



Dry Transfer Methodology

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Science and Technology

or Dry Transfer Methodology

- *The Good, the Bad and the Ugly*



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Qualitative and Quantitative Analysis of Explosives

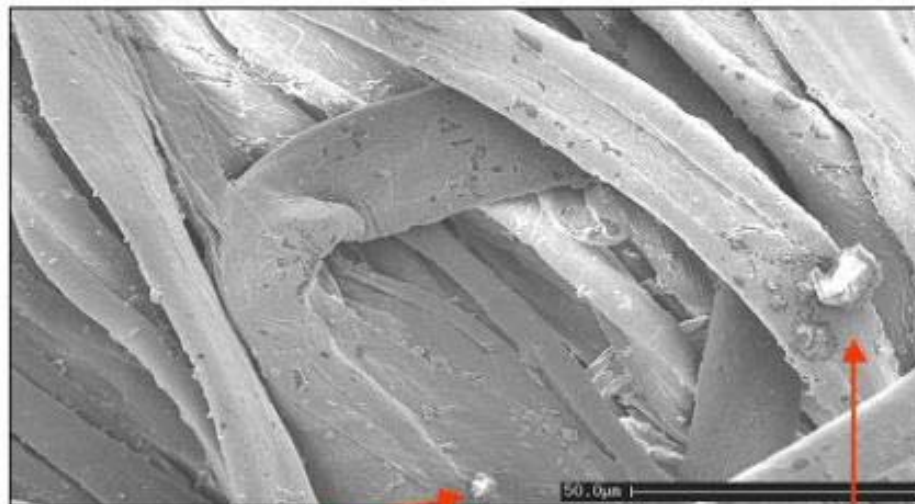


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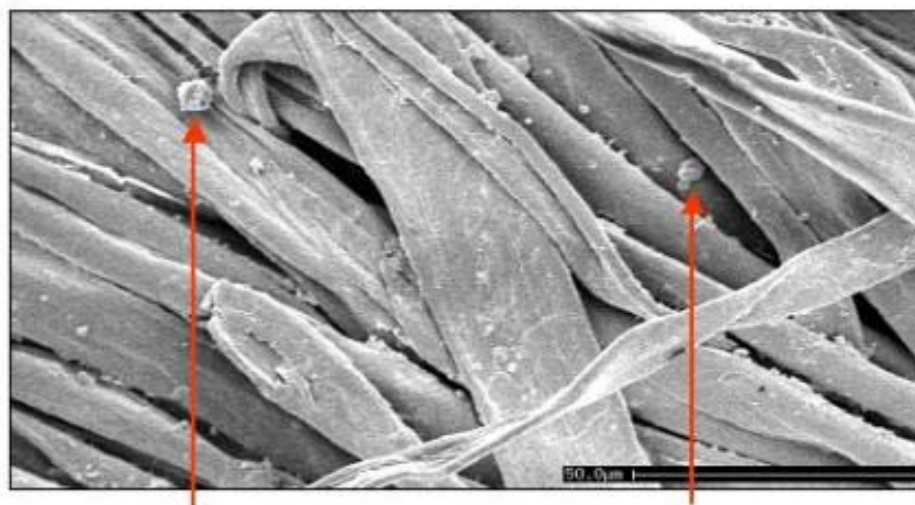
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Microscopy of Explosives

