Results from EPA Research Programs on Sample Flow Rate, Purge Volume, Tubing Type, Tedlar Bags & Temporal Variations On Soil Gas Concentrations

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Studies Overview

- August 2006 – Indy Field Study
- October 2006 – Sampling Variables VAFB
- March 2007 – Temporal Effects - VAFB
- March/Apr 2008 – Sub-slab vs. Near-slab, Rain effects, tubing type - Lemoore NAS
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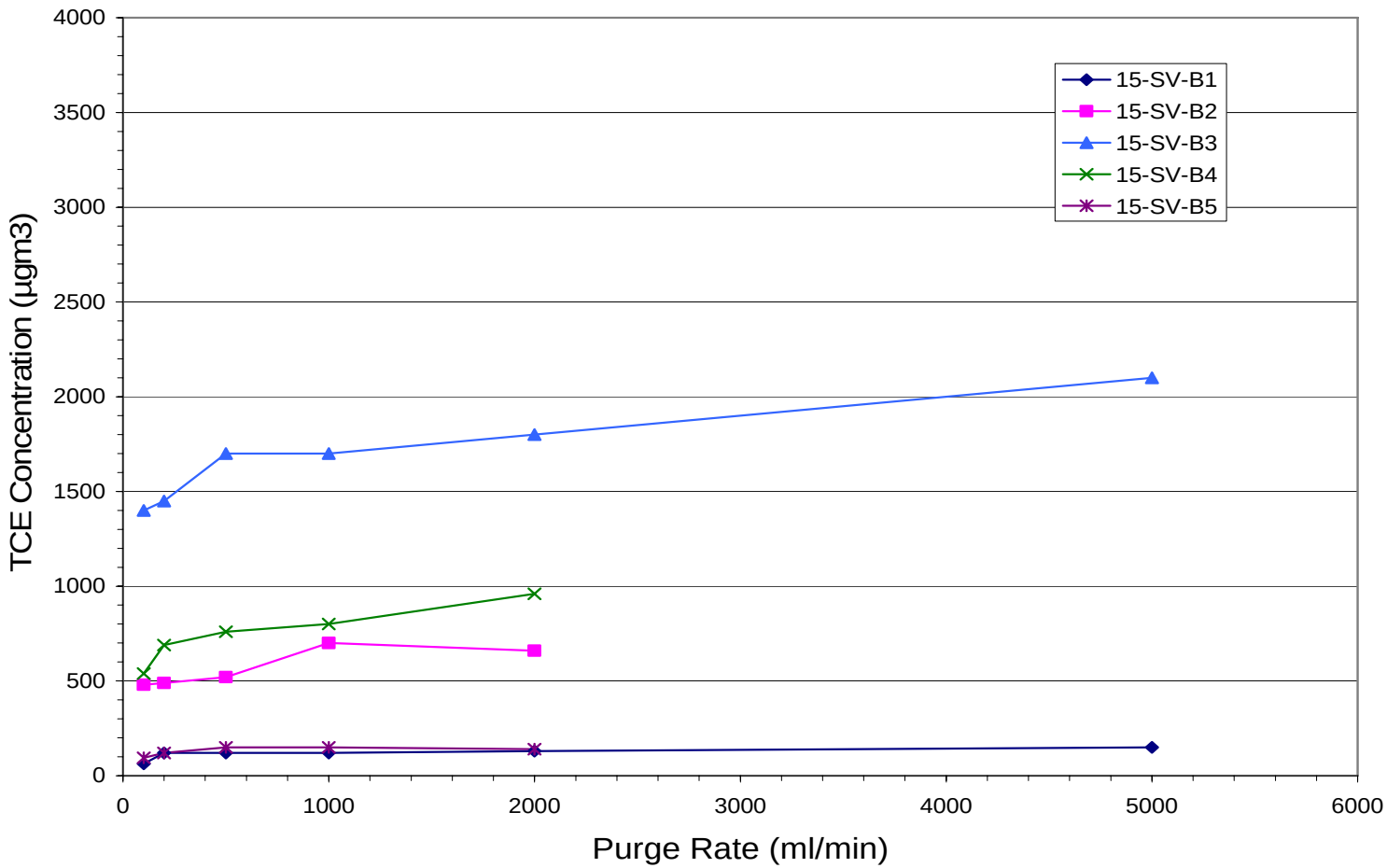
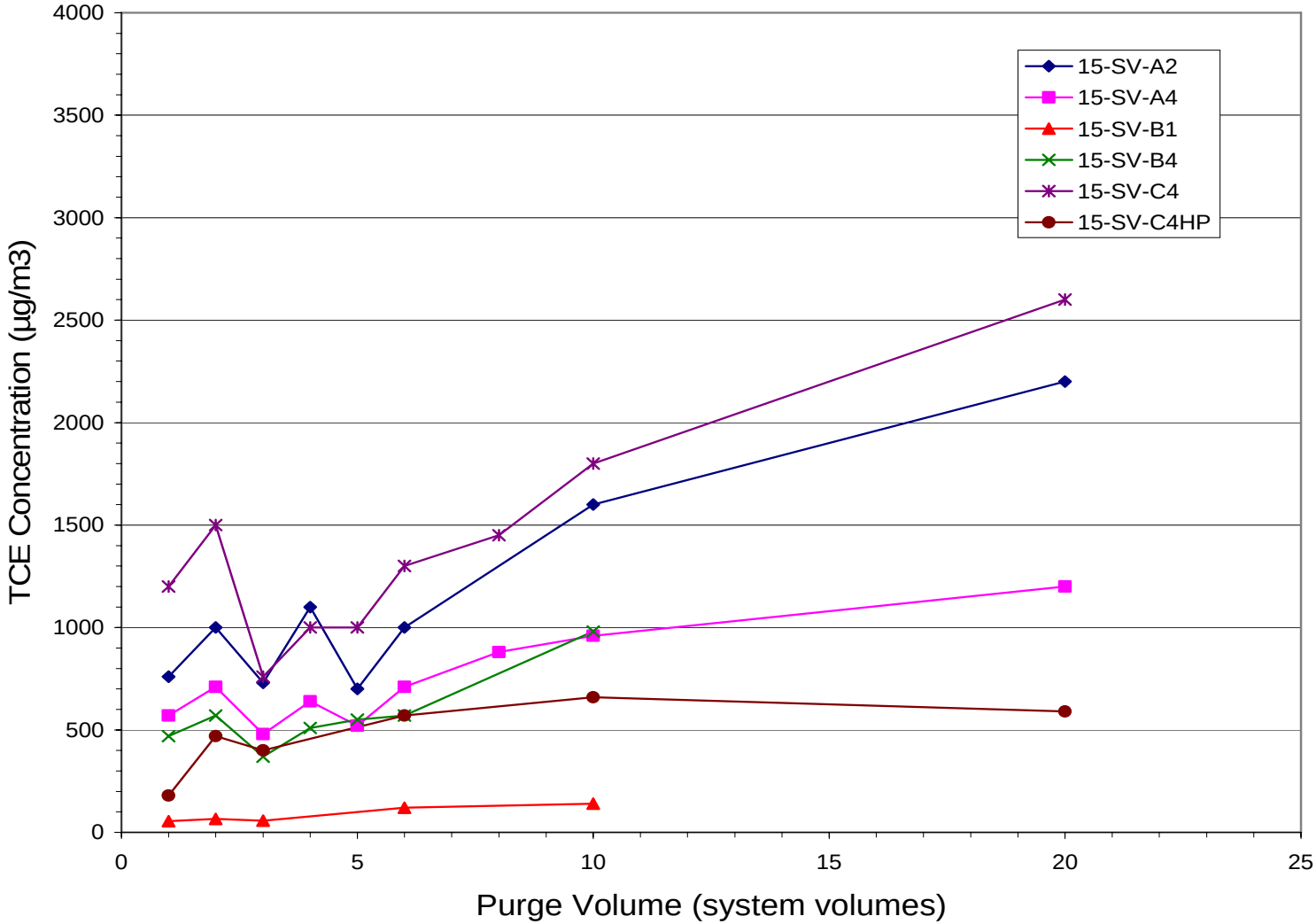
Sample Collection Variables Program

