raised arms on FST’s
• HGN with 15º angle onset, VN, Pupils normal
• DRE opinion PCP
• Lab results;
  • BR ac= .06
  • Blood PCP 25ng/ml
Blood THC 2003-06/2004

- COOH-THC >5ng/ml (n=70) range= 6-92 ave= 24.64
- 11-OH THC >2ng/ml (n=10) range= 2-7.2 ave= 3.07
- THC >2ng/ml (n=27) range= 2-8.3 ave= 3.74
  Parent found in 35% of cases

- THC and Polydrug use:
  ✓ THC/COOH found by itself n=9 13%
    With ETOH n=42  60%
    Methamp  n=13 18.6%
    Coca/Be  n=6  8.6%
    PCP      n=5  7.1%
    Benzo    n=3  4.3%
    Opiates  n=2  2.9%
    Soma     n=2  2.9%
Blood Opiates 2003-06/2004

• Total Opiates found in Blood n= 26
  – Hydrocod    n= 1 range= 57    ave= 57
  – Codeine     n= 2 range= 16-87  ave= 51.5
  – Morphine    n= 14 range= 10-470 ave= 126.1
  – 6AM         n= 1 range= 11    ave= 11
  – Oxycodone   n= 3 range= 61-236 ave= 120.3
  – Methadone   n= 2 range= 113-130 ave= 121.5
  – Propoxy/norprop n=2 qualitative
  – Tramadol    n=1 qualitative
Blood Benzodiazepines 2003-06/2004

- TOTAL BZDP found in Blood n= 58
  - Diazepam n= 14 range = 16-3239 ave= 473
  - Nordiaz n= 17 range= 12-613 ave= 223
  - Oxaz n= 6 range= 10-110 ave= 43
  - Temaz n= 5 range= 11-709 ave= 188
  - Loraz n= 6 range= 13-525 ave= 122
  - 7-amClonaz n= 1 range= ave= 84
  - Midaz/OH/mid n= 4 range= 40-84 ave= 68.7
  - Alpraz/oh-alp n= 5 range= 34-539 ave= 151
Case Study- Multi-Benzo’s

- Poor driving
- Tried to sue City
- HGN 30deg onset, slurred sp, unable to perform FST’s
- Lab results:
  - Blood temaz 709, oxaz 110 (restoril) record
  - Blood alpraz 539, α-OH alp 39 (Xanax) record
  - Diphenhydramine- qualitative
- Pending trial
Case Study-Valium

- Multi dui
- Diazepam 3239 record
- Nordiazepam 440
- Oxazepam 21
- Temazepam 162
MISC
Case Study Metaxalone

- Suicide attempt night before 19:00-21:00
- Found in collision at airport 06:00am
- Nystagmus 20° angle onset
- Blood metaxalone 12µg/ml (thanks Justin Poklis)
- Therapeutic <3µg/ml
- Plead
Case study- Zolpidem

- Suspect involved in collision across center line, extreme weaving prior.
- “Drunk” appearance, stuporous, slurred speech, slow responses and/or incoherent answers to questions. Dilated pupils.
- Could not recall if had an accident. Stated he took half an Ambien, went to bed, and then “I came up on all this”.
- Blood Zolpidem concentration 110ng/ml (2 hours post accident).
- Plead
Urine: The bulk of DUI/DRE
Urine COOH-THC incidence
2003/06-204

- Total confirmations 204 (cutoff >10 ng/ml)
- DRE cases considered 143 (poly-drug use)
  - Methamp  n=40  28%
  - COOH only  n=38  26%
  - Coc/Be  n=24  24%
  - ETOH  n=35  22%
  - Benzo  n=30  21%
  - Opiates  n=23  16%
  - PCP  n=12  8%
Urine COOH drug Levels

- All  \( n = 198 \)  range= 10-6100  c=590
- All Dre  \( n = 134 \)  range=10-6100  c=690
- Dre Call  \( n = 96 \)  range=10-6100  c=780
- No Call  \( n = 38 \)  range=13-4900  c=420
- SA  \( n = 17 \)  range=14-792  c=140
- SWL  \( n = 90 \)  range=20-1500  c=140
- CALL/NO CALL~2:1 (stim masking of THC call)
COOH-THC record holder-Urine

- 30 y/o Hispanic Male, no habla english
- Drifting out of lane, took awhile to pull over, crawled at 10-15 mph until finally stopping
- Vitals- pulse 99(hi); BP 110/60(low) temp 97.8(norm) pupils 4.5Rm/8.0Dk/4.0Dir
- FST’s time est 23/30; poor balance, backward turn, extra step
- Admit smoking Mj, one cigarette, didn’t remember time of use
- Lab results COOH-THC 21,000 ng/ml (2002) case
Urine PCP incidence  
2003-06/2004

