

# Data Interpretation Process

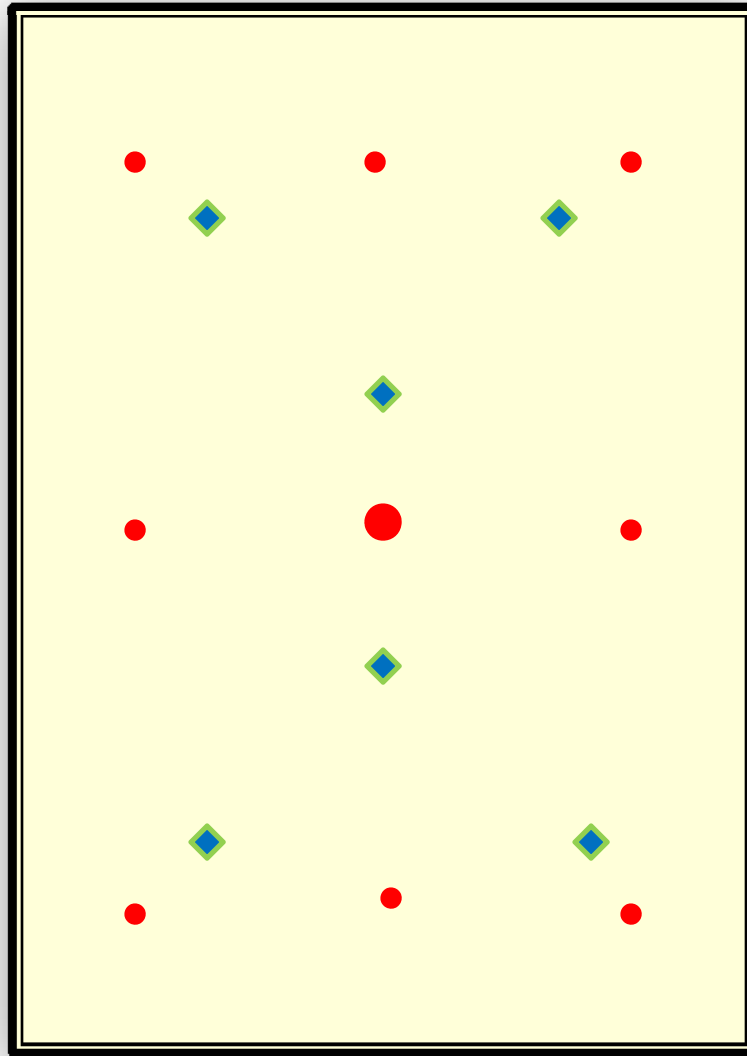


- Objectives:
  - Risk-Based Interpretation
  - Interpretation of source or subsurface contribution
  - Evaluating effectiveness of remediation or mitigation.
- Ability to meet objectives depends on adequate sampling design- including sufficient sample numbers and locations, media and analytes.

# Minimum Sample Density as it Relates to Data Use



- Recon Sampling
- ◆ Compliance Sampling
- Compliance Sampling w/Statistical Analysis



Note: Array of sampling points is hypothetical.

10,000 sq. ft. Commercial Building – Single Exposure Unit

# Risk Evaluation



- Approach will vary by site complexity and density of samples:
  - If sampled in reconnaissance mode, data limitation requires use of maximums. Results are screening-level- not definitive.
  - If sampled more densely to meet risk evaluation objective (i.e., larger sites & sample numbers, multiple operable units). Confidence limit calculations are possible.

