Versatile and Fast On Site Analytical Programs for Today's High-Resolution Site Characterizations

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Outline

- Rationale for Onsite Laboratories
- Current State of the Practice
- SPME with GC/MS Configurations
- Optimizing Onsite Analytical Programs
- Conclusions

Rationale for Onsite Labs

- Starts with HRSC, Life cycle cost savings
  - More Accurate CSMs
  - Targeted, cost effective remedies
- Onsite Analytical
  - High Density Sampling >>>lower cost per sample
  - Dynamic work strategies >>> fast TAT, more efficient characterizations

Current State of the Practice

- Three Categories
  - GC and GC/MS Suitcase
  - GC/MS DSITMS
  - GC/MS, benchtop, EPA 8260

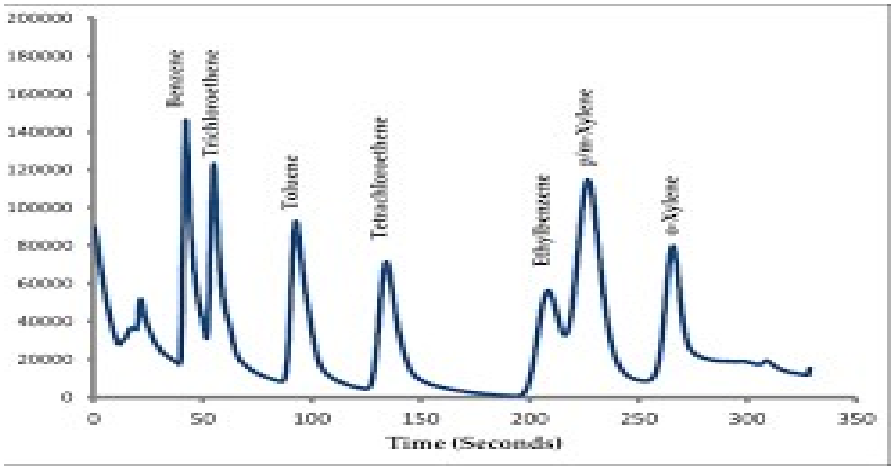
Current State of the Practice

- Lots of things to consider
  - Data Quality Objectives
  - Site chemistry, levels and mixed plumes
  - Experience of users
  - Throughput requirements
  - Reporting requirements

