## WAC 173-340-3510 Vapor intrusion evaluation procedures-general considerations.

**(1) Purpose.**
**(2) Tiered evaluation process.**
**(3) Information needs for vapor intrusion evaluations.**
**(4) Factors to consider in vapor intrusion evaluations.**

**(1) Purpose.** The purpose of a vapor intrusion evaluation is to determine whether hazardous substances present in ground water or subsurface soils could result in the accumulation of unacceptable indoor air concentrations in buildings or other structures in excess of air cleanup levels established under WAC 173-340-750. The vapor intrusion evaluation can be used to support decisions on ground water cleanup levels (WAC 173-340-720), soil gas cleanup levels (WAC 173-340-740) and cleanup actions (WAC 173-340-360).

**(2) Tiered Evaluation Process.** Vapor intrusion evaluations can be organized as a series of decision points that allow investigators to collect and evaluate data in a cost-effective manner. These steps are described in WAC 173-340-3511 through 173-340-3513. These steps can be performed separately in a sequenced manner or performed concurrently as part of a single investigation.

**(3) Information needs for vapor intrusion evaluations.** The following information is needed at a minimum to support a vapor intrusion evaluation:

(a) Conceptual site model;

(b) Identification of hazardous substances present or suspected to be present at the site;

(c) Site map that identifies all areas where hazardous substances are known or suspected to be located; and

(d) Preliminary characterization of subsurface and ground water actually or potentially affected by hazardous substance releases

(e) The location of existing and potential future buildings, underground utilities and other structures and relevant construction information on these structures.

**(4) Factors to consider in vapor intrusion evaluations.** There are many site-specific conditions that can affect vapor migration into buildings or other structures. These include, for example, seasonal weather patterns, barometric pressure, the types of soils underlying the structure, soil moisture conditions, changing groundwater levels, the presence of preferential migration pathways, building construction, and heating and cooling systems operations. Similarly, the location of vapor measurements, construction of vapor probes, sample collection procedures and analytical methods can significantly influence measured concentrations. It is important that the evaluator know these conditions at a site and understand how these factors can affect vapor migration and measurements when conducting a vapor evaluation.

**WAC 173-340-3511 Preliminary assessment of the vapor intrusion pathway.**

**(1) Purpose.**
**(2) Information needs.**
**(3) Decisions.**

(1) **Purpose**. The purpose of the preliminary assessment is to quickly identify whether the potential for vapor intrusion exists at a specific site, and if it does, which buildings may be affected.

(2) **Information needs**. The information in WAC 173-340-3510 is needed to support a preliminary assessment of the vapor intrusion pathway:

(3) **Decisions**. The information from the preliminary assessment may support one or more of the following decisions:

(a) No further actions are needed to address the vapor intrusion pathway because the hazardous substances present at the site are not sufficiently toxic and volatile. For purposes of this evaluation, a hazardous substance is considered to be "sufficiently toxic and volatile" if the maximum vapor pressure for the substance exceeds the applicable air cleanup level established under WAC 173-340-750 or the substance is present as free product at the site.

(b) No further actions are needed to address the vapor intrusion pathway because existing or potential future buildings, utilities and other structures are not located within 100 feet of subsurface contamination or are otherwise unlikely to be affected by vapor intrusion.

(c) Further information is needed to make decisions on the potential threats posed by the vapor intrusion pathway.

(d) Immediate action is needed to minimize human health risks and/or explosion hazards.

**WAC 173-340-3512 Tier I evaluation of the vapor intrusion pathway.**

**(1) Purpose.**
**(2) Information needs.**
**(3) Decisions.**

(1) **Purpose**. The purpose of the tier I evaluation is to determine whether concentrations of these hazardous substances in the subsurface ground water and soil gas are high enough to pose a vapor intrusion threat at current or future site buildings.

(2) **Information needs**. In addition to the information required under WAC 173-340-3510, the following information is needed to support a Tier I evaluation of the vapor intrusion pathway:

(a) Concentrations of hazardous substances present in ground water or soil gas samples collected at the site;

(b) Fate and transport modeling results

(3) **Decisions**. The information from the tier I evaluation may support one or more of the following decisions:

(a) No further actions are needed to address the vapor intrusion pathway because the hazardous substances in the ground water are present at levels below the ground water screening levels established using equation 351-1.

(b) No further actions are needed to address the vapor intrusion pathway because the hazardous substances in the soil gas are present at levels below the soil gas screening levels established using equation 351-2.

(c) No further actions are needed to address the vapor intrusion pathway because modeling approved by the department demonstrates that air cleanup standards established under WAC 173-340-750 will not be exceeded. The department may require soil vapor and/or air monitoring to be conducted to verify the calculations and compliance with air cleanup standards.

(d) Further information is needed to make decisions on the potential threats posed by the vapor intrusion pathway.

(e) Action is needed to prevent human health risks and/or explosion hazards.