# Risk Evaluation



- If estimating average concentrations is planned
  - Exposure units must be defined
    - Must be considered in developing DQOs for project, or results may not be accepted.*
  - Sufficient samples are required
    - 8-10 samples when contaminant concentrations vary within a narrow range
    - 10-15 sample when concentrations are less predictable
  - Calculate 90<sup>th</sup> Upper Confidence Limit (UCL) accordance with US EPA guidance for ProUCL. <http://www.epa.gov/esd/tsc/software.htm>



## Example 1: Commercial Facility

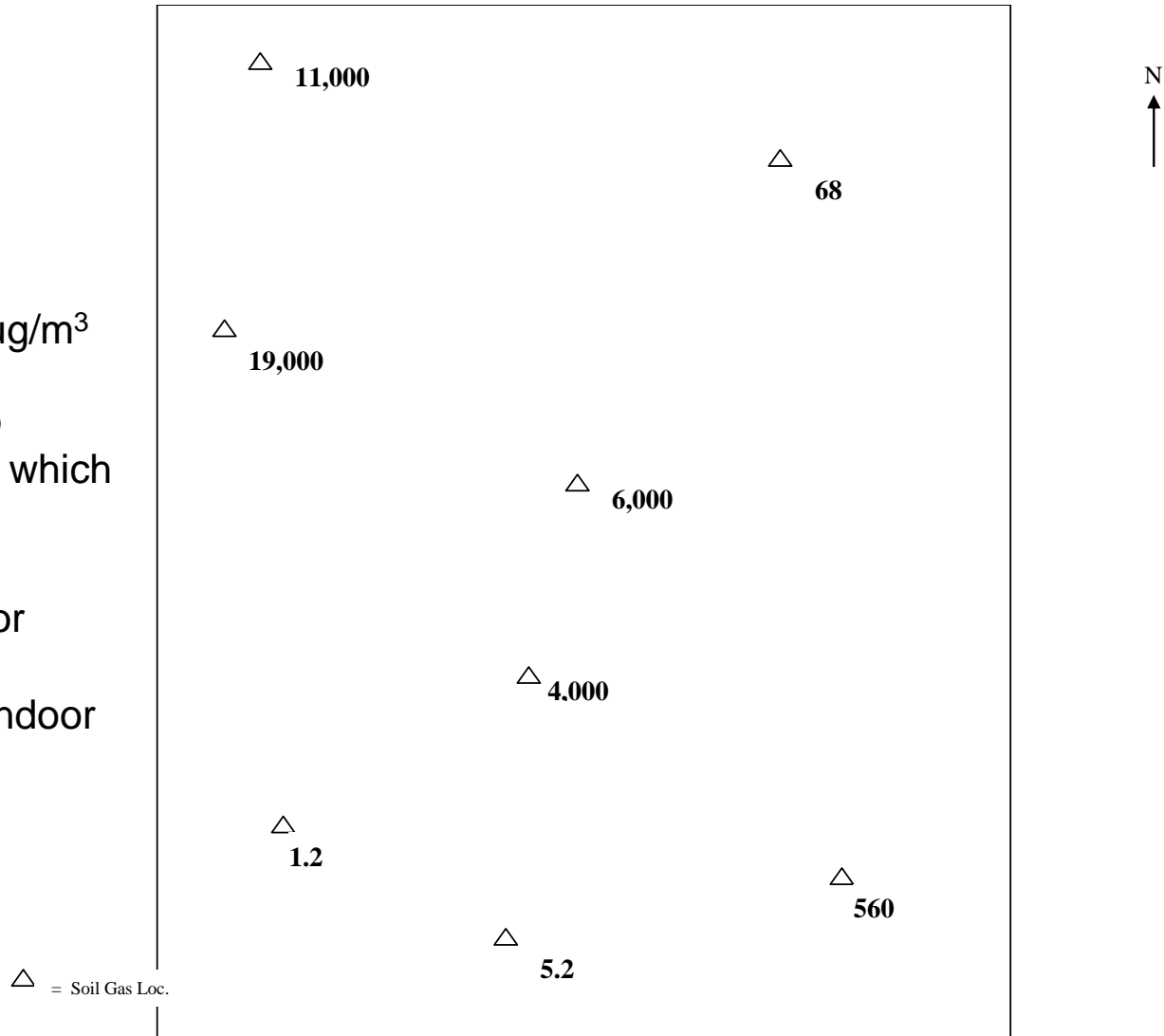
### Criterion:

RBC = 2,100 ug/m<sup>3</sup>

Hot spot = 210,000 ug/m<sup>3</sup>

90th UCL = 10,000 to  
44,000 depending on which  
statistic used

**Conclusion:** Soil vapor  
exceeds RBC but not  
hotspot levels: Go to indoor  
air sampling



# Risk Evaluation



## Example 2: Commercial Facility, Two phases of Investigation

### Criterion:

RBC =  $2,100 \text{ ug/m}^3$

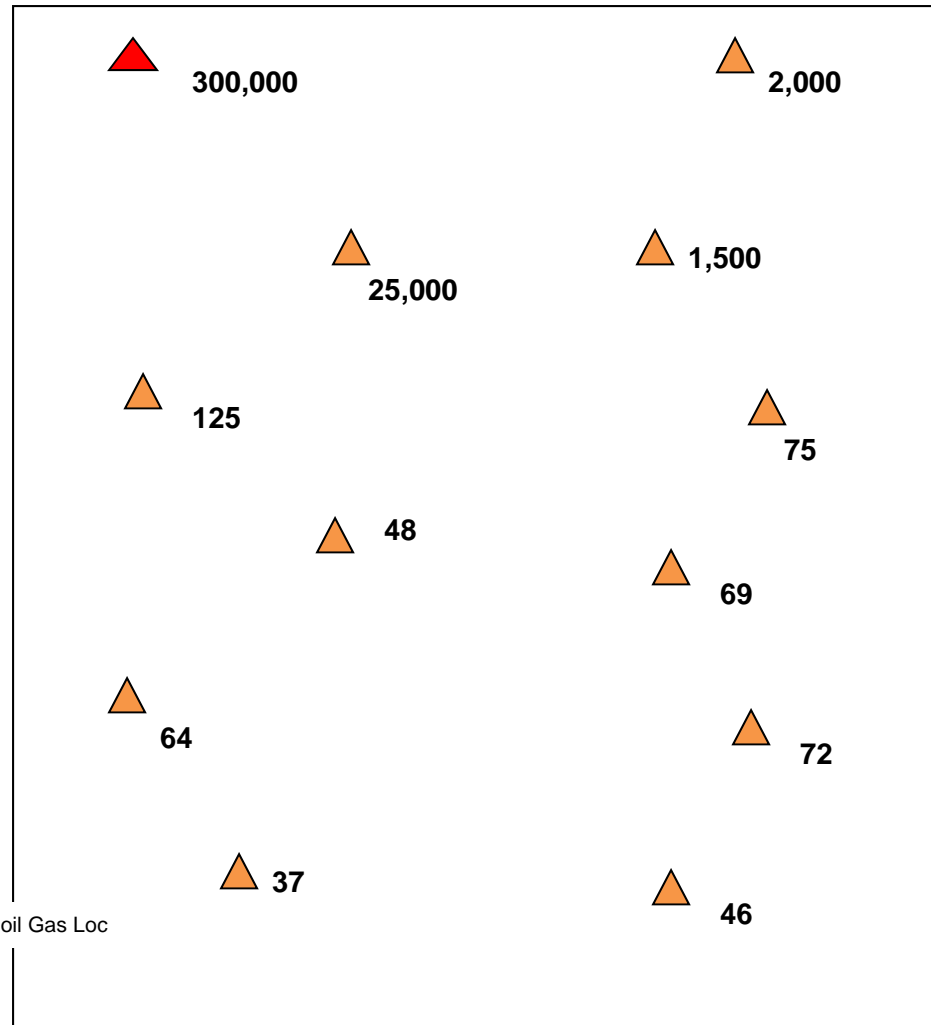
Hot spot =  $210,000 \text{ ug/m}^3$

### **Phase One Conclusion:**

Soil vapor sample exceeds hotspot level, additional samples will better characterize vapor plume.

