



Technology Transition Workshop | *Patricia Guerra-Diaz, Ph.D.*

Real World Sampling

Outline

Contact Sampling

**Non- Contact
Sampling**



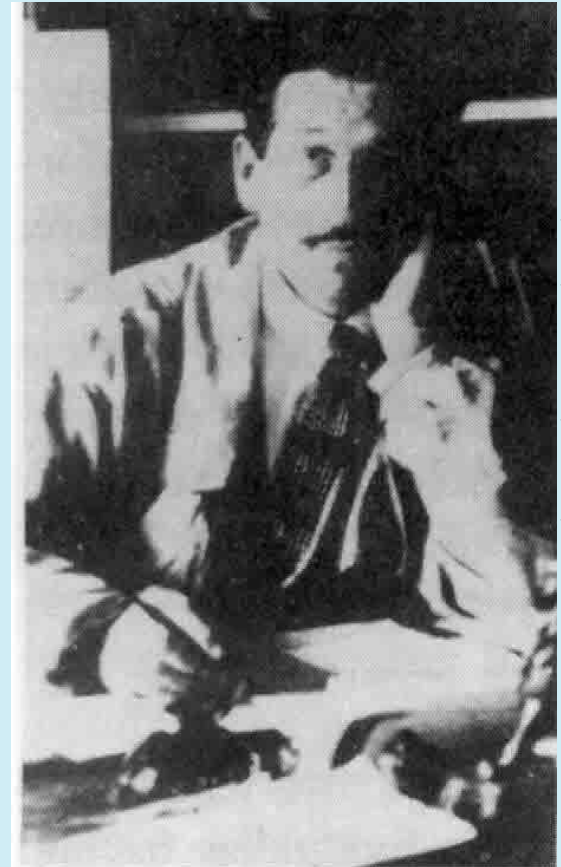
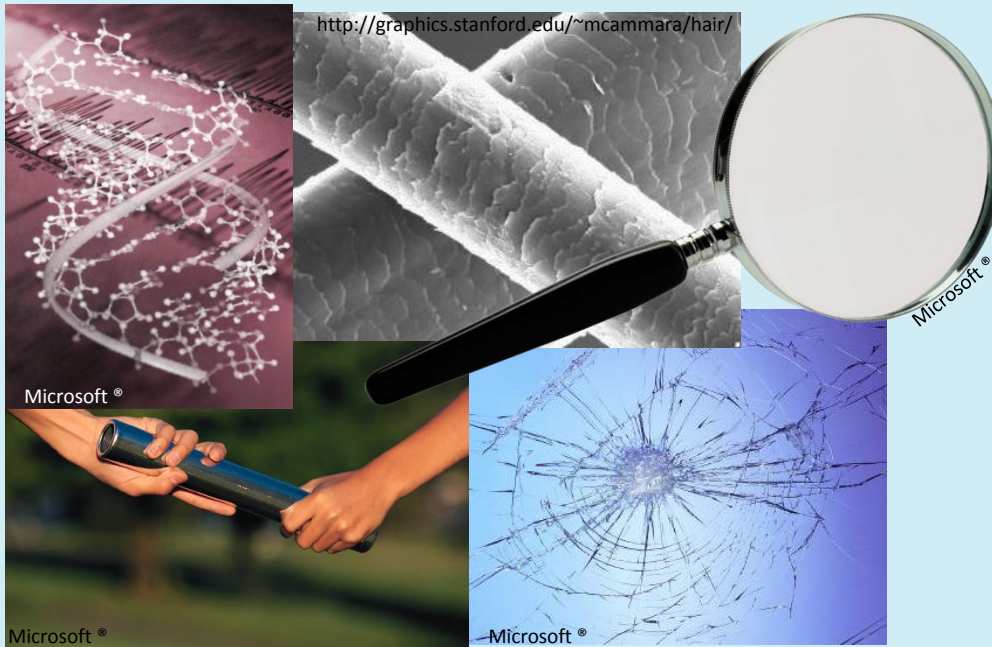
Vehicle Sampling



