

Vapor Intrusion Guidance FAQs

Version 3.0

Version Info

1.0 – August 2017

- Original public release.

2.0 – March 2021

- Updated language to reference incorporation of vapor intrusion (VI) guidance into 2019 Technical Guidance Manual (TGM) revision.
- Clarified responses to A.3 and A.4 regarding reporting limits (RLs) and the use of practical quantitation limits (PQLs).
- Updated response to F.1 regarding revisions to 2019 version of TGM.

3.0 – April 2023

- Added mercury VI pathway guidance to Section A.5.
- Clarified responses to A.4 regarding the use of practical quantitation limits (PQLs).

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2. [Process to Determine Site-Specific Standard RSL-Based Vapor Intrusion Screening Values](#)

A. General

A.1. What are the VI evaluation options when there is a crawl space present?

Response: There are many types of crawl spaces. Some buildings may have a crawl space below a concrete floor slab while others are just spaces below the subfloor of the building. EPA (2012b, 2015a) has indicated that there is often little to no attenuation between crawl spaces and occupied indoor spaces. As a result, crawl space sample data should usually be screened against indoor air screening values. However, in instances where a crawl space is below a concrete slab and the slab is comparable in construction to a slab-on-grade building with no significant openings in the slab, then samples collected in the crawl space can be compared to sub-slab screening values.

A crawl space may be considered a significant foundation opening if it has a dirt floor and there is no slab above it. In this circumstance, the presence of the crawl space would be equivalent to having a basement with a dirt floor and should be treated as such.

Crawl spaces may be sufficiently ventilated to prevent VI. However, if the crawl space is mostly enclosed, then it may accumulate vapors which could cause a VI problem in the building. The determination of whether a particular crawl space is a significant foundation opening will depend on the individual site characteristics. In any case, if there is any question as to how to proceed with evaluation of a crawl space, the remediator should consult with the DEP project manager.

Reference: Technical Guidance Manual Sections IV.C.2., IV.D.2., and Appendix IV-C.5.a.

A.2. Should a building with intermittent access such as a garage be evaluated for VI?

Response: The vapor intrusion guidance applies to “inhabited buildings.”

Inhabited buildings are buildings with enclosed air space that are used or planned to be used for human occupancy. A structure used exclusively for storage is not generally regarded as an “inhabited building.” The remediator will need to decide as to whether or not there is sufficient occupancy to pose a potential VI risk.

Reference: Technical Guidance Manual Section IV.A.

A.3. If substances of VI concern are detected but do not exceed soil and groundwater Statewide health standard VI screening values, is the VI pathway complete?

Response: The VI pathway is considered complete if a substance of VI concern is detected in soil or groundwater (or it is not detected and the reporting limit exceeds the VI screening value) within the proximity distance of a current or planned structure or within the separation distance of an external preferential pathway. However, if all of the concentrations are below the screening values then there is no potential VI source and no further VI analysis is necessary. If substances of VI concern are detected in soil or groundwater beyond the proximity distance of a current or planned structure or beyond the separation distance of an external preferential pathway then there is no complete exposure pathway, regardless of the concentrations detected.

A.4 At my site, 1,2-dibromoethane (EDB) is a contaminant of concern in groundwater but is non-detect in sub-slab samples; however, the laboratory’s reporting limits for EDB for several of the sub-slab vapor samples exceed the EDB sub-slab screening value. Am I required to perform further evaluation for the VI pathway for EDB? Can I screen the reporting limit using the PQL instead of the screening value?

Response: It is important to remember that VI screening values are not MSCs that must be attained to meet an Act 2 standard. Rather, the screening step is just one of several options available for remediators to evaluate the VI pathway. If reporting limits exceed screening values, then additional VI pathway evaluation may be necessary.

PQLs are not relevant to VI screening. Act 2 specifies that in demonstrating attainment of any standard, the concentration of a regulated substance shall not be required to be less than the PQL set by EPA. (301(c) of the Act) Screening is the process of determining if more evaluation is necessary to move towards attainment. Utilizing PQLs in screening could potentially eliminate compounds from further evaluation that still create an unacceptable risk via vapor intrusion. It is important to remember that the VI screening values are not MSC values.

