



DNR Approach to Vapor Intrusion Part 2

FET - DNR Seminar

Vapor Sampling for the
Environmental Professional,
September 23, 2008

Terry Evanson, 608-266-0941



Overview – Part 2

- Responses to sites with a complete vapor pathway
- Verification sampling
- Closure at sites with a complete vapor intrusion pathway
- Examples
- Common questions about VI results



Responses to Confirmed Vapor Intrusion Pathway

- Sub-slab depressurization systems (SSDS or “radon systems”) are the most common response for addressing VI at existing buildings.
- Vapor barriers and passive or active vapor extraction systems can be installed beneath new buildings.
- Other response options exist – see the ITRC Vapor Intrusion Guidance.



Responses to Confirmed Vapor Intrusion Pathway

- Vapor mitigation systems are NOT remedial actions.
- The long-term protection of the vapor pathway is not vapor mitigation at a building but remediation of the source of contamination.



Responses to Confirmed Vapor Intrusion Pathway

- SSDS should be considered an interim or auxiliary action to protect the breathing space of buildings.
- Remediation of the vapor source should be undertaken with a goal of eventually reducing vapor concentrations at the receptor to levels below the 1-in-100,000 excess lifetime cancer risk without the use of a SSDS.



Verification Sampling

- After mitigation has been installed, the system must operate effectively to be protective.
- All SSDS systems should be installed with a manometer for monitoring system pressure.
- Verification testing of system effectiveness should take place 3 to 6 months after installation.

Verification Sampling

- Verification sampling can consist of:
 - Indoor air samples – particularly if previous indoor air samples indicated VOC concentrations were greater or equal to 1-in-100,000 excess cancer risk.
 - Pressure gradient. Pressure transducers or a “smoke test” to show that pressure above the slab is greater than pressure below the slab.



Closure at VI sites

- All contaminant pathways addressed in accordance with NR 726
- Mitigation of vapors results in indoor air concentrations less than 1-in-100,000 excess life time cancer risk (with verification)
- Source of vapors is remediated to the extent practical to
 - Reduce future vapor migration
 - Reduce length of time vapor mitigation system is needed



Closure at VI sites

- Owner of building with vapor intrusion is responsible for maintaining the mitigation system, unless there is an agreement with the RP (ss 292.12, WI Stats)
- Property is entered onto the R&R's GIS Registry



Example #1 – Site Conditions

- PCE plume from former dry cleaner is located beneath several shops in a strip mall. The plume meets criteria for natural attenuation and there are is no direct contact pathway. Sub-slab vapors are present beneath the strip mall.

Example #1 - Scenarios

- **A:** Sub-slab concentrations < 1-in-100,000 excess life time cancer risk (with attenuation factor). Can close under NR 726
- **B:** SS concentrations \geq 1-in-100,000 excess life time cancer risk; IA less than this risk.
 - Install vapor mitigation to minimize future exposure
 - Can close if NR 726 requirements met

Example #1 - Scenarios

- **C:** SS and IA \geq 1-in-100,000 excess life time cancer risk.
 - Install vapor mitigation system
 - Post mitigation IA monitoring necessary
 - Additional remedial action may be necessary to reduce mass at the contaminant source to minimize on-going vapor intrusion.



Example #2 – Site Conditions

- TCE present at a redevelopment site. Developer removed a large amount of contaminated soil. Groundwater plume is receding; no direct contact issues. Below ground parking lot designed to vent car exhaust. At grade office space with condos on upper levels.

Example #2 - Scenarios

- **A:** Testing (soil gas or SS) done prior to operation of exhaust system shows COC concentrations < health risk levels. VI pathway addressed and site can be closed.
- **B:** Testing shows vapor concentrations \geq health risk levels. Because exhaust system must operate constantly, TCE levels in IA will be controlled below risk levels. Can close if all other NR 726 conditions met.