**Background and
Possible
Distractors**

Locard's Exchange Principle

- “Every contact leaves a trace”
 - Primary transfer
 - Secondary transfer



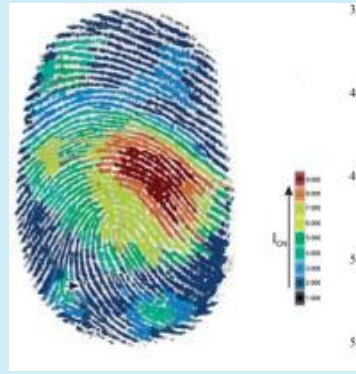
http://www.facstaff.bucknell.edu/mvigeant/univ_270_03/derek/EdmondLocard.jpg

Where Do These Traces Come From?

- Bulk explosive or drug
- Contact with contaminated hands (clothing, luggage, door handles, etc.)
- Secondary fingerprint
- Contact with tools, workspaces
- Odor emanating from concealment



http://assets.nydailynews.com/img/2010/10/31/amd_dubai_emirate_printer_bomb.jpg



http://www.spectroscopynow.com/FCKeditor/UserFiles/Image/spectroscopyNOW_ezines_2011/SpecNow/SN67b/SN67b_A_fingerprint.jpg

Contact v. Non-Contact Sampling

- Contact sampling- particles (surface wipe)
- Non-contact sampling- vapors and particles
- Depends on chemical/ physical properties of threat and sample surface



<http://pubs.acs.org/doi/pdf/10.1021/ac041665c>



Image courtesy of the Dr. José R. Almirall Lab



Image courtesy of the Dr. José R. Almirall Lab

Particle Sampling – Surface Wipe

- Conforms to surfaces
- Low cost sample collection
- Direct introduction to instrument via thermal desorption
- Wipe material more significant than applied pressure for removal

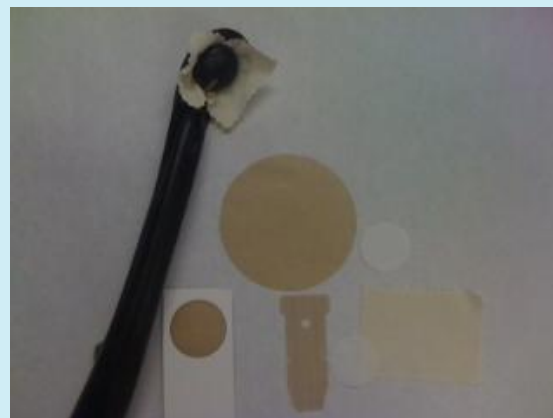
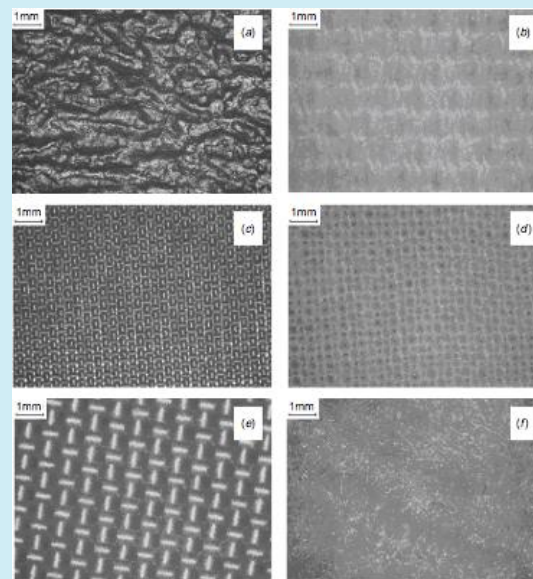


Image courtesy of Dr. Patricia Guerra-Díaz



Verkouteren et al. (2008)

Particle Sampling – Where?

