Response to Public Comments

Department of Toxic Substances Control
Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air - Interim Final

December 15, 2004 (Revised February 7, 2005)

Response Tracking Number: 1

Commenter Organization: American Petroleum Institute

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

The significance of vadose-zone biodegradation on the vapor intrusion of petroleum compounds is well recognized, but considered to a limited extent in the guidance document. Although exceptions can occur, the likelihood that dissolved hydrocarbons in groundwater will cause impacts to indoor air is remote. It is more reasonable to focus screening efforts on hydrocarbon release sites with i) shallow NAPL present below the building, ii) direct contact of dissolved hydrocarbons on the building, or iii) migration of petroleum vapors through preferential pathways in contact with contamination.

Studies have demonstrated that vadose-zone aerobic biodegradation of petroleum hydrocarbons is common and significant (Roggemans et al., 2001). The USEPA vapor intrusion database and industry experience both indicate that dissolved petroleum hydrocarbons in groundwater do not cause vapor intrusion impacts. Provided no preferential pathways are present, the potential for biodegradation is increased at sites with low hydrocarbon concentration, large depth to source, relatively permeable soils, and no capping effect (e.g., low permeability surface soil or cover that would limit transport of O2 into the subsurface) (Health Canada, 2004). Hence, Health Canada is currently considering a provision to allow for a 10x adjustment in the attenuation factor to account for biodegradation at sites with no surface cap and large depths to source. Modeling and site investigation studies demonstrate that biodegradation can result in many orders of magnitude reduction in vapor intrusion risk estimates (Abreu and Johnson, 2005b; Ettinger and McAlary; 2005; Gustafson et al., 2002; Lahvis et al., 1999) and a factor of 10 decrease in the attenuation factor has been proposed as a reasonable conservative assumption for the impact of biodegradation for petroleum hydrocarbons (Kremesec et al., 2005; SFBRWQCB, 2005; NJDEP, 2005).

API encourages the DTSC to re-evaluate its approach to petroleum hydrocarbon sites by adopting, at a minimum, a factor of 10 decrease in the attenuation factor for petroleum hydrocarbons, and to prioritize site screening to the scenarios itemized i – iii above. This will reduce some of the well-documented conservatism for the vapor intrusion pathway evaluation of petroleum hydrocarbons.

DTSC Response to Comment:

While biodegradation of petroleum hydrocarbons is well documented, biodegradation of vapor-phase petroleum hydrocarbon in the subsurface does not always occur. Roggemans et al. (2001) indicated that 6 of 28 soil gas profiles yielded no indication of petroleum biodegradation. Likewise, Davis (2005) noted that 7 percent of the benzene profiles and 27 percent of the total petroleum hydrocarbon (TPH) profiles exhibited little or no subsurface attenuation. Hence, petroleum hydrocarbon can pose a vapor intrusion risk in certain circumstances.

The following information is provided in regards to the specific comments:

1) The USEPA has yet to conclude from their empirical database that dissolved hydrocarbons in groundwater pose no vapor intrusion risk (Hers et al., 2005). This is largely due to the lack of empirical data associated with petroleum hydrocarbon.

2) The numerical modeling by Abreu and Johnson (2005, 2006) provides a theoretical framework for understanding biodegradation. While the results of the numerical modeling are compelling, the modeling warrants field validation to document that biodegradation occurs in these scenarios.

DTSC will adopt an attenuation factor for petroleum hydrocarbons when peer-reviewed scientific publications, both theoretical and empirical, clearly describe the conditions for the occurrence and non-occurrence of biodegradation in the vadose zone, or when USEPA adopts a policy concerning the biodegradation of petroleum.

References

Abreu, L. D. V., and P. C. Johnson. 2005. Effect of Vapor Source - Building Separation and Building Construction on Soil Vapor Intrusion as Studied with a Three-Dimensional Numerical Model. Environmental Science and Technology, v. 39, no. 12, p. 4550 - 4561.

Abreu, L. D. V., and P. C. Johnson. 2006. Simulating the Effect of Aerobic Biodegradation on Soil Vapor Intrusion into Buildings: Influence of Degradation Rate, Source Concentration, and Depth. Environmental Science and Technology, v. 40, n. 7, p. 2304 - 2315.