- Sample Flow Rate
- Purge Volume
- Sample Volume

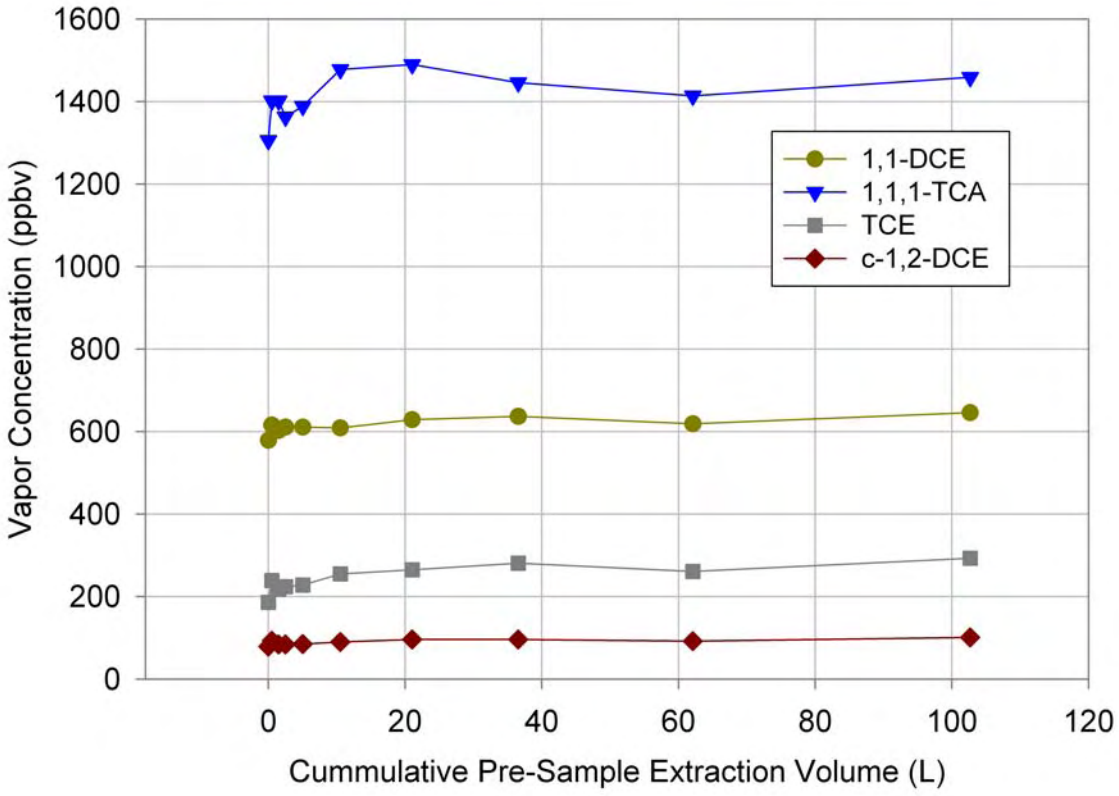
Purge Rate Study



Purge Volume Study



EPA Purge Volume Test



Tedlar Bag Stability Studies

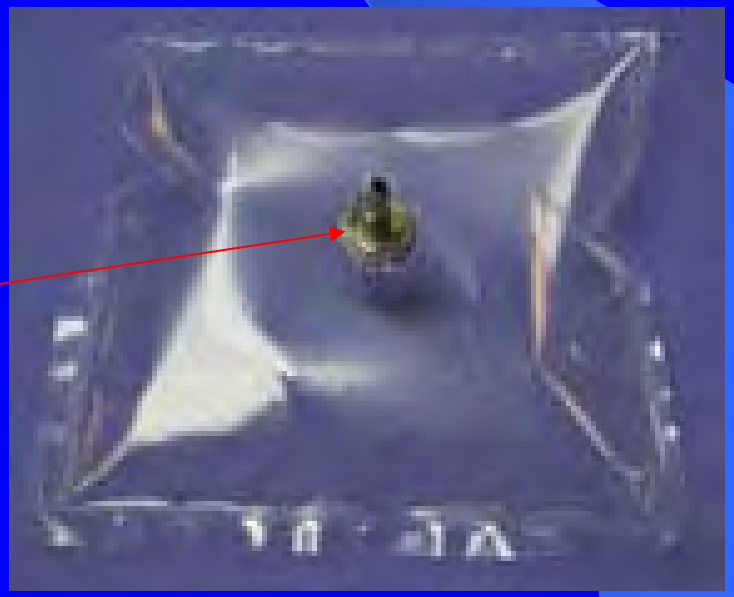
- EPA-ORD Study
- Study Done by H&P February 2008