Fingerprint



Dry Transfer

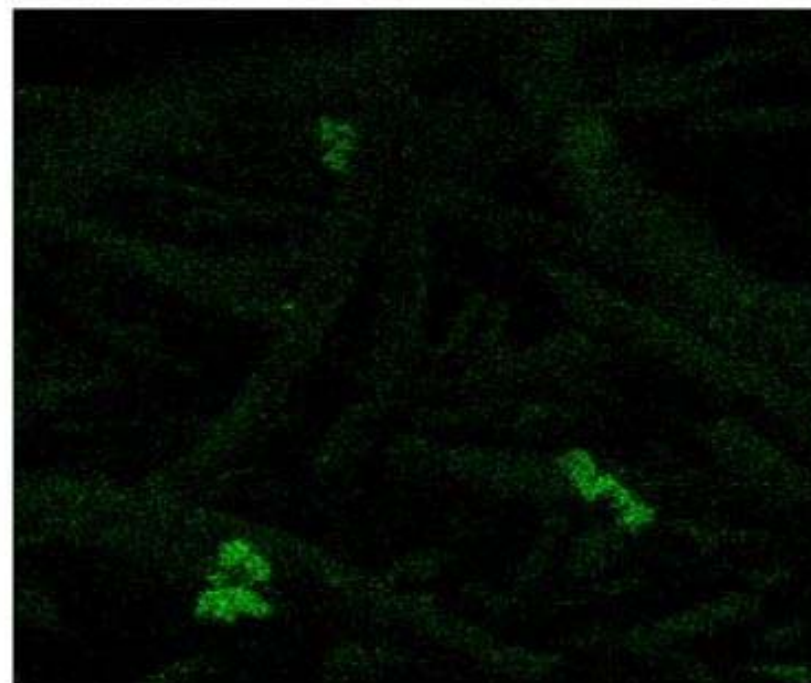
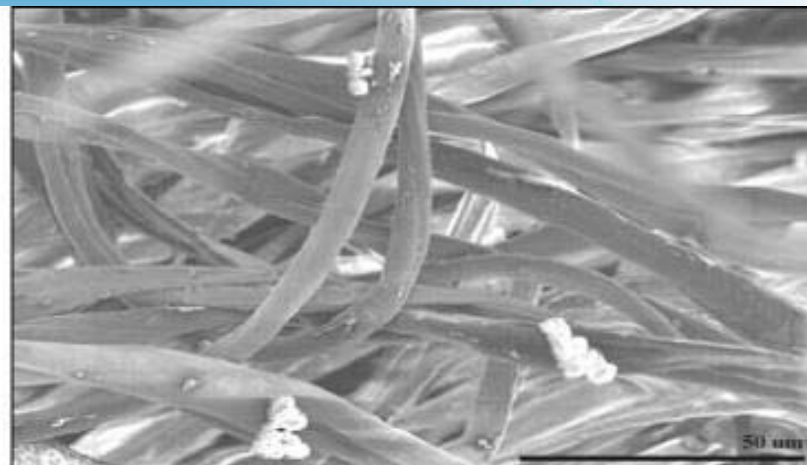


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Microscopy of Explosives

X-Ray Mapping
(Dry Transfer)

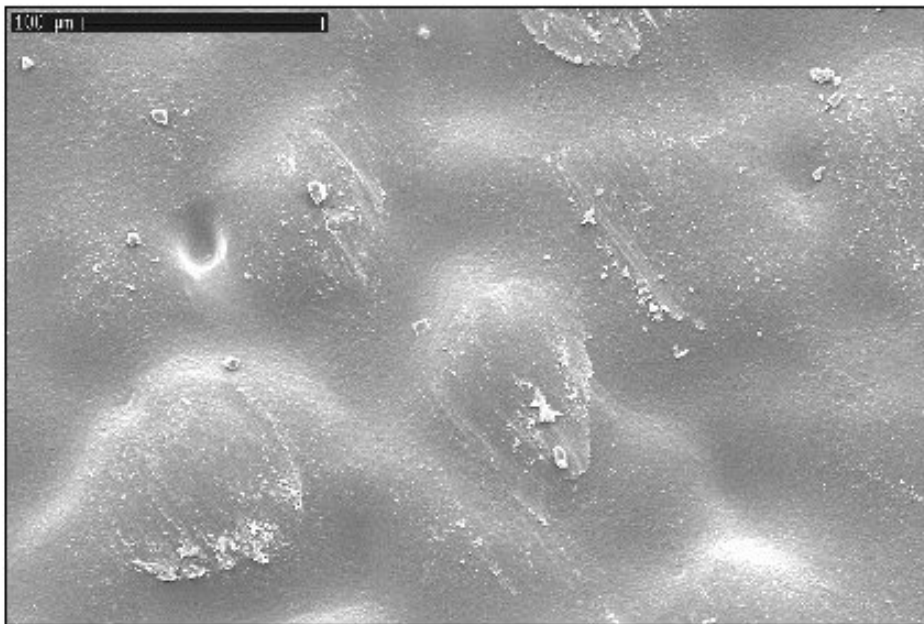


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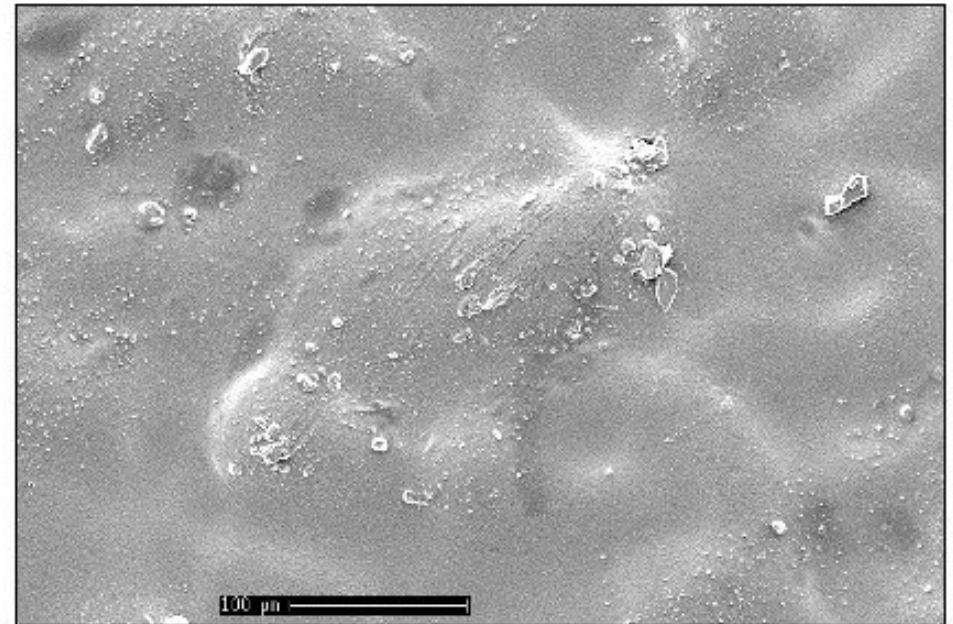
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Microscopy of Explosives