Davis. R. 2005. Making Sense of Subsurface Vapor Attenuation in Petroleum Hydrocarbon Sources. New England Interstate Pollution Control Commission LUSTLine Bulletin No. 49. March 2005. Pages 10 - 14.

Hers, I., H. Dawson, and R. Truesdale. 2005. Revising the Empirical Attenuation Factors: Data Analysis and Preliminary Results. Vapor Intrusion Workshop, 16th Annual West Coast Conference on Soils, Sediment, and Water; Association for Environmental Health and Sciences. San Diego, California; March 14, 2005.

Roggemans, S., C. L. Bruce, P. C. Johnson, and R. L. Johnson. 2001. Vadose Zone Natural Attenuation of Hydrocarbon Vapors: An Empirical Assessment of Soil Gas Vertical Profile Data. American Petroleum Institute Technical Bulletin No. 15. December 2001.

Response Tracking Number: 2

Commenter Organization: American Petroleum Institute

Technical Subject: Evaluation of Indoor Air Samples

Guidance Document Page: 29

Public Comment:

The guidance document does not quantitatively consider the effects of background concentrations in evaluating the risk from indoor air measurements. The USEPA database shows no correlation between petroleum hydrocarbon concentrations measured in groundwater and petroleum hydrocarbon concentrations measured in indoor air, primarily because of the influence of background (McHugh, 2004). It is common to find indoor air concentrations due to background sources resulting in risk estimates within the range of 10-6 to 10-5 and typical background concentrations for benzene exceed the 10-5 risk level (Kremesec et al., 2005). Consequently, there would be many sites where the vapor intrusion is not significant, but risk estimates using measured indoor air concentrations may lead to long-term monitoring and/or mitigation. Therefore, the guidance should provide a protocol to address compounds with typical background levels an order of magnitude greater than the risk-based targets. This protocol should include a preliminary screen of analytes for indoor air sampling to help avoid the inclusion of background contaminants in risk assessments where possible. The decision to test for benzene in indoor air should be based on the detections and concentration ratios in soil gas and outdoor air and the results of the site-specific screening relative to background concentrations. This will avoid the problems associated with analyzing for and detecting common background air contaminants such as benzene, unless benzene levels in soil gas warrant its inclusion as an analyte.

DTSC Response to Comment:

See response no. 322.

Response Tracking Number: 3

Commenter Organization: American Petroleum Institute

Technical Subject: Evaluation of Indoor Air Samples

Guidance Document Page: 35

Public Comment:

In addition, the DTSC should acknowledge in the guidance that even at typical background concentrations, indoor sources of VOCs have been shown to impact soil gas below the building foundation through diffusion or advection (see McHugh, 2006). As a result, the detection of VOCs in sub- slab samples does not necessarily indicate the upward migration of VOCs from deeper sources.

DTSC Response to Comment:

DTSC is hesitant to revise the vapor intrusion guidance document based on the work by McHugh et al. (2006). While the advective transport model within McHugh et al. (2006) is compelling, the empirical data shown in their paper does not support the supposition that indoor air contaminants move into the subslab area. The limited empirical dataset, as shown in Table 3 of their paper, indicates that not all the indoor air contaminants moved in the subslab area. It appears from their Table that 1,4-dichlorobenzene in indoor air moved into the subslab area but methylene chloride did not. This observation is counterintuitive. One would expect all contaminants in indoor air to move uniformly into the subslab area, not just a subset of the indoor air contaminants. Accordingly, additional research is needed on this topic to fully understand this phenomena. Nonetheless, DTSC will acknowledge that indoor air movement into the subslab and crawl space areas is possible and that practitioners should be cognizant of this possibility.

References

McHugh, T.E., de Blanc, P.C., and Pokluda, R.J. 2006. Indoor Air as a Source of VOC Contamination in Shallow Soils Below Buildings. Soil and Sed. Contam., Accepted for Publication in Vol. 15, No. 1, January 2006.