- Total confirmations PCP n= 32
  - (cutoff>25 ng/ml)
- DRE cases considered 28
- (poly drug use)
  - THC n=10 36%
  - PCP alone n=9 32%
  - Coc/be n=8 28%
  - Opiate n=3 10%
  - ETOH n=2 7%
  - Benzo n=2 7%
- Close group
  - Two double DUI
  - Three relationships
  - Don’t work
Urine PCP levels

- All cases   n=33   range 490-26000 c=4300
- All DRE   n=28   range 490-26000 c= 3600
- DRE call   n=21   range 740-26000  c= 4900
- DRE no call n=3   range 1000-4000  c= 2100
- SWL   n=1   47 ng/ml

- If PCP <4000ng/ml DRE may not see Effects
- If PCP >4000ng/ml DRE called PCP
- DRE called PCP as low as 740ng/ml
Urine Cocaine/Be/CE Incidence
2003-06/2004

- Total coc/be confirmations n=99
- DRE cases considered n=73
- Poly-drug use
  - Cooh-THC n=27 37%
  - Amp/Meth n=23 31%
  - Opiates n=21 29%
    - Morph n=10 14%
    - 6-AM n=7 10%
  - Benzo’s n=16 22%
    - NOT n=7 10%
    - aOH-Alp n=5 7%
    - 7-AMCLN n=4 5%
- ETOH n=15 20%
- Coca/BE only n=10 14%
- PCP n=8 11%
Urine
Cocaine/Benzoylcegonine/Cocaethylene levels 2003-06/2004

• All cases n=118
  – Coca n=80 range 30-145,000 c=15,900ng/ml
  – Be n=118 range 277-1,321,000 c=115,000ng/ml
  – CE(>8/03) n=20 range 46-16,000 c=4,000ng/ml

• Cocaine is found in urine, at PCL 68% of the time
• BE/Cocaine ratio ~10:1 in urine (blood ~13:1, more stable in urine?)
• Cocaethylene found in urine at PCL 35% of the time (since monitoring)
• Due to short half life and habits of users, range extremely wide
Urine Coca/BE levels

- DRE call Stim coc only n=10
  - Coca range 300-145,000  c=42,000
  - BE range 800-1,321,000  c=310,000
  - ratio 7:1  range 0.8 to 25:1
- DRE no call n=35
  - Coca range 0-49,000  c=8,700
  - BE range 277-343,000  c=89,000
  - Ratio 10:1  range 1.5 to 578:1
- SWL n=69
  - BE range 150-49,000  c=2900

- Cocaine/BE ratio and total concentration of either cocaine or BE may be good predictors of a DRE call.
- Complicated by poly-drug use.
BE record Holder Story

- 23 Y/O White Fem
- Q/A- last slept 24hr ago, last ate 3 days ago.
- Vitals pulse 90(up) BP 110/68(norm) Temp 98deg
- HGN none; Pupils 4.5Rm/7.0Dk/3.0Dir; BSW eyes
- Time estimation 10seconds (30 actual)
- Poor FST’s walks backwards, arms out like airplane
- Scrapes,bite marks,blisters, scars
- Admit an “8 ball” DRE- Stimulant
- Lab results coc 52,000 BE 1,300,000 CE 8,400
- Cooh-THC 70 Amp200 Meth 1900
Urine Amp/Meth incidence
2003-06/2004

- Total amp/meth confirmations = 151
- DRE cases considered n=94 (polydrug use)
- COOH-THC n=36 38%
- Amp/meth only n=31 33%
- BE/coca n=25 26%
- Opiates n=20 21%
  - Morph n=10
  - 6AM n=6
  - MDNE n=5
- Benzos n=18 19%
  - NOT n=9
  - 7-AMCLN n=4
  - Alp n=3
  - Loraz n=2
Urine Amphetamine/Methamphetamine levels 2003-06/2004

• All cases n=141
  – Meth  n=139  range 330-460,000  c=59,900ng/ml
  – Amph  n=139  range 190-45,600  c=8100ng/ml
  – M/ARatio  range 0.8:1 to 36:1  c=7.7:1

• MDA/MDMA found only once.
• Average Meth/Amp ratio same in urine as blood.
• Due to short half life and habits of users,
  • range extremely wide
Urine Meth/Amp levels