- Surfaces expected to come in contact with contaminated hands/tools
 - Luggage handles
 - Steering wheel, gear shift
- High volume sampling for particles
 - Cargo containers
 - LD3 containers



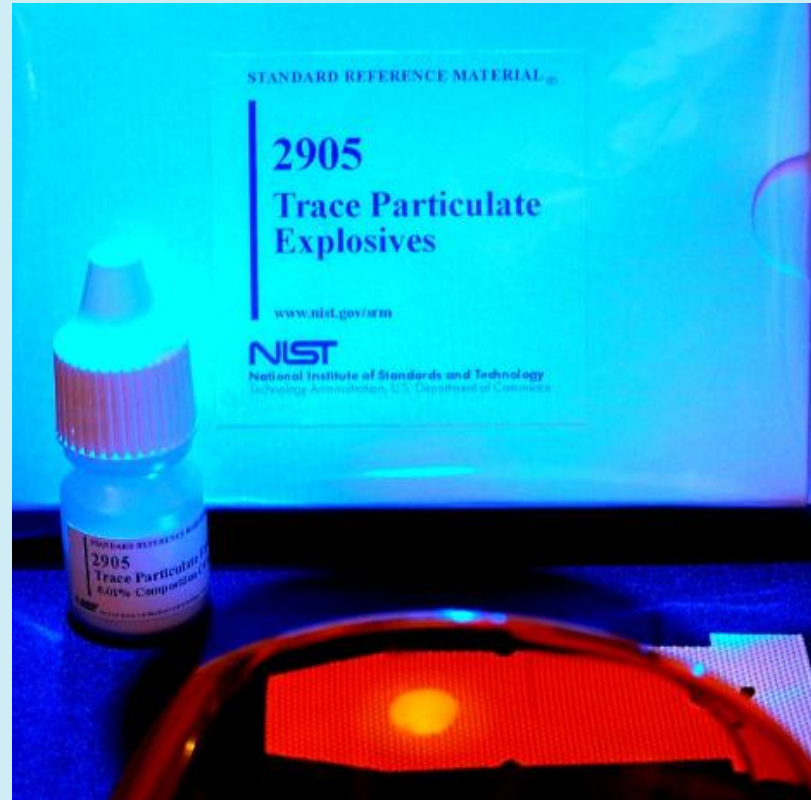
Image courtesy of Dr. Patricia Guerra-Diaz



Image courtesy of the Dr. José R. Almirall Lab

Contact Sampling

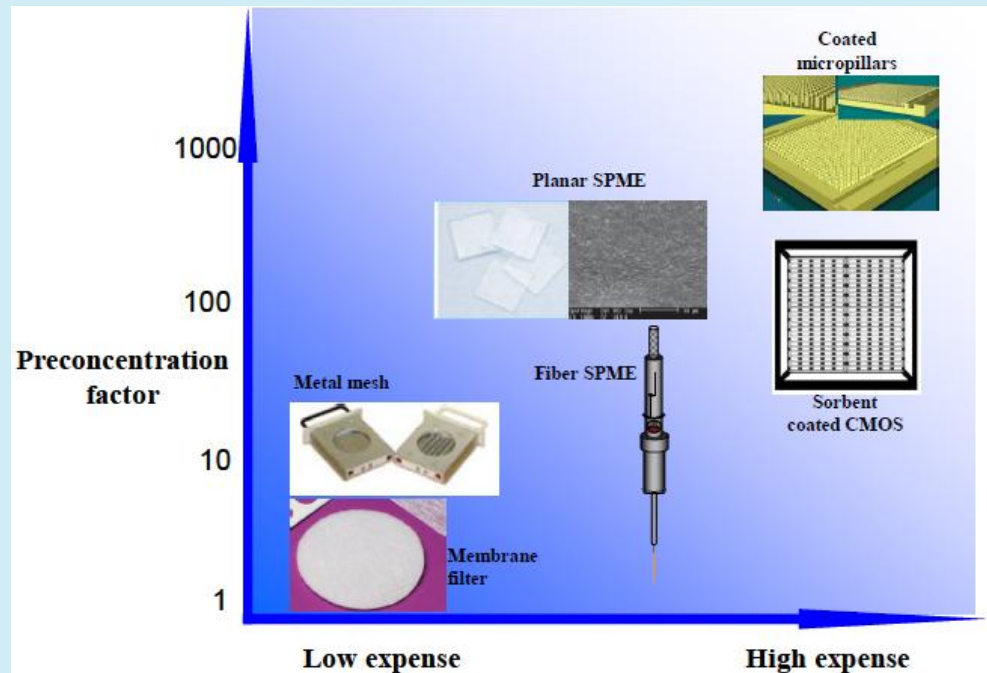
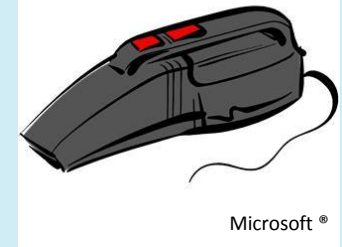
- Determination of sample collection efficiency
 - NIST SRM 2905
 - Certified concentrations TNT, RDX and HMX (C4)
 - Fluorescently tagged



