Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
Section 1: Introduction					
1	Section 1.0 Introduction	Geosyntec Consultants	1	Consider including a broad statement to supplement this Guidance that recognizes the value and supports the application of emerging technologies and approaches published in widely recognized reliable sources, including the Interstate Technology & Regulatory Council (ITRC, www.itrcweb.org), Department of Defense VI Fact Sheets (https://www.denix.osd.mil/irp/vaporintrusion/), USEPA Engineering Issue Papers (www.epa.gov), ESTCP/SERDP Final Reports (https://www.serdp-estcp.org), peer-reviewed journal articles, regulatory guidance/procedures from other states, etc. Guidance documents can become outdated as research and development of new VI investigation and mitigation methodologies are completed. For example, ITRC has a series of work products coming out in January 2021 on VI mitigation. Recognition of the acceptability of these new resources in the Guidance will allow for the continuing implementation of best practices for VI assessment and mitigation as advancements are made.	The section entitled "Guidelines for Applicability and Use of this Guidance Document" has been modified to state the following: This guidance document is intended to be generic in nature, so that applies to a majority of sites. Using the methods and recommendations in this guidance document will provide for streamlined EPD review of vapor intrusion exposure pathway evaluations. Other approaches, emerging technologies, and new methodologies will be considered given site-specific conditions and can be accepted if they meet the requirements of applicable statutes and regulations. If another approach, technology, and/or method is being considered, EPD recommends discussing that approach with EPD staff involved with the project prior to implementation.
2	Section 1 - Introduction	Jeff Baumann (Delmonico)	1	In the description provided for the location of a building that is 'near' a release the reference given provides for general distances based on conditions that are not necessarily typical conditions that we might find in the various regions of Georgia (i..e. tight clays do not allow vapor migration as readily as sandy soils, etc.), so something might need to be added to qualify this statement to make it applicable on a case by case basis.	Please see the response above. Site specific conditions noted in the CSM will need to be taken into account. Methodologies for evaluating VI may change based on site-specific conditions. No change has been made to the document in response to this comment.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
3	Sec. 1.0 Introduction, page 1	GBA	1	**Broaden Applicability to Comprehensive Environmental Response Compensation and Liability Act (CERCLA or "Superfund") Sites** The Guidance is applicable to various Georgia programs including the delegated portions of the U.S. Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) hazardous waste management rules (codified in Georgia at Chap. 12-3-11). Unfortunately, the Guidance does not include potential applicability to the USEPA CERCLA (Superfund) program. Another recent EPD (2020) guidance document does include potential applicability to the USEPA CERCLA (Superfund) program. USEPA (2018a, Sec. 4.8.1) recommends that the June 2015 Technical Guide (USEPA, 2015) be used to assess the vapor intrusion pathway. USEPA (2018a, Sec. 4.8.2) continues by also recommending that five technical support documents be used during the assessment process. Except for USEPA's August 2015 version of "Frequently Asked Questions about VI"1 all the other five technical support documents are discussed and referenced in the Guidance. Recommendation: The Guidance should also be applicable to CERCLA (Superfund) sites in Georgia where EPD provides oversight as a support agency.	EPA does not delegate CERCLA to the States; therefore, the GA EPD VI Guidance document is not applicable to CERCLA or NPL sites. No change has been made to the document in response to this comment.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
4	Sec. 1.0 Introduction, page 1	GBA	2	**Clarify that the Guidance is Applicable to Residential and Non-Residential Settings** The Guidance states that it should not be used to assess exposure to employees in occupational settings. If an occupational assessment is being considered, the Guidance recommends that EPD be contacted. Because the reference here to "occupational settings" could be interpreted to include industrial and commercial buildings, EPD should clarify the use of the word "occupational" by stating that the Guidance is not intended to be used in place of Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs) in occupational situations where indoor air quality concerns result from the volatilization of chemicals currently used or processed in a workplace. Recommendation: The Guidance should clearly state that is intended to evaluate indoor air exposures from vapor intrusion from contaminated soil or groundwater into residential and non-residential (*e.g.,* commercial, industrial and occupational) settings but not to assess worker exposure to chemicals used or processed in the workplace under OSHA.	Agree. The introduction has been revised to state that the guidance document is intended to be used to evaluate the subsurface vapor intrusion to indoor air pathway at residential and non-residential structures.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
5	Sec. 1.0 Introduction, page 2	GBA	3	**Broaden Applicability to All Volatile Chemicals** The Guidance states that its focus is vapor intrusion from: (1) chlorinated volatile organic compounds (VOCs) or (2) petroleum hydrocarbons not covered by EPD's regulations for registered underground storage tanks (USTs). But the analytical test methods in the Guidance (*e.g.,* USEPA Methods TO-14a, TO-15, TO-17 and 8260) can include results for non-chlorinated VOCs. There are potentially numerous situations where non-chlorinated volatile organic or inorganic chemicals unrelated to releases from registered USTs could pose a potential vapor intrusion threat. For example, there are 209 chemicals listed in the VISL Calculator database (USEPA, 2020) that are considered volatile chemicals (with a Henry's Law constant > 1 x 10-5 atm-m3/mole or a vapor pressure > 1 mm Hg) and they have an associated inhalation unit risk (IUR) value for risk assessment purposes. Slightly more than half of these chemicals are not chlorinated nor are they exclusively petroleum related. Selected chemicals from this third set of chemicals include: mercury, benzene, 1,4-dioxane, methyl ethyl ketone (MEK), etc. Recommendation: The scope of the Guidance should be expanded to include the assessment of any volatile chemical with an IUR. The release of volatile petroleum hydrocarbons from a registered UST should be assessed according to EPD's registered UST Management Program.	Agree. The word "Chlorinated" has been removed from the guidance. This guidance is applicable to all chemicals listed in the VISL calculator as sufficiently volatile. The EPD guidance may be used to evaluate petroleum hydrocarbons; however, that approach would be more conservative since the biodegradability of petroleum hydrocarbons is not considered in this guidance. EPD recommends that petroleum non-UST releases be evaluated using the ITRC PVI guidance.
Section 2					
6	Section 2 Overview of Assessment Approach	Geosyntec Consultants	2	Section 2 is focused on sampling and analysis of multiple media (e.g. chemistry). While chemistry is one line of evidence, the US EPA Guidance (US EPA, 2015) recommends multiple lines of evidence, including building science and construction, geologic, hydrologic and biochemical factors, physics, preferential pathways, etc. The second bullet suggests that VI investigations are limited to media (air) sampling when in fact other lines of evidence are evaluated throughout the investigation.	Text has been added or revised in several sections to emphasize that a multiple lines of evidence approach should be used in any VI investigation.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
7	Section 2 - Overview of Assessment Approach	Jeff Baumann (Delmonico)	2	When considering sampling inside a building that includes indoor air sampling, it should be recommended that a qualified industrial hygienist and other appropriate counsel be consulted to provide input on indoor air sampling methodologies and potential exposures to workers or residents. Confusion and anxiety not to mention business owner liability and risk can be created if the indoor air sampling and subsequent results of indoor air sampling are not handled appropriately.	In the Guidelines for Applicability and Use of this Guidance Document section, the text states, "this guidance document is intended for use by environmental professionals who have experience in the investigation and remediation of subsurface contamination." The introduction also states that, "This guidance document is not intended to be used to evaluate indoor air exposure to chemicals used in an workplace setting, which would be regulated by OSHA." No changes to the document have been made in response to this comment.