- DRE call Stim n=42
  - Meth range 6600-200,000 c=75,000
  - Amp range 760-19,000 c=9,000
  - Ratio 9:1 range 3.2 to 36:1
- DRE no call n=30
  - Meth range 760-116,000 c=36,000
  - Amp range 380-25,000 c=6,200
  - Ratio 7:1 range 0.9 to 31:1
- Sex Assault n=22
  - Meth range 1400-330,000 c=55,000
  - Amp range 340-38,000 c=9,500
  - Ratio 6:1 range 1.3 to 23:1
- SWL n=53
  - Meth range 610-140,000 c=12,000
  - Amp range 260-40,000 c=2,400
  - Ratio 4.5:1 range 0.6 to 15:1
Urine Opiates 2003-06/2004

- Total opiate confirmations =93 (DUI=79)
- Frequency in all cases
  - Morphine 36 38%
  - Hydrocod 27 29%
  - Codeine 25 26%
  - Oxycod 19 20%
  - 6-AM 18 19%
  - MDNE 12 13%
  - Propox 7 7%
  - Meperid 1 1%
  - Tramadol 1 1%
  - Two opia 15 16%
  - Three opia 4 4%

[Bar chart showing the percentage distribution of different opiates]
Urine opiate levels

- Mor(free) n=36 range 67-54,000 mean 9900 C:M 0.15:1
- SWL-total n=11 range 790-35,000 mean 2400
- Hydrocod n=27 range 84-33,000 mean 5700
- Codeine n= 25 range 61-5900 mean 1500
- SWL n=15 range 1400-73,000 mean 4600 C:M 2:1
- Oxycod n=19 range 140-9600 mean 2900
- 6-AM n=18 range 51-8900 mean 1600
- SWL none

- Urine cutoff of 100ng/ml would eliminate only one from each category
Urine Benzodiazepines
2003-06/2004

- Total confirmations n=102 (DUI n=84)
- Frequency in all cases (>50ng/ml, hydrolyzed)
  - Oxaz n=48 47% (Valium, Serax-1, Chlordiazepoxide-2)
  - Temaz n=46 45% (Valium, Serax, Restoril-4)
  - Nordz n=29 28% (Valium, Chlordiazepoxide)
  - Diaz n=2 1% (Valium)
  - 7Amcln n=21 20% (Clonopin)
  - OHalp n=20 20% (Xanax)
  - Alp n=10 10%
  - Loraz n=14 14% (Ativan)
  - OHmid n=5 5% (hospital)
  - DesF n=1 1% (proficiency)
  - UtoConf n=2 2%
Benzodiazepines Con’t
BZDP levels (hydrolyzed)

- Valium, etc
  - Diaz  n=2  range 55-65  mean 60
  - Nord  n=29 range 78-1917  mean 570
  - Oxaz  n=43 range 66-8900(39,000)  mean 1900
  - Temaz  n=42 range 57-5100  mean 1400
- Restoril
  - Oxaz  n=4  range 860-13,000  mean 4700
  - Temaz  n=4  range 6000-100,000  mean 34,000
- Alpra
  - Alp  n=10 range 64-2000  mean 580
  - OHAlp n=20 range 44-2500  mean 580
- Clonazepam  n=21 range 67-12,000  mean 2300
- Lorazepam  n=14 range 74-9100  mean 1800
- OH midaz  n=5 range 110-5500  mean 1300
Benzo Con’t

• 11 bzp confirmed <screening CU i.e. Loraz, 7-AMCLN
• 50 ng/ml cutoff good for >99% of cases
• D:N:O:T ~ 0.1:1:3:2 ratio
• Restoril T:O ratio ~ 7:1
• Alpazolam ratio ~ 1:1
Multi-DUI-Urine Depressants

1. 38 y/o W Fem pulled over twice/2 diff officers
   • HGN/VN present both cases 35º onset/ unable to do FST’s without falling.
   16:00  Loraz 1400, SOMA, Diph, Guaif
   21:30  Loraz 2200, SOMA, Diph, Guaif

2. 15 y/o W Male two DUI a Month apart
   Horrible FST’s, “I have many doctors”
   HGN/VN present 35º, Imm, respectively
   02-21-04: NOT 340/5400/3200, SOMA, OH-Bup, Hcod 1300
   04-02-04: DNOT 65/530/4900/4400, SOMA, OH-Bup, Ocod
Conclusions

• There is a difference between WPDT and DUI.
• The shorter the t½, the more useful urine quant.
• PCP and Heroin users don’t work.
• Therapeutic drugs (benzo’s & opiates) urine quant are generally useless.
• SAMHSA cutoffs are inclusive for >99% of cases
• Poly-drug use rampant.
• Tolerance an issue, DRE eval/witness a must.
• Methamphetamine is a problem in Phoenix.
The End

Thanks to:

• Special
• Will Arnold-access db’s
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