Fingerprint



Dry Transfer



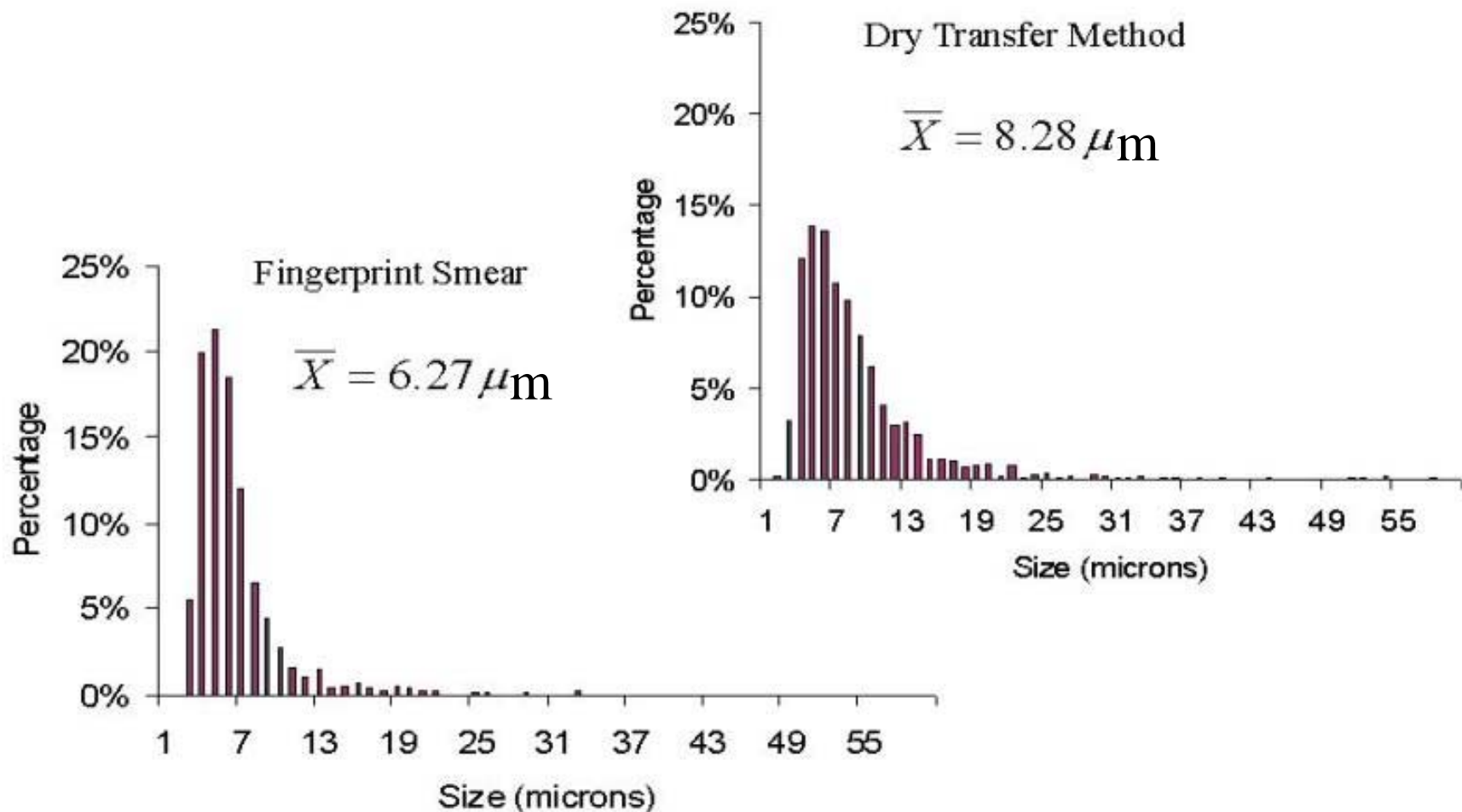
SEM of floppy diskette surfaces



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Particle Sizing of C-4 on Flannel Patch



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Ref: TSL internal Techn. Report, @1999.