8	Section 2 Overview of Assessment Approach, page 2 and Table 1, page 5	GBA	4	**Multiple Lines of Evidence Approach** The Guidance is focused on sampling and analysis of multiple media (*e.g.,* chemistry). While chemistry is one line of evidence, the USEPA Guidance (USEPA, 2015) recommends multiple lines of evidence. The decision logic presented in this section should incorporate other lines of evidence such as building science [*e.g.,* air exchange rate, air changes per hour (ACH)/heating, ventilating and air conditioning (HVAC) zones, etc.], building construction (presence of footers, sumps, slab integrity, etc.), geology/hydrogeology, preferential pathways, etc. Recommendation: Consider describing a multiple lines of evidence approach in this section and/or Section 3 (Conceptual Site Model). In addition, consider adding other important elements of a CSM to Table 1 to match the added discussion on a multiple lines of evidence approach.	Section 2 of the guidance document has been revised to include emphasis on a multiple lines of evidence approach. Additionally, Table 1 has been revised to include additional informational needs for the CSM as suggested.
Section 3					
9	Section 3 Conceptual Site Model	Geosyntec Consultants	3	The Guidance should provide a clear definition of "Occupied" space, because typical risk-based screening levels are not applicable to areas with limited occupation (e.g., utility tunnels, bathrooms, etc.).	This guidance does not include a definition for "occupied" as a structure is considered occupied when a person is present within the structure for any duration.
10	Section 3	Geosyntec Consultants	5	Section 3 should also cite USEPA, 2012c and USEPA, 2015, which are two excellent references with pertinent information on CSMs. Full references for these documents are provided at the end of the comments.	Agree. These references have been added to Section 3.
11	Section 3 - Conceptual Site Model	Jeff Baumann (Delmonico)	3	3rd sentence in the first paragraph: Perhaps it should read that 'a CSM should be included as part of the evaluation of vapor pathway submittal'.	The referenced sentence states that the CSM should be developed and submitted to EPD to support the VI pathway evaluation. No change has been made to the guidance in response to this comment.
Section 4					

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
12	Section 4 Sampling Guidelines	Mark Kram (Groundswell Technology)	1	We have observed dynamic concentrations at just about every one of the more than 100 vapor intrusion sites we've investigated over the past four years. Concentration dynamics on the order of 2X to more than 100X is common. USEPA (2015) acknowledges that dynamics occurs. As such, they've recommended that the reasonable maximum exposure (RME) dictate all vapor intrusion risk related decisions. Unfortunately, this criteria has been generally disregarded. EPA also acknowledges that randomly-timed samples can yield incorrect conclusions and recommendations. In fact, Schuver et al (attached) calculated that 58 randomly-timed traditional samples (e.g., canister and sorbent samples) would be required to meet the RME criteria with a sufficient level of confidence. In fact, this is the key reason why EPA is sponsoring their indicator, surrogate and tracer (IST) program – to improve the sample timing to improve risk decisions. Here is a link to their most recent workshop: https://iavi.rti.org/workshops.html. You will see that continuous monitoring data is being used to help them meet their new policy objectives.	Considerations for temporal variation have been discussed in the guidance document. Continuous monitoring has been acknowledged in Section 4 of the document.
13	Section 4 Sampling Guidelines	Mark Kram (Groundswell Technology)	2	We have documented that both natural and anthropogenic factors control the exposure concentrations (see attached Hosangadi et al article and Kram et al (2019)). Once the controlling factors are identified, superior assessment and mitigation becomes possible. It would be helpful to reference this article in the GEDP Draft Guidance.	This topic is too specific for the guidance document. No revisions to the document in reference to this comment are planned at this time.
14	Section 4 Sampling Guidelines	Mark Kram (Groundswell Technology)	3	In the attached Kram et al (2020) article, we document how slight differences in sample timing can yield very different results, conclusions and recommendations. This article is resulting in a regulatory re-evaluation of vapor intrusion risk assessments in many states as well as in Australia, Brazil and Europe. It would be helpful to reference this article in the GEDP Draft Guidance as well.	See response to comment #13

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
15	Section 4 Sampling Guidelines	Mark Kram (Groundswell Technology)	5	We've used rapid assessment techniques to quickly screen neighborhoods. Most large VOC plumes migrating under neighborhoods require years to sample a very small subset of buildings. With our field mobile approach, we can process 50 or more samples in a day, which allows us to rapidly evaluate many buildings per week, and then to monitor those meeting specific criteria (e.g., folks experiencing harm, detections that require a better understanding of range of exposure or location of either indoor sources or vapor entry pathways, etc.). One example of this can be found in Franklin, Indiana, where we rapidly screened more than 30 homes in a few days (see: https://www.indystar.com/story/news/environment/2019/03/04/new-technology-tests-levels-dangerous-chemicals-franklin/2951953002/).	This topic is too specific for the guidance document. An acknowledgement of continuous monitoring and mobile laboratories has been added to the document in Section 4.
16	Section 4 Sampling Guidelines	Mark Kram (Groundswell Technology)	6	Clearly articulate critical shortcomings of traditional randomly-timed time-integrated sampling methods (e.g., false positives, false negatives, incorrect risk assessments, etc.).	See response to comment #15
17	Section 4 Sampling Guidelines	Mark Kram (Groundswell Technology)	7	Describe various continuous monitoring options (e.g., automated continuous laboratory grade chemical and physical parameter monitoring; hand-held devices; screening devices; etc.) and articulate benefits and shortcomings of each option. Perhaps these could be described in an appendix. I have generated a comprehensive matrix based on an a similar effort by the US Navy (see: https://www.groundswelltech.com/VaporIntrusionMatrix.aspx).	See response to comment #15
18	Section 4 - Sampling Guidelines	Jeff Baumann (Delmonico)	6	2nd paragraph states that sampling of multiple media can be valuable. Sometimes the results can also be confusing and potentially damaging (See comment on Section 2 above). What 'other factors' are being alluded to in this sentence? Recommend that further discussion of indoor air contaminants from other sources be included to aid in the assessment process.	Agreed. Text has been added to Section 4.3.2 to emphasize that background sources may cause misleading results. Additionally, a paragraph regarding background sources has been moved to the beginning of the section.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
19	Section 4.1 Groundwater Sampling Considerations	Geosyntec Consultants	6	We recommend adding additional groundwater data that could add value to the VI assessment, such as depth to groundwater, groundwater elevation trends, vadose zone soil lithology (boring log), soil characteristics at the water table interface (assists with characterizing the capillary fringe), groundwater conditions (e.g., is water table perched, confined, or submerged), etc.	Agreed. The requested sentence has been added to Section 4.1 of the guidance.
20	Section 4.2 Soil Gas Sampling Considerations, pages 8 and 9 and Section 4.2.3 Equilibration Time, page 10	GBA	5	**Soil Gas Probe Equilibration** The Guidance recommends minimum equilibration times prior to sampling a newly installed soil vapor implant. In addition to this minimum criterion, consider adding a second option of purging and screening soil gas until readings are stable to demonstrate equilibration. USEPA (2006b) simulated purging via mass-balance calculations and noted that extracting five purge volumes of the tubing and probe prior to sampling were likely sufficient to ensure that sampled gas would be 99 percent of undisturbed soil gas concentrations, even if probe installation had completely diluted the air surrounding the probe. Recommendation: We suggest adding a discussion with a suggestion to purge and screen soil gas prior to sampling.	Text has been added to Section 4.2 to state that the purge and screen method may be used on a case by case basis, and can only be used after sufficient time has elapsed between probe construction and sampling to allow cements to cure and bentonite seals to hydrate according to manufacturers' recommendations. Documentation of steady-state conditions will be needed to demonstrate that an adequate purge has been completed prior to sampling.