### **Phase Two Conclusion:**

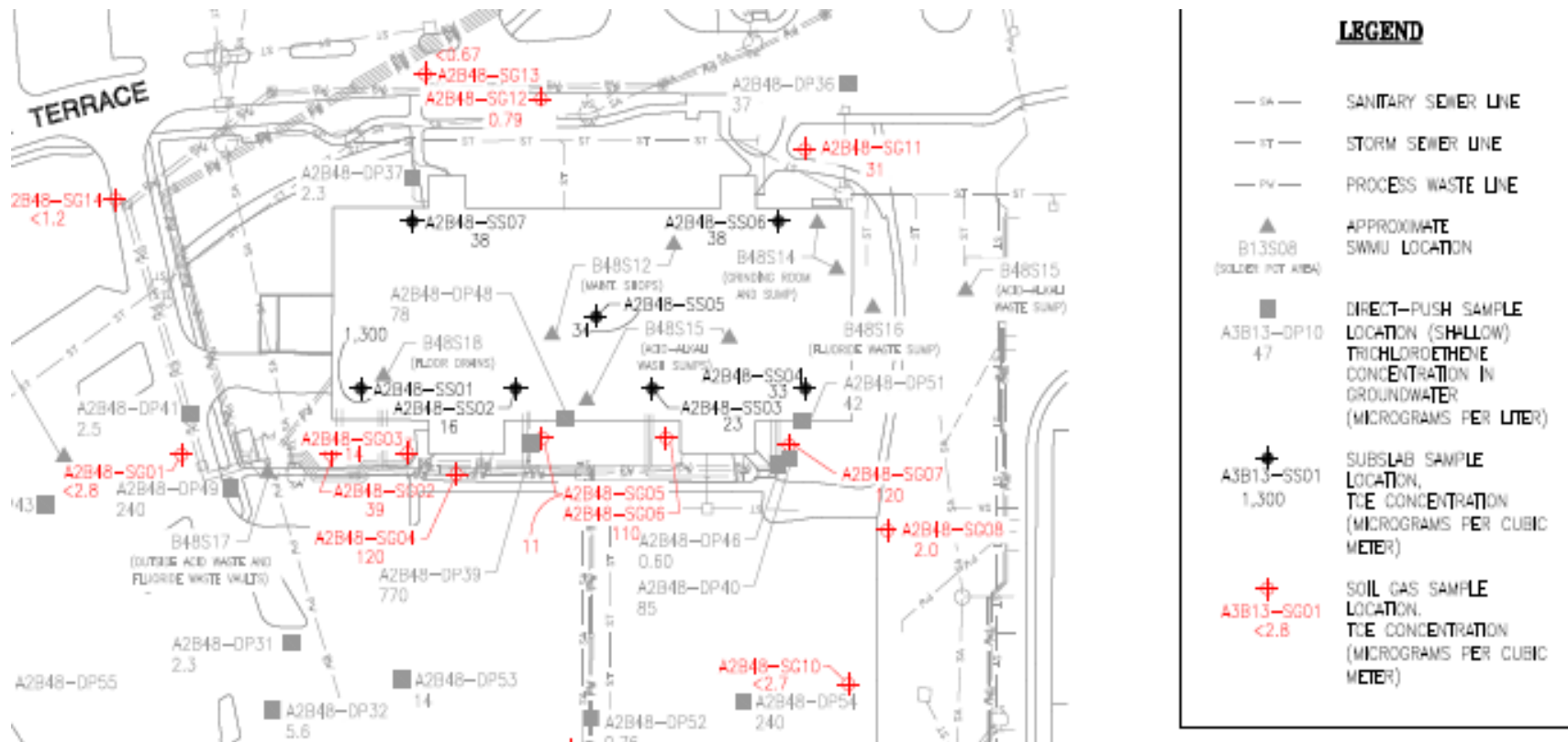
Vapor delineated for scoping remedial options. Indoor air to establish baseline conditions.