EPA Laboratory Study

One-liter Tedlar® bags (7” by 7”) with single stainless steel septum fitting were used in this study

Made of PVF
Available in 0.5 L – 100 L

Fittings available in polypropylene, stainless steel, and Teflon®



EPA Tedlar Bag Study

Analytes 100 ppb	***Storage Time***	***Storage Temp.***
TCE	8 hr	15°C
1,1,1-TCA	16 hr	25°C
Benzene	1 day	
Toluene	2 days	
	3 days	
	4 days	
	1 week	
	2 weeks	

Tedlar® Bag Study Conclusions

- Results show concentration loss at one week to be <20% for TCE, 1,1,1-TCA and benzene.
- No consistent differences were seen between storage at 15ºC and 25ºC; however, lower concentrations would be expected at lower temperatures due to loss from condensation.
- "Container" blanks must be used to ensure that Tedlar bags are not a source of VOCs when detection limits are low (e.g., less than 5 ppbv).

H&P Tedlar Bag Test

- Study Done Feb 2008:
  - 1,2 DCE, TCA, TCE, PCE mixed in tedlars
  - 25 ppbv to 50 ppbv conc.
  - Survived near freezing temperatures & light
  - Shipped via airline to CA
  - Analysis on 9th day within 20%

H&P Tedlar Bag Test

Test #1 (25 ppbv)	TCE	PCE
2/11/08 - NY	25.0	25.0
2/15/08 - NY	25.2	22.6
2/21/08 - CA	25.3	25.1
Test #2 (50 ppbv)		
Before 2/17/08	50.0	50.0
2/19/08	44.2	43.4
2/29/08	43.7	54.9

Use of Tedlar Bags

Advantages offered by Tedlars:

- Many Consultants More Familiar With than Swageloks
- Easy to Fill: Perhaustalic Pump, Syringe, Lung Box
- Disposable - No Chance of Carry-over/False Positives
- Allows Repeat Analysis of a Sample if in Field
- Allows Measurement of Gaseous Tracer
- Allows On-site & Off-site Analysis of Same Sample!

Sample Collection

Sample Transfer

Tedlar Bags

OK for Naphthalene ?

- Naphthalene – Tedlar Study in the works

Tubing Test

- Ongoing at Lemoore NAS
- Tubing Types: Cu, SS, Teflon, Nylon, PEEK, polyethylene
- Nested Together in Same Borehole/Sandpack
- Sampled Twice So Far

Tubing Test

Tubing	TCE #1	TCE #2	Average
SS	470	350	410
PEEK	460	340	400
Nylaflow	400	390	395
Teflon	380	410	395
Polyethylene	310	310	310
Cu	nd	170	?