21	Section 4.2 - Soil Gas Sampling Considerations	Jeff Baumann (Delmonico)	7	How does one account for the accumulation or buildup of vapors under a building foundation over time versus steady state conditions of contaminant vaporization and migration from the source after vapor mitigation has been implemented? For example: A soil gas sample taken beneath a building of non-steady state conditions (before any sub-slab depressurization or vapor mitigation has been implemented) will most likely show much higher concentrations and therefore result in a greater risk using the VISL calculator as opposed to after vapor mitigation. Once the vapors that have built up over time are allowed a way to escape from beneath the building (essentially removing the vapor pathway into the building) the sub-slab vapor concentrations could be considered steady state and those concentrations could be used to calculate the risk.	Please note that the accumulation of vapors under a building foundation should never exceed source concentrations. All data should be obtained under steady state conditions. Steady state conditions can be accomplished by proper leak testing and adequate purging of the sample point to obtain a representative sample of subslab vapor. No change has been made to the document.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
22	Section 4.2, Page 9	Craig Cox	1	Top of the page indicates that 3 volumes need to be purged before sampling. This is a holdover from groundwater monitoring (which is no longer used) and it is not appropriate for vapor sampling. Why 3 volumes? In many instances this would only be a few cubic centimeters. It would be preferable to rely on a test based on the stabilization of oxygen content or other factors (i.e., PID readings). This information can be obtained by readily available direct reading instruments and can indicate the presence of soil gas, as oxygen content diminishes, or if VOC content rises and remains stable. In a practical sense, these conditions are typically reached in sub-slab sampling within 30 seconds or so.	Text has been added to Section 4.2 regarding the purge and screen method when sampling subslab vapors. See response to comment #20 above.
23	Section 4.2.1 Exterior Soil Gas Sampling and Section 4.2.1.2 Near Slab or Shallow Soil Gas	Geosyntec Consultants	7	Section 4.2.1 says,". . . exterior soil gas samples should be collected . . . from locations that are otherwise representative of soil gas concentrations beneath the building foundation". Section 4.2.1.2 says, ". . . soil gas samples collected from depths as shallow as 2.5 feet bgs can provide useful data regarding potential vapor concentrations near the foundation of a structure." However, it needs to be noted that exterior (near slab) soil gas samples collected shallower than 5 feet may not represent soil gas 5 feet below a building foundation. If there is less than 5 feet of vadose zone between the water table and the deepest foundation element, advection of the building is likely to dominate mass transport over diffusion throughout the vadose zone. Therefore, the absence of a building near an exterior (near slab) soil gas sample collected shallower than 5 feet bgs may make it not comparable to soil gas collected beneath a building. The Guidance should emphasize that sub-slab soil gas samples are preferred for assessment of the VI pathway. Section 4.2.1.2 states, ". . . near-source soil gas sampling is recommended to provide a reliable estimate of vapor intrusion risk." We recommend replacing the word "reliable" with "conservative". There are numerous uncertainties associated with vapor transport through the vadose zone (e.g., biodegradation of petroleum hydrocarbons).	Agreed. Exterior shallow vapor concentrations are highly dependent on site conditions. The word "reliable" has been replaced with "conservative".
24	Section 4.2.1.1 Deep Soil Gas	Geosyntec Consultants	8	This section states that soil gas samples collected between the deeper soil gas and the shallow soil gas (or near slab soil gas) provide information regarding the contribution of any soil contamination to the total vapor phase contamination. This statement may be too vague for a guidance document. Instead, the sample depth(s) to identify the presence, absence, or significance of soil sources should come from the CSM.	No change has been made to the document as the guidance states that the location and depth of any sampling point should be based on information from the CSM.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
25	Section 4.2.2. Page 10	Craig Cox	2	Why would the entire slab thickness need to be sealed with impervious material, with the tip of the point below the base of the slab? The hole through the slab provides a conduit for soil gas to move. If you have a sufficient seal in the upper portion of the slab, you are able to collect high quality samples following the purge. This appears to be another holdover from the early days of VI, when it was believed that the act of drilling through the slab produced a smooth uniform hole through the entire length of the slab. In reality, hammer drills will blow out the bottom inch or so of the slab creating a rather large void. Trying to make an impermeable barrier in the void that you can't easily see can cause points to become plugged and prolong the process of sample collection as you wait for grout to set up. If, however, you suspect that the slab is saturated with VOCs, then you should take the precaution of sealing off the base of the slab, but this is a pretty rare occurrence. The majority of other State VI guidances moved away from this requirement.	While we agree with your comments, our VI Technical Advisory Committee recommends the more conservative approach of sealing the entire slab thickness because it provides a higher integrity seal. There is no downfall in sealing the entire slab, but there are risks if you do not, especially when the slab may be saturated with VOCs. Sealing only the upper portion of the slab at the sampling point will be considered on a case by case basis with justification.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
26	Section 4.2.3 Equilibrium Time	Geosyntec Consultants	9	The Guidance recommends minimum equilibrium times prior to sampling a newly installed soil vapor implant, but the guidance documents cited do not offer an empirical basis or justification for equilibrium times in soil gas probes (AZ, CA, MI, WI). However, Wisconsin offers the option of purging and screening purged gas until readings are stable. We recommend the purge and screen option because purging and screening allows practitioners to make data quality decisions based on data collected prior to sampling. USEPA addressed equilibrium with modeling, which suggested that subslab probes would equilibrate in less than 2 hours. USEPA also simulated purging via mass balance calculations and noted that extracting 5 purge volumes of the tubing and probe prior to sampling were likely sufficient to ensure that sampled gas would be 99 percent of undisturbed soil gas concentrations, even if probe installation had completely diluted the air surrounding the probe. A third (empirical) finding was that extracted volumes of soil gas up to 14 liters prior to sampling had little or no effects on sampling results. We suggest removing the equilibrium timetable and discussion and replacing them with a suggestion to purge and screen soil gas for oxygen, carbon dioxide and organic vapors prior to sampling. In addition, the Guidance should state that sufficient time between probe construction and sampling should be used to allow cements to cure and bentonite seals to hydrate according to manufacturers' recommendations.	Text has been added to this section to include the purge and screen method as an acceptable purging method on a case by case basis; however, the equilibrium timetable has not been removed. The equilibrium time values in the table are from a compilation of other state guidelines with the exception of the shallow and deep soil vapor information which was based on a study done by Blayne Hartman for the US EPA.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
