

Observed Sub-slab to Indoor Air Attenuation Factors (AF) for Industrial and Commercial Buildings



Vapor Intrusion In Commercial and Industrial Buildings

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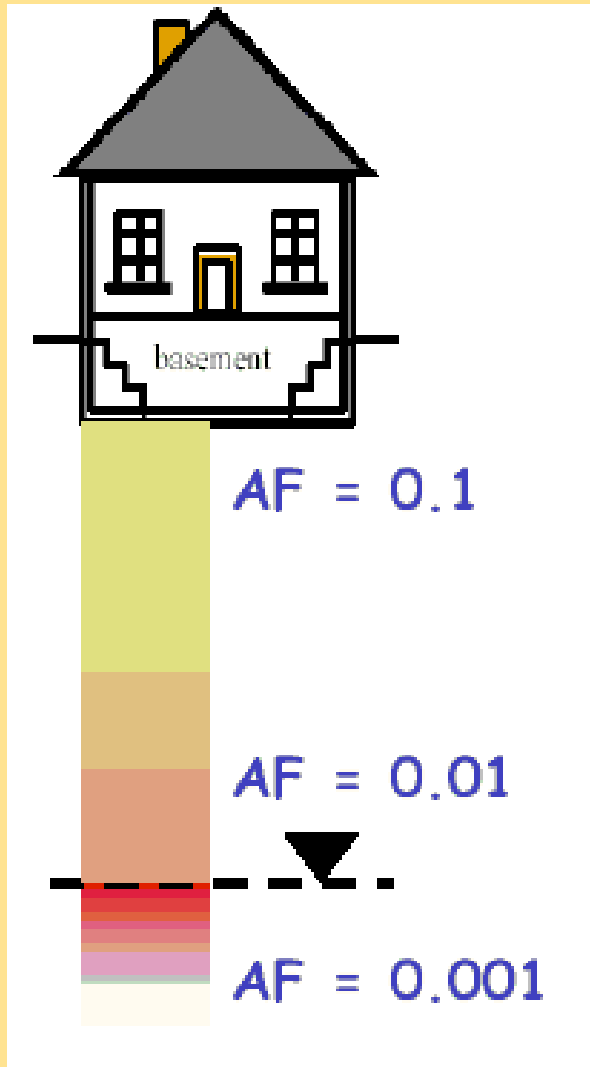
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Outline

- Attenuation Factor (AF)
 - Definitions
 - EPA,
 - NYSDOH
- Sampling Methods
 - Sub-slab point Installation
- Industrial / Commercial Building
 - Case Study Data
- Factors Influencing AFs

USEPA Screening Levels



- Attenuation factor (AF or alpha) is defined as:

$$AF = \text{Indoor air conc.} / \text{Soil gas conc. at source}$$

- Select indoor air target screening level (IASL)
- Shallow (≤ 5 ft) soil gas screening level ($SGSL_{\text{shallow}}$) is 10x indoor air target screening level

$$SGSL_{\text{shallow}} = IASL \times 10$$

- Deep (> 5 ft) soil gas screening level ($SGSL_{\text{deep}}$) is 100x indoor air target level

$$SGSL_{\text{deep}} = IASL \times 100$$

(H. Dawson, USEPA, 2002)