Reference: § 250.4(c), 250.701(c).

A.5 [What are the available screening options and evaluation tools for the VI pathway for mercury?](#)

Response: Elemental mercury is a volatile substance, and the vapor intrusion pathway must be evaluated under the SHS and SSS when mercury is a contaminant of concern.

In October 2022, DEP developed options for the evaluation of the VI pathway for mercury under the SHS. DEP has calculated screening values for mercury in indoor air, sub-slab soil gas, and near-source soil gas sampling data. After running some example calculations utilizing the standard attenuation factors for sub-slab and near source, DEP determined that they were applicable to mercury. Mercury has also been added to version 6.9 of the PA DEP J&E residential and non-residential soil gas models for the same reasons.

DEP has not developed soil or groundwater screening values or models for mercury because those methods are applicable to VOCs and may be inaccurate for mercury. The VI screening value tables and J&E models can

be accessed on the LRP website by clicking on “Standards Guidance and Procedures”, “Guidance and Technical Tools”, then clicking on “Vapor Intrusion”. Remediators choosing to evaluate mercury under the SSS should refer to section IV.K of the TGM for guidance.

Mitigation is an option for mercury VI. Technical specifications and testing of the engineering control must be provided to document that it will be effective, consistent with DEP’s guidance.

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B. Effect of New Guidance on In-Process Sites

B.1. If a report is submitted before the effective date and is disapproved, does the old guidance still apply to the resubmittal of that report?

Response: There is a difference between reports that are disapproved and reports that have technical deficiencies.

If a report is disapproved, and a new report is then submitted after the new guidance becomes effective, then the new report would need to follow the new guidance.

If a technical deficiency letter is issued for an Act 2 report, then the resubmittal is considered to be a minor correction to the original report that addresses the deficiencies, and therefore the old guidance would still apply to the resubmittal.

Reference: Technical Guidance Manual Section IV.A.

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C. Future Use of Site

- C.1. How should a future planned building be evaluated if the vapor source is shallower than 5 feet below grade? The new guidance does not permit soil gas sampling within a depth of 5 feet below grade.

Response: Horizontal proximity distances should be considered to determine if the proposed building location is beyond the horizontal proximity distance from the source. If so, no additional VI evaluation would be needed unless preferential pathways are a concern.

For a future slab-on-grade building within a proximity distance to a vapor source shallower than 5 feet below grade, soil or groundwater data can be used to model indoor air concentrations or inhalation risks, depending on the standard being attained.

Additional options include prohibiting future construction in certain areas using a land use restriction, requiring mitigation systems for future construction, remediating the VI sources, or post-construction VI evaluation with activity and use limitations.

Reference: Technical Guidance Manual Sections IV.E., IV.G.3, and IV.H.

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D. Modeling

- D.1. Is it necessary to use the default attenuation factors to evaluate soil gas data for the SHS vapor screening process? Can the J&E model be used to estimate a site- or building-specific attenuation factor instead?

Response: Under the SHS, screening values cannot be adjusted. If a remediator wishes to adjust attenuation factors, then VI must be evaluated under the SSS. The default attenuation factors for the sub-slab screening values and the groundwater screening values are based on EPA's empirical database.

The default attenuation factors for the near-source soil gas and soil screening values are based on DEP's modeling studies.

Attenuation factors other than the default values may be used with adequate justification under the site-specific standard.

Reference: Technical Guidance Manual Appendix IV-B.6.

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E. Off-Site Properties

E.1. Do remediators need to address the potential future use of off-site properties while evaluating vapor intrusion? Does the source property need to use an environmental covenant to cover the potential future use of off-site properties?

Response: If the future use plans for the off-site property are known, then VI should be evaluated considering the planned future use of the off-site property. Otherwise, no additional VI evaluation is necessary for the off-site property.

When there is planned future development for an off-site property, an environmental covenant may be required for the deed of that property if the VI exposure pathway is potentially complete. If a covenant cannot be placed on the downgradient property, then the selected cleanup standard or remedy may need to be revisited. The source property owner has the option of using an EC to monitor for potential future exposure pathways at off-site properties, but it is not required. If future use is not evaluated and a building were to be constructed, VI would need to be evaluated.