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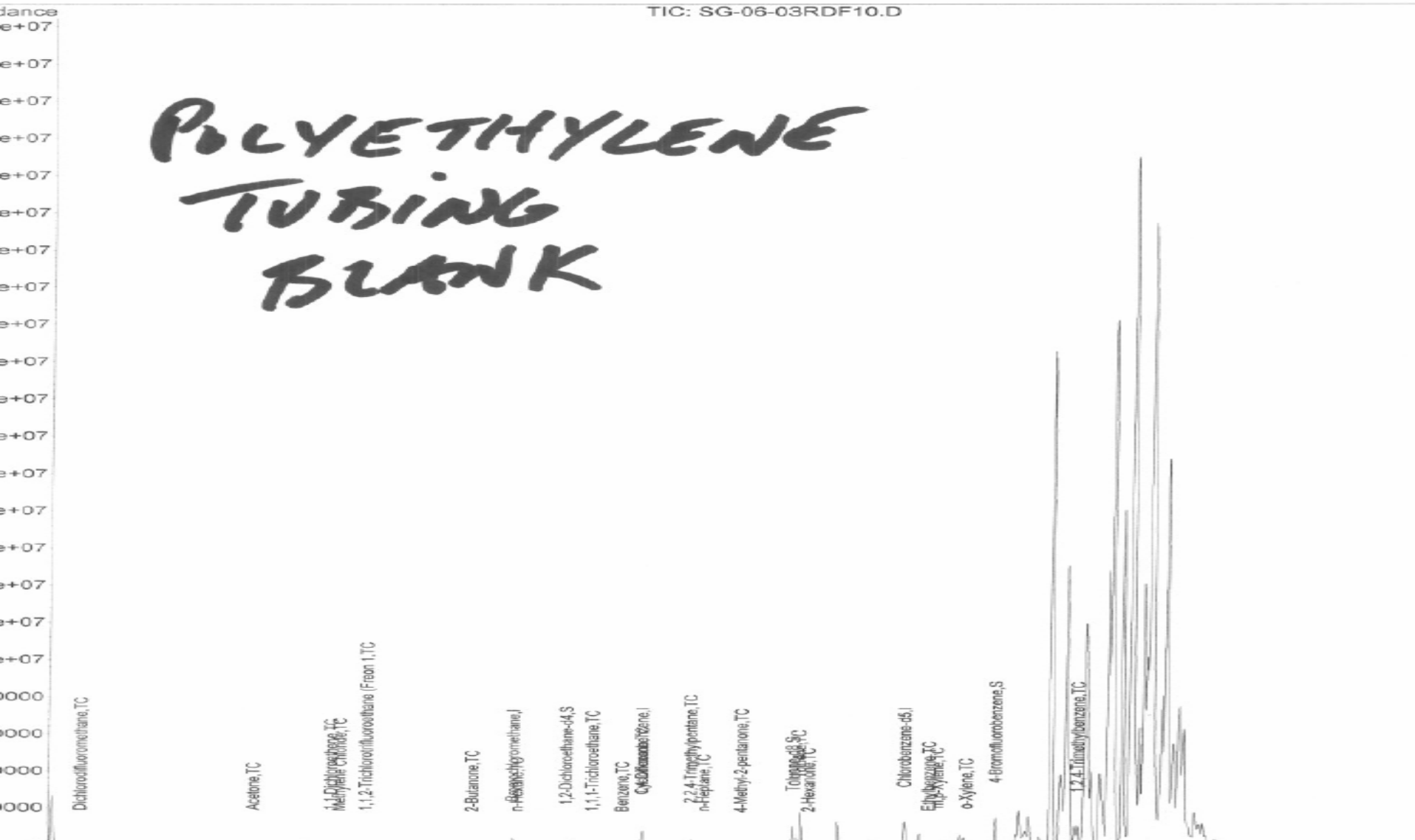
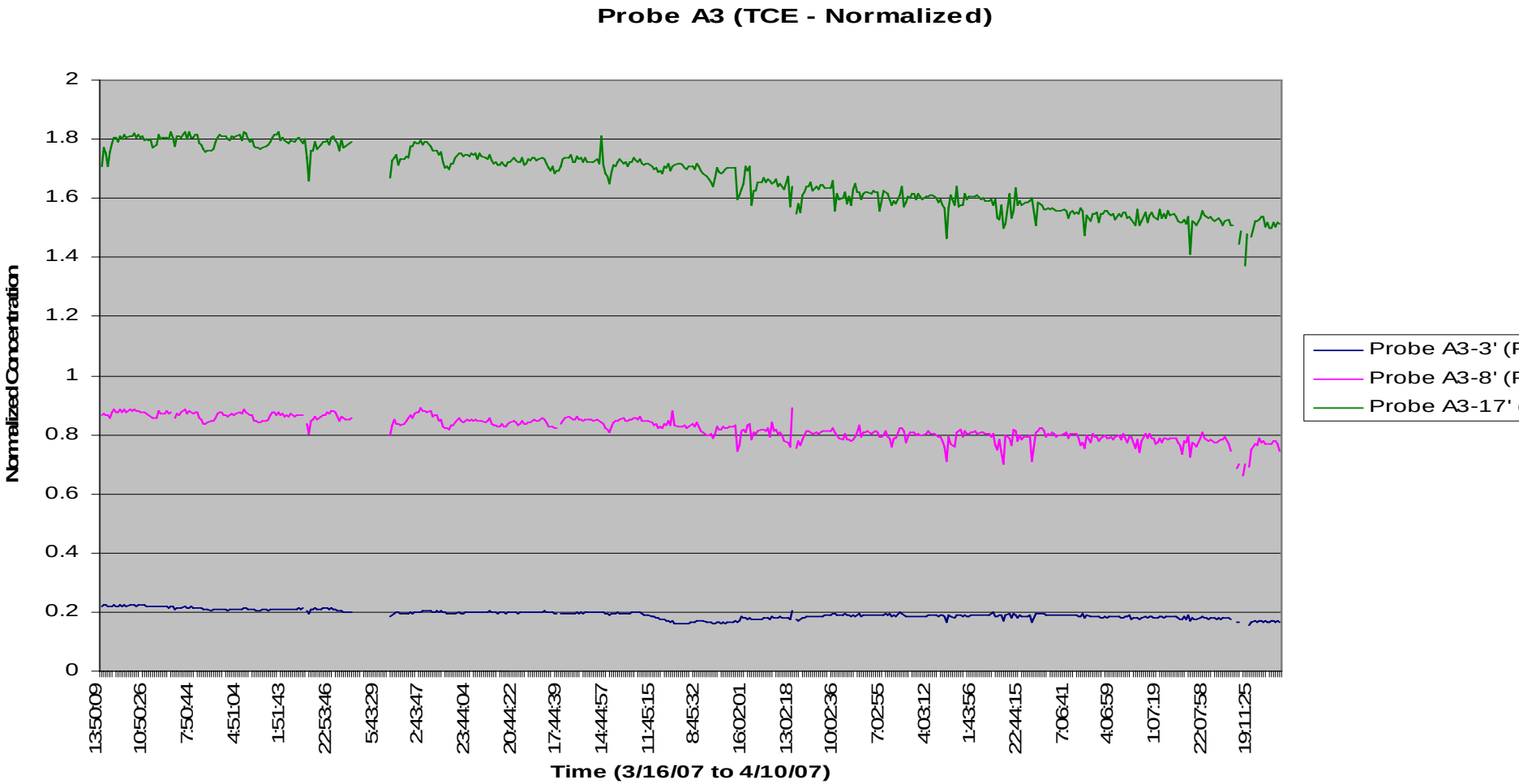