NYSDOH Decision Matrix

Soil Vapor/Indoor Air Matrix 1

WORKING DRAFT 02.23.05

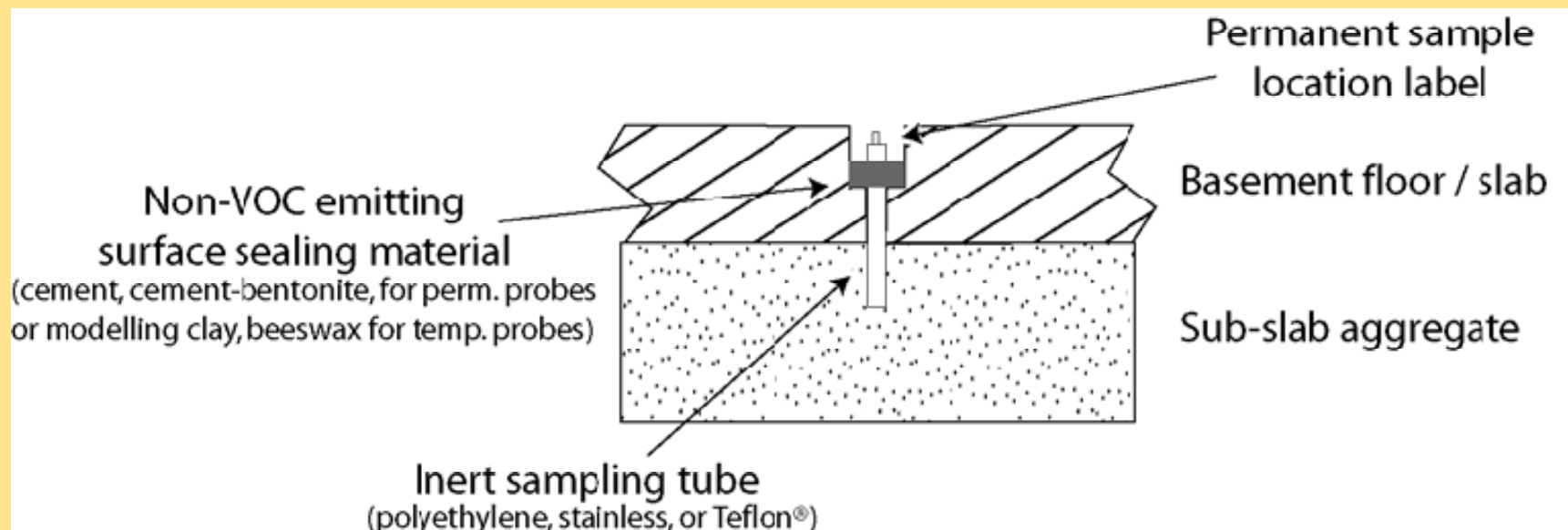
SUBJECT TO CHANGE

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m ³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m ³)			
	< 0.25	0.25 to < 2.5	2.5 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures — and — Monitor	4. MITIGATE — or — Take reasonable and practical actions to identify source(s) and reduce exposures — and — Monitor
5 to < 50	5. No further action	6. Monitor	7. Monitor	8. MITIGATE
50 to < 250	9. Monitor	10. Monitor	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

Effective Attenuation Factor ~0.005

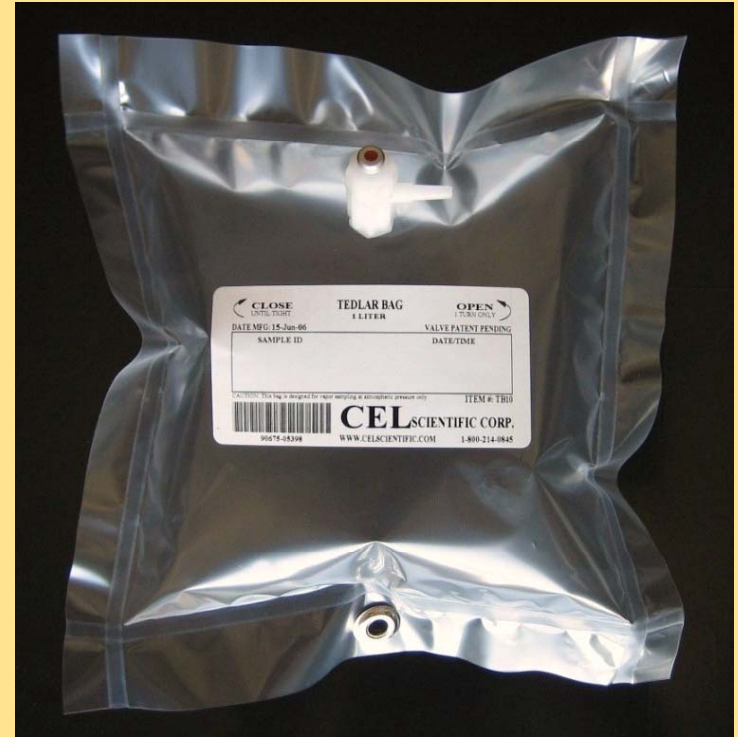
Sampling Strategy

- Sub-slab Samples
 - Semi-permanent Point (AMS GVP Tip)
 - Sand Pack with Bentonite Seal



Sampling Methods

- Field Screening
 - Soil Vapor
 - Tedlar Bag
 - Evacuated Canister
 - PID/ GC-FID
 - Ambient Air
 - Vacuum Readings
 - Back-up Cans/Controllers



Sampling Strategy

- Sampling Time
 - 8 hr
 - Worker Exposure
- Sample Size
 - 6 L





Sampling Methods

■ Field Quality Assurance

- Blank Samples
 - Batch Container Certification
- Background Samples
 - Ambient Air

■ Lab Quality Assurance

- Method Blanks
- Lab Duplicates
- LCS/LCSD



* Photo Courtesy of CAS Labs

Sampling Methods

- Co-located Samples
 - Simultaneous Collection



Background Samples

- Inconspicuous Upwind Location





Case Study 1

- Active Industrial Manufacturing Facility
 - 6-10 inch Concrete Foundation
 - Numerous sub-basements/vaults and sumps
- Subsurface soil Impacts
- Groundwater Impacts
- Biased Sampling
 - Source Areas
 - Office Spaces



Case Study 2

- Active Manufacturing Facility
- Low level Groundwater Contamination
 - Less than 10 ppb cVOC
- Warehouse space with basement
- Sub-slab samples collected less than 5ft from groundwater table.