Response Tracking Number: 4

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 09

Public Comment:

While the preference to use soil gas data over soil matrix data is clearly understood, there are many sites where soil matrix data have been previously collected and the evaluation of these data should be considered before collecting new soil gas samples. The study referenced in the vapor intrusion guidance does show a poor correlation between soil matrix and soil gas samples; however, other studies (Hewitt, 1998) have shown a good correlation between soil gas samples and soil matrix samples collected using Method 5035. Judicious use of soil data should be permitted in the vapor intrusion evaluation process and the uncertainty in the use of soil matrix data addressed in the risk-based decisions made following the data evaluation.

DTSC Response to Comment:

See response no. 21 and 289.

Response Tracking Number: 5

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

The guidance document recommends vertical and lateral delineation of soil gas concentrations to non-detectable levels. The requirement for soil gas delineation to non-detectable concentrations is not warranted. The objective of the soil gas investigation is to assess the vapor migration pathway due to the soil or groundwater source areas. For example, groundwater characterization should be the first step in any risk-based investigation where the source is known to be groundwater. This info can be used to select appropriate soil gas sampling locations. The soil gas plume does not need to be delineated once these source areas are adequately characterized, but the soil gas data should provide sufficient data to evaluate contaminant fate and transport through the vadose zone.

DTSC Response to Comment:

See response no. 204, 289, and 292.

Response Tracking Number: 6

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 18

Public Comment:

Similarly, there is no need to collect soil gas samples at a density that reflects the current or proposed future building density. If the soil gas data can demonstrate that the vapor intrusion pathway is not of concern within the higher concentration areas of the site, there is no need to collect additional data over lower concentration areas of a groundwater plume. A sufficient amount of soil gas data needs to be collected to evaluate the vapor intrusion pathway throughout the site, but it is not necessary to collect soil gas data throughout the entire site to meet this objective.

DTSC Response to Comment:

DTSC fundamentally agrees with this approach to site characterization. Subsurface delineation of a plume should continue until risk-based screening levels are obtained. For California, these risk-based screening levels can be the California Human Health Screening Levels (CHHSLs) pursuant to Senate Bill 32 if cumulative health effects are not of a concern. Once the soil gas plume is delineated to risk-based levels, a survey should be conducted of the existing and future building locations. If buildings are within 100 feet of the edge of the plume, as delineated by risk-based levels, a survey of potential conduits for preferential contaminant migration should be conducted. If conduits exist, assessment and mitigation of the conduits might be warranted. See response 14 for additional information on preferential pathways.

Response Tracking Number: 7

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

The work by Abreu and Johnson (2005a) and Lowell and Eklund (2004) show that the potential lateral migration of contaminant diffusion in the vadose zone is a function of contaminant depth and degradability. For many cases, the assumed 100-foot lateral distance between vadose-zone impacts and a potential receptor may be overly conservative, especially at sites with shallow source depth conditions. Additionally, recent vapor intrusion guidance from some other states has taken into consideration aerobic biodegradation, which reduces the investigation distance criterion. For example, in order to take into consideration aerobic biodegradation, the New Jersey Department of Environmental Protection's 2005 Draft Vapor Intrusion Guidance utilizes an investigation distance of 30 feet for sites with petroleum-related groundwater contamination; provided that non-aqueous phase product is not present. The option to determine a site-specific lateral distance for this evaluation should be included in the guidance.

DTSC Response to Comment:

See response no. 280.

Response Tracking Number: 8

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

We encourage you to include a key reference currently missing from the guidance: API's Collecting and Interpreting Soil Gas Samples from the Vadose Zone: A Practical Strategy for Assessing the Subsurface-Vapor-to-Indoor-Air Migration Pathway at Petroleum Hydrocarbon Sites, by Lesley Hay Wilson, Ph.D., Sage Risk Solutions LLC, Paul C. Johnson, Ph.D., Department of Civil and Environmental Engineering, Arizona State University, and James R. Rocco, Sage Risk Solutions LLC, May 2005 (See API [2005] in the reference list). This peer-reviewed manual is specifically designed to lead the user through a weight-of-evidence approach to evaluating the vapor intrusion pathway without being prescriptive about the methods used.

DTSC Response to Comment:

The API document will be included as a reference in the DTSC document, along with the ITRC document.