Standard Solution Prep;

- TSL prepares each threat standard solution via real explosive particles (powders), weighed and dissolved in carefully chosen solvents. These working solutions are then diluted to the requested concentrations, and QC performed.
- Alternatively, one could use COTS purchased standards and dilute, and perform QC.
- Deposition of standard is performed with calibrated micro-pipettes, carefully controlling the volume desired (e.g., 10 or 20 ul).



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System Quality Control (SQC) Test Kit



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System Quality Control

Dry Transfer Method

- Patent #647030, by Dr. Tom Chamberlain, PhD (retired)
- Secondary transfer of explosives onto a surface
- Rub firmly against the surface 3-4 times (back and forth motion)
- Explosive precipitate is quantitative, stable, and reproducible

Application

- Laboratory setting
 - R&D
 - Pre-certification
 - Certification
 - Acceptance testing of prototype ETDs
 - ***Part of procedures for measuring swipe sampling efficiencies.***



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System Quality Control (cont.)

- Applicable to all surfaces - hard and soft, smooth and rough, solid and porous
 - ABS plastic
 - Vinyl
 - metal
 - Muslin
 - Luggage surfaces
 - ID Badges
 - Boarding Pass
 - Passport
 - Clothing
 - Etc.



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Dry Transfer Methodology;

Direct transfer consists of depositing DEWS (or solvent) onto an SQC strip, allowing the solvent to evaporate, and dry transferring the material on the strip to ETD sampling media. A dry box is used to dry the solvent or explosive doped SQC strips.

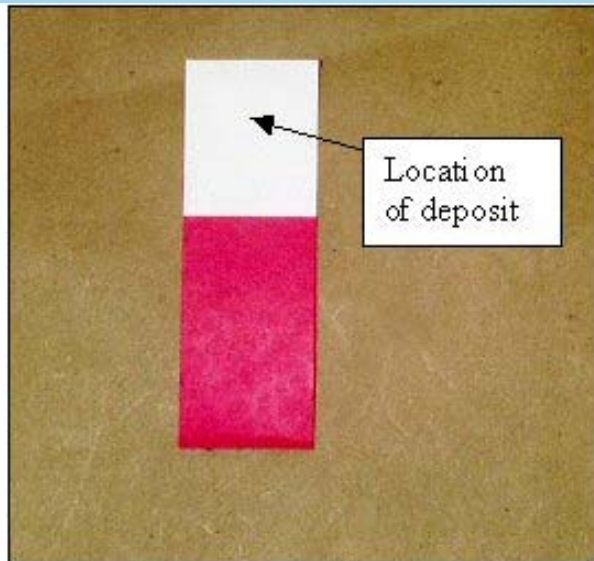
- **DEWS = Dissolved Explosives Working Solution**
- **SQC = System Quality Control check**



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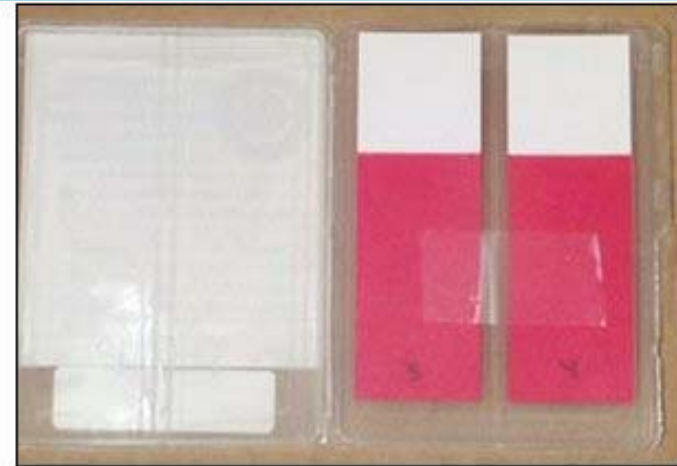
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SQC Kit Components; TSL old material



3" x 1"

- Red portion is manila paper
- White portion is Bytac[®] plastic



Plastic Mailer



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SQC Kit Components – New material