Example #3 – Site Conditions

- Industrial tank of TCE leaks, groundwater plume spreads beneath nearby residential subdivision. Homes on city water. Risk levels may be exceeded based on estimates from soil gas results. IA & SS tests at target homes. Remedy included soil removal and groundwater P&T with SVE.

Example #3 - Scenarios

- **A:** As long as remedy operational, site will not close. If risk levels exceeded in SS or IA, mitigation must be installed in homes.
- **B:** Remedy completed and shut down. Subsequent testing shows SS and IA < health risk levels. Can close if all other NR 726 requirements met.

Example #3 - Scenarios

- **C:** Remedy completed and shut down. IA is ND for TCE, but SS \geq health risk levels. Site can be closed, but land use control will be placed on homes for continued operation of SSDS. Homeowners may negotiate an agreement with RP for payment of long-term O&M of system.

Example #3 - Scenarios

- **D:** P&T and SVE shut down, plume stable. SS and IA exceed health risk levels for 2 additional homes. Mitigation installed at the homes. Additional source control actions evaluated, including turning P&T and SVE back on. If additional remediation necessary, site closure not appropriate at this time.



Example #4 – Site Conditions

- High levels of PCE are identified beneath the building of an existing dry cleaner. Due to low permeability soils, groundwater impacts are minor. No direct contact threat. Issue of potential vapor intrusion into building due to PCE levels.



Example #4: Scenarios

- **A:** Dry cleaning continues at the property. OSHA standards apply to IA, so affect of VI on IA is difficult to define. SS samples exceed commercial health risk standards. Therefore, if the building changes use, the potential for VI exists.

Example #4: Scenarios

- **A1:** Owner has the option of installing mitigation system now. Site can be closed, but IA can not be used to verify system effectiveness.
- **A2:** Closure condition requires that vapor intrusion be assessed after dc no longer occurs at building. If needed, mitigation and further remediation occurs in the future.

Example #4: Scenarios

- **B:** DC moves business after site closure issued. Space rented to a bookstore. OSHA rules no longer apply and VI evaluation needs to be done to determine PCE vapor concentration. If vapor exceeds health risk levels and further remedial action needed, site would be reopened to address the vapor contaminant pathway.



Example #4: Scenarios

- **C:** Developer purchases dc property & plans to demolish building. Closure letter would require additional investigation once original building removed and require evaluation of VI pathway for determining mitigation needed for new building. Additional source control may be necessary.

Common Questions about VI results

- Averaging sub-slab sample results
 - In general, sample results should NOT be averaged. Particularly, soil gas and sub-slab samples should help the investigator identify “hot spots” or preferential pathways of vapor migration.
 - Redevelopment often changes the configuration of a building, so indoor air impact is not necessarily “averaged” over a large space.

PCE Levels in Soil Vapors Beneath Home in SE WI

Date	Sample Period	Sub-Slab Soil Vapor	Basement Location
4/11/06	15 min	63,328	SE Corner
"	"	15	N. Rm
"	"	2,030,160	S. Central

Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)



Common Questions about VI results

- Background VOCs in indoor air
 - A number of studies have been made of background indoor air VOCs. Before sampling, survey and remove contributing sources of VOCs (like spot cleaners, etc.).
 - The issue of background VOCs has been considered in the DNR's recommendation of the 1-in-100,000 excess lifetime cancer risk.



Common Questions about VI results

- What if lab detection levels are above the screening levels?
 - We will work with you regarding the limitations of the lab methods.
 - Relatively few compounds will be non-detect at the recommended risk screening level



Common Questions about VI results

- Does the DNR have guidance on use of the Johnson & Ettinger model for screening out the VI pathway?
 - No. The DNR does not usually accept model results as an alternative to rule out a contaminant pathway.



Common Questions about VI results

- Will the DNR accept different attenuation factors from those recommended by EPA?
 - DNR recommends the attenuation factors set out by EPA in their 2002 VI guidance
 - We will implement whatever changes EPA makes to their recommendations