27	Section 4.2.4 Soil Gas Sample Collection Density	GIEC	1	Table 4 present recommended minimum number of sub-slab or soil gas samples for existing or proposed buildings, including residential buildings. The minimum number of recommended samples for a building that is less than 1,500 square feet (ft^2) is two samples. While there may be some spatial variability with regard to sub-slab sample results, the magnitude of spatial variability associated with sub-slab samples is low as compared to exterior soil gas samples, especially when looking at relatively small building footprints with one type of foundation (e.g., all slab on grade, all basement). Vapors tend to migrate in the path of least resistance. In terms of vapor migration through soil, vapors will migrate and collect at higher concentration where soil moisture content is low and more air-filled pore space is available. Soils present underneath building foundations will generally contain less soil moisture than exterior open locations and soils towards the center of the building foundation will contain less moisture than locations along exterior walls. One centrally-located sub-slab sampling point is acceptable for most residential buildings when paired with IA sampling (IDEM, 2012). In most cases, one sub-slab samples collected during worst-case conditions within a standard size residential property (1,500 ft^2) and paired with an indoor air sample will provide representative information to make a determination on the completeness of the vapor intrusion pathway. Collecting the information on more than one occasion during differing seasonal conditions will provide further confidence in the data. Accordingly, the EPD Draft Guidance should be revised to allow for one sub-slab sample location within standard residential buildings.	There is greater variability in sub-slab vapor concentrations than in soil gas vapor concentrations. A footnote has been added to Table 4 to state that, "One centrally-located sub-slab sampling point may be acceptable for residential buildings with footprints less than 1,500 square feet, provided that indoor air sampling is also conducted and that more than one sampling event is conducted." For any variations from the guidance, please consult with EPD prior to sampling.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
28	Section 4.2.5, Page 12 Table 5	Craig Cox	3	The use of a water barrier, which is supported by many other states, and included in their VI Guidance (e.g., MI, NJ, and Ohio), is an integral part of the vacuum leak check. The vacuum leak check can be used to check all portions of the sample train except for: 1) the connection to the sub slab point, and 2) the seal between the point and the slab. The water barrier is a very good way to test those final two portions of the sample train. Would you consider including the water barrier as part of the Vacuum leak check? The water barrier has been proven to be effective and is cost effective and saves time. I wanted to pass along some whitepapers that we did demonstrating side-by-side testing of our Vapor Pins(r) against the probes installed consistent with your current guidance and with other inserts. I hope it provides some additional information that would be useful in crafting your guidance. I have also included a link to Ohio EPA's guidance, Michigan's guidance, and some draft Latin American guidance that we have been asked to assist with. All of them include the use of Vapor Pin(r) as an appropriate device for the collection of the sub-slab soil gas samples and differential pressure monitoring. Ohio EPA Guidance https://epa.ohio.gov/portals/30/vap/docs/VI%20guidance%20Final%203-6-2020.pdf Michigan Guidance https://www.michigan.gov/documents/deq/deq-rrd-VIGuidanceDoc-May2013_422550_7.pdf	There are several concerns when using a water barrier as a means to evaluate the seal of a vapor probe in a slab. [Please note that in addition to evaluating the seal of the vapor probe, a leak test (such as a vacuum test) should also be conducted to determine if there are any leaks in the above ground sampling train (tubing, valves, gauges or other appurtenances associated with summa cannister).]: 1) The use of a water barrier does not provide documentation that a sub-slab implant is leak proof with regards to vapor or air. Placing a liquid barrier over a point and creating a "dam effect" has no bearing on what happens when the water barrier is removed. If a leak is present, any vapors in the subsurface will tend to migrate from areas of higher concentrations (unless another pathway exists) to areas of lower concentrations such as the indoor air once the water barrier is removed. We recommend that a leak test be performed on the implant using a vapor phase compound such as helium to determine if the implant is leaking. 1) A water barrier should only be used on solid impermeable surfaces such as concrete (not wood floors or carpeted surfaces). 2) Part of a leak test is to check the integrity of the concrete around the sub-slab point to make sure it was not damaged during the drilling of the sub-slab. The water dam typically only covers a 2" diameter PVC rig placed around the sub-slab point, while a helium shroud covers a much larger diameter around the probe. The borehole and the area around the borehole in the slab should be inspected closely to determine if the slab has been compromised (cracks) before sampling. 3) If using the water barrier, and there is a leak between the borehole and the probe, water may enter the area below the slab around the sampling point , and may impact the probe's ability to obtain a representative sample. If enough water has entered the borehole to impact the integrity of the sampling point, another borehole will have to be drilled into the slab and a new probe installed nearby. We do not recommend using a water barrier during the sampling of permanent probes for the reasons above. However, if you believe that the water barrier can be used during the sampling of vapors from permanent probes given the constraints above, please discuss your proposal with EPD prior to sampling.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
29	Section 4.2.5 Leak Test Methods	GIEC	2	The Draft Guidance only recommends using the Water Barrier or Water Dam leak test for temporary sub-slab samples and only if an appropriate leak test has failed and attempts to correct the construction defect are not successful. The Water Barrier or Water Dam leak test has been proven to be an efficient and effective leak test for sub-slab sample ports, specifically when using vapor pins for sub-slab port installation and collection. This leak detection method is accepted by many State regulatory agencies (IDEM, 2012; NJDEP, 2018; WDNR, 2018) and should be included in the EPD Draft Guidance as an acceptable leak detection test for both permanent and temporary sub-slab vapor ports.	See above
30	Section 4.3.2 Indoor Air Sampling	Geosyntec Consultants	12	This section identifies several factors to consider in passive sampling without providing specifics for certainty. These factors are covered in the USEPA Engineering Issue paper entitled Passive Samplers for Investigations of Air Quality: Method Description, Implementation, and Comparison to Alternative Sampling Methods (USEPA, December 2014). We recommend that this document be cited in the Guidance.	Agree. These citations have been added to the guidance document.
31	Section 4.3.2 Indoor Air Sampling	Geosyntec Consultants	13	Spatial Variability in the subsurface and temporal variability and background sources in indoor air have been persistent challenges for a couple of decades. During this time, a lot of research has been done to minimize these uncertainties. The Guidance should specifically acknowledge ESTCP/SERDP research and articles published in peer-reviewed journals as "acceptable alternatives" to the generic approach. For instance, the guidance does not mention building pressure control (BPC), a diagnostic investigative tool that can address spatial and temporal variability with a single test.	The section entitled "Guidelines for Applicability and Use of this Guidance Document" has been modified to state the following: This guidance document is intended to be generic in nature, so that it applies to a majority of sites. Using the methods and recommendations in this guidance document will provide for streamlined EPD review of vapor intrusion exposure pathway evaluations. Other approaches, emerging technologies, and new methodologies will be considered given site-specific conditions and can be accepted if they meet the requirements of applicable statutes and regulations. If another approach, technology, and/or method is being considered, EPD recommends discussing that approach with EPD staff involved with the project prior to implementation.
