Defense Forensic Science Center

Database Development and Product Variability in Lubricant Materials

Jeffrey Dake*, MSFS
DFSC – Office of Quality, Initiatives, and Training
Edward Sisco, PhD
NIST – Surface & Trace Chemical Analysis Group (MML)

Trace Evidence Data Workshop: Improving Technology and Measurement, July 19-20, 2016

Disclaimer

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

Names of commercial manufacturers or products included are incidental only, and inclusion does not imply endorsement by the authors, DFSC, OPMG, DA or DoD.

Unless otherwise noted, all figures, diagrams, media, and other materials used in this presentation are created by the respective author(s) and contributor(s) of the presentation and research.

Outline

1. Purpose
2. Composition
3. Variation
4. Current Database
5. Other Factors
6. Direction
7. Summary

Purpose

- Improve interpretation of lubricant evidence
- Why?
  - Encountered in sexual assault (SA) cases: condom use, object/digital penetration, sodomy
  - Make up a meaningful portion of SA cases: 11.7%-15.6% of cases (n=841)*
- Challenges:
  - Many materials common to environment
  - Materials typically not controlled

*O'Neal, Decker, Spohn, Tellis, "Condom use during sexual assault" ,Journal of Forensic and Legal Medicine, 20 (2013) 605-609.