Reference: Technical Guidance Manual Sections IV-A. and IV-H.; Act 2 Section 505.

F. Preferential Pathways

- F.1. Do both of the vertical and horizontal separation distances between an external preferential pathway and a potential VI source need to be met for the separation distances to apply, or does only one of the two need to be met?

Response: The 2017 VI guidance was incorrectly worded in Section D.1 and has been corrected upon inclusion into the January 2019 Technical Guidance Manual update. The text states that the contamination should be at least 30 horizontal or 5 vertical feet from the feature. The same correction applied to SPL: any SPL should be at least 30 horizontal or 15 vertical feet from the feature.

Reference: Technical Guidance Manual Section IV.D.1.

- F.2. Can a preferential pathway be addressed by eliminating the pathway?

Response: Yes. If the pathway to the building is eliminated, then it is no longer affecting receptors and the preferential pathway is no longer of concern. A covenant may be needed to ensure that this pathway elimination measure is maintained.

Reference: Technical Guidance Manual Sections IV.D. and IV.H.

- F.3. Will the department require the remediator to obtain access to buildings to look for significant foundation openings?

Response: Remediators should make a reasonable effort to access buildings whenever possible so that they can get the best possible information when evaluating significant foundation openings. However, addressing significant foundation openings does not always require obtaining access to the

building. Options for assessing significant foundation openings that do not require building access are provided in Section IV.D.2 of the Technical Guidance Manual. Additionally, the significant foundation opening information could be acquired from a written survey completed by the property owner or from an interview with the owner or occupants.

Reference: Technical Guidance Manual Section IV.D.2.

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G. Proximity Distances

G.1. There are horizontal and vertical proximity distances listed for petroleum-based contaminants. For non-petroleum-based contaminants, there is a horizontal proximity distance of 100 feet. Is there a vertical proximity distance for non-petroleum contamination that exceeds screening values?

Response: There is not a vertical proximity distance for non-petroleum substances. Proximity distances are based on the attenuation of vapors caused by diffusion through soil. A non-petroleum vertical proximity distance would be deeper than bedrock and groundwater at many sites, and it would not account for vapor advection through fractures.

Reference: Technical Guidance Manual Section IV.E.

G.2. If there is a release of a non-fuel material that contains petroleum hydrocarbons (such as benzene or 1,2,4-trimethylbenzene), do the vertical proximity distances apply?

Response: Yes. The petroleum proximity distances apply to all petroleum hydrocarbons, not just to chemicals in petroleum fuels.

Reference: Technical Guidance Manual Section IV.E.

G.3. [Is it necessary to account for future groundwater migration?](#)

[Contamination may be outside of proximity distances from a building now, but it may be within proximity distances in the future.](#)

Response: Yes. The use of proximity distances should account for future plume migration as determined in a fate-and-transport analysis.

Reference: Technical Guidance Manual Section IV.E.

G.4. [How do proximity distances apply for a gasoline release that includes non-petroleum additives such as MTBE, 1,2- dichloroethane \(EDC\), or 1,2-dibromoethane \(EDB\)?](#)

Response: The petroleum proximity distances apply only to the petroleum hydrocarbons in a release, not the non-petroleum additives. The non-petroleum proximity distances apply to any non-petroleum hydrocarbon additives present along with the fuel, including, but not limited to, EDC, EDB, and MTBE.

It is worth noting that some of the substances on the petroleum short list are not petroleum substances. The petroleum short list represents the chemicals of concern that need to be tested for to demonstrate attainment of an Act 2 standard. MTBE, EDB and EDC are on the petroleum short list because they are often present in petroleum contamination, but they are non-petroleum substances.

Reference: Technical Guidance Manual Section IV.E.

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H. Sample Collection

H.1. Sub-slab and indoor air samples are being collected in mid-February. If the second round is collected 45 days later, the 15°F indoor–outdoor temperature differential guideline may not be met. Will the data be acceptable?

Response: Sub-slab samples do not have a differential temperature limitation and may be collected at any time of the year.

If indoor air data is required for screening, and scheduling does not allow for the two rounds to satisfy both the 45 days and 15°F guidelines, then DEP would consider data obtained with the minimum 15°F temperature difference but less than 45 days apart to be more reliable than data obtained at a < 15°F differential but 45 days or more apart. These situations should be discussed with the DEP project manager.