32	Section 4.3.4 Crawl Space Air Samples	Geosyntec Consultants	14	The Guidance should specify that crawl space samples should be collected at least 6 feet away from crawl space vents.	Agree. A statement has been added to the guidance document in Section 4.3.4 stating that crawl space samples should be taken at least 6 feet away from the crawl space vents.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
33	Section 4.4 Analytical Methods	Geosyntec Consultants	15	This section says that USEPA Method 8260 could be considered to reduce reporting limits at sites with high concentrations of background compounds that may require dilutions. However, Method TO-15 and 8260 are not "chromatographically" very different. Both methods could have interferences due to high concentration of other compound(s). To address this issue, the Guidance should recommend that VI practitioners work closely with their laboratory to take all practical steps needed to achieve the reporting limits desired. This process could include discussing the constituents of concern with the laboratory. For instance, if you suspect a high concentration of acetone, but acetone is not important to the VI assessment, share this information with the lab so that they do not overly dilute and increase the reporting limit for a separate compound that is of interest (for instance TCE). We recommend removing the reference of Method 8260 as an alternative method for reducing reporting limits at sites with high concentrations of background compounds.	Agree. The guidance document has been revised to incorporate this comment. The text has been revised to include a discussion on elevated detections levels and achieving the lowest practicable reporting limits (consultation with the laboratory up front and obtaining a full sample). Please note that Method 8260 is a valid method for analyzing soil gas (not as much for sub-slab although it can be used). The sub-slab soil gas screening levels are much higher than indoor air levels; therefore, it is acceptable, and more affordable to use Method 8260.
34	Section 4.4 Analytical Methods	Geosyntec Consultants	16	The second paragraph of Section 4.4 regarding elevated reporting limits is difficult to understand in the way it is written and is subject to multiple interpretations. We understand that the GA EPD is conveying here that if only a fraction of a Summa canister is filled during the sampling period, it may affect the laboratory's ability to produce expected reporting limits. We recommend stating this relationship of sample volume and reporting limits and then listing a few site conditions under which that may occur to alert practitioners, such as the presence of low conductivity or high-moisture soils. In addition, the Guidance should recommend up-front discussion with the laboratory during the work plan stage to establish ample volumes and reporting limits for every compound being analyzed for. If there are known site conditions that may inhibit the ability to collect the necessary sample volume, passive sampling techniques could be considered.	The text will be revised to address this comment. It is important to have a discussion with your selected laboratories prior to beginning the collection of any vapor samples. Conditions encountered in the field (low permeability, high moisture, etc) may reduce the amount of vapor available for collection. Having knowledge of the minimum volume of vapor required for collection to achieve the necessary detection limits is advisable. The use of smaller volume summa canisters (400 ml, 450ml or 1 liter) can also be beneficial in time where limiting conditions are encountered.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
35	Sec. 4.4 Analytical Methods, page 14	GBA	6	**Effect of Elevated Reporting Limits** The occurrence of elevated reporting limits can have a detrimental effect on subsequent risk assessment calculations. If the reporting limit is substantially higher than the risk-based screening level, then it is a common practice to use one-half of the reporting limit (or another surrogate estimation method) in the risk assessment calculations. Unfortunately, this approach can lead to calculating "artificially" elevated risks when one-half of the reporting limit is higher than the risk-based screening level. The concentration of the chemical of interest could be zero or less than the risk-based screening level. However, the elevated reporting limit used as the exposure point concentration masks this important information on the actual concentration of the chemical of interest. Recommendation: The Guidance should emphasize the importance of archiving the lowest practical reporting limit for subsequent risk assessment purposes.	See the response above. The text has been revised to include a discussion on elevated detections levels and achieving the lowest practicable reporting limits (consultation with the laboratory up front and obtaining a full sample).

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
36	Section 4.5 Passive Vapor Sampling	Geosyntec Consultants	17	This section does not accurately describe the uses and limitations for passive samplers used for soil gas sampling. Some applications are fully quantitative, while others (like very low k soils) are likely to be biased low due to withdrawing target compounds from the surrounding media faster than they are replenished (e.g., starvation). This section needs a clearer introduction to what qualitative and quantitative passive samplers are and how and where they are best applied. Consider breaking Section 4.5 into at least two paragraphs, one for indoor air (or describe in Section 4.3.2) and one for soil gas because the issues are very different for quantitative passive sampling for these two media. • For indoor air, the key issues are sensitivity, retention, recovery, and calibration, which require good sorbent selection, appropriate sample duration, and for the highest level of accuracy we also recommend field calibration via co-located and coincident samples via an alternative method. Capillary flow controllers are now available for 14-day sampling via 6L Summa canisters. This 14-day sampling method can be used to verify passive sampler uptake rates to minimize uncertainties from temporal variability for assessing chronic risks, or as a stand-alone method. This verification method was demonstrated and validated by ESTCP Project ER-201504. • For quantitative passive soil gas sampling, the key issue is selecting a sampler that has an uptake rate lower than the diffusive delivery rate as demonstrated and validated by ESTCP Project ER 200830. The EPA Engineering Issue paper (referenced below) covers these topics as well. Two recognized reference sources on passive sampling that should be cited in this section are the DoD Fact Sheet Passive Sampling for Vapor Intrusion Assessment (DoD, February 2017) and USEPA, 2014.	Text has been added to the section to address this comment.
Section 5					

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
37	Section 5 Data Evaluation Guidelines and Section 5.2 Decision Matrices	GIEC	3	The EPD Draft Guidance recommends the use of the US EPA Vapor Intrusion Screening Level (VISL) calculator; however, it appears that the guidelines recommend using a forward calculated risk evaluation for each constituent to obtain the cumulative risk. While this is in line with US EPA guidance, it differs from many states' regulatory guidance documents. Calculation of the potential risk for specific constituents in specific media can be valuable but may not be necessary for many sites. Calculating individual risk factors can be cumbersome for commercial/industrial scenario with many sampling locations and several constituents of concern. Calculating medium-specific screening levels using the VISL calculator with appropriate attenuation factors, site or regional specific temperature, and the appropriate target cancer risk and hazard index is more appropriate om this situation. The EPD Draft Guidance should be revised to include the calculation of medium-specific screening levels (groundwater, soil gas, and sub-slab vapor) using the VISL calculator for a direct comparison to analytical results as an appropriate screening method.	The method of using the VISL calculator to obtain a cumulative risk posed by vapor intrusion provides some flexibility with screening levels (e.g., one compound exceeds screening level but others do not; if cumulative risk does not exceed 10^{-5} and HI of 1, no further action would be necessary). We disagree that this is cumbersome process. Individual screening levels calculated using the VISL calculator at a cancer risk of 10^{-6} and HQ of 0.1 may be used only when there are 10 or less volatile compounds being evaluated. A statement has been added to the guidance to state such.
38	Section 5.1 Calculating Risk Using the Vapor Intrusion Screening Level Calculator	Geosyntec Consultants	18	At the top of page 16 – rather than "estimated risk", we suggest calling this "modeled risk". The reason is that risk is estimated or calculated from exposure point concentrations (EPCs). If we only have subsurface data like subslab soil gas that need to be transformed to indoor air to get an EPC, such as by applying an attenuation factor, then the EPC is modeled and so is the calculated risk. We also are not truly calculating risk unless we are conducting a risk assessment.	All risk is estimated and sometimes modeled. The text remains unchanged.