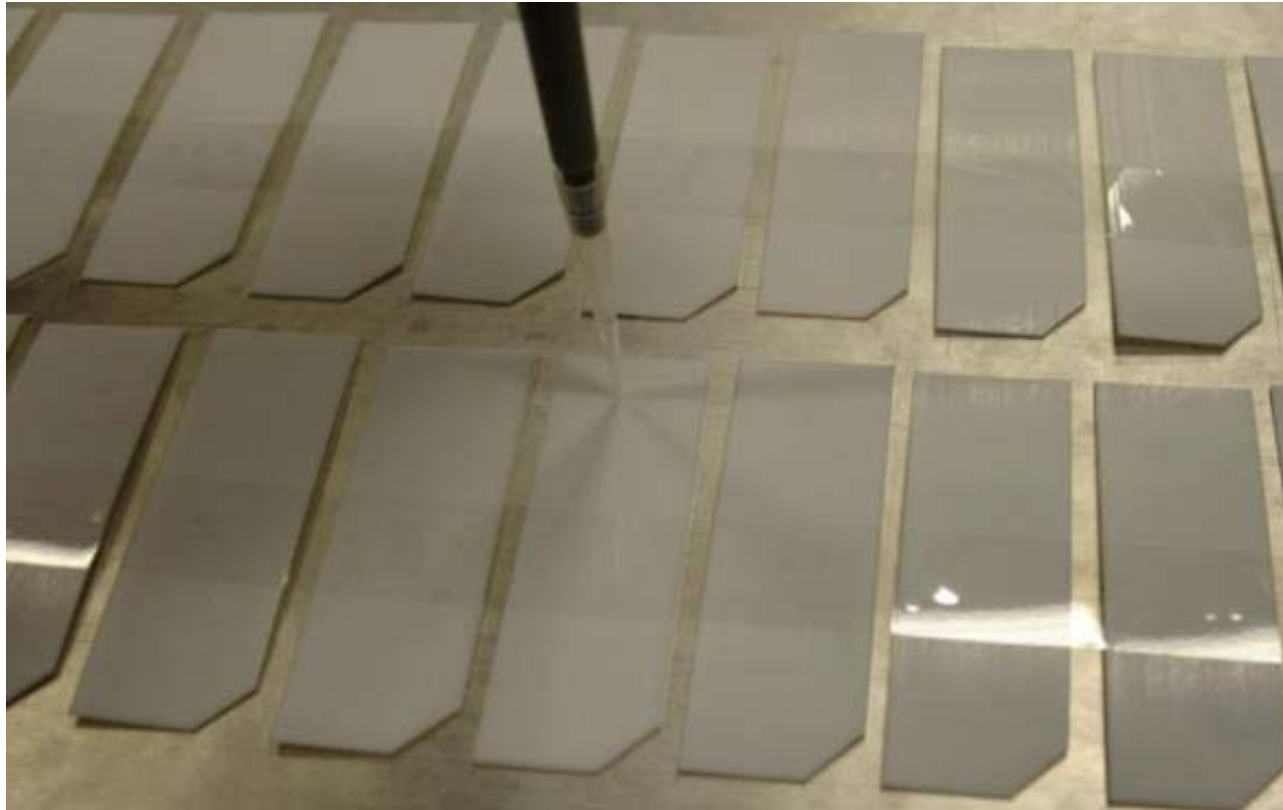


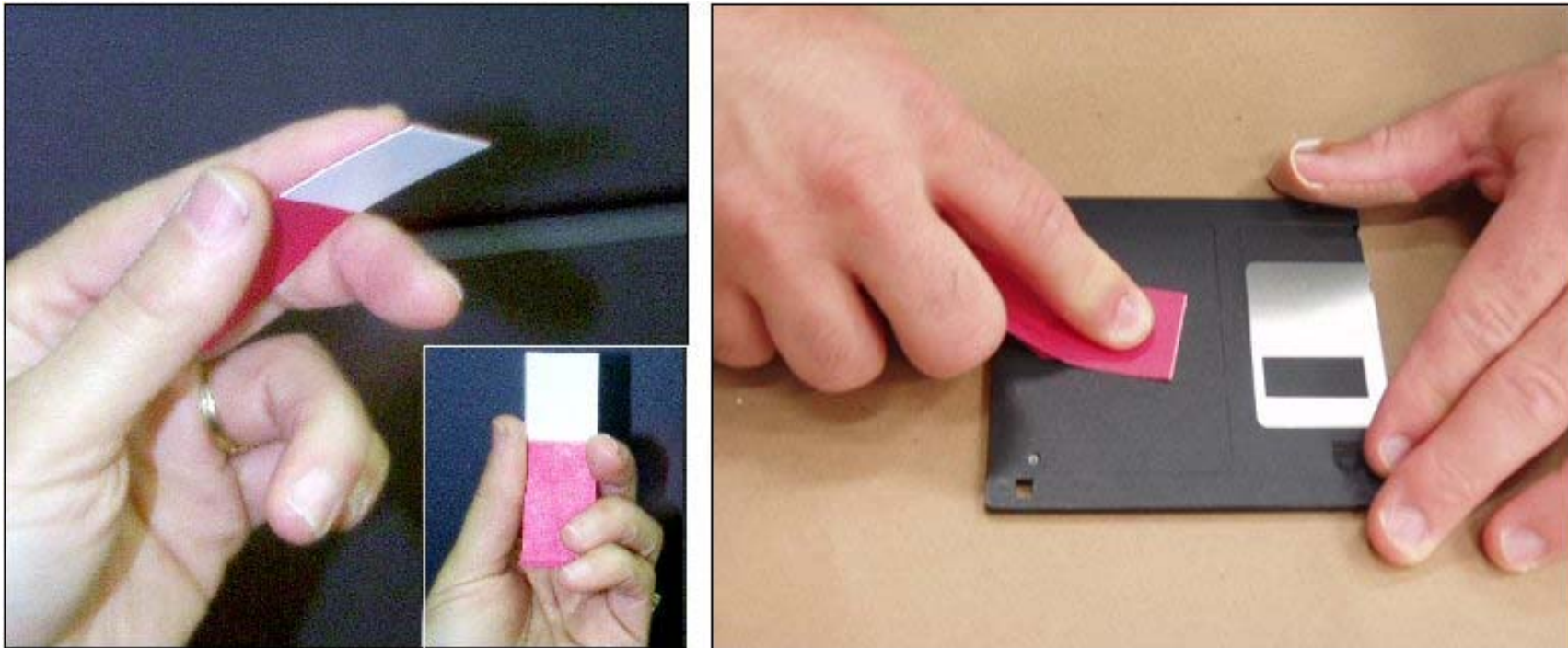
Figure - Depositing onto a SQC Strip



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SQC – Application to a Surface



Rub firmly against the surface back and forth 3-4 times.



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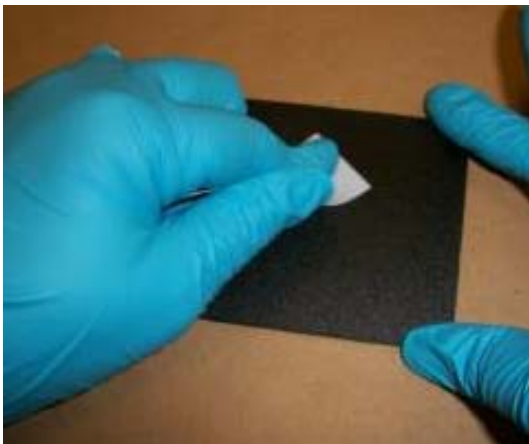
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Preparing and Using Dry Transfer Strip

