

**Land Recycling Program Technical Guidance Manual  
Statewide Health Standards  
Proposed Vapor Intrusion Guidance Discussion Document**

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**Explanation for general framework:**

The focus of this draft document is to create a workable procedure for addressing vapor intrusion (VI) issues under the Statewide health standard (SHS). The General Assembly intended the SHS to be a streamlined procedure to facilitate the remediation process. If the VI requirements under the SHS become overly complicated the SHS will become dysfunctional.

The EPA, NJ and other states have rejected the use of soil screening tables based on fate and transport modeling from volatile organic analysis of soil data. This modeling has a high degree of uncertainty. The new Johnson and Ettinger model will not support indoor air modeling based on soil data. The development of soil screening tables and the associated sampling methods pose numerous concerns about the scientific validity of any soil screening procedure. Therefore, this draft document does not contain soil screening tables.

Inhabited buildings located beyond the groundwater point of compliance, where SHS used aquifer standards are attained, do not need to address potential VI impacts from the groundwater under inhabited buildings since this groundwater is acceptable for use inside the inhabited buildings.

Soil gas sampling in open areas poses technical concerns regarding data quality, reproducibility, and validity. These technical limitations associated with accurately measuring soil gas concentrations in open areas force the SHS VI guidance to limit soil gas sampling to sub-slab soil gas sampling under inhabited buildings.

**NOTES on Land Recycling Program Technical Guidance Manual (TGM):**

As part of the overall project currently underway to revise the TGM, the existing SHS VI language included in the TGM under the Fate and Transport Analysis section (Section IV.A) will be deleted.

The proposed SHS VI language (below) will be inserted under the Statewide Health Standard section (Section II.B) to emphasize that the SHS vapor screening process is only applicable under the SHS standard. This SHS VI language would be inserted as the new Section II.B.6.

In addition to this SHS VI section, VI language relating to the site-specific standard will be added to the Site-Specific Standard section (Section II.C); and VI language relating to sampling and analysis will be added in General Guidance Section IV.

**NOTES on Tables:**

After the general approach is finalized, Tables #1 and #2 will need to be developed.

The numbering of tables #1 and #2 is temporary. Final TGM table numbers will be designated when this section is inserted into the TGM.

Table #1 will be a list of substances that pose potential vapor intrusion impacts with indoor air screening concentrations.

Table #2 will include substances where the calculated groundwater to indoor air screening number was higher than the used aquifer groundwater MSC.

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**PROPOSED SHS VAPOR INTRUSION SECTION TO BE ADDED TO TGM**  
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**Land Recycling Program Technical Guidance Manual**  
**Section II. Remediation Standards**  
**B. Statewide Health Standards**  
**6. Vapor Intrusion**

Releases of regulated substances in soil or groundwater near inhabited buildings can result in intrusion of the regulated substances into indoor air. The resulting impacts to indoor air may pose a threat to human health in inhabited buildings. Inhabited buildings are structures with enclosed air space that are designed for human occupancy.

This section provides guidance for addressing potential vapor intrusion of volatile and semivolatile organic substances into inhabited buildings using the Statewide health standard. If volatile inorganic substances are the contaminants of concern (i.e., mercury, ammonia, cyanide), the potential vapor intrusion impacts can only be addressed under the site-specific standard.

Compliance with this guidance will address vapor intrusion impacts for existing inhabited buildings located in or near the source areas and will provide the relief of liability granted by the act when the final report is approved. These procedures do not necessarily address potential vapor intrusion impacts to inhabited buildings that may be constructed in or near a source area in the future. Any new construction of inhabited buildings in or near a source area must be designed and constructed to address potential vapor intrusion impacts. Failure to address vapor intrusion impacts associated with any new construction of inhabited buildings in or near a source area that results in an unacceptable risk to human health due to vapor intrusion impacts may result in the case being reopened based on changes in exposure conditions.

**a) Groundwater to Indoor Air Pathway**

If the groundwater concentration of any substance on the list of indoor air screening concentrations (Table #1) or the Short List of Petroleum Products (Table IV-9) does not meet either the used aquifer MSCs or the groundwater screening concentrations (Table #2), the groundwater to indoor air pathway must be addressed for inhabited buildings in the following areas:

- Any inhabited building located within 15 feet of any area where the groundwater concentration of any substance listed on the Short List of Petroleum Products (Table IV-9) does not currently meet (or will not meet in the future) either the used aquifer MSCs or the groundwater screening concentrations (Table #2).
- Any inhabited building located within 100 feet of any area where the groundwater concentration of any substance listed in Table #1 (excluding substances listed on the Short List of Petroleum Products) does not currently meet (or will not meet in the future) either the used aquifer MSCs or the groundwater screening concentrations (Table #2).
- Any inhabited building located where there is a reasonable likelihood that preferential pathways associated with a groundwater source area will result in groundwater to indoor air pathway exposures that exceed the indoor air screening concentrations (Table #1). An underground feature that passes through the source or within 30 feet of the source and is between the source and the receptor is considered a preferential pathway.