Response Tracking Number: 9

Commenter Organization: American Petroleum Institute

Technical Subject: General

Guidance Document Page:

Public Comment:

API encourages DTSC to consider issuing a revision of the guidance for comment before publishing a final version. We also encourage DTSC to work with API in its ongoing efforts to identify quality petroleum site data sets that can provide more insight on what combination of site conditions are more likely to cause concern relevant to vapor intrusion.

DTSC Response to Comment:

DTSC will allow interested parties to review our responses to the public comments prior to the finalization of the guidance document. Also, DTSC welcomes the opportunity to work with API concerning the documentation of petroleum vapor bioattenuation (see response 330).

Response Tracking Number: 10

Commenter Organization: American Petroleum Institute

Technical Subject: General

Guidance Document Page:

Public Comment:

The tiered approach to the evaluation of the vapor intrusion pathway is a useful framework for the guidance. Clear identification of the preliminary screening, default screening and site-specific screening should be maintained in the guidance. As mentioned in the guidance, it is important to note that there is flexibility in the step-wise approach indicated in DTSC guidance Figure 1. Steps in the evaluation may be skipped under certain site conditions. For example, there is no need to conduct a formal screening level assessment if data suggest a site-specific evaluation is warranted.

DTSC Response to Comment:

DTSC does not anticipate changing the tiered approach for site screening within the revised guidance document. Additionally, the text of the guidance document will be enhanced to further clarify that site-specific conditions may allow deviation from the recommended approach.

Response Tracking Number: 11

Commenter Organization: American Petroleum Institute

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

It is critical to highlight that this document provides a technical framework for the evaluation of the vapor intrusion pathway, but other technically defensible approaches may be used for this analysis. Note that the language in many sections of this guidance tends to exclude some alternate approaches without the opportunity to make technically defensible arguments (e.g., the use of bulk soil data). The entire document should be reviewed to ensure that phrases such as “must” or “will be required” are not included.

DTSC Response to Comment:

See response no. 16.

Response Tracking Number: 12

Commenter Organization: American Petroleum Institute

Technical Subject: General

Guidance Document Page:

Public Comment:

There are some sections containing too many specifics with information that may be presented more effectively in an appendix (e.g., indoor air monitoring approach, mitigation system). Reorganization of this guidance to include more details in the appendices should be considered.

DTSC Response to Comment:

See response no. 276.

Response Tracking Number: 13

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

There appears to be confusion within the regulatory and regulated communities regarding the applicability of the California Human Health Screening Levels (CHHSLs). The discussion included in the vapor intrusion guidance document on CHHSLs is an important section to clarify their use and thus should be retained in future versions.

DTSC Response to Comment:

The text associated with the use of the CHHSLs will remain in any revised version of the guidance document due to the importance of this subject.

Response Tracking Number: 14

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 05

Public Comment:

Inconsistent definitions of “preferential pathways” are presented in the guidance document. A distinction should be made between preferential pathways that may affect sub-surface vapor transport and soil gas entry points into buildings. All buildings will have potential soil gas entry points and it needs to be made clear that the presence of these cracks and openings does not preclude the use of the screening attenuation factors or models referenced in this guidance document.

DTSC Response to Comment:

The definition of preferential pathway will be further clarified in the revised guidance document. A distinction between building preferential pathways and vadose zone preferential pathways will be made upon document revision. Building preferential pathways are items such as foundation cracks, control joints, utility stub-ups, floor drains, sub-floor plenums, utility vaults, and elevator shafts. Whereas vadose zone preferential pathways are subsurface features, such as lenticular sand bodies, and utility corridors (sewer, water, storm water, electrical, fiber optic, cable, natural gas, and telephone). Some of the before-mentioned building preferential pathways were envisioned in the construction of the J&E model and are not of concern to DTSC when vapor intrusion modeling is conducted. These building preferential pathways are foundation cracks, control joints, and other small foundation openings that yield a crack-to-total area ratio of approximately 0.01 (unitless). However, when large void spaces are present in foundations, such as for elevators, utilities, and ventilation, use of the J/E model may not be appropriate for risk evaluation because the model may underpredict the soil gas entry rate in the building. Also see response no. 38.

Response Tracking Number: 15

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

The quantification of both soil gas and groundwater risks is not necessary. This requirement implies that the soil gas and groundwater concentrations are not related when in fact they typically are correlated. Soil gas data are often collected to provide a better estimate of potential vapor migration from groundwater and therefore should be considered the more appropriate data for the vapor intrusion evaluation. For example, if the risks calculated from the groundwater data exceed a threshold but the risks from soil gas do not, then no corrective action would be necessary.

DTSC Response to Comment:

The risk associated with contaminated soil gas and groundwater should be quantified so an appropriate risk management decision can be made for vapor intrusion. Ideally, if the media are in equilibrium, the associated vapor intrusion risk should be approximately the same. If not, a reasonable risk management decision should be made as compelled by the interpretation of the data. Both lines of evidence should be considered in the decision making process and the guidance document will be revised to state this.

Response Tracking Number: 16

Commenter Organization: American Petroleum Institute

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

"Please recognize that this guidance document is not regulation. Other technically equivalent procedures may exist, and this Guidance is not intended to exclude alternate approaches or methodologies. Hence, users of this guidance document are free to use other technically sound approaches."

It is critical to highlight that this document provides a technical framework for the evaluation of the vapor intrusion pathway, but other technically defensible approaches may be used for this analysis. Note that the language in many sections of this guidance tends to exclude some alternate approaches without the opportunity to make technically defensible arguments (e.g., the use of bulk soil data). The entire document should be reviewed to ensure that phrases such as "must" or "will be required" are not included.

DTSC Response to Comment:

DTSC will review the document to determine when it is appropriate to use the terms "must" or "will be required" in the context of whether another technically sound approach may be used.

It should be noted that scientific studies have limited the utility of some technical approaches for evaluating vapor intrusion. For example, the use of soil matrix data as a sampling technique for the quantification of contaminant source terms is inappropriate. The analytical results from soil matrix samples are biased low due to vapor loss as indicated by USEPA in SW-846 for Method 5035A. Likewise, soil gas results obtained from soil matrix samples are subject to uncertainty due to the assumptions made for contaminant partitioning. These two issues, vapor loss and partitioning uncertainty, make soil matrix sampling a less than ideal technique for the quantification of contaminant sources.

Response Tracking Number: 17

Commenter Organization: American Petroleum Institute

Technical Subject: Scope

Guidance Document Page: 02

Public Comment:

"The step-wise approach in this guidance document is meant to be flexible and may be tailored to site-specific circumstance."

This is an important consideration and should be kept in this guidance document.

DTSC Response to Comment:

This language will remain in the guidance document (also, see response no. 195).

Response Tracking Number: 18

Commenter Organization: American Petroleum Institute

Technical Subject: Scope

Guidance Document Page: 02

Public Comment:

"While the assessment process is presented in a step-wise fashion, the vapor intrusion pathway may be evaluated in an iterative process."

This is an important consideration and should be kept in this guidance document.

DTSC Response to Comment:

This language will remain in the guidance document (also, see response no. 195).

Response Tracking Number: 19

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 02

Public Comment:

"All potential preferential pathways for vapor migration should be documented."

No consistent definition of preferential pathways is included in this document. Piping, floor drains, and foundation construction joints are features normally found in buildings and represent potential soil gas entry points. These should be differentiated from vadose-zone transport preferential pathways.

DTSC Response to Comment:

See response no. 14 and 38.

Response Tracking Number: 20

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

No discussion is included in this section regarding how to evaluate shallow soil impacts (e.g., soil impacts less than 5 feet below ground surface). This scenario may be of concern for sites where surface releases have occurred and future buildings will be constructed. For these scenarios, it is recommended that the guidance clearly indicate that either soil matrix data or soil gas data collected less than 5 feet below ground surface (with appropriate quality control to verify that surface leakage has not occurred) may be used to evaluate impacts in this zone.

DTSC Response to Comment:

See response no. 216 and 289.

Response Tracking Number: 21

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"DTSC views this increased uncertainty (partitioning from soil or groundwater) as unacceptable in any indoor air evaluation."

While there is uncertainty associated with the partitioning between soil gas and soil or groundwater, this uncertainty is not significantly greater than the uncertainty associated with the other steps in the risk assessment process (e.g., site characterization, exposure estimation, or toxicity assessment). While the use of soil gas data will reduce uncertainty in the vapor intrusion pathway assessment, the guidance should not preclude the use of soil and/or groundwater data.

DTSC Response to Comment:

The USEPA vapor intrusion guidance document does not have soil matrix screening numbers, reflecting USEPA's uneasiness with screening sites exclusively with soil matrix samples. USEPA specifically addresses soil matrix samples on page 29 of their 2002 document, stating that "soil (as opposed to soil gas) sampling and analysis is not currently recommended for assessing whether or not the vapor intrusion pathway is complete". Hence, DTSC is consistent with USEPA's position on soil matrix sampling.

Additionally, the use of any fate and transport model requires assurance that the model closely represents reality so that human health can be adequately protected. Hence, the uncertainty associated with a fate and transport model should be reduced whenever possible so that the model, as embodied by a mathematical algorithm, is a correct representation of a physical system. Partitioning assumptions add uncertainty to vapor intrusion modeling. Partitioning calculations assume chemical equilibrium, and determinations for porosity, moisture content, and fraction of organic carbon must be made. Prudence would dictate that, when possible, this uncertainty should be eliminated from exposure calculations through the reliance on soil gas measurements. Also, see response no. 289.

References

United States Environmental Protection Agency. 2002a. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Office of Solid Waste and Emergency Response. November 29, 2002.

Response Tracking Number: 22

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Characterization should continue until non-detectable concentrations of VOCs are encountered in the subsurface laterally and vertically."

The requirement for soil gas delineation to non-detectable concentrations is not warranted. While there may be some cases where lateral delineation of soil gas plumes may be appropriate (e.g., shallow releases of chlorinated hydrocarbons resulting in "vapor clouds"), the delineation should be to risk-based concentrations and not detection limits. However, most often the objective of the soil gas investigation is to assess migration of subsurface VOCs from soil or groundwater sources through the vadose zone to the surface. The soil gas plume does not need to be delineated once these source areas are adequately characterized, but should provide sufficient data to evaluate contaminant fate and transport through the vadose zone. Furthermore, in some cases it may not be possible to delineate to non-detectable concentrations particularly in the case where the VOCs of interest are present in outdoor air.

DTSC Response to Comment:

See response no. 204.

Response Tracking Number: 23

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"The minimum amount of soil gas sampling needed in the vertical direction to evaluate vapor intrusion is the collection of soil gas samples at 5 and 15 to 20 feet below surface grade."

While vertical soil gas profiles can aid in the evaluation of the vapor intrusion pathway, this information is not the minimum amount required. If the soil and groundwater impacts have been well characterized, soil gas data collected from a single depth may be sufficient for the pathway evaluation in many cases. An additional concern with this statement is that it has been interpreted to mean that multiple depth samples are necessary at every location. At many sites, soil gas profile data collected at a limited number of locations (but not all) can be effectively used to characterize the vapor migration pathway. Finally, selection of sampling depths based on site-specific evaluation of stratigraphy would be more appropriate than the specified arbitrary depths: 5, 25 and 20 feet.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document (see response 216).

Response Tracking Number: 24

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"For sites that overlie contaminated groundwater, an effort should be made to collect soil gas sample from immediately above the capillary fringe zone and half-way to the surface."

This statement suggests that soil gas samples should be collected at 3 locations when groundwater is impacted. While this may be useful in certain circumstances (e.g., to assess pathway completeness or the significance of biodegradation), the decision of when to collect samples at multiple depths should be made on a site-specific basis and it is unlikely to be necessary for most locations where soil gas sampling is conducted. For example, if deep soil gas concentrations are below screening levels and vapor intrusion from impacted groundwater is demonstrated to be not of concern, soil gas profile data are not necessary.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document (see response 216, 271, and 289).

Response Tracking Number: 25

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"To allow for subsurface conditions to equilibrate, sampling from direct-push probes should not occur for at least 20 to 30 minutes after probe installation and sampling from probe installed with hollow-stem drilling methods should not occur for at least 48 hours after probe installation."