Temporal Variation Program

- Study Temporal Variations & Rain effects
- Automated GC Running 8021
- Meterological Parameters
- Vadose Zone Pressure
- Monitored 12 Probes, 2 Vertical Profiles
- ~Six Weeks. Over 12,000 Measurements

Soil Gas Temporal Study



Meteorological Variations

- Barometric Pressure: 29.7 - 30.2 in Hg
- Vadose zone Pressure: 0.046 - 0.056 in Hg
- Wind Speed: 0 to 22 mph
- Ambient Temperature: 0 to 28 ^{o}C
- Soil Temperature: 15 – 17 ^{o}C at 3’ bgs
- Precipitation: < 0.25”
- Water Moisture Variation: <0.1%

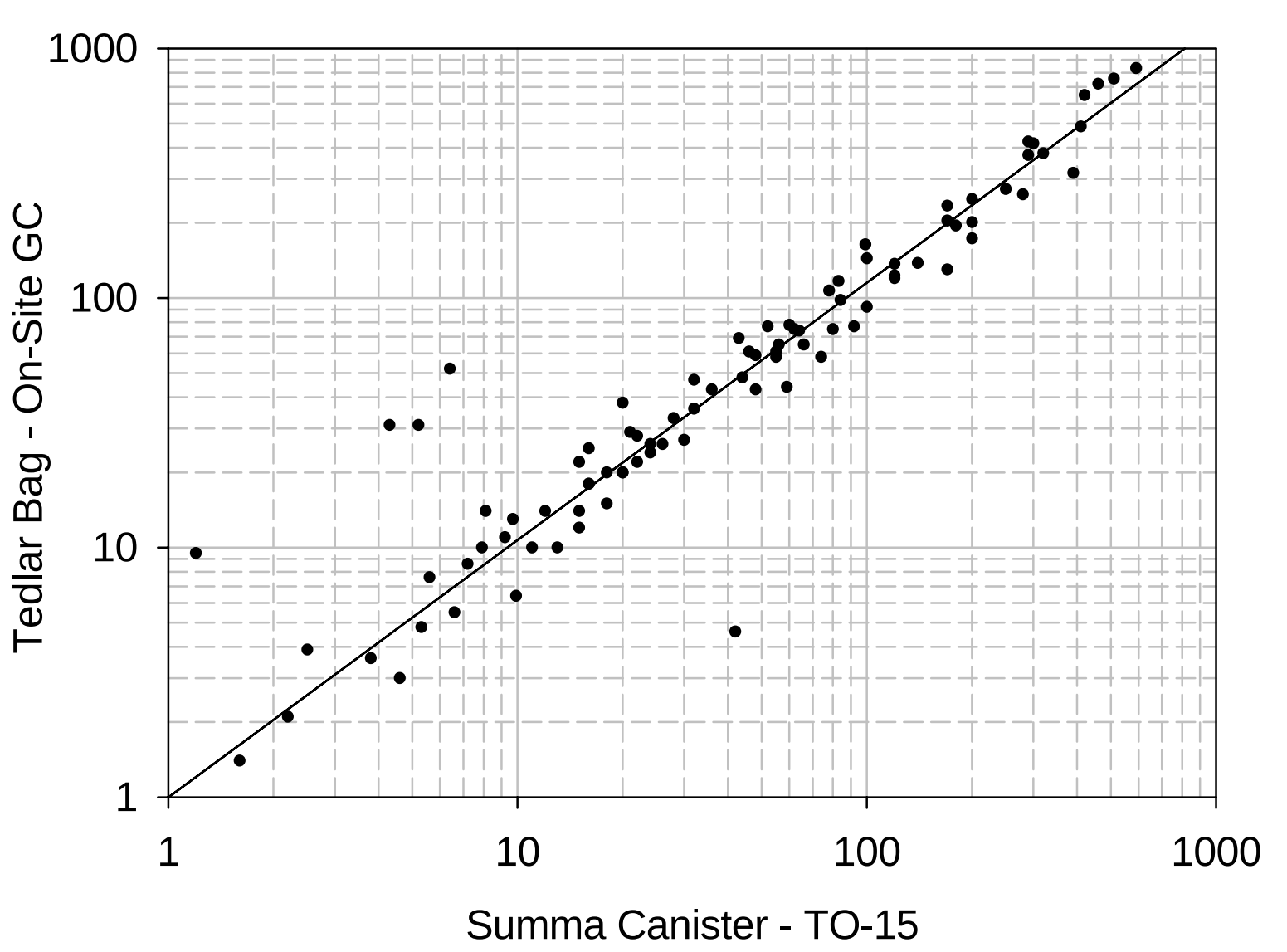
Advances:
On-site TO-15 Scan/SIM

- Simultaneous Scan/SIM mode enables
  ~ 10 ug/m3 for All VOCs &
  ~ 1 ug/m3 for subset of compounds.
- Only 2cc of Sample. Eliminates Hardware
- Real-time Analysis in Structures: Control!

