



# Comparison of EPA Compendium Methods TO-15 and TO-17 for the Measurement of Naphthalene in Soil Gas

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# Outline

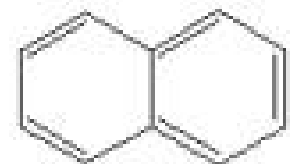


- Study Objectives
  - Scope
  - Experimental Design
- Results
  - Data comparison
- Conclusions

# Focus on Naphthalene



- Potential toxicity re-classification
- Low volatility presents potential sampling and analysis challenge
- Risk assessment requires confidence in result





# Analytical Options

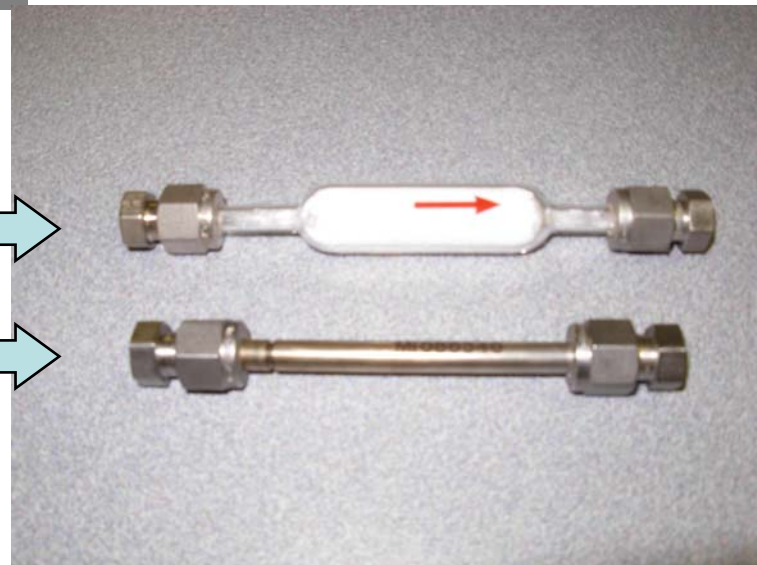


TO-15

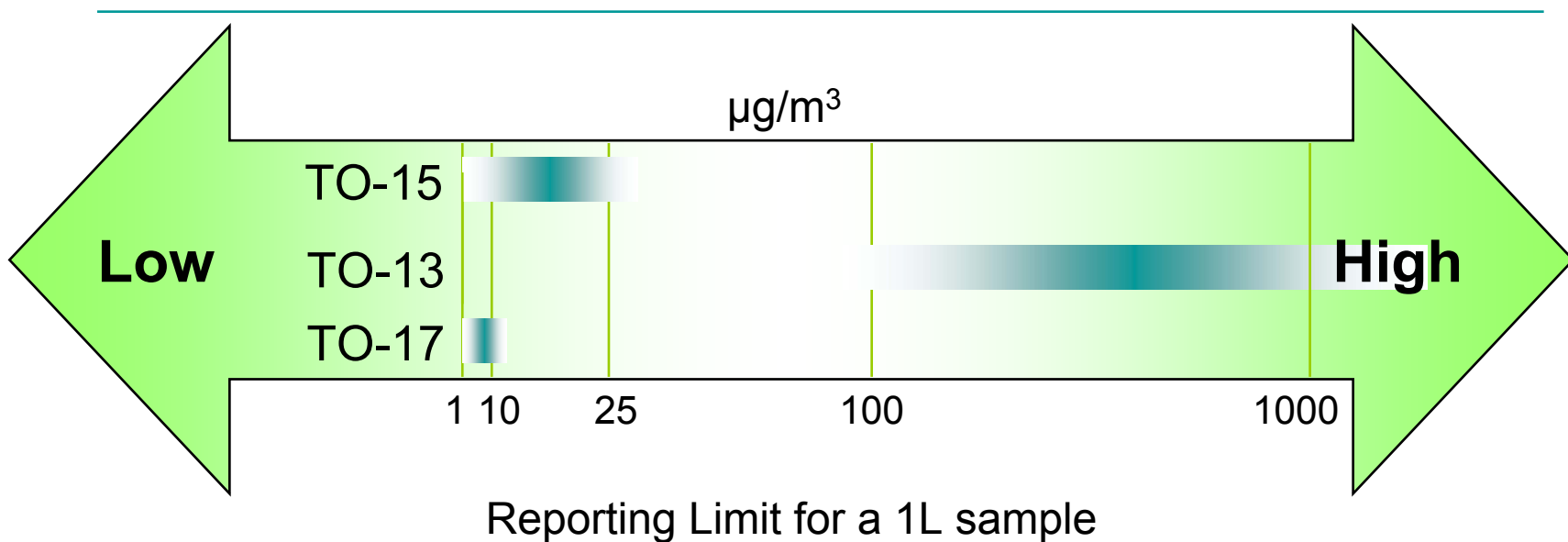
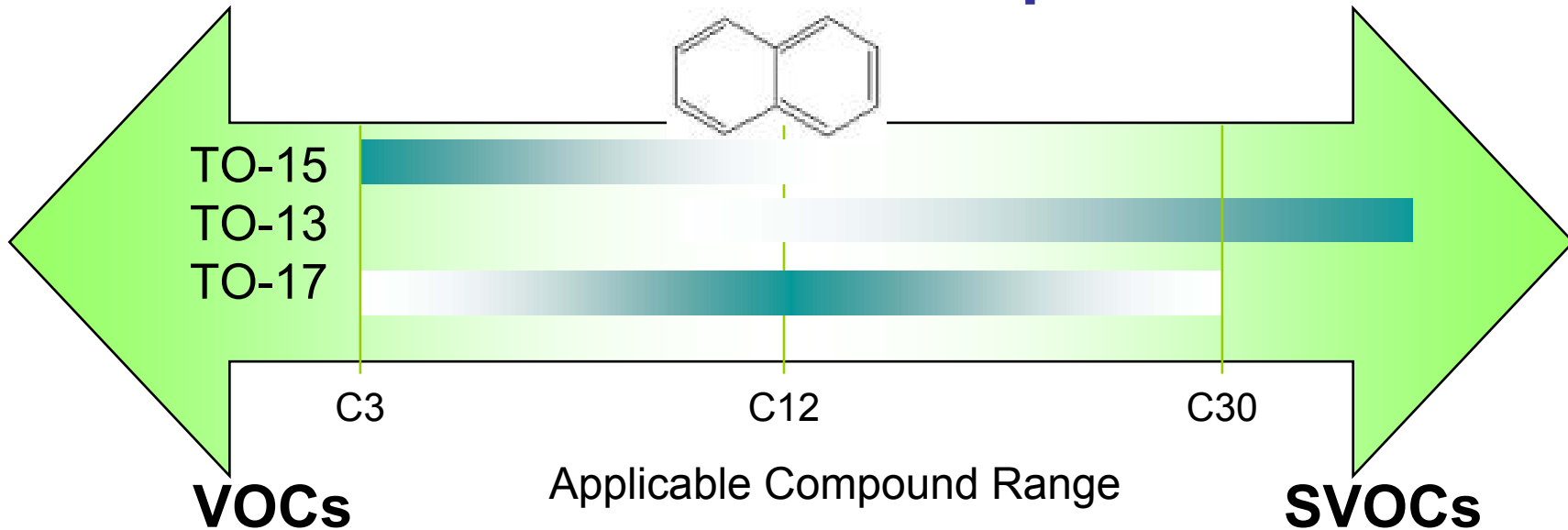
TO-13A