<http://patapsco.nist.gov/ImageGallery/retrieve.cfm?imageid=697&dpi=300&fileformat=jpg>

Non-Contact Sampling

- Particle collection
 - Dustbusters
 - Adsorbent tubes
 - Membrane filters
- Vapor collection
 - Adsorbent tubes
 - Metal felts
 - SPME devices
 - PSPME



Lai (2010)

Vapor Sampling Considerations

- **What is my sample?**
- **What are the options for collecting the sample?**
 - Dwell time
 - Static or dynamic sampling
- **Will the method collect enough vapor for detection?**
 - Pre-concentration
 - Distance from vapor source
- **What are the environmental conditions?**
 - Temperature, background contamination, etc.

Non-Contact Sampling – Mechem

Mine Clearing

Remote Explosive Scent Tracing

- 1) Sample collected on adsorbent tube**
- 2) Presented to off-site dogs**



http://www.gichd.org/fileadmin/pdf/publications/MDD/MDD_ch4_part1.pdf



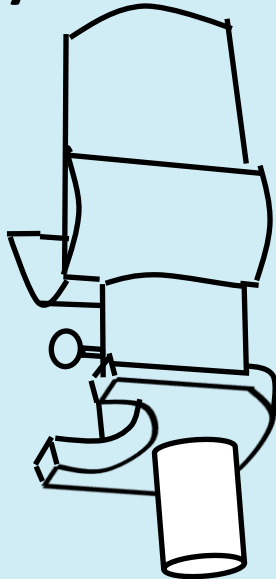
http://www.gichd.org/fileadmin/pdf/publications/MDD/MDD_ch2_part2.pdf



http://www.gichd.org/fileadmin/pdf/publications/MDD/MDD_ch4_part1.pdf

Non-Contact Sampling – PSPME

Dynamic Sampling



Guerra-Diaz, Gura, and Almirall (2010)

Static Sampling

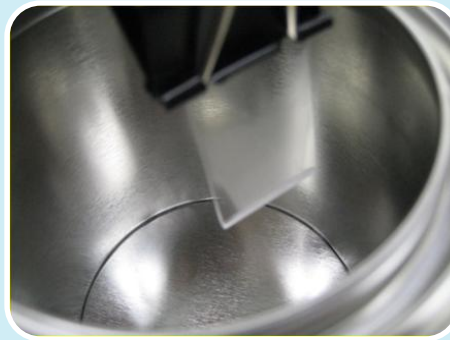


Image courtesy of Dr. Patricia Guerra-Diaz

Drug Testing and Analysis

www.drugtestinganalysis.com

SUSPECTED MDMA TABLETS

PSPME SAMPLING

IMS DETECTION

PIPERONAL

MDMA ALERT

Gura, Guerra-Diaz, Lai, and Almirall (2009)