- Deposition Area



- Figure 7. How to properly hold SQC strip prior to dry transfer and location of deposition area.



- Figure 8. Test substrate with dry transfer being performed



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Applying Dry Transfer to a Test Surface

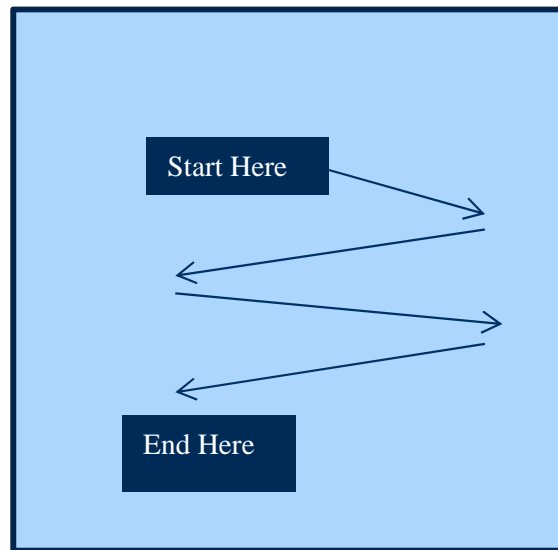


Figure - Example of direction of multi-cycle dry transfer



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Quality Control assessments;

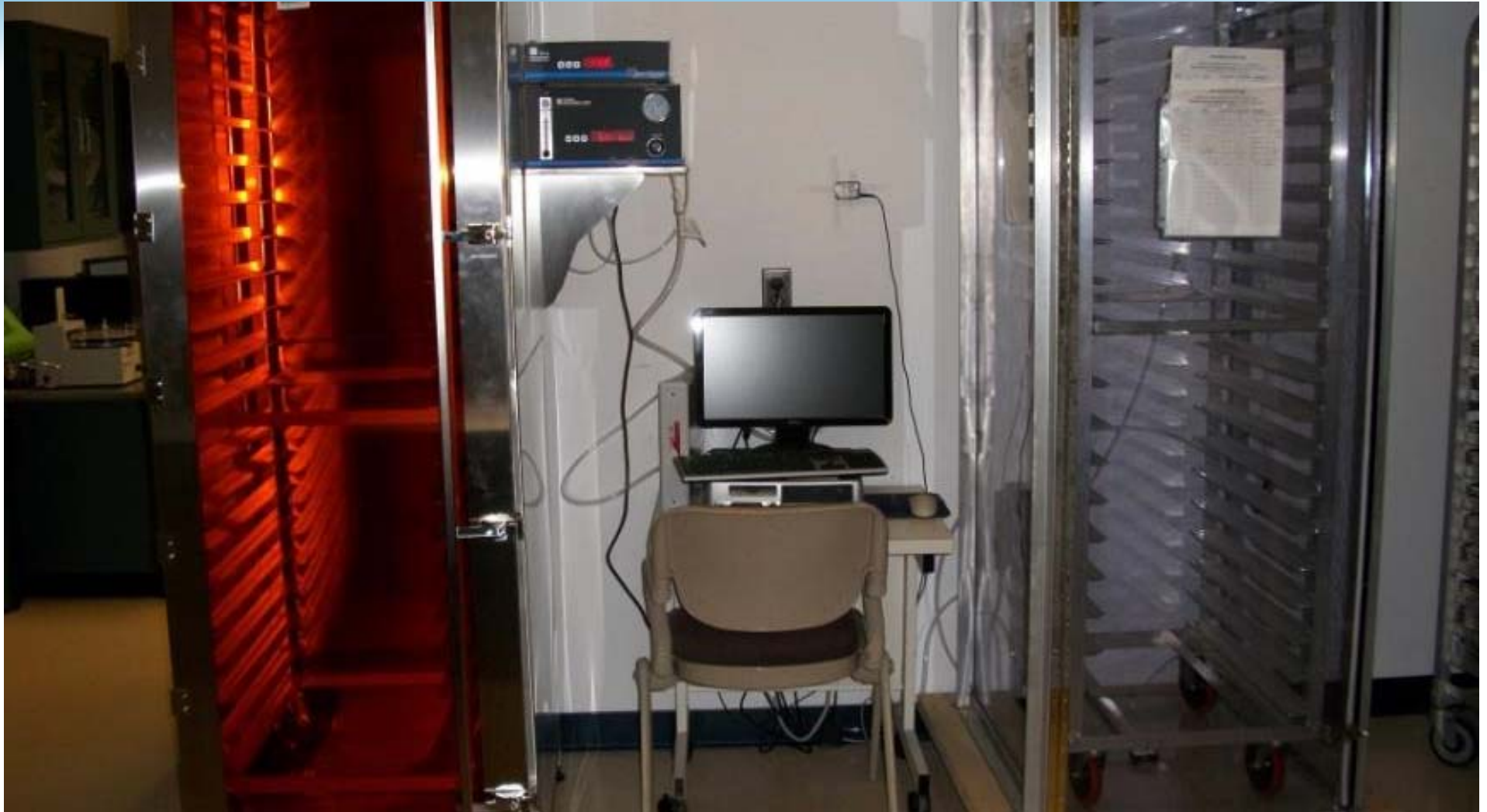
- **Solvent extract all deposit from SQC and perform analysis (e.g., GC, HPLC, IC, TD-MS, etc.).**
- **Solvent extract remaining deposit from SQC, after transfer of deposit onto test substrate; perform analysis.**
- **Deposit threat/solvent directly into analytical vial, rather than Teflon SQC strip; perform analysis.**



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Controlling drying time/envirom conditions



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Dry boxes with N2 flow & environmental monitoring

SQC – Percent Recovery Study

Analytical Instrument: HPLC

C-4 Disks, 100ng	90%
C-4 Disks, 300ng	94%
C-4 Handles, 100ng	106%
Detasheet Disks, 100ng	104%
Detasheet Disks, 300ng	97%
Semtex-H Disks, 100ng (RDX)	105%
Semtex-H Disks, 300ng (RDX)	101%
Semtex-H Disks, 100ng (PETN)	111%
TNT Disks, 300ng	84%
TNT Handles, 300ng	58%
AVERAGE	95%



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SQC – Percent Recovery Study

	Ionscan 400B Cloth	EGIS II Tab	Itemlser² Paper	Itemlser² MUST	Itemlser³ Teflon	AVERAGE (for RDX)
SQC→ swab	97%	83%	98%	96%	70%	89%

Analytical Instrument: GC



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SQC – Percent Recovery Study



1000ng Teflon Strip Residual RDX Analysis

Sample	Solution Conc. (ng/ul)	Residual Qty. (ng)	Transferred Qty. (ng)
T-1	0	0.0	1000
T-2	0.1404	70.2	930
T-3	0.3348	187.3	813
T-4	0.4800	240.0	760
T-5	0.0035	1.8	998
T-6	0.0888	42.8	957
T-7	0.0788	37.8	962
T-8	0.8044	282.2	718
T-9	0	0.0	1000
T-10	0.0471	23.8	976
AVERAGE TRANSFER QUANTITY-->			918
Average Recovery: 92%			