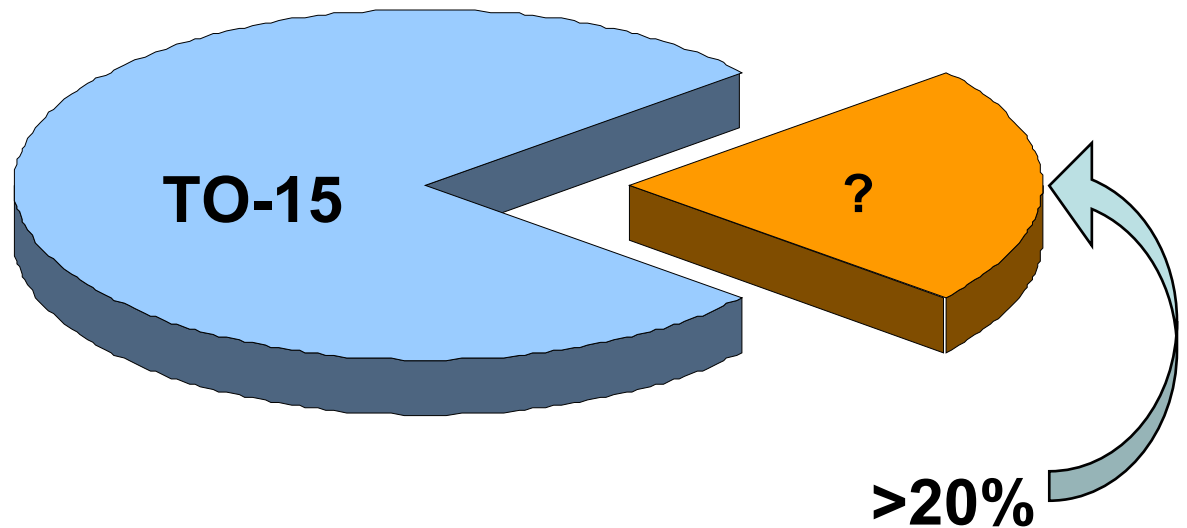
TO-17



# Method Comparison



# Growing need for TO-17



**ASTM E2600 Compound Table**



# TO-17 Historical Drawbacks

- Unfamiliarity with technique
  - Infrequently used in the U.S.
  - Little published data for soil gas
- Fear of perceived limitations
  - Traditionally considered a “one-shot” deal
  - Breakthrough and overloading concerns
- Considered more difficult to sample
  - Requires a sample pump and calibrator

# Study Objectives



- Compare TO-15 and TO-17 methods for soil gas samples
  - Field collection protocols
  - Analytical results
- Evaluate the practical use of TO-17 for soil gas collection
  - Can we “bust” the TO-17 myths?



# Study Scope



- 4 former MGP sites and 2 UST sites
- Samples collected in at least two consecutive quarters, with up to six consecutive quarters at one site
- Over 60 sets of samples collected

# Sample Collection



- Micro-wells
  - Permanent sample points (3/4” diameter, 1 ft screen)
  - Shallow wells <4 ft
- Tracer tests performed with Helium
- Low flow rates (<<200 mL/min)
- 2-hour equilibration time between TO-15 and TO-17 collection

# Sample Collection



	TO-15	TO-17
Collection media	1 L Summa can & Flow restrictor (certified clean)	3.5" Tenax GR tubes (front and back)
Flow rate	~13 mL/min	~50 mL/min
Duration	~1 hour	~0.5 hour
Total soil vapor collected	~0.8 L	~1.5 L
Field QC	Field dup with "T"	Field dup with "T" Trip Blank