#### **b) Soil to Indoor Air Pathway**

The soil to indoor air pathway does not need to be addressed for the remediation of petroleum products where the remediation and demonstration of attainment is conducted in accordance with Chapter 250.707(b)(1)(iii) (relating to statistical tests).

The soil to indoor air pathway must be addressed for inhabited buildings located in any area of the site where substances listed in Table #1 may remain in the soil after the remediation is completed which may result in vapor intrusion impacts that exceed the indoor air screening concentrations (Table #1). This would include the following:

- Any inhabited building that is within 15 feet of any area where the soil concentration of any substance listed on the Short List of Petroleum Products (Table IV-9) exceeded the SHS MSC prior to the remediation.
- Any inhabited building that is within 100 feet of any area where the soil concentration of any substance listed in Table #1 (excluding substances listed on the Short List of Petroleum Products) exceeded the SHS MSC prior to the remediation.

- Any inhabited buildings where there is a reasonable likelihood that preferential pathways associated with a soil source area will result in soil to indoor pathway exposures that exceed the indoor air screening concentrations (Table #1).

**c) Options for Addressing Vapor Intrusion Impacts for Inhabited Buildings**

Remediators have the following options available to address vapor intrusion pathways for inhabited buildings for sites where it has been determined that potential vapor intrusion impacts must be addressed:

**i) Groundwater to Indoor Air Pathway Modeling**

If the pathway of concern is the groundwater to indoor air pathway, the remediator can address the vapor intrusion concern by conducting groundwater to indoor air fate and transport modeling and demonstrating that the contaminated groundwater will not cause the indoor air in the inhabited buildings to exceed the indoor air screening concentrations (Table #1). The modeling can account for biodegradation and other attenuation factors. Additional information concerning fate and transport modeling is provided in Section IV and on the DEP web site.

**ii) Sub-slab sampling**

Conduct sub-slab soil gas sampling and demonstrate that soil gas concentrations are not greater than 30 times the indoor air screening concentrations (Table #1). This option can be used for buildings with a concrete slab on-grade, a crawlspace, or basement floors. This option cannot be used for buildings with soil floors or buildings where the water table is within 5 feet of the concrete slab. At least two sub-slab soil gas sampling events must occur 2 to 4 weeks apart and must include multiple sampling locations. Additional information concerning sampling is provided in Section IV.

**iii) Indoor air sampling**

Conduct indoor air sampling to demonstrate that the indoor air concentrations are below the indoor air screening concentrations (Table #1). At least two indoor air sampling events must occur at least two weeks apart and be conducted during cold weather conditions when the building is closed up and the heating system is operating. Additional information concerning sampling is provided in Section IV.

**iv) Mitigation using Engineering and Institutional Controls**

The remediator has the option to proceed directly to the mitigation option at any point in the process. Mitigation systems may not be feasible in all cases. The feasibility of using a mitigation system to address vapor intrusion impacts will depend on the specific details of the site, the building, and the design of the system.

Mitigation most commonly involves the installation of an active sub-slab depressurization system (similar to a fan-driven radon abatement system).

For residential buildings used as single family homes, these standard radon-type mitigation systems may be installed by anyone certified by the Department to install radon systems. These standard residential systems do not need to be designed or approved by a Licensed Professional Engineer.

The active sub-slab depressurization systems can be tested using pressure differential testing. The remediator must demonstrate depressurization throughout the sub-slab. When active sub-slab depressurization systems are tested using pressure differential testing, the remediator is not required to conduct indoor air confirmation testing.

An environmental covenant must be placed on the deed to assure maintenance of the mitigation system. The environmental covenant must include language that requires the property owner to assure maintenance of the vapor intrusion mitigation system, but the environmental covenant does not need to include language requiring periodic monitoring or reporting to the Department.

Many areas of Pennsylvania have high levels of naturally occurring radon gas, which can pose a significant public health threat. This guidance is intended to facilitate the installation of vapor intrusion mitigation systems that will not only address potential vapor intrusion concerns associated with the release of regulated substances at remediation sites but will also provide additional public health benefits associated with reducing the significant public health threat caused by naturally occurring radon gas.

**d) Access to inhabited buildings on neighboring properties**

If the remediator needs access to an inhabited building on a neighboring property to conduct sub-slab or indoor air sampling but access is denied by the neighboring property owner, the remediator should provide the Department with information documenting that a good faith effort was made to gain access and that access was denied.

After verifying that the neighboring property owner is not willing to grant access, the Department may order the neighboring property owner to either provide access to the inhabited building or conduct the necessary sampling in the inhabited building.

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