Reference: Technical Guidance Manual Section IV.G.2.

H.2. How should near-source samples be collected above a groundwater source when there is a fluctuating water table? At the site in question the water table fluctuates seasonally between 8 and 13 feet vertically, so a probe set within 1 foot of the highest concentrations would be under water for much of the year. Is the top of the smear zone considered to be near-source, or is near-source defined as within 1 foot of the highest known residual occurrence of hydrocarbon?

Response: Near-source soil gas screening generally cannot be used when sources are at two or more depths. In this case, there's a source in the smear zone, which is periodically unsaturated, and another source in groundwater, which can be a few feet deeper. The near-source soil gas screening values were derived assuming that contamination is at a single depth, and that the sample is collected immediately above that one source. It is reasonable to screen the soil gas point at the top of the smear zone, but the data should be evaluated differently. If the soil gas point is beneath laterally extensive pavement, the data can be compared to sub-slab

screening values; if not, it should be compared to indoor air screening values. Alternatively, modeling the soil gas data with J&E could be done.

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I. Sampling Options (Soil, GW, NS, SS, IA)

- I.1. If sub-slab soil gas samples are collected, and the first round has an exceedance of the soil vapor sub-slab screening values, does a second round of samples have to be collected?

Response: A minimum of two rounds of vapor sampling is necessary for screening. If the initial round of sampling (soil gas, sub-slab, or indoor air) exceeds a screening value and the remediator chooses to move on to another VI evaluation option, then the remediator is not required to collect a second round of samples.

Reference: Technical Guidance Manual Sections IV.G.2. and IV.K.

- I.2. If there is a clean groundwater lens above a deeper potential VI source, does VI need to be addressed?

Response: If a clean groundwater lens is present, it can serve as a barrier between the VI source and the receptor, and VI from groundwater can be considered an incomplete pathway. It is necessary to demonstrate that a clean water lens is present beneath potential receptors at the site, that it is laterally continuous, and that it is a perennial feature. Potential preferential pathways should be evaluated because they could allow contamination from below the lens to move above it.

Reference: Technical Guidance Manual Section IV.C.1.

- I.3. In shallow groundwater conditions where the capillary fringe is less than 5 feet below grade, is groundwater or near-source soil gas sampling an option? Are there other options?

Response: Shallow groundwater samples (< 5 feet below grade) can be collected but cannot be compared to the groundwater screening values in Table 1. Shallow groundwater data can only be compared to the used aquifer groundwater MSCs.

Soil gas samples should not be collected less than 5 feet below ground surface because atmospheric conditions can affect shallow soil gas samples. Thus, near-source screening would not be an option. Data from sub-slab samples collected beneath intact paved areas large enough to be representative of future inhabited buildings can be screened with sub-slab screening values.

Reference: Technical Guidance Manual Sections IV.F.1., IV.G.2, and Appendix IV-A, Section 2.

- I.4. There is a site with future plans for a building that must be evaluated for VI. It is not possible to collect a near-source soil gas sample. There are grassy areas and a paved area on the site. Since no buildings are currently on the site, are there any conditions under which a sub-slab sample may be considered here?

Response: Sub-slab samples must be collected under an intact slab. The intact slab is normally a building foundation, but it could also be an intact paved area large enough to be representative of a future inhabited building without a basement. The paved area should be examined in the same way a building foundation would be. The presence of large gaps in the pavement or areas of broken pavement would preclude the use of sub-slab screening values due to the potential variability caused by atmospheric affects. If the area is grassy, a sub-slab sample is not possible.

Another solution available in this scenario is to use a covenant requiring mitigation if a post-construction VI investigation indicates a complete pathway.

Reference: Technical Guidance Manual Section IV.G.

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J. Site-Specific Standard

J.1. Do I use a one-tenth adjustment of screening values to determine the presence of potential VI Sources for the SSS?

Response: No. For the site-specific standard, potential VI sources may be identified by using the Statewide health standard groundwater and soil screening values (Tables 1 and 2). A one-tenth adjustment factor is not required when determining the presence of potential VI sources.