# Sample Collection

Sampling Pump



Teflon Tubing



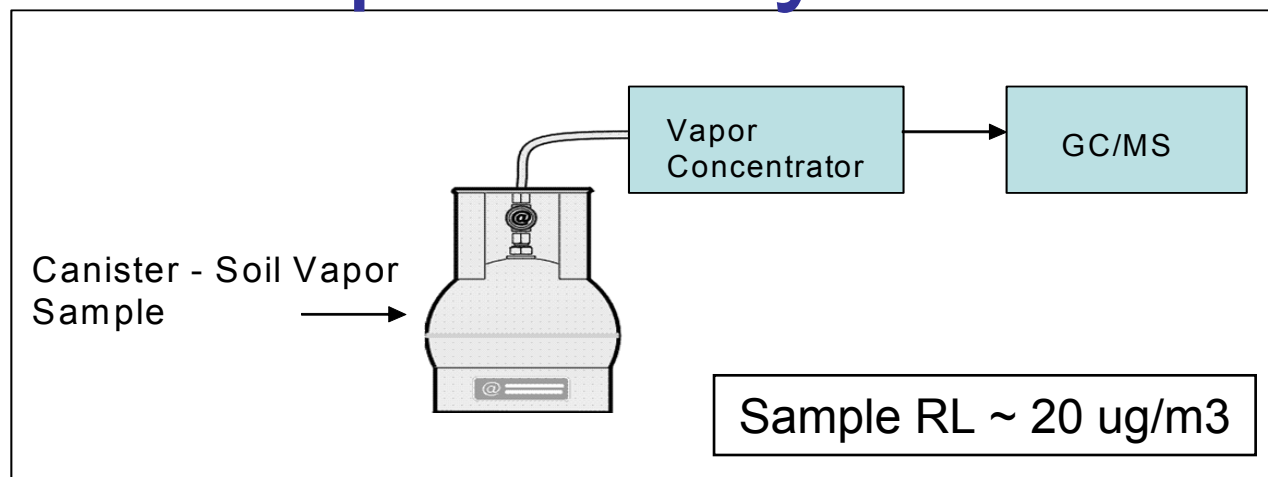
Tenax GR Tubes in Series

Photos courtesy of DMS Environmental Services LLC

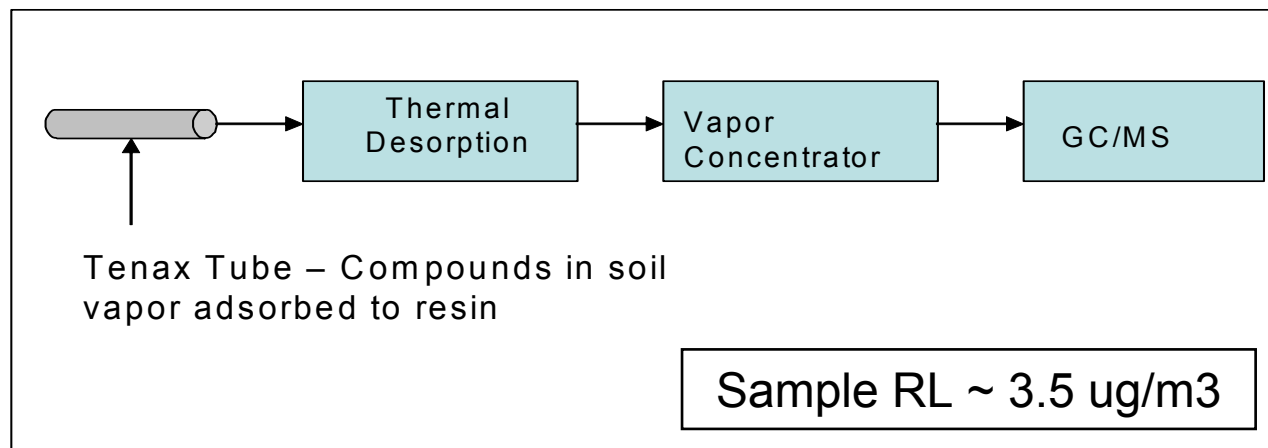
# Sample Analysis



TO-15



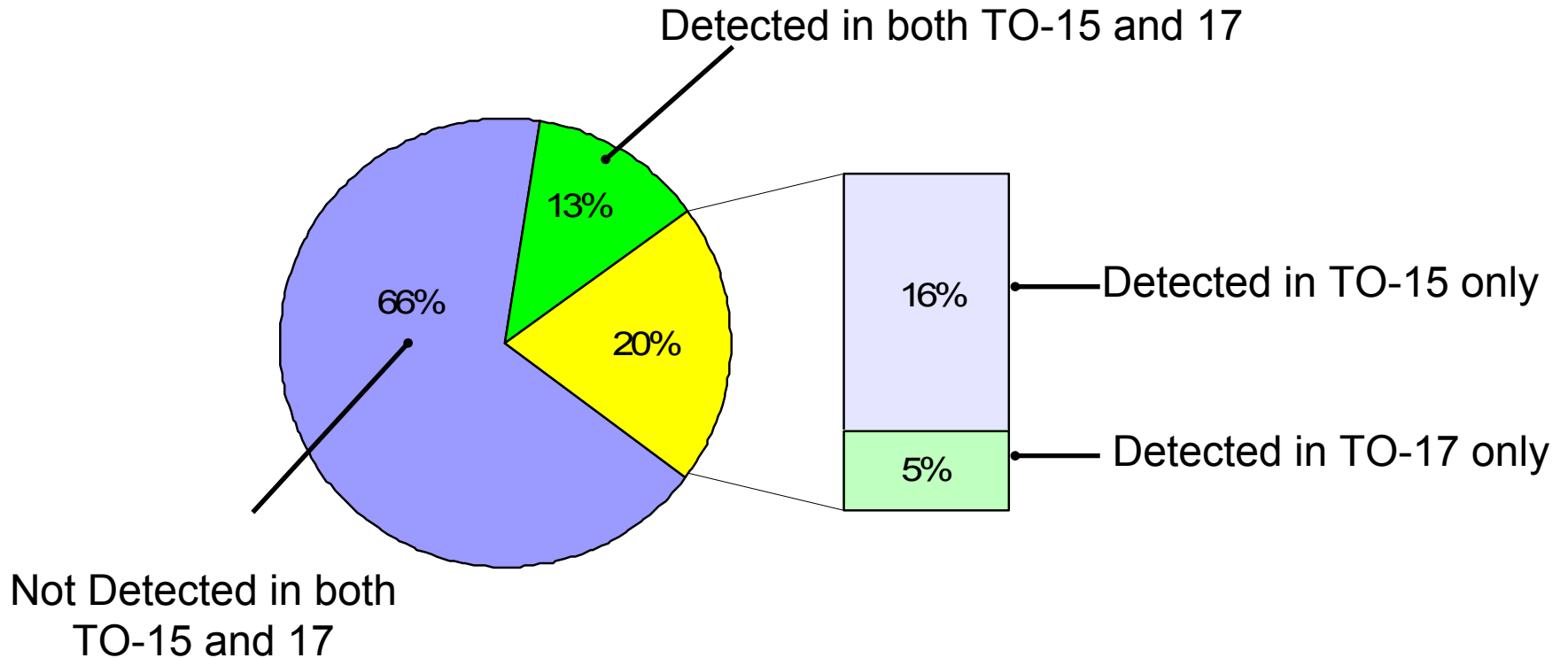
TO-17



***Evaluated results below RL and above MDL***

# Sample Results

## Frequency of Naphthalene Detections in TO-15 and TO-17 Samples



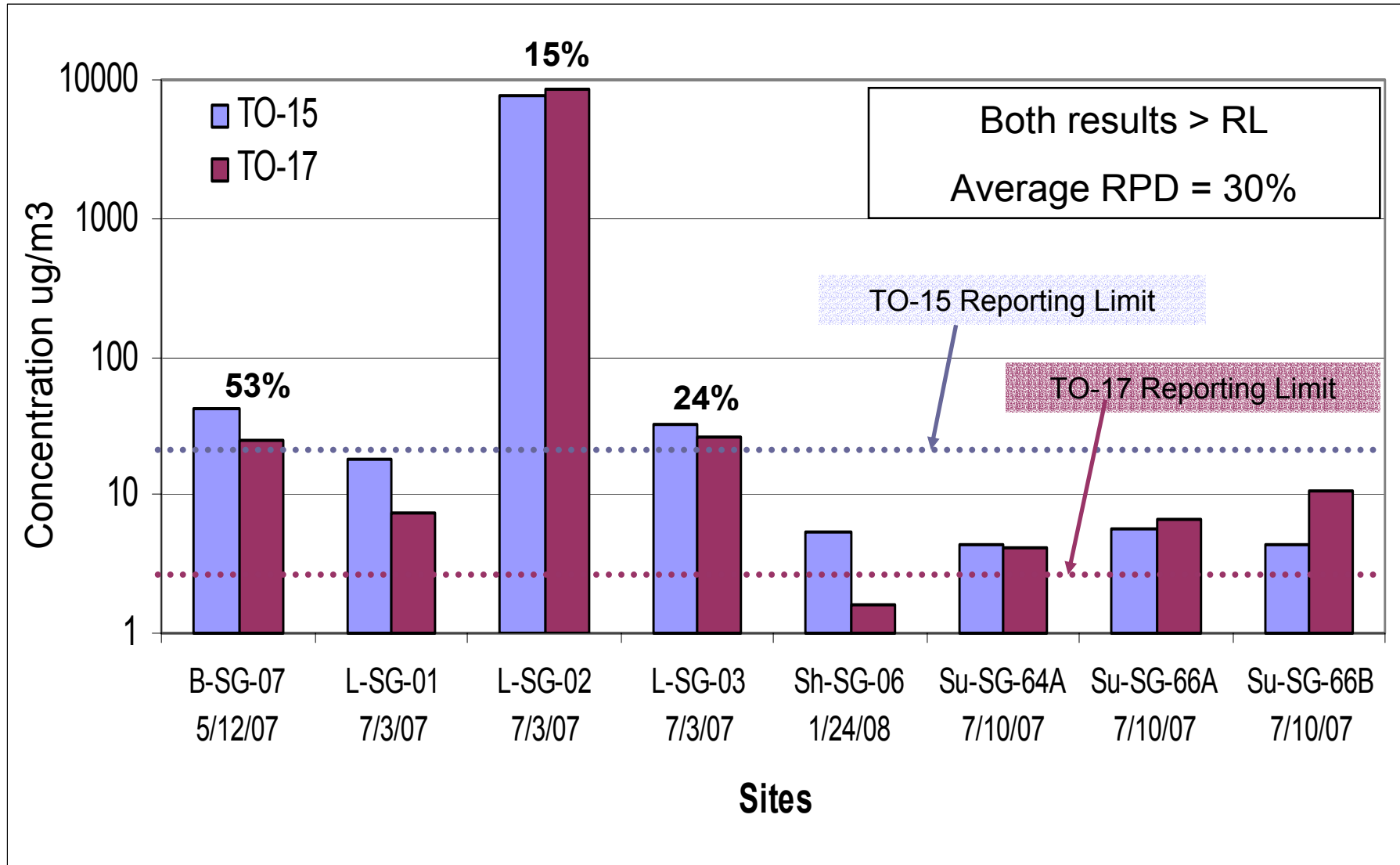
# Sample Results



- Greater frequency of detection by TO-15
  - All but 2 TO-15 detections < reporting limit.
  - Hits below the reporting limit suspect due to presence of similar low-level concentrations of naphthalene in lab blanks
  - High degree of uncertainty and questionable usability

***Greater frequency of detection by TO-15 not an advantage over TO-17.***

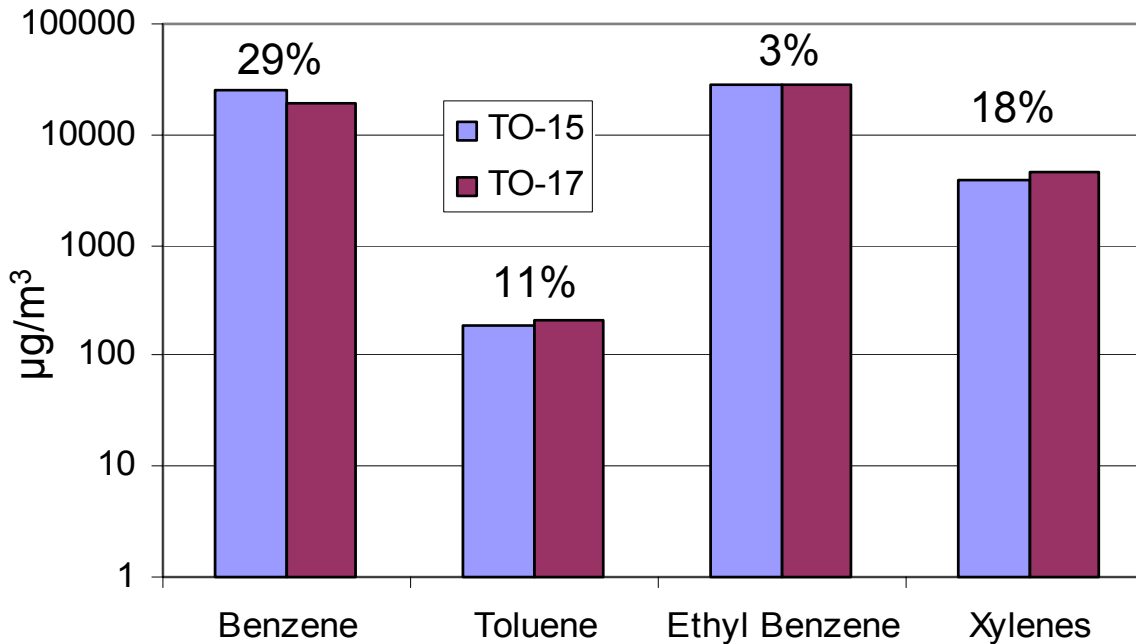
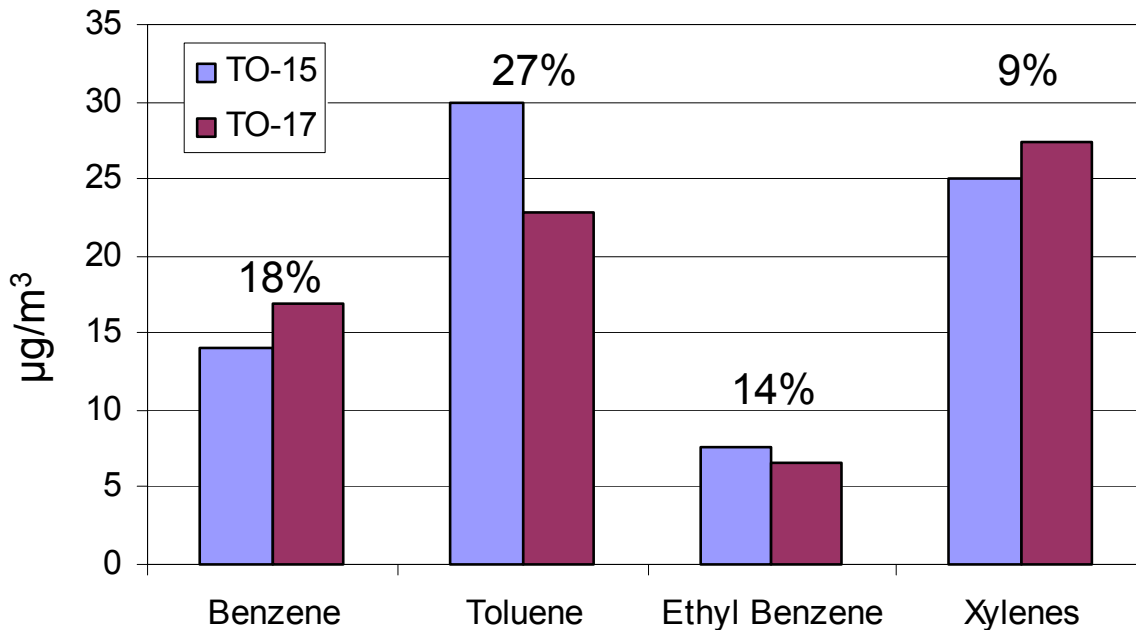
# Naphthalene Comparison