39	Section 5.1.1 Recommended Attenuation Factors	Geosyntec Consultants	20	This section states, ". . . if a tracer supported sub-slab attenuation factor of less than 0.006 is being relied on for decision-making, indoor air sampling for vapor intrusion constituents of concern should be conducted to validate the attenuation factor." The GA EPD should consider a less restrictive recommendation because the median value for residential properties in the USEPA attenuation factor database is appropriately 0.003 (USEPA, 2012). Recent studies have shown that empirical attenuation factors for commercial buildings and slab-on-grade residences in moderate climates such as Georgia are much lower than the USEPA 95 percentile (Ettinger, et al, 2018). Therefore, the GA EPD should consider revising the subject sentence to recommend indoor air sampling for tracer-supported sub-slab attenuation factors less than 0.003.	Disagree. An attenuation factor (AF) of 0.006, which is 75^{th} percentile of the EPA database, is conservatively protective of residential structures. AFs below 0.006 need to be validated through sampling.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
40	Section 5.1.2 Use of Modeling	Mark Kram (Groundswell Technology)	4	Of all the projects we've worked on, the J & E model has *never* correctly predicted indoor concentrations based on previously observed soil vapor concentrations. This may be because initial EPA attenuation factor studies and current field protocol includes time-integrated samples without regard to sample timing. More specifically, samples were not collected during upward advective flux conditions (which is when the RME will most likely occur). We've been encouraging California regulators to support a new attenuation investigation that accounts for this, but this has not yet been pursued. The J&E model should only be used as an initial guide and not as the defining site closure criteria. It is not correct, does not consider dynamics, does not consider advective flux or controlling factors, and as such, should not be relied upon for risk decisions. Note that California and other agencies no longer accept the J&E model for risk decisions. Along the same lines, an attenuation factor that is anything less than the most conservative consensus value should not be relied upon. For instance, if a much lower than conservative attenuation factor is employed and the RME and sample timing continue to be disregarded, citizens of Georgia will unnecessarily be exposed to potentially harmful conditions. In recognition of this, California is advocating for a conservative default attenuation factor of 0.03 (as recommended by USEPA).	Agree. The J&E should not be used a single defining criteria for site closure pertaining to VI. In response to this comment, text has been added to this section to clarify how and when the J&E model should be used. The J&E model can be used to determine site-specific attenuation factors for commercial and industrial buildings. Please note, however, that use of the model may require that additional information about the site (e.g., grain-size distribution data, etc.) be collected to substantiate input of data into the model. If the site-specific AF calculated by the J&E model is less than the USEPA's 75th percentile AF from their AF database (0.0002 for groundwater and 0.006 for soil gas/sub-slab soil gas), sampling must be performed to validate the AF. The J&E model should not be used to calculate the risk associated with vapor intrusion as it may not include the most recent toxicity and exposure factors.
41	Section 5.1.2 Use of Modeling	Geosyntec Consultants	23	Recent research on VI assessment of transport across building slabs (McAlary, et al, 2018) presents a new model for building-specific attenuation factors. The Guidance should reference this paper. The technique includes: (i) sub-slab extraction with flow and vacuum measurements and mathematical modeling to characterize the bulk average vertical gas conductivity of the floor slab; (ii) monitoring of the ambient pressure gradient across the floor slab with a micromanometer; (iii) calculating the volumetric flow of soil gas into the building (Q_{soil}); and (iv) dividing Q_{soil} by the building ventilation rate ($Q_{building}$) to calculate a building-specific attenuation factor.	The requested revision is too detailed for the guidance document. EPD will accept these methods on a case-by-case basis.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
42	Section 5.1.2 Use of Modeling	Geosyntec Consultants	24	The Guidance needs to address the following limitations of the 2017 USEPA J&E Model Spreadsheet: • Error in calculation of TCE risk for workers (incorrectly includes age-adjustment factor for toxicity values); and • Spreadsheet uses incorrect building height for crawl space scenario (only includes height of crawl space but should include height of crawl space + living space.	Agree. In addition to this guidance, EPD is drafting a fact sheet to discuss the limitations of the J&E model and information necessary to justify inputs or attenuation factors. This information will be added to the fact sheet.
43	Section 5.1.2 Use of Modeling	Geosyntec Consultants	25	This section recommends the use of modeling be limited to commercial buildings that may not be well-represented by the USEPA Attenuation Factor database. However, given the uncertainties and limitation of the USEPA empirical AF database with respect to conditions in Georgia, the Guidance should include flexibility for modeling for residential structures.	Based on currently available information, the EPA-recommended attenuation factors are appropriate for use with residential buildings in Georgia. We do not recommend using the J&E model for residential structures due to the variations in residential construction, HVAC systems, etc., and the likely presence of preferential pathways (e.g., sumps, water main and sewer pipes). If you believe that you have a site where modeling vapor intrusion at residential structures is valid given the above constraints, please contact EPD to discuss before conducting the modeling.
44	Section 5.1.2 Use of Modeling, page 19	GBA	8	**Modeling for Residential Structures** The Guidance recommends the use of modeling be limited to commercial buildings that may not be well represented by the USEPA (2012) attenuation factor database. While this is true for commercial buildings, residential structures in the southeast U.S., including Georgia, are also not well-represented in the USEPA database. Recommendation: Given the uncertainties and limitation of the USEPA (2012) attenuation factor database with respect to conditions in Georgia, the Guidance should include flexibility for modeling residential structures in Georgia.	See the response above.
Section 6					

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
45	Section 6	Thomas Szocinski, Land Science	1	It has been our experience in states that either do not have VI guidance or do not reference in greater detail on the VMS, that with the lack of guidance, there is not a uniformity or minimum requirement for how these systems are installed, specifically to the passive VMS design and install. a. Our recommendation would be to build out the in-field installation requirements for a passive VMS (Certified applicator from the manufacturer to install barriers, QA/QC of barrier installation [smoke testing, coupon sampling). If you need example language, I would be happy to provide examples from other states, and also suggested updates to your specific section.	References to the new ITRC guidance on VI Mitigation Systems (VMS) and a recommendation that VMS be installed according to manufacturer's specifications have been added to Section 6 in response to this comment.
46	Section 6	Thomas Szocinski, Land Science	2	Land Science has been extremely successful in states all across the US with the application of our Retro-Coat™ vapor intrusion coating system for existing buildings. In Georgia alone we have numerous sites in which Retro-Coat has been installed and effectively eliminated VI for existing buildings. b. Our recommendation would be to add "vapor intrusion floor coatings" to your existing building section on how to address VI. Again, I would be glad to provide possible language to add for this section as well. More and more states are adding this to their guidances and also ITRC is currently preparing a Vapor Mitigation System Guidance (which I and our team have been part of the review and implementation) which is scheduled for public release either the end of this year of in Q1 2021. There is a specific section in this upcoming guidance that will reference floor coating VI systems.	Reference to floor coatings has been added to the guidance as mitigation, but no specific brand names will be mentioned.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
47	Section 6.1 New Construction	Geosyntec Consultants	26	This section provides good information on the benefits of including vapor-mitigation design into new construction and offers a few examples of types of systems. However, aerated floors are one type of systems that is not mentioned in the Guidance and has been implemented successfully at VI sites across the country (including Georgia) for new construction. Other State-issued VI guidelines, including the New Jersey Department of Environmental Protection (NJDEP) VI Technical Guidance (2018) and the North Carolina Department of Environmental Quality (NCDEQ) VI Guidance (2018), recommend aerated floor/void space systems for new construction. In addition, the Draft ITRC Tech Sheet for mitigation (the Final Tech Sheet should be available in early 2021) references aerated floors. Aerated floors create a highly permeable sub-slab amenable for a passive system. We recommend adding aerated floors as one of the recommended VI mitigation systems for new construction. For any VI mitigation system, a critical component is a sub-slab permeable layer. The Guide should put emphasis on proper design of a VI mitigation system (permeable layer, venting stacks, selection of barrier type, etc.) and construction quality control within the Guidance. The Guidance should reference in this section the ANSI/AARST document titled "Soil Gas Control Systems in New Construction of Buildings" (2018). This document provides minimum requirements for the construction of any building intended for human occupancy to reduce occupant exposure to radon and other hazardous soil gases.	References to aerated floors/void space have been added to the guidance as mitigation systems. The reference was not added to the document as it is not a publicly available document.
48	Section 6.3 Mitigation System Design, Diagnostic Testing and Verification	Geosyntec Consultants	28	The Guidance states in the last sentence of Section 6.3, "Termination of monitoring/maintenance or VMS decommissioning may be considered if it is demonstrated that mitigation is no longer needed." The Guidance does not further explain what metrics would be necessary to demonstrate that termination of O&M or decommissioning is warranted. We recommend adding a brief discussion on the lines of evidence that GA EPD may accept when proposing to terminate monitoring/maintenance or VMS decommissioning. Similarly, we recommend adding a discussion regarding the frequency of a long-term monitoring plan and the types of data that should be collected to evaluate system performance. We suggest that the GA EPD review the mass emissions monitoring and stress-test methods in ESTCP ER201322.	Examples of multiple lines of evidence have been added to this section of the guidance. EPD is open to any kind of evidence that someone would submit to show that VMS is no longer needed to control VI. Frequency and the type of monitoring is dependent on the system that is installed, which is site-specific. Therefore, that information has not been added to the guidance since this guidance is intended to be generic in nature and meant to apply to a wide range of sites.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
49	Section 6.3 Mitigation System Design, Diagnostic Testing and Verification	Geosyntec Consultants	29	This section states that membrane barriers should have a minimum single sheet thickness of 30 mil. The Guidance references a USEPA 2008 Engineering Issue document which compares 40-60 mil moisture barriers to thin plastic sheeting. Many of the membranes available today (in a 20-mil range) were not available or evaluated for the EPA 2008 Engineering Issue. Since 2008, there have been advancements with composite membranes that provide increased strength, flexibility, and diffusion control, and now with proper design and construction quality control (CQC), 15 to 20 mil membranes can withstand the construction process and are specifically designed for VI mitigation (e.g., Raven VaporBlock Plus and Stego Drago). There are few 30-mil vapor barriers for VI mitigation on the market today, and they were intended for large buildings. Therefore, the draft Guidance, if implemented, would force industry to use a 40 to 60 mil spray-on membrane. We recommend revising the guidance to state that barriers should be at least 15 to 20-mil thick so that industry would have more types of VI barriers in the market to select and tailor to their site-specific need. Finally, we recommend that the Guidance puts less emphasis on the thickness of the barrier and recommend that a barrier be selected based on its properties (e.g., strength, flexibility, diffusion control, compatibility with the site CCs, etc.) and the type of mitigation system (more robust barriers for passive systems and less robust barriers for active systems).	Agree. Text in Section 6.3 has been added in response to this comment.
50	Section 6.3 Mitigation System Design, Diagnostic Testing and Verification, page 24	GBA	9	**Intrinsically Safe Blowers** The Guidance at Section 6.3 states that intrinsically safe blowers are recommended for situations where petroleum hydrocarbons or methane may be present. The requirement for intrinsically safe blowers will depend on the magnitude of concentration of petroleum hydrocarbons and/or methane. Recommendation: The ITRC Petroleum Vapor Intrusion Guidance (ITRC, 2014) recommends the use of intrinsically safe equipment at sites that contain compounds near or within their explosive limits. The ITRC Petroleum VI Guidance (2014) also recognizes methane generation by anaerobic biodegradation and recommends that the lower explosive limit of methane (5 percent) be used to select equipment. EPD should consider adding similar language to the ITRC guidance on when to use intrinsically safe equipment.	Text has been added to the guidance document in response to your comment to clarify that Intrinsically-safe blowers should be used where appropriate when determined by a qualified professional.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
51	Section 6.3 Mitigation System Design, Diagnostic Testing and Verification, page 24	GBA	10	**Shut Down of VI Mitigation Systems** The Guidance does not provide recommended methods to demonstrate that a VI mitigation system is no longer required to mitigate the VI pathway. Recommendation: Consider adding a brief discussion on the lines of evidence that EPD may accept when proposing to shut down a VI mitigation system.	Agree. Text has been added to Section 6.3 to state that a multiple lines of evidence approach should be presented to EPD to reduce monitoring requirements or to terminate operation of the VMS. Specifics are not provided as any lines of evidence can be provided to support reductions in monitoring or VMS termination.
52	Section 5.2 Decision Matrices	Mark Kram (Groundswell Technology)	8	In light of recommendation #3 and in consideration of the other items raised, site closure should follow an empirical process whereby concentrations are monitored during a confirmed upward advective flux condition (e.g., via tracking of nominal [not induced via building depressurization] differential pressure). If concentrations remain below risk screening levels during upward advective flux conditions, practitioners and regulators can confidently conclude that the potential for harmful indoor vapor intrusion exposures is minimal.	A statement about measuring the pressure differential between sub-slab and indoor air has been added to Section 6.3 in response to this comment.
Tables					

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
53	Table 1 Summary of Information to Consider for a CSM for Vapor Intrusion	Geosyntec Consultants	4	It is understood that the GA EPD likely did not intend for Table 1 to be an all-inclusive list of CSM elements important to the VI pathway. However, we suggest adding the following: • A row for "Source Identification" (dry cleaner, tank, landfill, etc.). This information is often important to identifying previously undocumented sources. • Available lines of evidence: Since there are more lines of evidence beyond analytical results, the title of this section should be changed. • Include another row for the CSM that documents other non-traditional lines of evidence, including tracer testing and building pressure control (BPC) test data. • Levels of Contamination in Various Media: Concentration of background sources in indoor air and outdoor air are important to the VI-CSM. • Type of Construction – We recommend adding a checkbox for "other". • Preferential Pathway – The guidance does not define "Preferential pathway". We recommend adding a definition. • Exposure Scenario - <pre detailed description of the exposure scenario is often beneficial to the assessment approach. We recommend adding "Residential – Single Family Home", "Residential Multi-family Home", "Warehouse", and "School". • Building Ventilation – We recommend adding additional detail such as the number of HVAC/Air Handling Unit (AHU)zones and if the air exchange rate was measured or assumed.	Agree. The table has been revised to include the recommended items.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
54	Table 1: Subsurface Characteristics	Jeff Baumann (Delmonico)	4	The air-filled porosity and permeability of soils has a significant influence on the migration and accumulation of vapors in the subsurface. It should be recommended that a thorough geotechnical evaluation of soils characteristics for these parameters be performed by a qualified geotechnical engineer and not just estimated as 'low, medium or high'. It would be best to take in situ samples of soils and have them analyzed at a geotechnical laboratory.	Agree that these soil characteristics influence vapor intrusion; however, analysis of these parameters by a geotechnical laboratory is not necessary in a vapor intrusion investigation.
55	Table 1: Type of Construction	Jeff Baumann (Delmonico)	5	How is the evaluation of compacted dirt in the crawl space being performed? Is this a visual assessment or is the inspector doing compaction tests (i.e. pocket penetrometer?). How are varying conditions of soil in a crawl space evaluated?	No changes have been made to the document. The examination of soil characteristics should be performed by environmental professionals.
56	Table 5 Leak Check Considerations	Geosyntec Consultants	10	This table identifies select approaches to verify the integrity of the sampling train, and thus, the quality of the sampling data. The first leak check types, vacuum leak check, is not clearly defined. It would be helpful if there was a reference that could be included to better define what GA EPD is expecting. A Shut-In Test is a vacuum leak check, but it typically does not include a sample implant/port. However, a water barrier (e.g., water dam) can cover that component of the sampling device. It is common practice to use a water dam test along with a Shut-In Test to verify the integrity of the sampling device. A water barrier (e.g., water dam) can be useful for a leak check for both permanent and temporary probes. These methods are described in the Wisconsin Department of Natural Resources' (WDNR) Sub-slab Vapor Sampling Procedures (WDNR, 2014).	A reference to a description of the vacuum test has been added to the text in this section in response to this comment. Please see response to Comment #28 above regarding the water dam test.
57	Table 5 Leak Check Considerations	Geosyntec Consultants	11	Table 5 recommends that liquid tracers not be used for leak check purposes. Liquid tracers can be used successfully, especially when used with a mobile lab. The California Environmental Protection Agency (CalEPA) Advisory for Active Soil Gas Investigations (CalEPA, 2015) states that "Liquid tracer compounds, such as hexane, pentane, difluoroethane, and n-propanol" and "other compounds not listed here" may be used to evaluate sample integrity. The GA EPD should consider including the option to use liquid tracers in the Guidance.	Table 5 has been revised to state that the liquid tracer test should only be used in conjunction with mobile lab.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
58	Table 7 Sources for VISL Calculator Inputs, page 17	GBA	7	**Using Sampling Results for Commercial Buildings** The last row of Table 7 and the table footnote indicate that it may be appropriate to consider representative concentrations, other than the maximum measured concentration, to estimate exposures in large commercial buildings. The text in the table lists the 95% UCL statistic as an example; however, the footnote is highly prescriptive and focuses exclusively on the 95% UCL statistic. Recommendation: The footnote should be revised to clarify that there may also be other acceptable methods for the development of exposure point concentrations used in the risk-based evaluation of VI data. It might also be helpful to include examples of exposure point concentration calculations in Appendix C.	The text has been revised to reflect that there are other acceptable methods for the development of exposure point concentration (EPC) used in calculating risk. Under reasonable maximum exposure, an EPC is considered to be either the maximum concentration of time-integrated samples from multiple sampling events or the 95% UCL (determined with a minimum of 10 samples). The 95% UCL of the mean may only be used when there are 10 or more vapor samples per sample event for large buildings. Other methods may be considered on a case-by-case basis given the amount of data available and the scientific applicability of the approach. Please discuss any proposal for developing an EPC with EPD prior to sampling.
59	Note below Table 7 Sources for VISL Calculator Inputs	Geosyntec Consultants	19	The note below Table 7 suggests that a 95 percent UCL of the mean analyte concentration from subslab soil gas samples be used "to characterize exposure units" in large buildings. This language is unclear because it blends investigation strategy with data screening. Instead, we recommend that the Guidance emphasizes a multiple lines of evidence CSM to guide VI pathway investigations. We also believe that appropriate data screening is best informed through the CSM. If the GA EPD wishes to use a statistical application for sorting investigation data for screening, the Guidance would need to provide greater clarity, perhaps by including an example in Appendix C.	Please see the response above. We agree that a multiple lines of evidence CSM should be used to guide investigation. No changes to the document have been made to address this comment.
60	Table 8 Groundwater Attenuation Factors	Geosyntec Consultants	21	Table 8 provides the supporting information needed for attenuation factors of 0.001, 0.0005, and 0.0002. For further clarification for attenuation factors in between these values, consider bounding the third row for attenuation factors less than 0.0005 and greater than or equal to 0.0002. The supporting information needed would include only the first three bullets in the third row. Then add a new fourth row to include attenuation factors less than 0.0002. The supporting information would be: "Same as above plus validation sampling".	Agree. Table 8 has been revised as discussed in this comment.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
61	Table 9 Soil Gas or Sub-Slab Attenuation Factors	Geosyntec Consultants	22	Table 9 provides the supporting information needed for attenuation factors of 0.03, 0.01, and 0.006. For further clarification for attenuation factors in between these values, consider bounding the third row for attenuation factors less than 0.01 and greater than or equal to 0.006. The supporting information needed would include only the first three bullets in the third row. Then add a new fourth row to include attenuation factors less than 0.006. The supporting information would be: "Same as above plus verification sampling."	Agree. Table 9 has been revised as discussed in this comment.
Figures					

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
62	Figure 7 Mitigation System Design and Performance Guidelines for New Construction Based on Vapor Intrusion Risk from Groundwater and Soil Gas	Geosyntec Consultants	27	Figure 7 recommends a vapor barrier as a minimum form of mitigation if the cancer risk is greater than 1E-5 and less than 1E-4 and the hazard index is greater than 1 and less than 3. This could be interpreted as installing only a vapor layer. We recommend against mitigating an occupiable building with a vapor barrier alone because barriers alone are unlikely to be effective. The Guidance places emphasis on the vapor barrier without any emphasis on other critical components of a barrier system such as the importance of a sub-slab permeable/venting layer allows for efficient depressurization or ventilations and/or air inlet pipes. A sub-slab permeable/venting layer allows for efficient depressurization or ventilation and allows less reliance on the performance of the barrier. For both passive and active systems, a "path of least resistance" approach should be included in the system design to allow vapors below the slab to vent to the atmosphere. This approach would include a permeable layer (gravel or aerated floor voids), as well as riser pipes and/or air inlet pipes. Consider revising Figure 7 to indicate a minimum design of a "passive system with active option" for risk level between 1E-5 and 1E-4. At higher risk sites (greater than 1E-4), a more robust barrier and/or a more sophisticated system would be recommended. Under both risk scenarios, a permeable layer and a barrier would be needed; however, for lower risk sites, the barrier would not need to be as robust. Similar to the coloration bars presented for risk, consider adding similar bars for "Barrier Requirement." The color bar would range from the far left being "No minimum Criteria" to the far right being "Robust Barrier Required". Consider including a footnote to iterate that vapor barriers are more important in passive systems than active systems. In active systems, vapor barriers are a redundancy in the system. A similar colorimetric bar could be done for "Permeable Layer". The bar would range from "Less Important" to "Most Important".	Agree. No changes were made in order to allow flexibility in system design depending on what is known about the site at the time. Wording was added to the text indicating mitigation system design to meet higher risk situations may be warranted when investigations are ongoing.
Appendices					
63	Appendix E	Geosyntec Consultants	30	The table in Appendix E should include Method 14-A only as a footnote for TO-15. Method TO-15 is an improvement of Method 14-A. There are not many instances where Method TO-14A would be the preferred method; therefore, the method is not worthy to have its own row in the table.	Agree. TO-14 has been removed from the table in response to this comment.

Ref #	Section of the Guidance	Commenter	Comment #	Comment	Response
References					
64	References, page 28		11	**Errata to USEPA Technical Guidance** On January 29, 2018, USEPA (2018b) issued errata for portions of their June 2015 technical guidance (USEPA, 2015). Recommendation: The reference section of the Guidance should include a copy of the January 29, 2018, errata.	The January 29, 2018 errata has been added to the references.