3000ng Teflon Strip Residual RDX Analysis

Sample	Solution Conc. (ng/ul)	Residual Qty. (ng)	Transferred Qty. (ng)
T-11	1.285	642.5	2358
T-12	0	0.0	3300
T-13	0.7402	370.1	2630
T-14	1.488	727.6	2273
T-15	1.662	831.0	2169
T-16	0.8025	281.3	2719
T-17	0.4243	212.2	2788
T-18	0.7720	388.0	2914
T-19	0.1848	82.0	2918
T-20	0.5856	282.8	2717
AVERAGE TRANSFER QUANTITY-->			2821
Average Recovery: 87%			



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Summary

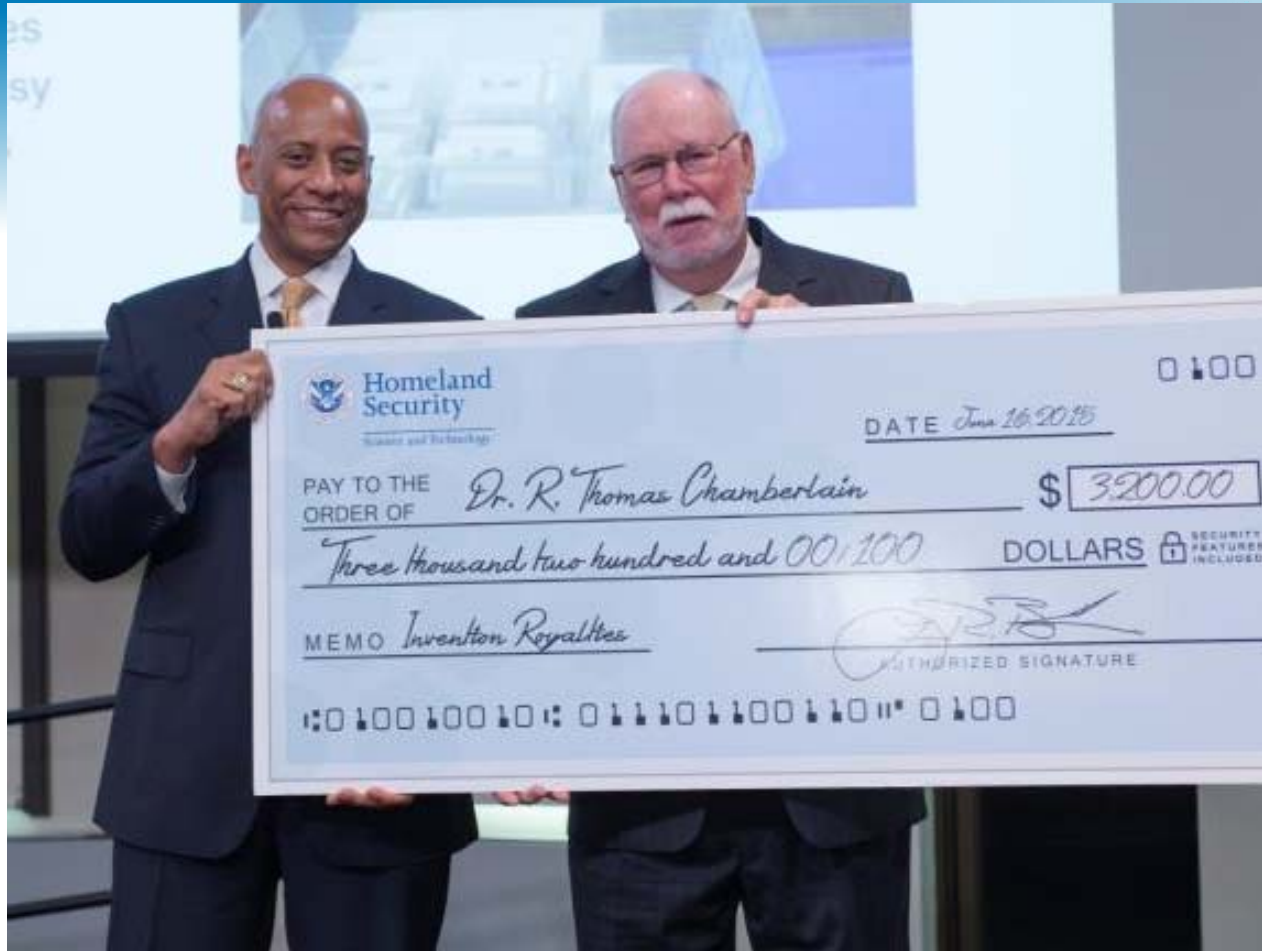
Use of Dry Transfer;

- * developed for specific laboratory use
- * reasonable approximation of original threat properties
- * quantitative
- * transfers approximately 90% from Teflon to substrate (varies per analyte/solvent and environmental conditions)



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Recent DHS US Patent Ceremony – Dry Transfer Royalty Check...



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