# Other VOC Comparison

L-SG-01 7/3/07

Average RPD = 17%

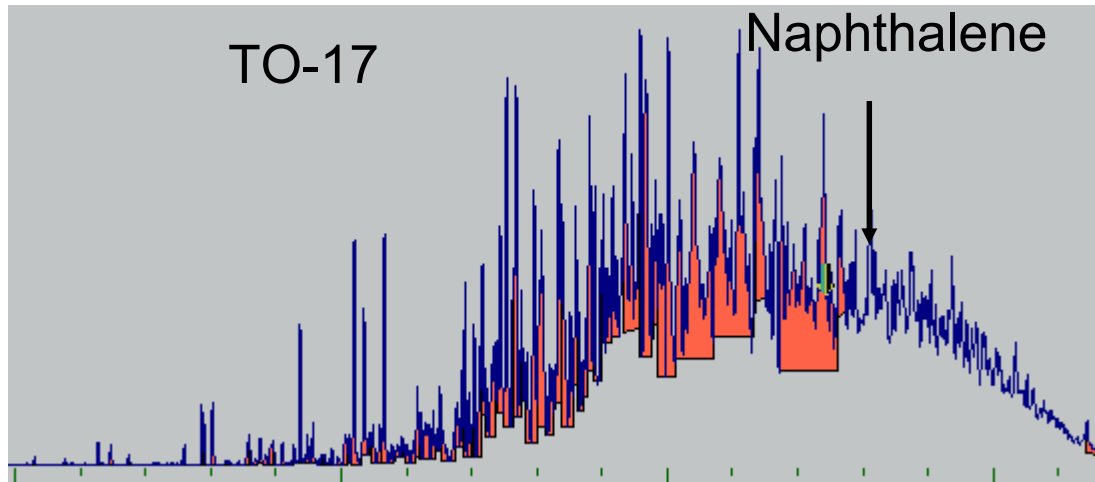
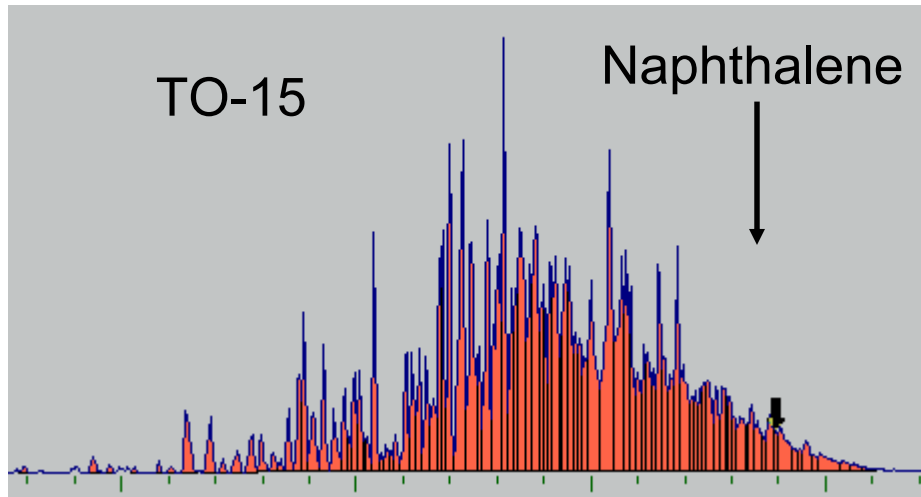


L-SG-02 7/3/07

Average RPD = 15%

# Other VOC Comparison

L-SG-01 7/3/07













- Advantage for site with middle distillate fuels
- Better characterization of the fuel pattern
- Useful tool for PAHs

# Did we bust the TO-17 myth?



- ⊘ Traditionally considered a “one-shot” deal
  - Newest TD allowed for re-runs and dilutions
  
- ⊘ Breakthrough and overloading concerns
  - Mitigated by sampling with front and back tubes
  - Two volumes collected when “hot spots” encountered
  
- ⊘ Considered more difficult to sample
  - Field staff easily handled pump and calibrator
  - Robust media - No issues with loss of vacuum as with canisters, fittings, equipment connections
  - ✗ Tight soils may inhibit pump flow; may need in-line flow meter or flow default feature

# Overall Summary Comparison

Method	Application to Naphthalene and BTEX	Accuracy at lowest naphthalene concentrations	Application to compounds greater than C10	Collection media reliability	Ease of sampling; soil lithology factors
TO-15					
TO-17					

# Next Steps



- Evaluate TO-17 for wide range of compounds from MTBE to PAHs
- Assess accuracy and precision of gas-tight syringe instead of pump for soil gas TO-17 collection
- Evaluate the use of field surrogates to monitor recovery of target compounds due to storage conditions and sampling volumes

# Questions?



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