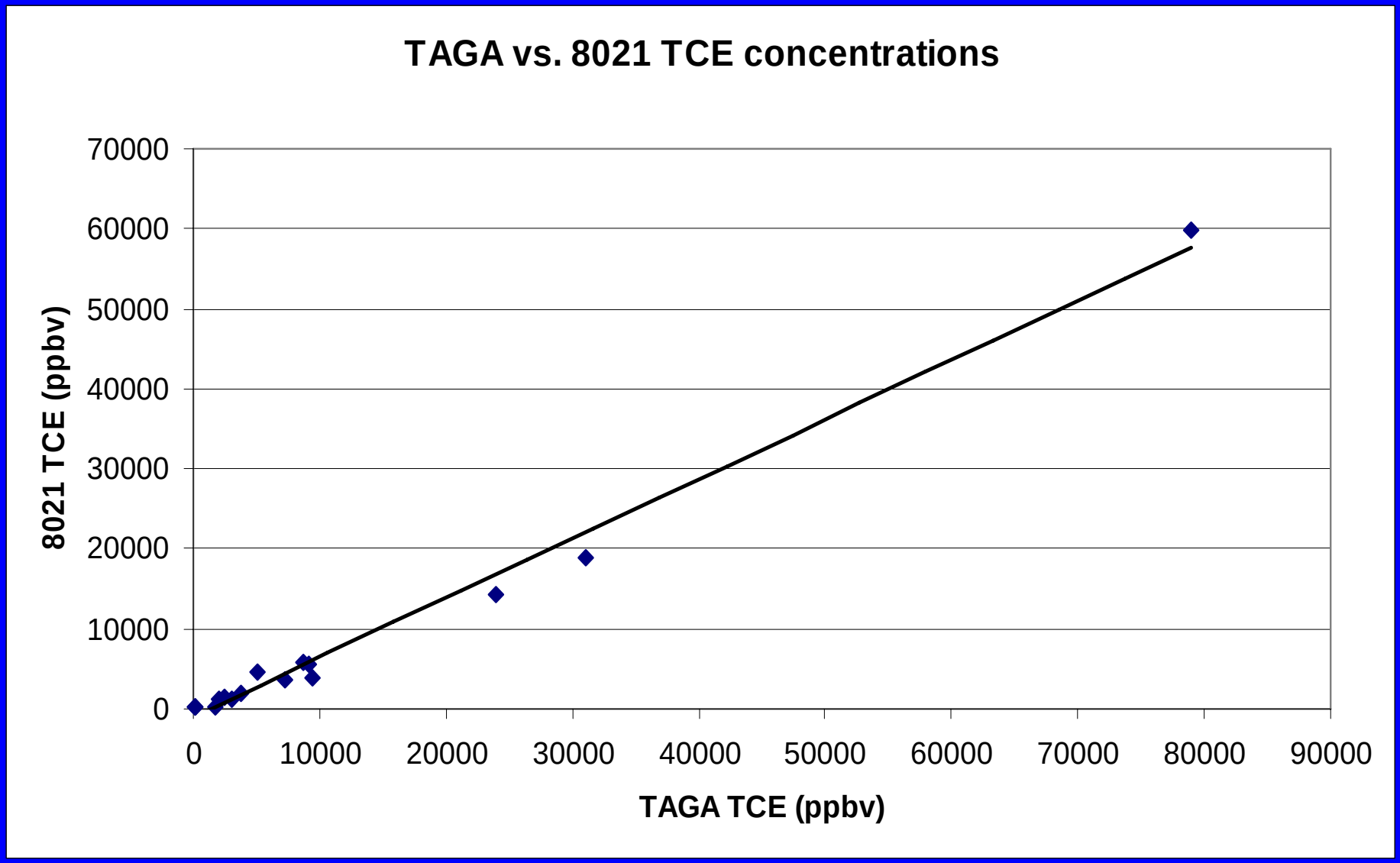
Don’t Forget 8021

- Can get to 1 ug/m3 for TCE, CCl4, PCE
- Can get to ~25 ug/m3 for Benz & Napthalene
- 5 minute run time for benzene, TCE & PCE
- Cost ~ 1/5 of TO-15
- Can automate to monitor structure

On-site 8021 vs.off-site TO-15



On-site 8021 vs TAGA



Conclusions

- Sample Flow Rate Not Significant
- Purge Volume: < Factor of 2
- Temporal Variation Insignificant at 3’ bgs
- Tedlar Bags OK for at Least Hours
- Methods 8021, 8260, TO-15 All OK
- New SIM/Scan Software Allows for real-time, on-site TO-15

MOBILE GEOCHEMISTRY

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