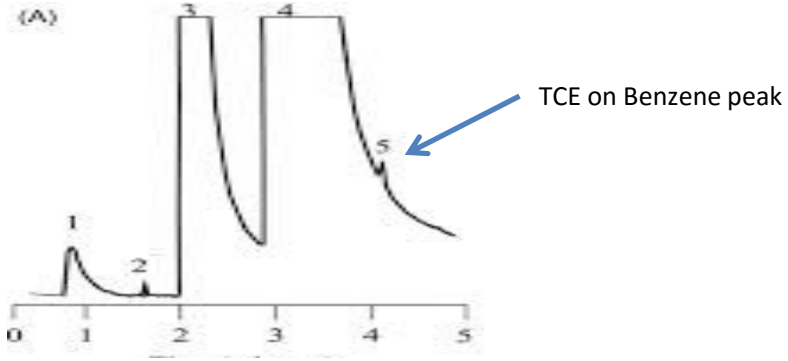
Current State of the Practice

Limitations of GC

Calibration Std
Easy quantitation

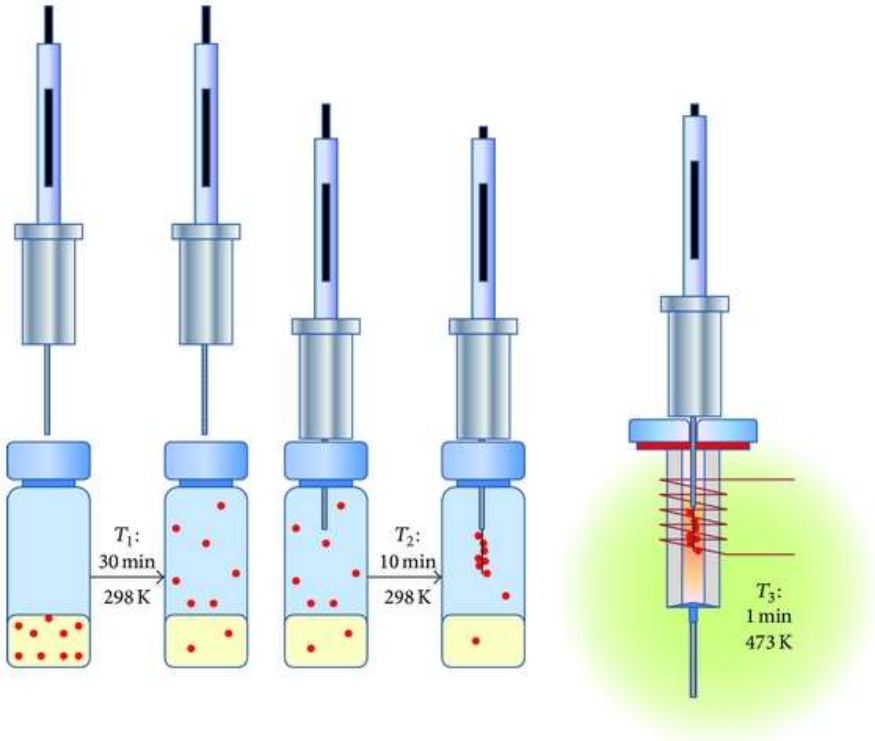


Real world sample
Difficult quantitation



Mass Spec not nearly as susceptible to this problem

SPME/GC/MS
Theory and Practice



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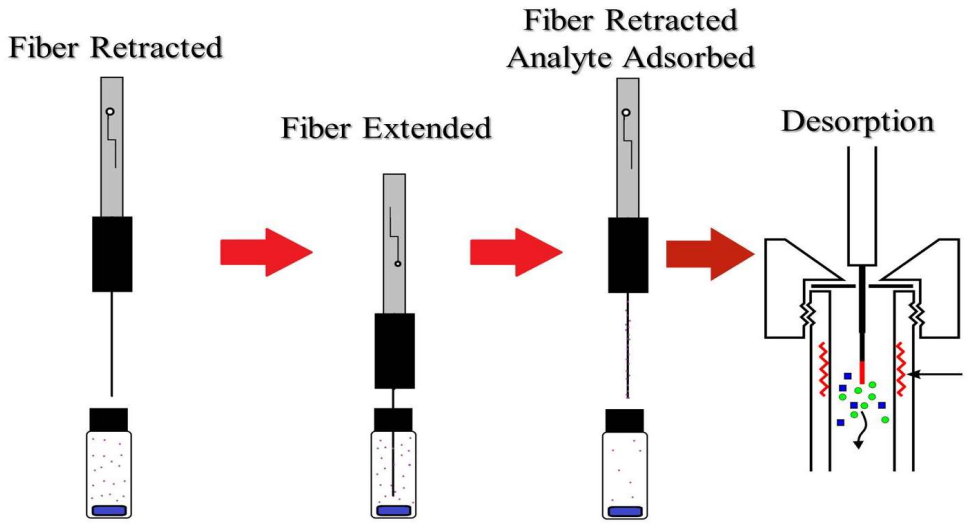
Theory and Practice: Sample Extraction/Introduction

- Alternative to P&T
- Solventless
- Immersion or headspace
- Absorbent and adsorbent
- Consistent timing
- Minimal Carryover



