

DNR Approach to Vapor Intrusion – Part 1

FET - DNR Seminar

Vapor Sampling for the Environmental
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Overview – Part 1

- Preliminary screening for presence of vapor pathway
- Conditions where additional vapor investigation is warranted
- Criteria for determining health risk at vapor intrusion sites
- How ASTM E-2600 Standard fits



Conceptual Site Model

- Identify the pathways in which contaminants can move from the point of discharge to receptors.
- Release of contaminated vapor is a discharge and can contaminate the environment



Preliminary VI Screening

- ❑ Volatility & toxicity of contaminants of concern (inorganic or organic)
- ❑ Contaminant source location & concentration in soil & groundwater
- ❑ Distance between source and building(s)
- ❑ Geology and hydrogeology, including preferential pathways such as fractures in glacial till or bedrock; interbedded sand units, etc.



Preliminary VI Screening

- Fate and transport processes and likely affect on vapor migration
- Sub-surface structures facilitating vapor movement away from source (e.g., utilities)
- Condition of existing building or planned building – age, size, condition of foundation, perforations in foundation, etc.



Conditions Where Additional Vapor Investigation is Warranted

Guidelines for BETX Contaminants:

- ❑ Free phase petroleum product within a 100 feet of building
- ❑ BETX contaminated groundwater entering building
- ❑ BETX contaminated soil or groundwater within 30 feet of building



Conditions Where Additional Vapor Investigation is Warranted

Guidelines for Chlorinated Volatile Chemicals

- ❑ Source properties where CVOC release has occurred – particularly where buildings exist or are planned
- ❑ Buildings within 100 feet of soil contaminant levels indicative of free phase product
- ❑ Buildings overlying CVOC groundwater plume located at the water table.



Conditions Where Additional Vapor Investigation is Warranted

Guidelines for Chlorinated Volatile Chemicals

- Buildings located within 100 horizontal feet in all directions beyond a CVOC groundwater plume located at the water table
- CVOC contaminated groundwater entering a building



Conditions Where Additional Vapor Investigation is Warranted

- Actual extent of vapor investigation will depend on site specific factors, distances discussed here are guidelines only



Conditions requiring immediate action

- Detection of petroleum odors in building
- Detection of contaminants in indoor air at or above 1-in-10,000 (1×10^{-4}) excess lifetime cancer risk



Redevelopment Properties

- Soil gas samples taken near the likely vapor source may be useful for screening the potential for vapor migration
- It is usually cost effective to build vapor protection into new construction.



Approach to VI Investigation

- ❑ If the VI pathway can not be ruled out after screening, the next most common step to take vapor samples
- ❑ However, presumptive mitigation of the VI pathway may be undertaken at any time.
- ❑ Consultants are expected to use professional judgment and determine the best way to conduct the VI investigation, based on site circumstances



Soil gas sampling

- ❑ To define the extent of vapor migration away from a source
- ❑ Surrogate for sub-slab sampling when sub-slab samples can not be collected, but sub-slab samples are strongly preferred
- ❑ Define risk of VI at redevelopment properties



Sub-slab samples

- When a building is located in the immediate vicinity where COCs were released
- When buildings are within a certain distance of a vapor source (outlined previously).
- Whenever vapor migration near or beneath a building is suspected



Sub-slab samples

- Multiple sub-slab samples should be collected beneath a building, specifically targeting areas or directions from which vapors may be originating.



Indoor Air Sampling

- ❑ May or may not be performed concurrently with sub-slab sampling
- ❑ May be performed where contaminant vapors have been confirmed sub-slab and contaminants of concern are NOT in use in the building.
- ❑ Often, sub-slab and indoor air samples are collected at the same time (twinned), but this is up to the investigator.



Indoor Air Sampling

- If sub-slab vapor concentrations are above risk levels for VI, mitigation of the VI pathway should be implemented, regardless of the current indoor air concentrations.



When must action to mitigate VI be taken?

- DNR at this time is proposing that **actual or potential vapor contaminant concentrations** in the breathing space of buildings **equal to or greater than 1-in-100,000 excess lifetime cancer risk** are considered to present a human health hazard and must be addressed as part of the remediation effort.



When must action to mitigate VI be taken?

- Standard exposure equations, as found on EPA websites, can be used to calculate the ambient air screening level. Equations should be adjusted for residential or non-residential use.
- Standard EPA attenuation factors should be used
 - 0.1 sub-slab vapor to indoor air
 - 0.01 deep soil gas to indoor air
 - 0.001 groundwater to indoor air



When must action to mitigate VI be taken?

- If indoor air OR sub-slab concentrations (with the appropriate attenuation factor) exceed the 1-in-100,000 excess lifetime cancer risk, then an actual or potential human health risk exists and action to mitigate the risk must be taken.
- Exceedance of risk screening levels in sub-slab vapors alone will trigger the need for mitigation.



How does new ASTM VI Standard Compare?

- ASTM Standard Practice E-2600-08, Assessment of Vapor Intrusion into Structures on Property Involved in Real Estate Transaction
- Tiered assessment starting with screening for contaminant sites within “minimum search distance” of the building.
 - 1/10 mi. for petroleum sites; 1/3 for other VOCs
 - Up to 1 mi. for upgradient sources



How does new ASTM VI Standard Compare?

- Tier 1 “Critical distance” concept - a potential vapor intrusion condition (pVIC) is presumed to exist if:
 - boundary of VOC contaminant plume or petroleum LNAPL is within 100 feet (any direction)
 - Boundary of petroleum plume within 30 feet



How does new ASTM VI Standard Compare?

- Cleanup status of the property. ASTM recommends that VI be assessed if residual contamination left at the time of closure and VI pathway was not considered at the time of closure.



How does new ASTM VI Standard Compare?

- ASTM recommends the following if a pVIC exists after Tier 1 screening:
 - Go on to Tier 2 screening (then Tier 3, if necessary); OR
 - Install pre-emptive mitigation at the building

Major difference between ASTM and DNR approach

- ASTM states that if an indoor air results are below health risk levels, VIC may be eliminated from further consideration.
- DNR's approach is that if sub-slab concentrations are above health screening levels, the vapor pathway must be addressed - - even where current indoor air concentrations may be below health risk levels.