## Example 3: Risk-Based Evaluation

**Relatively Few Samples:** Seven sub-slab samples to represent an existing building  
surrounding soil gas low to non-detect





## Example 3: Risk-Based Evaluation

Sub-slab data low & consistent but one high value causing high variability across exposure unit.

Sample I.D.	PCE	TCE	cis,1,2-DCE
SS01	< 14	<b>1,300</b>	<b>110</b>
SS02	< 0.61	<b>16</b>	< 0.61
SS03	< 0.68	<b>23</b>	< 0.68
SS04	< 0.61	<b>33</b>	< 0.61
SS05	< 0.61	<b>34</b>	< 0.61
SS06	< 0.69	<b>38</b>	< 0.69
SS07	< 0.61	<b>38</b>	< 0.61

- ProUCL warns that seven results may be inadequate. Over all seven samples, Data do not fit any distribution, and 90<sup>th</sup> UCL estimates range from approximately 400 to over 1,000. Does this accurately represent the building?
- Removing extreme value: Data appear normal and 90<sup>th</sup> UCL estimated at 35. However, this data set is likely still too sparse for a single building average estimate.



## Example 3: Risk-Based Evaluation

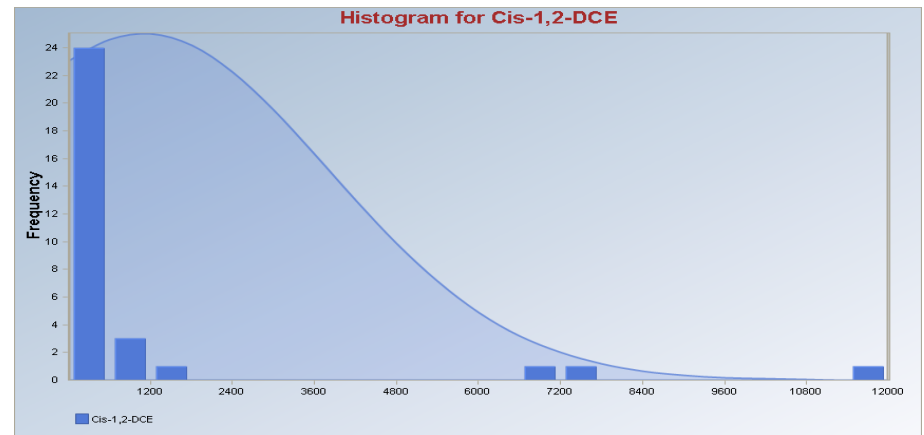
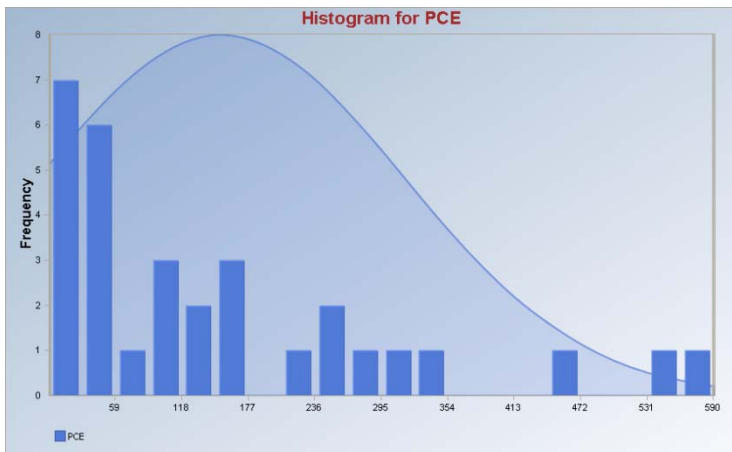
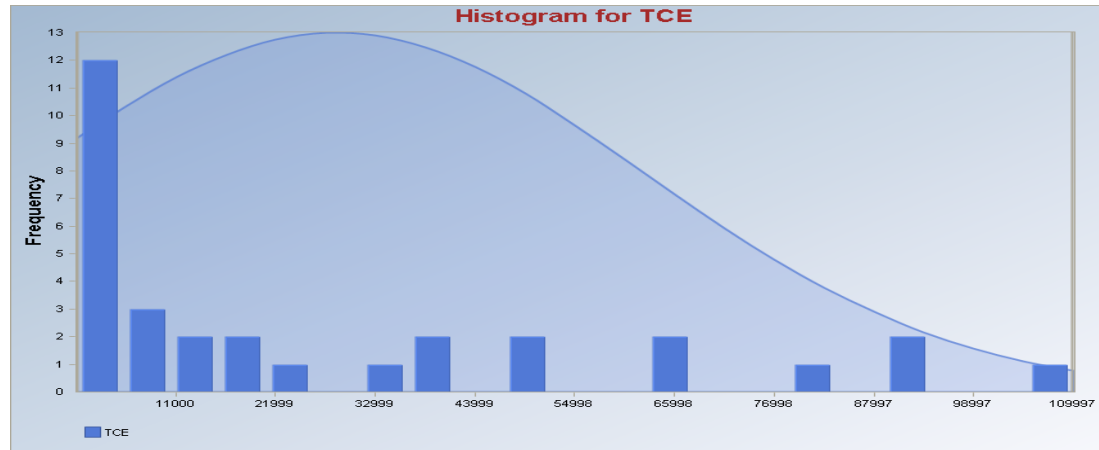
- *Conclusion:* Most of the building subsurface shows acceptable risk conditions, but one localized area needs additional investigation and may represent a source area.
- In this case, data is not adequate to estimate a single UCL for the entire building, the maximum is a better value to estimate this localized risk and support need for either additional investigation or cleanup.

# Risk Evaluation



## Example 4: Risk-Based Evaluation

Multiple samples over a single exposure unit.  
Analytes: PCE, TCE and cis-1,2-DCE





## Example 4: Risk-Based Evaluation

	Soil Vapor (ug/m3)							90th UCL	Occ. RBC
	N	% NDs	Min	Max	Median	Mean			
PCE	31	19%	0.41	450	110	131	<b>183</b>	<b>2,100</b>	
TCE	31	0%	3.5	110,000	15,000	28,630	<b>45,441</b>	<b>140</b>	
cis-1,2-DCE	31	26%	0.21	12,000	240	1,470	<b>2,564</b>	<b>&gt;Pv</b>	

*Conclusion: cis-1,2-DCE and PCE are below default RBCs, TCE substantially exceeds occupational RBCs >100x and therefore exposure unit represents a hotspot.*



## Other Uses of Site Data: Interpretation of Sources

- Section 4.6.4 briefly discusses some uses of site data for purposes other than risk evaluation.
- VOC data in indoor air and soil gas, particularly when co-located and collected concurrently can inform source attribution questions.
- Objectives: May vary- can be used as supporting information to confirm subsurface source is being addressed or confirm compliance based on chemical of concern.



## Using multiple lines of evidence: Interpretation of subsurface contribution

### Methods

#### Scatter Plots:

Can be used to evaluate if constituents in subsurface are correlated and have the same or different sources.

#### Ratio Plots:

Can be used to evaluate if ratios of constituents in subsurface are similar or different from those in indoor/outdoor air, potentially informing decisions about confounding ambient sources.

#### Multivariate Methods:

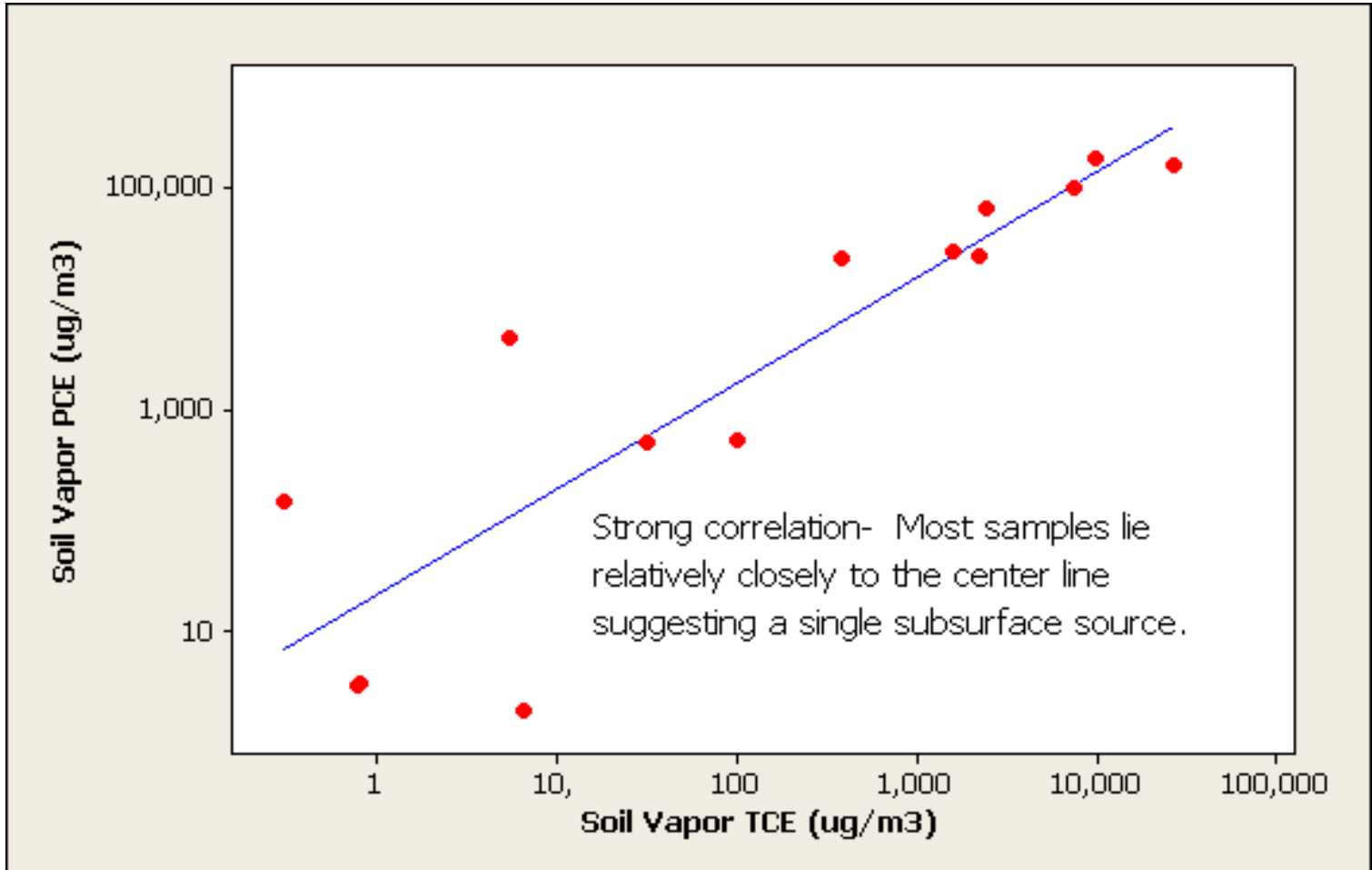
Multidimensional scaling

PCA-Principle components analysis

# Source Interpretation



**Scatterplots in Subslab vapor: Objective:  
Confirm same subsurface source for two  
analytes**



# Source Interpretation



## Scatterplots-Indoor Air: Objective: Indoor air source for two analytes