Multiple desorption steps to clean fiber between runs

Clean and Simple

SPME/GC/MS Configurations

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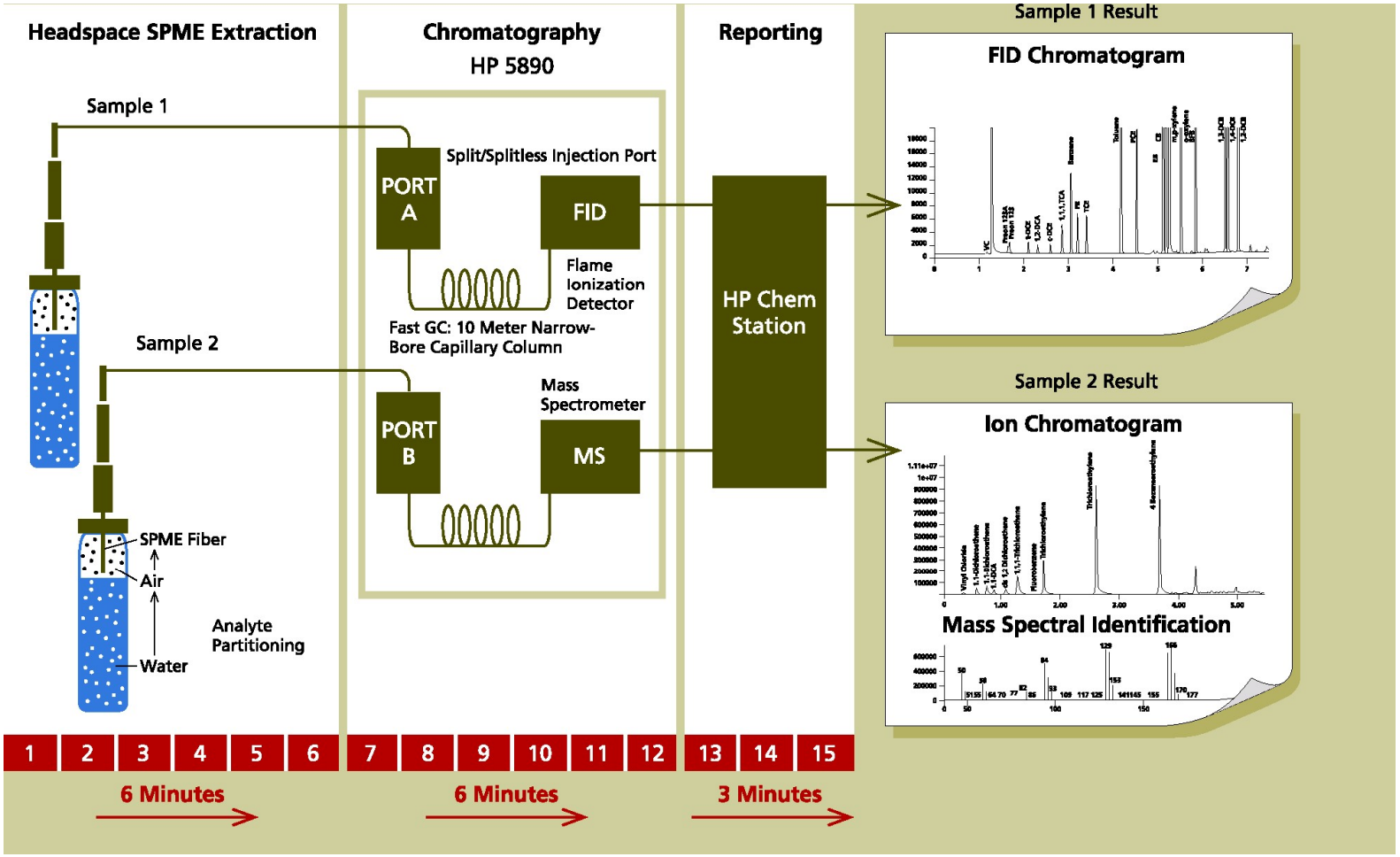
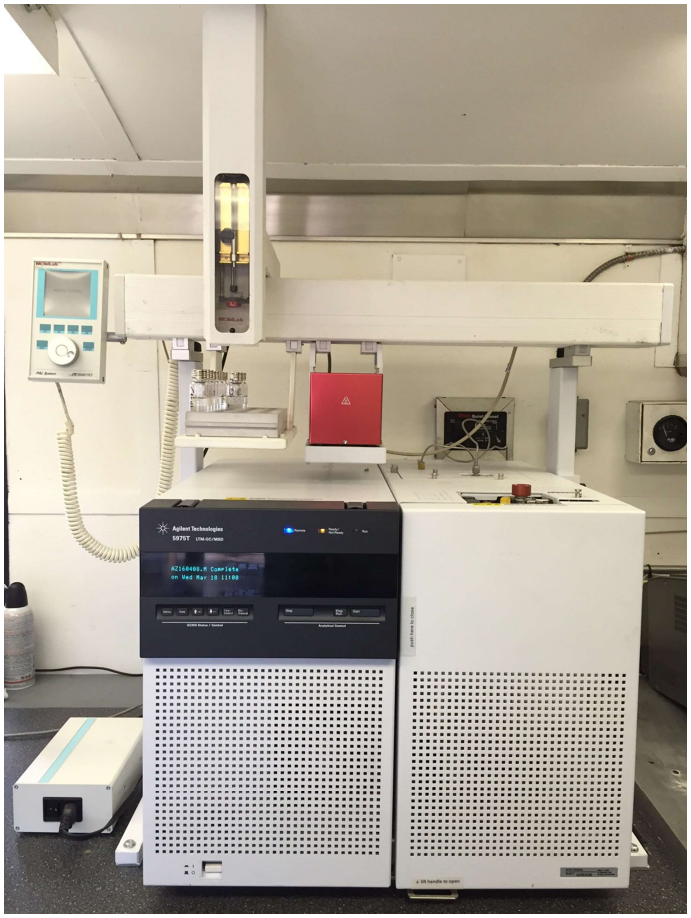
SPME – Dual Configuration Manual Sampling