Reference: Technical Guidance Manual Sections IV.K.2, IV.K.3, and IV.K.4.

J.2. I am screening SSS attainment data with one-tenth the SHS soil and groundwater SVs. Are the generic soil-to-groundwater numeric values and used aquifer groundwater MSCs also lower bounds for the SSS, or do I apply the one-tenth adjustment to these values as well?

Response: When screening soil and groundwater attainment data for the SSS it is necessary to use one-tenth of the SVs, as stated. The generic soil-to-groundwater numeric values and used aquifer groundwater MSCs are lower limits only for the SHS SVs. Under the SSS, the one-tenth adjustment is made to the generic soil-to-groundwater and used aquifer groundwater MSCs as well as the screening values in Tables 1 and 2 when attainment data is being screened.

Reference: Technical Guidance Manual Sections IV.K.2, IV.K.3, and IV.K.4.

- J.3. When screening constituents for a SSS vapor intrusion risk assessment, is it necessary to select a screening value by evaluating both the EPA RSLs (10^{-5} or 10^{-6} cancer risk, as applicable) and the one-tenth adjusted DEP SVs, or can one method be selected for all constituents being evaluated?

Response: When screening indoor air, sub-slab, or near-source soil gas data for an SSS vapor intrusion risk assessment, a screening value may be selected from EITHER one-tenth of the SHS screening value OR the EPA indoor air RSL value divided by the appropriate attenuation factor. It is entirely up to the remediator which method of calculating screening values is selected; the same method may be selected for all constituents, or a different method can be used for each constituent.

Reference: Flowchart [Representative Process to Determine Site-Specific Standard RSL-Based Vapor Intrusion Screening Values](#) at the end of this document and Technical Guidance Manual Section IV.K.4.

- J.4. If the SSS is being pursued for soil and/or groundwater, is it necessary to evaluate VI under the SSS as well? Why can't the SHS be pursued for vapor even though soil and groundwater are attaining the SSS?

Response: The Statewide health standard cannot be pursued for VI if either soil or groundwater are attaining the site-specific standard. The Statewide health standard does not address individual exposure pathways separately. Attainment of the site-specific standard requires an evaluation of individual exposure pathways, and Act 2 considers VI to be an exposure pathway, not an environmental medium.

Reference: Flowchart [Representative Process to Evaluate Vapor Intrusion with a Combination of Standards](#) at the end of this document; Technical Guidance Manual Section IV.C.3.; Chapter 250 Section 250.404.

- J.5. When assessing risks with the site-specific standard, if inhalation is the only potentially complete exposure pathway but there are multiple

potential receptors (e.g., building occupants and utility workers), is the VI screening with RSLs still permitted at a cancer risk of 10^{-5} ? When can 10^{-5} be used as opposed to 10^{-6} ?

Response: An RSL cancer risk of 10^{-5} can be used for each receptor when VI is the only potentially complete exposure pathway for that receptor, regardless of the number of potential receptors. Reducing the cancer risk from 10^{-6} to 10^{-5} is not appropriate if there is more than one exposure pathway for a given receptor (e.g., ingestion and inhalation).

Reference: Technical Guidance Manual Section IV.K.4.