Case Study 3

- Former Heavy Industrial Manufacturing Building
 - Currently used for office space
 - 6 -18 inch concrete slab on spread footings
- Sub-slab soil contamination
- Limited groundwater impacts
- Sub-slab samples collected <5 ft from groundwater table.





Case Study 4

- Retail/Commercial Building
 - 4-6 “ concrete Slab on grade
- No Sub-slab soil sources

- Widespread Groundwater impacts

- Soil vapor samples collected >5 ft from groundwater table

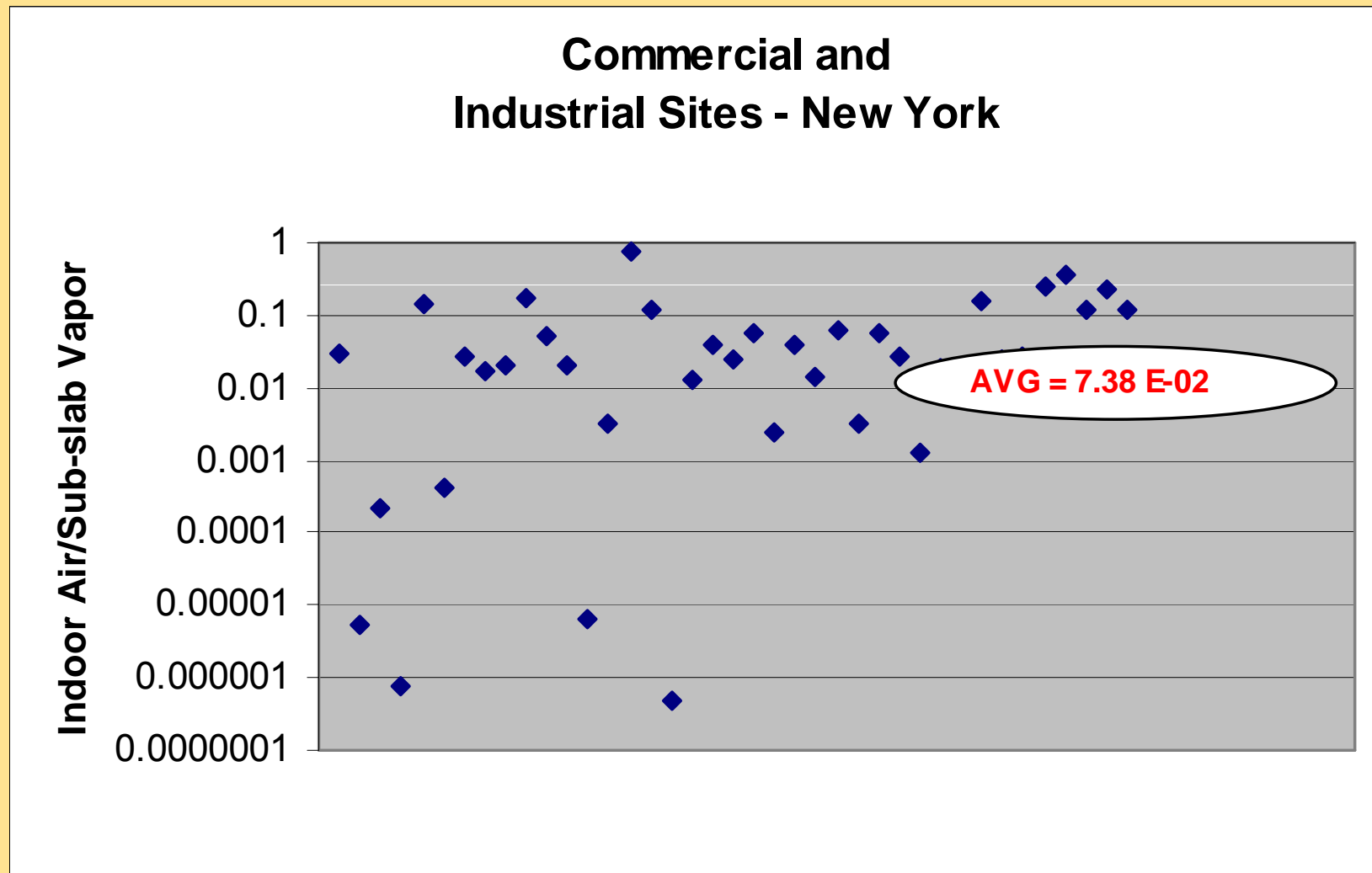


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Sampling Locations



Observed Attenuation Factors





Summary

- Factors influencing AFs at industrial Sites
 - Analytical Detection Limits
 - Foundation Construction
 - Facility size and volume
 - Source of Impacts
 - Soil/Groundwater
 - Soil Vapor Sample
 - Depth to GW
 - Ambient Background



Conclusions

- AFs can range from 1E-07 to 1E-01
- Facility Construction influences AFs
- Independent of cVOC detected
- Site Specific AF can be developed to use Sub-slab concentrations to predict IA impacts.



Thank You

- Questions

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