The image shows the cover of the book 'Drug Testing and Analysis'. The cover features a grid background with various scientific and forensic elements. On the left, there are molecular models and green pills. In the center, a white envelope is labeled 'PSPME SAMPLING'. To the right, a chromatogram plot is labeled 'IMS DETECTION' with a red circle around a peak and the word 'PIPERONAL' below it. Further right, a red warning triangle with an exclamation mark is labeled 'MDMA ALERT'. Blue arrows indicate the flow of information from the sampling stage to the detection stage.

Vehicle Screening

- Concealed drugs/explosives
- Evidence of contraband handling
- Methods
 - Visual inspection
 - Canine teams
 - Bulk detection
 - Trace detection



Witus, Gerhart, Smuda, and Andrus (2006)



http://205.130.201.42/ImageCache/cgov/content/newsroom/photo_gallery/canine_5training_5ficho/canine_20enforcement_20traini ng_20octr/hires/cetc_5f08_5fhires_2eipg/v1/cetc_5f08_5fhires.jpg

Vehicle Screening – VACIS



CBP's VACIS, its mobile vehicle and cargo inspection system

<http://www.youtube.com/watch?v=xkFxfokqnmE>

Vehicle Screening – IMS



http://www.youtube.com/watch?v=kCO_4dsiHjg

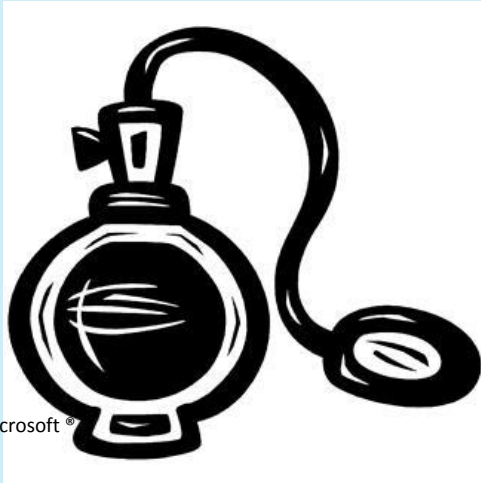
Sabre 4000

Video prepared by Smiths Detection

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Possible Distractors



Microsoft®

Can materials that also produce “odors” affect sample collection/detection?

Instrumental background
Canine distractors



http://www.justice.gov/dea/images_ecstasy.html



http://www.justice.gov/dea/images_cocaine.html



Image courtesy of Dr. Patricia Guerra-Diaz



<http://www.little-trees.com/>

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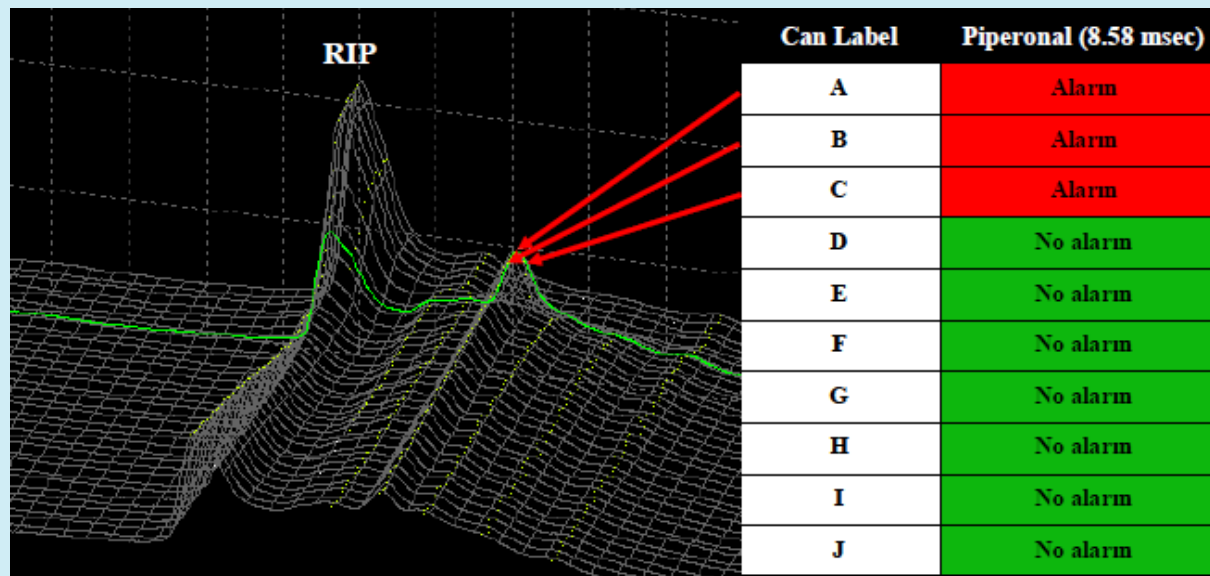
Possible Distractors

	<i>METHYL BENZOATE</i>		<i>PIPERONAL</i>	
<i>Household Items</i>	<i>Without Cocaine</i>	<i>With Cocaine</i>	<i>Without MDMA</i>	<i>With MDMA</i>
Green tea leaves	2096@5.120 msec 1550@5.435 msec	2652@ 5.105 msec 2588@5.456 msec	1470@7.338 msec	1849@7.369 msec 1056@8.577 msec
Rosemary	NONE	2099@ "	NONE	1347@ "
Oregano	1682@5.678 msec	N/A	1741@7.860 msec	1387@7.900 msec 1353 @ 8.577 msec
Hemp rope	NONE	2129@ "	NONE	922@ "
Dried mushroom	NONE	2103@ "	1141@7.081 msec	1294@ "
Sesame seeds	NONE	2256@ "	1310@7.351 msec	1361@ "
Black pepper	2049@6.688 msec	2080@ " 2512@6.737 msec	NONE	1300@ "

Marijuana - No interference

Data from Lai (2010)

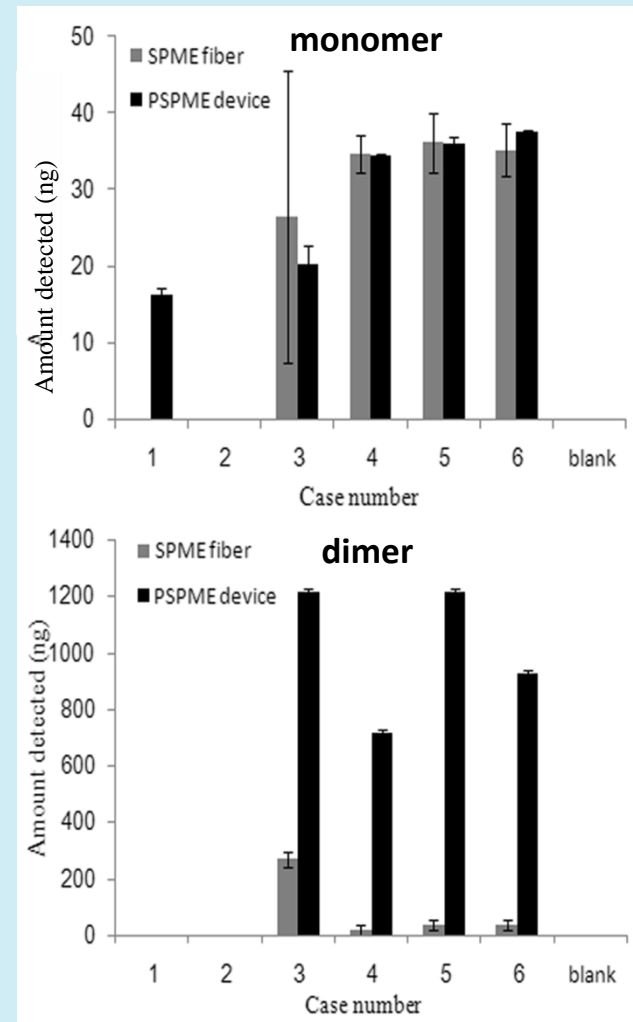
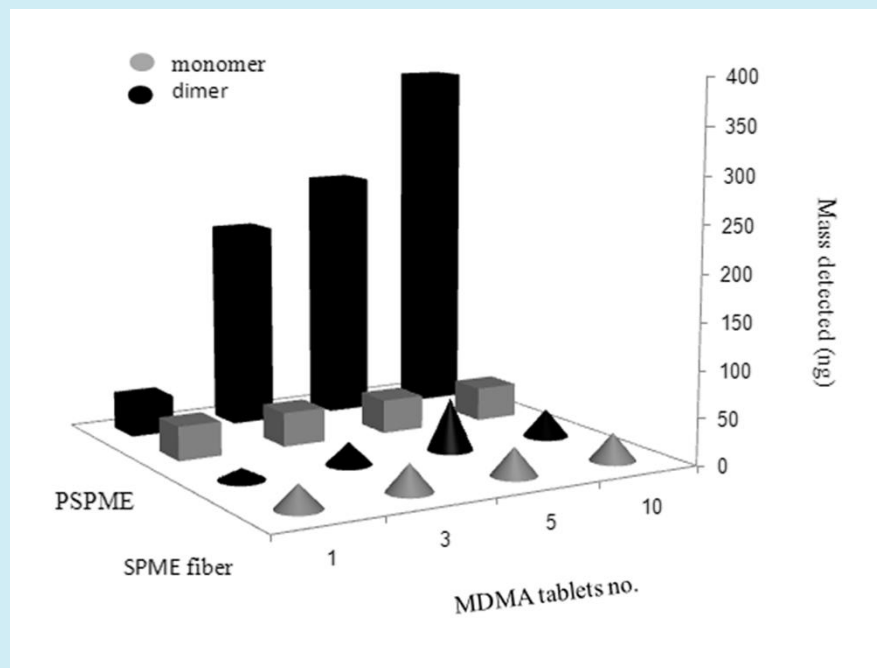
MDMA Blind Study – SPME-IMS



Lai (2010)

MDMA Blind Study – PSPME-IMS

Seized drugs were sampled and analyzed using the static PSPME-IMS method at Miami-Dade Police Department, Crime Laboratory Bureau.



Gura, Guerra-Diaz, Lai, and Almirall (2009)

Canine Distractors

- MythBusters, Season 8, Episode 12
- Potential distractors tested
 - Coffee
 - Citronella
 - Bleach
 - Perfume
 - Peanut butter

BUSTED!

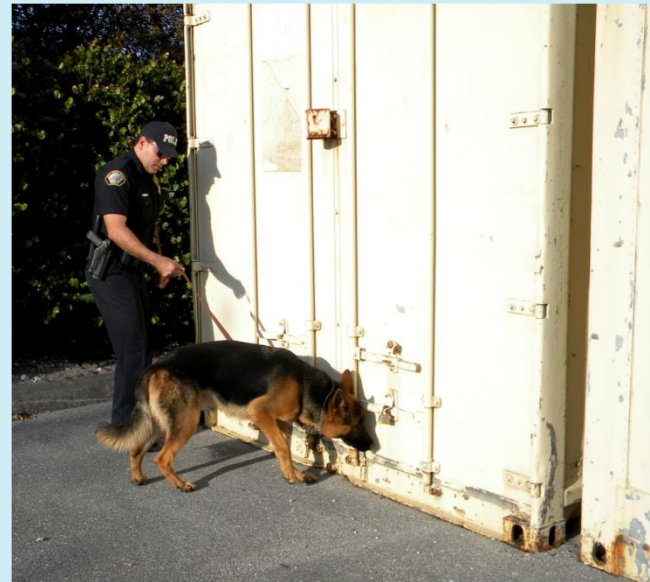


Image courtesy of Dr. Patricia Guerra-Diaz

MythBusters, Hair of the Dog

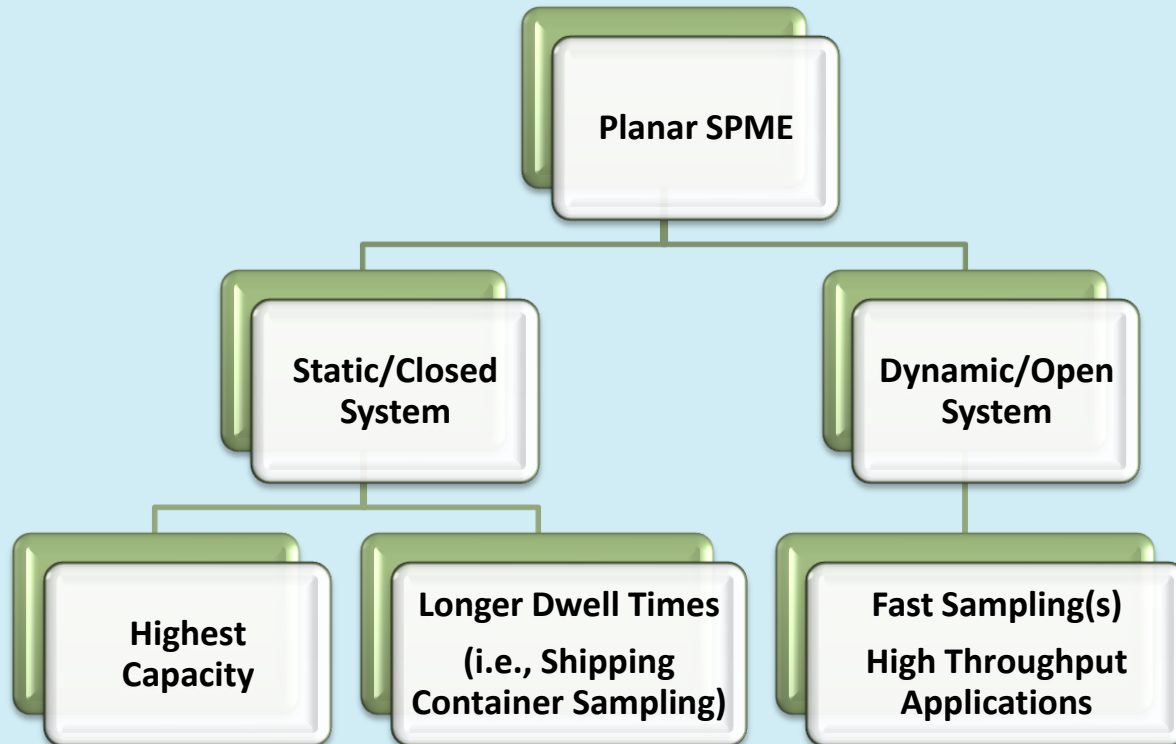
- <http://dsc.discovery.com/videos/mythbusters-hair-of-the-dog/>



[MythBusters S08E18 Hair of the Dog](http://dsc.discovery.com/videos/mythbusters-hair-of-the-dog/)

Conclusions

- Sample media for surface wipe sampling may be evaluated (instrumental, visual) using NIST SRM 2905
- When sampling for vapors, note potential background interferences such as green tea for cocaine



Conclusions (Continued)

- **Vehicle sampling**
 - Particle sampling (steering wheel, door handle, gear shift)
 - Vapor sampling (dynamic PSPME near suspicious item)
 - Cases where PSPME-IMS may be used as a presumptive test
- **PSPME advantages**
 - Low cost
 - Easy to use
 - Adaptable to existing IMS systems
 - Sampling options

Cited Scientific References

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(accessed August 25, 2011)

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Questions?

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