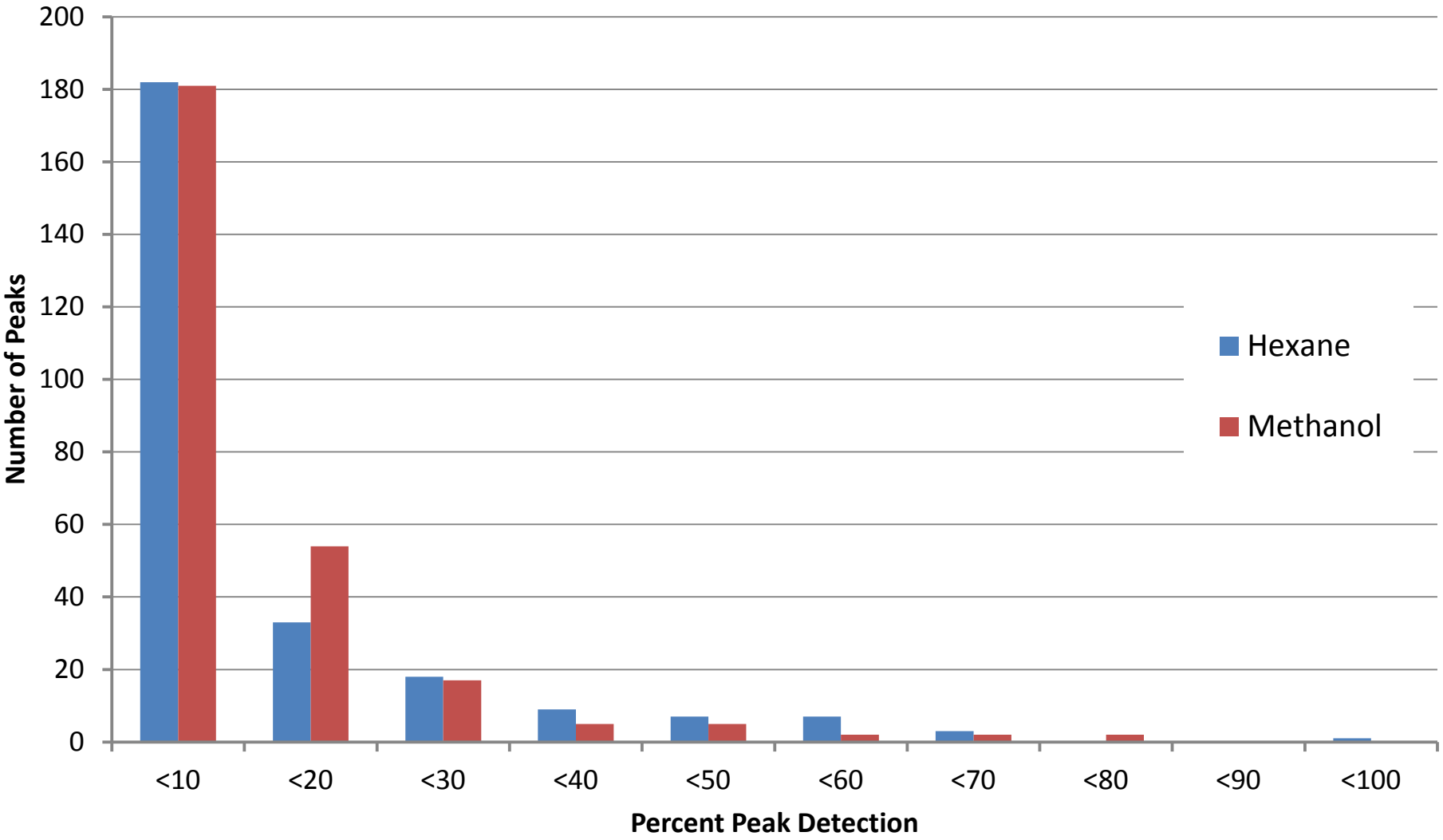
Composition

- All classes:
  - Lubricants
  - Texture elements
  - Preservatives
- Condoms/Sexual lubricants:
  - Active ingredients
- Lotions:
  - Emollients
  - Humectants
  - “Effect” components

Variation

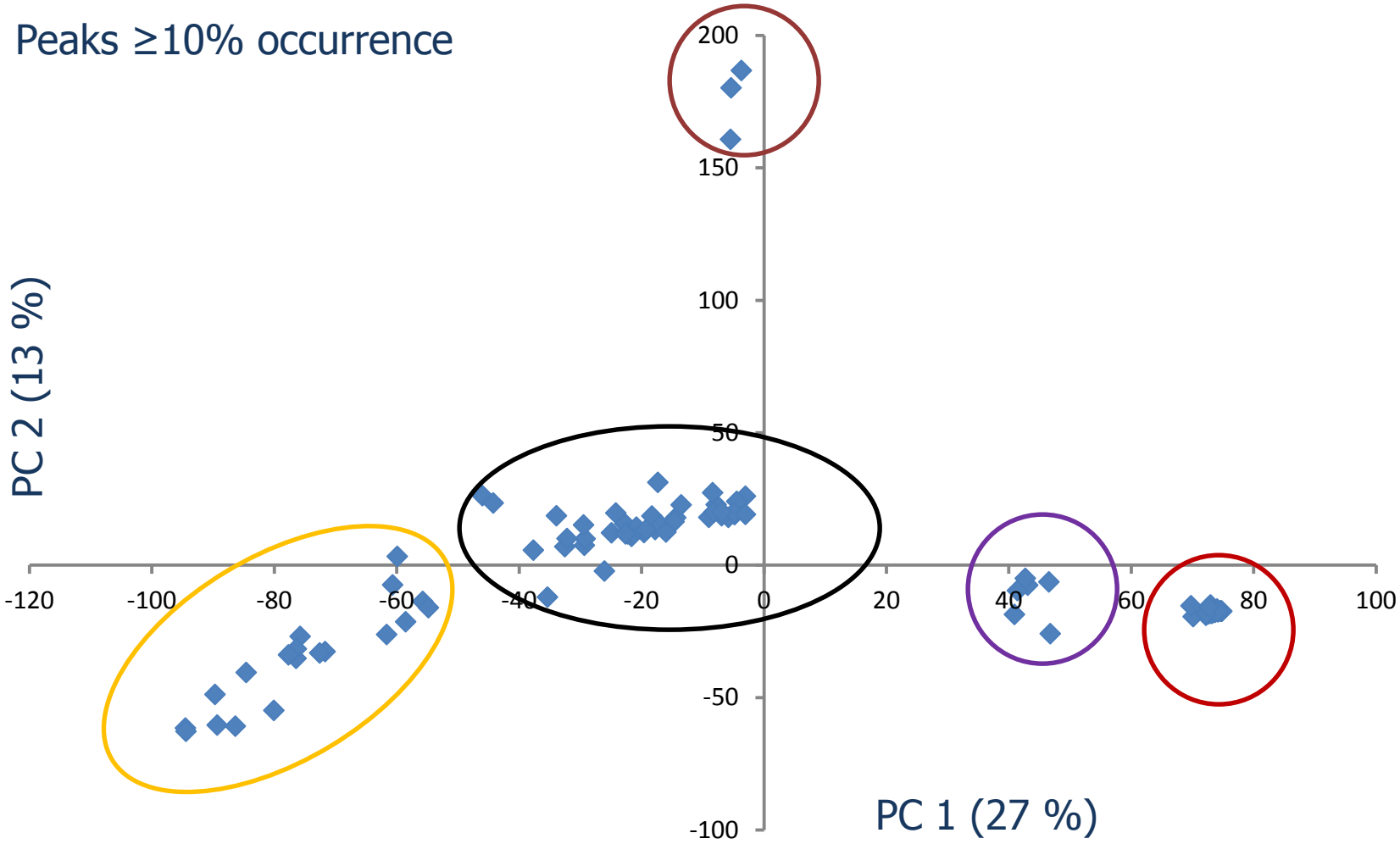
- Few basic lubricant materials
- Total composition differs between condoms/lubricants vs lotions/cosmetics
- Few points of analysis in lubricants
- Wider variability in lotions
- Goals:
  - Discriminate class
  - Discriminate product
  - Discriminate lots

Compound Frequency in Lotions



PCA – Methanol Day 0 DART

Peaks ≥10% occurrence



Current Database

- Contains over 200 samples (some replicates)
  - 98 condoms
  - 86 lotions
  - 60 sexual lubricants
- Expansion
  - New product lines
  - Exemplars from different manufacturing sites/lots
  - Detergents
  - Cosmetics

Condom Data

Brand	PDMS	%	PDMS & Starch	%
Durex™	22	88%	4	16%
Lifestyles™	32	97%	31	94%
Trojan™	24	77%	18	58%
Other	8	89%	3	33%
Total	86	87%	56	57%

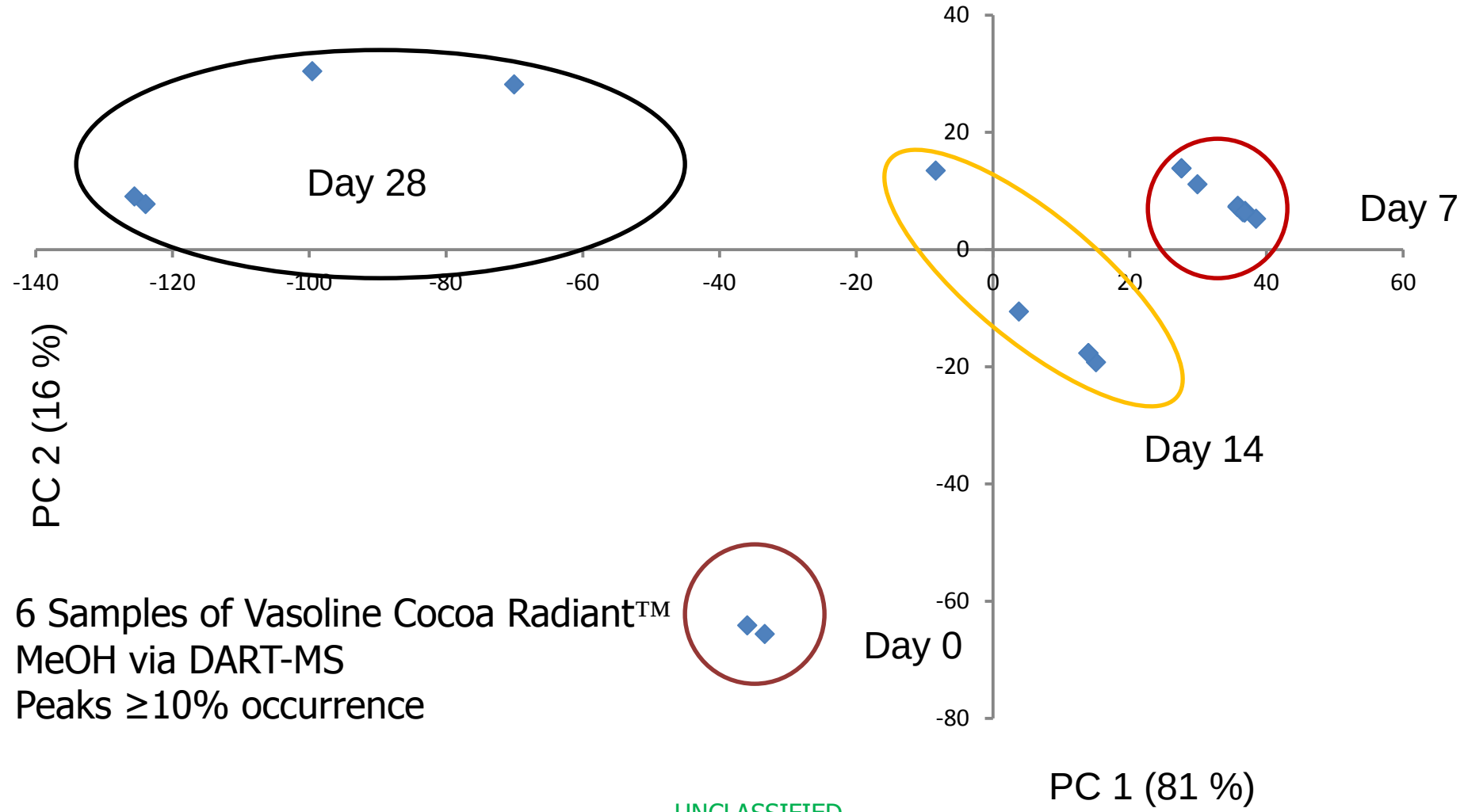
Condom Data Cont.

Condom Brand	N-9	N-9 + PDMS	Pro-glycol	Glycerin	PEG	Other
Durex	1 (5%)	1 (5%)	4 (16%)	0 (0%)	3 (12%)	4 (16%)
Lifestyles	9 (27%)	8 (24%)	6 (18%)	4 (16%)	0 (0%)	3 (9%)
Trojan	6 (19%)	0 (0%)	9 (29%)	3 (10%)	4 (13%)	9 (29%)
Other	1 (11%)	0 (0%)	1 (11%)	0 (0%)	1 (11%)	2 (22%)
Total	17 (17%)	9 (9%)	20 (20%)	7 (7%)	8 (8%)	18 (18%)

Additional Factors

- Mixtures
- Loss on the body/clothing
- Transferability
- Stability of source/unknown
- Regulatory issues
- New product development

Variability Based on Aging



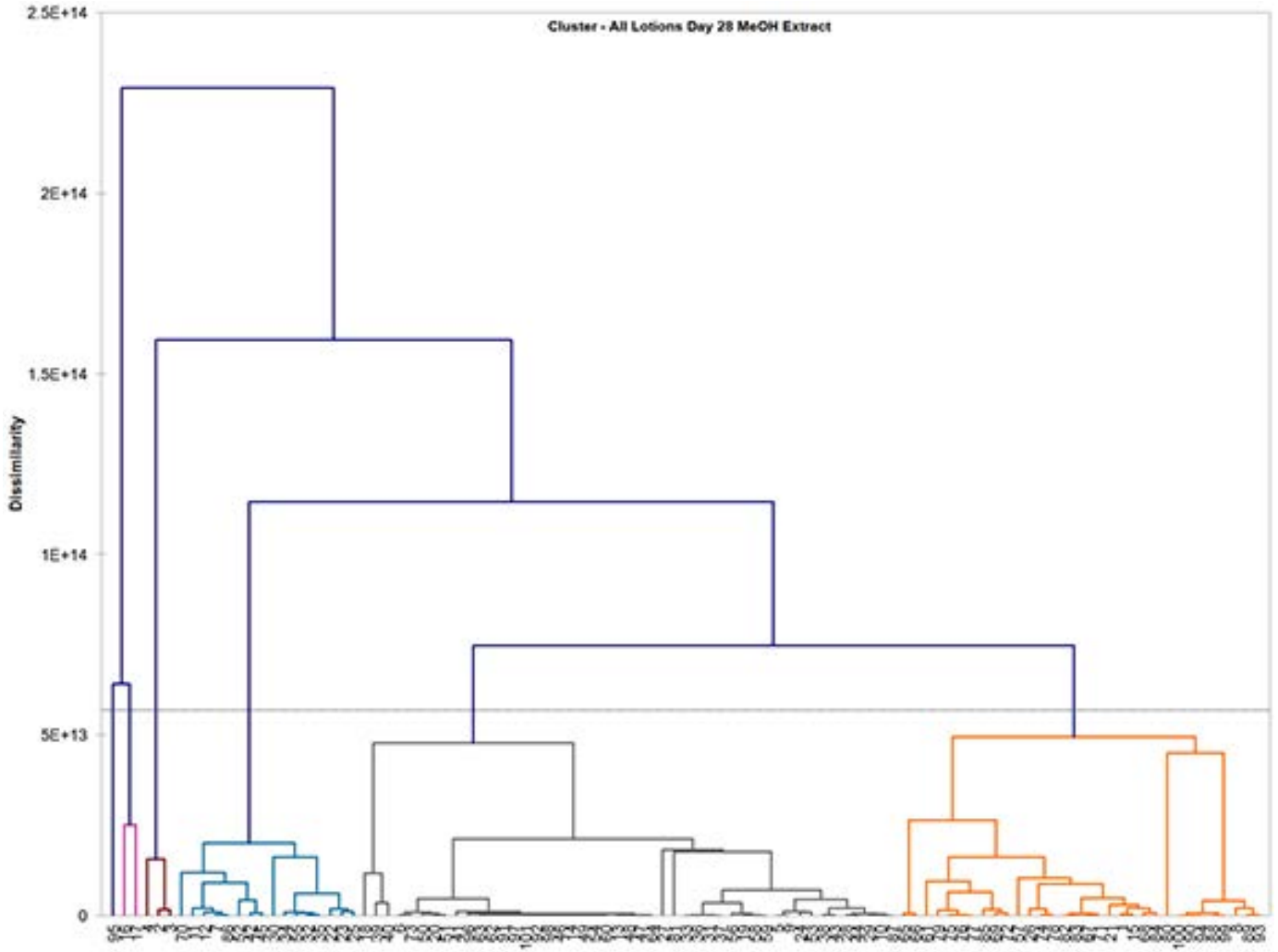
6 Samples of Vasoline Cocoa Radiant™
MeOH via DART-MS
Peaks ≥10% occurrence

Direction

- Expand library*
- New analytical methods*
- Long term trends in product lines
- Further statistical population discrimination
- Persistence studies*
- Classification scheme

*Denotes projects in progress at DFSC

Cluster Analysis



Summary

- Basis for variability proven
- Database will lead to classification
- Expanded analysis will define limits of selectivity
- Persistence will refine value

Acknowledgement

James Adams, BS – Forensic Chemist, DFSC

Derek Dorrien, MS – Forensic Chemist, DFSC

Richard Lute, BS – Forensic Chemist, DFSC

Kate Schilling, PhD – Forensic Chemist, DFSC

Jeffrey Dake

Chemistry Technical Leader

Jeffrey.h.dake.civ@mail.mil

404-469-4566