SPME/GC/MS - Automated

- Increased P&A
- Easier to maintain Certifications
- Increase throughput
- Works after hours
- Various media
  - Groundwater
  - Soil/rock

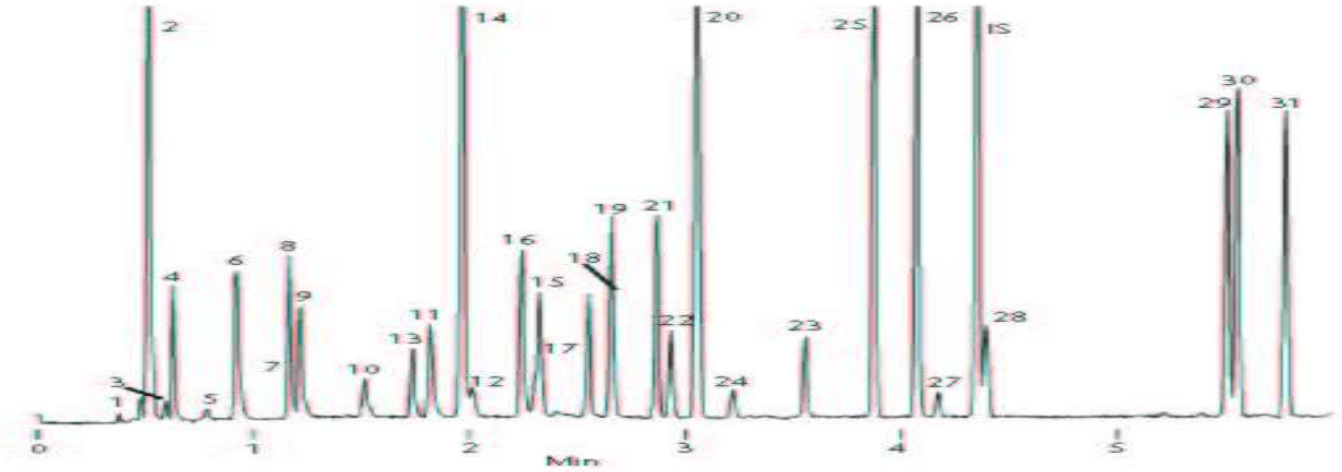


SPME/GC/MS – Groundwater
Fast and Standard Configurations

- Fast Program
  - Abbreviated List of 10-15 compounds
  - Run time = 9 minutes, includes 5 minute extraction
  - 67 runs in 10 hr day – equates to about 55 sample analyses
  - Over 90 runs in a 24-hr day with two chemists - ran out of samples
- Standard Program
  - 46 compounds
  - Run time = 15 minutes, includes 5 minute extraction
  - 40 Runs in 10 hr day – equates to about 30 sample analyses
- Certified Laboratory Methods

SPME/GC/MS – Groundwater
Project Appropriate Analytical Programs

- Standard Program with 35 VOCs, 1,4-dioxane and aniline
- Single SPME/GC/MS run versus potentially
  - Three separate analyses
  - Three separate samples



SPME/GC/MS – Soils

- Mid level, EPA 5035 – methanol preservation
- Low Level Method often not needed – DLs < 30 ug/Kg
  - P&T for cohesive soils underestimates mass
- Optimize Extraction Efficiency and Time
  - Disaggregation and suspension required for low permeability soils
  - Centrifuge often required to expedite analyses

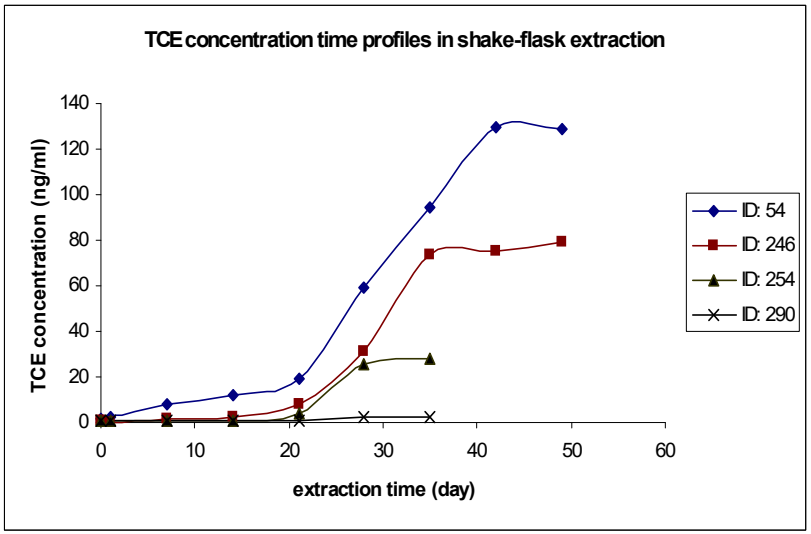
Orbital Shaker

40-ml VOA Centrifuge

SPME/GC/MS with Microwave Assisted Extraction for Soils/Rock That Won't Disaggregate

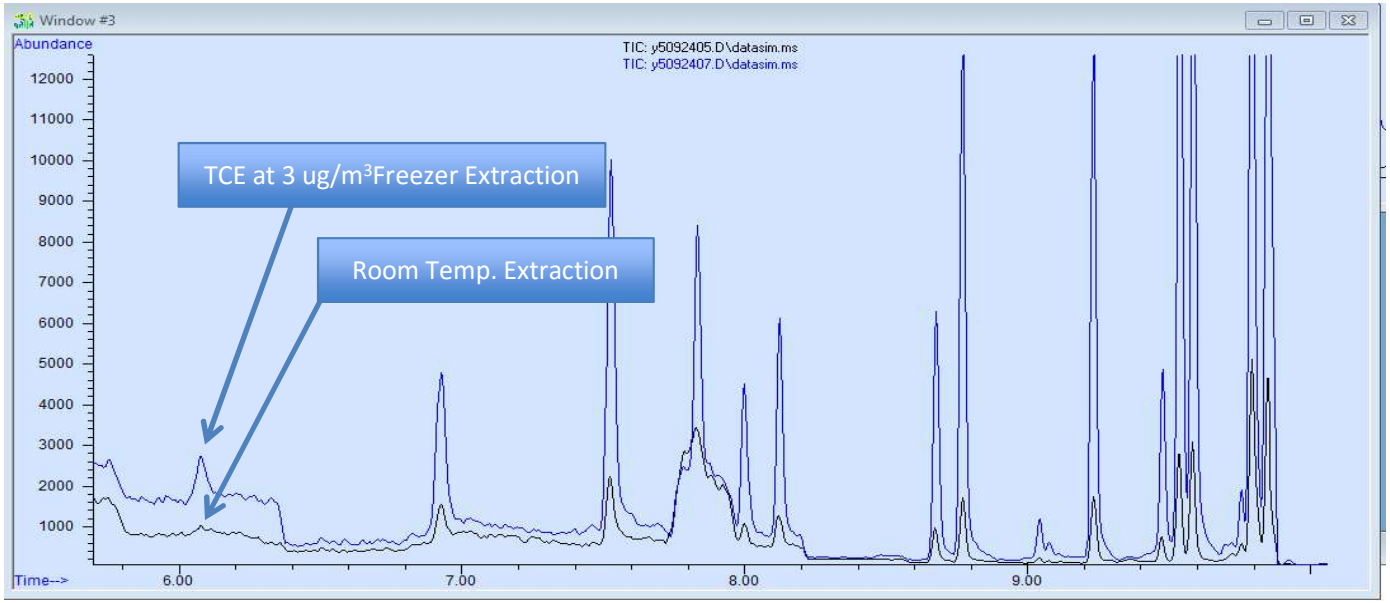
- Microwave Assisted Extraction
- 2 hr TATs versus weeks

Microwave – 24-place rotor



SPME/GC/MS – Soil Gas

- Manual Injections
- Screening level analyses
- Active soil gas samples collected into Tedlar bags
- Satisfy most sub slab action levels with DLs at single digit ug/m^3
- Effect of Temp of Extraction – improve DLs tenfold



Conclusions

- Design Project Appropriate Programs
- Staff Lab Appropriately
- SPME Can Provide Robust and Versatile Lab Solutions

Questions?

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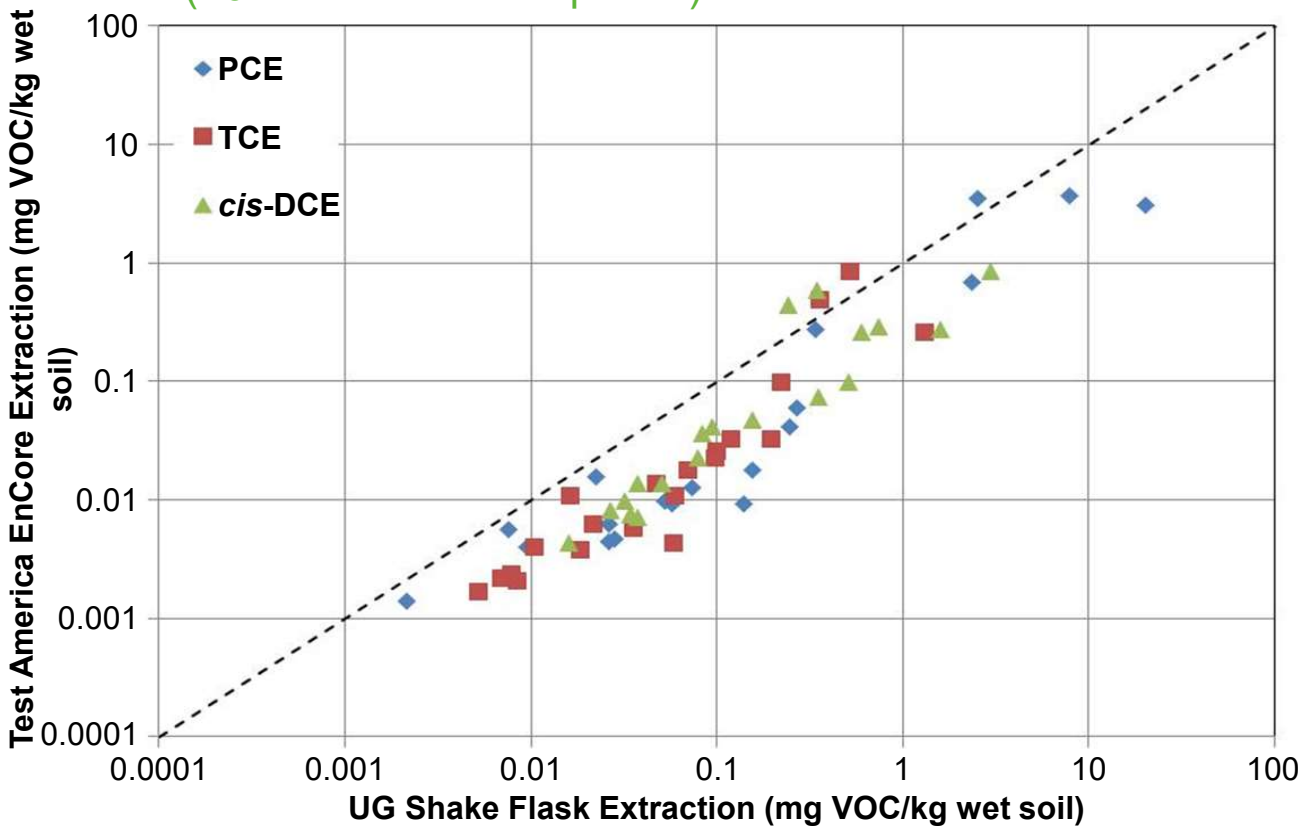
Backup Slide

Test America EnCore vs. UG Field Methanol Preservation and Shake Flask Extraction (~6-week extraction period)



Key Point **Commercial (*i.e.*, Standard) lab method provides incomplete extraction.**