**WAC 173-340-3513 Tier II evaluation of the vapor intrusion pathway.**

**(1) Purpose.**
**(2) Information needs.**
**(3) Decisions.**

(1) **Purpose**. The purpose of the tier II evaluation is to determine whether indoor air concentrations pose a health risk that requires measures to reduce vapor intrusion threats. Tier II evaluations should be performed when there are volatile, toxic substances at the site, that the subsurface contamination is close to one or more existing or potential future buildings, utilities and other structures and that the subsurface contamination is significant enough to pose a threat to indoor air quality.

(2) **Information needs**. In addition to the information required under WAC 173-340-3510, the following information is needed to support a Tier II evaluation of the vapor intrusion pathway:

(a) Concentrations of hazardous substances present in indoor air, crawl-space and/or sub-slab gas samples collected from buildings at the site. Such measurements must be representative of current and future site conditions when vapors are likely to enter and accumulate in structures;

(b) Concentrations of hazardous substances present in outdoor air samples collected in the vicinity of buildings at the site;

(c) Fate and transport modeling results.

(3) **Decisions**. The information from the tier I evaluation may support one or more of the following decisions:

(a) No further actions are needed to address the vapor intrusion pathway because indoor air concentrations measured using procedures approved by the department are present at levels below the applicable air cleanup standards established under WAC 173-340-750.

(b) No further actions are needed to address the vapor intrusion pathway because the hazardous substances in the sub-slab soil gas are present at levels below the screening levels established using equation 351-3.

(c) No further actions are needed to address the vapor intrusion pathway because modeling approved by the department demonstrates that air cleanup standards established under WAC 173-340-750 will not be exceeded. The department may require soil vapor and/or air monitoring to be conducted to verify the calculations and compliance with air cleanup standards.

(d) Further information is needed to make decisions on the potential threats posed by the vapor intrusion pathway.

(e) Action is needed to prevent human health risks and/or explosion hazards.

## Equation 351-1. Generic groundwater VI screening levels

$$SL_{GW} = \frac{SL_{IA}}{VAF * UCF * H_{cc}}$$

Where

| | |
|---|---|
| $SL_{GW}$ | Screening level in groundwater protective of indoor air, μg/L |
| $SL_{IA}$ | Acceptable indoor air screening level, μg/m$^3$. These levels are concentrations protective of human health and can be calculated using the methods and parameters in the MTCA cleanup regulations (WAC 173-340-750). |
| VAF | Vapor attenuation factor (VAF; unitless);[1] a default value of 0.001 should be assumed in Tier I |
| $H_{CC}$ | Henry's Law constant, unitless[2] |
| $UCF$ | Unit conversion factor, 1000 L/m$^3$ |

[1] The VAF is the reciprocal of attenuation. It is defined as the indoor air concentration of a substance, due to vapor intrusion, divided by its subsurface soil gas concentration.

[2] Henry's Law constants for many VOCs can be found in the Ecology CLARC database or are available from EPA. The constants are temperature dependent. Screening Levels in Appendix B have been calculated using Hcc values adjusted to 13°C (average Washington shallow groundwater temperature).

**Equation 351-2. Generic soil gas VI screening levels**

$$SL_{SG} = \frac{SL_{IA}}{VAF}$$

Where

| | |
|---|---|
| $SL_{SG}$ | Screening level in soil gas protective of indoor air, μg/m$^3$ |
| $SL_{IA}$ | Acceptable indoor air screening level, μg/m$^3$. These levels are concentrations protective of human health and can be calculated using the methods and parameters in the MTCA cleanup regulations (WAC 173-340-750). |
| *VAF* | Vapor attenuation factor (unitless). A default value of 0.1 should be assumed during Tier I when $SL_{SG}$ will be compared to a sub-slab or shallow soil gas measurement. 0.01 should be assumed when $SL_{SG}$ is compared to a deep measurement (soil gas samples collected at least 15 feet below the ground surface or building foundation).[3] |

[3] EPA's draft VI guidance document (2002) suggests that generic soil gas screening levels can be utilized to assess the potential for unacceptable indoor air impacts. EPA's document recommends screening levels based on a VAF (which they, consistent with the JEM, denote as "α") of 0.1 for soil gas collected sub-slab. Screening levels based on a VAF of 0.01 are recommended for soil gas collected at greater depths.

On March 4, 2008, however, EPA issued another draft document entitled "Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors." For soil gas detections above the analytical reporting level, the 95$^{th}$ percentile database VAF was calculated to be about 0.3 (with a median value between 0.01 and 0.001). The sub-slab 95$^{th}$ percentile database VAF was calculated to be between 0.15 and 0.48 (with a median value similar to the soil gas value; again, only sub-slab detections above the reporting limit were used in the calculation). This suggests the possibility of certain scenarios leading to less attenuation than assumed in EPA's 2002 screening level recommendations. EPA does not appear to understand what these scenarios are (or, at least, understand them well enough to be able to advocate default attenuation factors for only a subset of the conditions an investigator might encounter). Consequently, Ecology only recommends using generic soil gas screening levels during Tier 1 after consideration of the "limitations" discussed in Section 3.1.3.1.