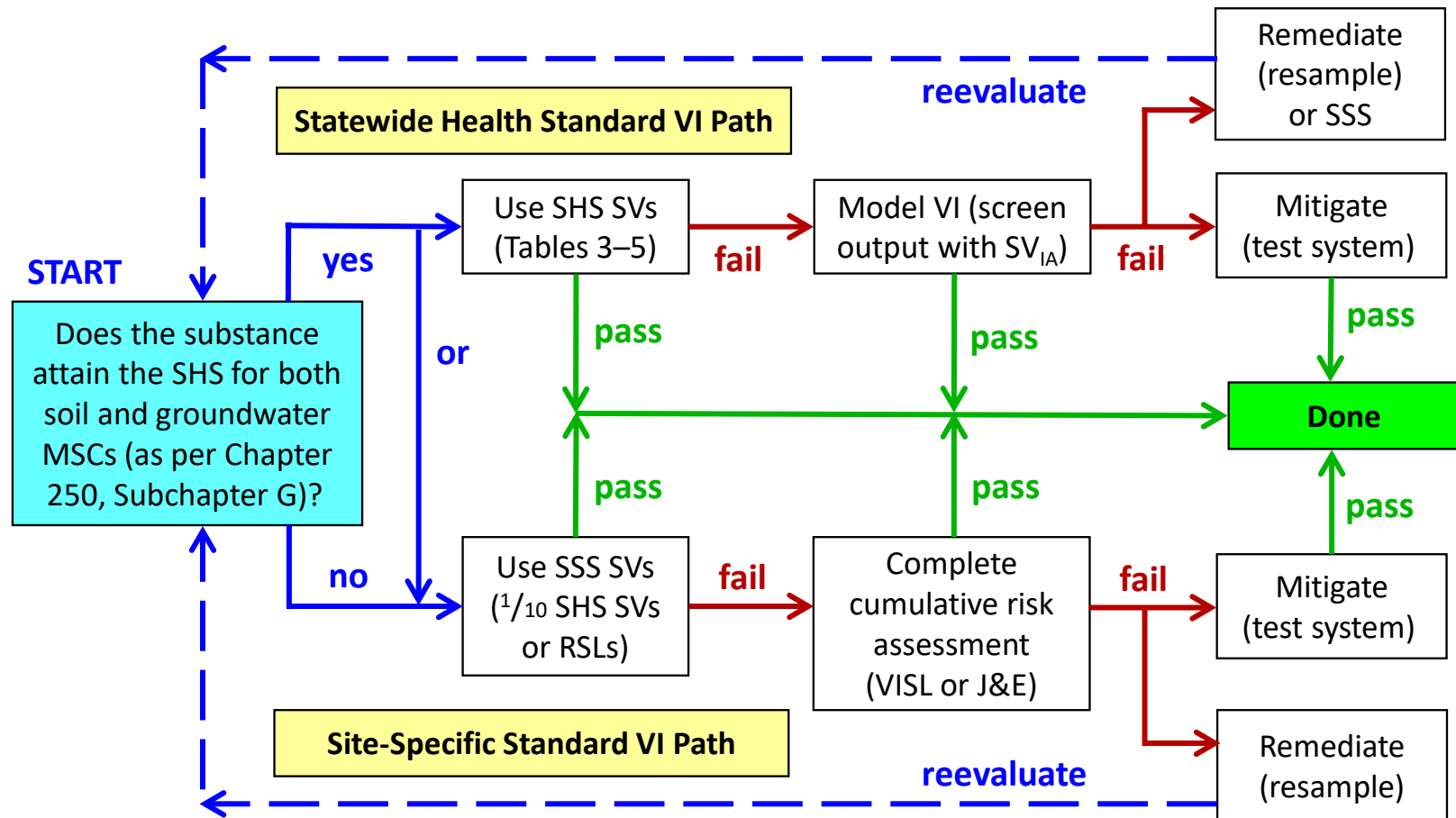
J.6. Why aren't SHS screening values available for SSS screening? If DEP will accept screening at a cancer risk of 10^{-5} for the SSS when VI is the only potentially complete exposure pathway, then the SHS screening values determined at this risk level should be applicable.

Response: According to Act 2, the cumulative excess cancer risk shall not be greater than 1 in 10,000 (10^{-4}) and, where several systemic toxicants affect the same target organ or act by the same method of toxicity, the hazard index shall not exceed one. The hazard index is the sum of the hazard quotients for multiple systemic toxicants acting through single- or multiple-media exposure pathways. Calculated SHS screening values, generic soil-to-groundwater numeric values, and groundwater MSCs are based on a cancer risk of 10^{-5} and a hazard quotient of 1.0. Therefore, for substances that are systemic toxicants, the SHS screening values do not generally satisfy the SSS statutory requirement of a maximum hazard index of one. When there is more than one substance of VI concern under the SSS, the cumulative non-cancer risk could exceed a hazard index of one even though individual concentrations are less than SHS screening values.

Reference: Technical Guidance Manual Section IV.K.4., Chapter 250 Section 250.402.

Representative Process to Evaluate Vapor Intrusion With a Combination of Standards

For each substance that is a potential VI source:



Process to Determine Site-Specific Standard Vapor Intrusion Screening Values

For each site-specific standard substance:

