At facilities with subsurface contamination, what other chemicals may your workers be breathing?

Matt Raithel

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Chemicals your workers may be breathing

- Chemicals employees work with
- Chemicals employees bring into the work place
  - dry cleaning chemicals, etc.
- Other indoor air sources
  - building material, cleaning supplies, etc.
- Ambient air (outdoor air)
  - car exhaust, neighboring facility, etc.
- Vapor intrusion

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Chemicals your workers may be breathing

- Chemicals employees work with
- Chemicals employees bring into the work place
  - (dry cleaning chemicals, etc.)
- Other indoor air sources
  - (building material, cleaning supplies, etc.)
- Ambient air (outdoor air)
- Vapor intrusion

Focus of this presentation

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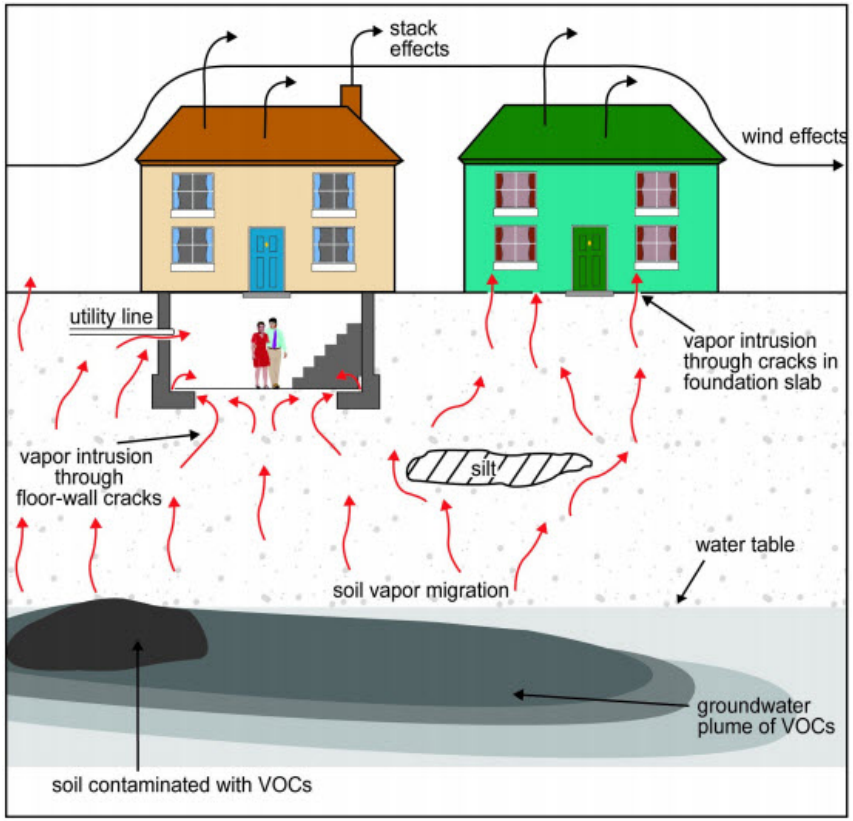
What is vapor intrusion?

"Vapor intrusion occurs when there is a migration of vapor-forming chemicals from any subsurface source into an overlying building."

(USEPA Vapor Intrusion Website)



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Key elements of an indoor air sampling plan to assess vapor intrusion

1. Review subsurface data
2. Conduct site visit/interviews
3. Generate sampling plan
4. Conduct indoor air sampling
5. Evaluate data

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How do we estimate indoor air concentrations?

- Future buildings
  - Groundwater data
  - Soil vapor data
- Existing buildings
  - Subslab data
- Modeling (Johnson & Ettinger Model)
- Default attenuation factors
- Uncertainty/conservative

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Indoor air sampling

Due to uncertainties from estimating indoor air concentrations from subsurface concentrations (groundwater or soil vapor), regulators are increasing requesting indoor air sampling

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Problems with indoor air sampling

- Indoor air sources
  - Chemicals
  - Dry cleaning
  - Cleaners
  - Ambient air
- Communication with employees

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Pre-sampling activities

- Building survey
- Interviews
  - Both current and historical information
- Purpose: to gather information to identify indoor air sample locations

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Information to gather

- Results of previous investigation activities (elevated sub-slab, soil gas, groundwater)
- Building use and layout
- Potential preferential pathways (cracks, conduits, floor drains, subsurface utilities)
- Areas of chemical storage

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Information to gather - continued

- Building ventilation
  - Clean room (positive pressure)
  - Air exchange rate (higher vs. lower)
  - Air handling areas
  - Intake
- Screen with ppb-RAE

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Sampling plan

Indoor air sampling

- Remove chemicals from building
- Summa cannisters
- 8 hour samples
- Indoor and ambient samples
- Two rounds – seasonal variation

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Chemicals that may be detected in indoor air samples

- Chemicals employees work with
- Chemicals employees bring into the work place
  - dry cleaning chemicals, etc.
- Other indoor air sources
  - building material, cleaning supplies, etc.
- Ambient air (outdoor air)
  - car exhaust, neighboring facility, etc.
- Vapor intrusion

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Data evaluation

- Objective – identify chemicals in indoor air that are related to vapor intrusion
  - If a VOC is detected in indoor air at concentrations similar in ambient air, the indoor air concentrations are likely attributed to ambient air from the exterior.
  - If a VOC is detected in indoor air and not detected in ambient air or sub-slab vapor, the indoor air concentration is likely attributed to an indoor air source.
  - If a specific VOC is detected in indoor air and sub-slab soil vapor and is either not detected in ambient air or the ambient air concentrations are less than the indoor air concentrations, a portion of the indoor air concentrations may be attributed to indoor air source(s) and/or may be attributed to subsurface vapor intrusion.

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Data evaluation

Indoor air sources	Ambient air sources	Vapor intrusion sources
Acetone	1,1,1-TCA	1,1-DCA
isopropyl alcohol	Chloroform	1,2-DCA
	Carbon tetrachloride	cis-1,2-DCE
	Hexane	trans-1,2-DCE
	Benzene	PCE
	Toluene	TCE
	Ethylbenzene	
	Xylenes	
	Freon	

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How is vapor intrusion different from occupational exposure?

- "OSHA PELs are not appropriate criteria for evaluating risk associated with vapor intrusion. OSHA sets PELs to regulate worker exposures to hazardous vapors and gases present in workplace air from chemical handling or use, not exposure to air contaminants originating from the subsurface."
- "PELs are based on the assumption that only healthy, appropriately trained and monitored workers may be exposed to chemical concentrations as great as or exceeding the PELs."

(California DTSC Vapor Intrusion Guidance, October 2011)

- EPA indoor air screening levels are risk-based concentrations that are protective of the most sensitive receptors.

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Comparison of PCE OELs vs EPA Screening Levels

- OELs
  - PEL TWA = 100 ppm (680,000 ug/m^3)
  - TLV TWA = 25 ppm (170,000 ug/m^3)

- EPA commercial/industrial worker RSL = 47 ug/m^3

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Summary

- Workers may be breathing chemicals from vapor intrusions
- If you conduct indoor air sampling:
  - Conduct site visit
  - Conduct interviews
  - Generate a focused sampling plan
  - Remove chemicals from building
  - Evaluate relevant data
- Chemical concentrations requiring mitigation may significantly lower than OELs

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Thank you!

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