Although a 48-hour waiting period is often cited, the technical basis is suspect and flexibility should be allowed regarding when sampling can begin.

DTSC Response to Comment:

A waiting period after probe installation is prudent to allow equilibration of the subsurface. While DTSC recognizes that the technical basis for the specific 48 hour waiting period is limited, nonetheless some timeframe must be suggested. A timeframe of 48 hours appears reasonable. Additionally, API (2005) in Appendix C suggests that the representative samples can be collected soon after the seals are set, usually "within a few days". Hence, until additional scientific information is available, DTSC will retain the 48 hour waiting period for vapor wells installed with a hollow-stem auger drilling rig.

References

American Petroleum Institute. 2005. Collecting and Interpreting Soil Gas Samples from the Vadose Zone; A Practical Strategy for Assessing the Subsurface Vapor-to-Indoor Air Migration Pathway at Petroleum Hydrocarbon Sites. Regulatory Analysis and Scientific Affairs, Publication Number 4741, November 2005.

Response Tracking Number: 26

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"Ideally, there should be a soil gas sample for every potential future residential building."

This recommendation does not take into account the fact that for many sites the contaminant distribution will be well characterized through soil and groundwater assessment. For example, consider a large site with no remaining soil sources and a well-characterized groundwater plume. If vadose zone conditions are consistent over the site, then collection of soil gas data over the higher groundwater concentration areas can be used to assess the vapor intrusion pathway over the larger area without the need to collect soil gas samples for every potential future residential building.

DTSC Response to Comment:

See response no. 125.

Response Tracking Number: 27

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"Soil gas samples should be collected until the soil gas contaminant plume is fully delineated and a clean zone of 100 feet beyond the extent of the soil gas plume is demonstrated."

The requirement for soil gas delineation to non-detectable concentrations with a 100 foot clean zone is not warranted. The objective of the soil gas investigation is to assess the vapor migration pathway due to the soil or groundwater source areas. The soil gas plume does not need to be delineated once these source areas are adequately characterized, but should provide sufficient data to evaluate contaminant fate and transport through the vadose zone.

DTSC Response to Comment:

Subsurface delineation of a plume should continue until risk-based screening levels are obtained. For California, these risk-based screening levels can be the California Human Health Screening Levels (CHHSLs) pursuant to Senate Bill 32 if cumulative health effects are not of a concern. Also, the guidance document will be revised to allow for the option to determine a site-specific lateral offset to determine a safe building location as indicated by Abreu and Johnson (2005) and Lowell and Eklund (2004). See response no. 280 for more information about building offsets.

Response Tracking Number: 28

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"…the results of the field work should be independently confirmed through the collection of duplicate soil gas samples in Summa canisters."

The need for confirmation with Summa canisters is an unnecessary expense. If the mobile laboratory is certified and it uses the appropriate methods and quality control, then confirmation samples should not be required.

DTSC Response to Comment:

See response no. 221.

Response Tracking Number: 29

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

"For chemicals known to exist in the subsurface, whether determined through direct measurement or historical records review, the chemicals should be evaluated for vapor intrusion even if the concentrations in soil gas concentrations [sic] are non-detectable. In these cases, the chemical should be evaluated at concentrations equal to the method detection limit."

This is an overly conservative approach that is not consistent with typical risk assessment practice. If a chemical is not detected in soil gas and the detection limit is sufficient to demonstrate the constituent is below screening level values, then it is appropriate to not include this compound in the risk assessment. For sites with multiple VOCs, the requirement to include all compounds in the risk assessment (whether or not they are detected in soil gas) may result in unacceptable risk estimates even when some or all of the chemicals are not present. Further, this statement does not consider the case of petroleum hydrocarbons (PHCs) in groundwater, where biodegradation in the vadose zone can result in no detectable PHCs in the soil gas. In this case, the vapor intrusion pathway is incomplete and it would not be appropriate to calculate risks using detection limits as surrogates for the non-detect PHC concentrations.

DTSC Response to Comment:

The DTSC will revise the guidance to state that volatile chemicals that could be present on site, as indicated by subsurface testing of other media (soil matrix and/or groundwater), but have not been detected in soil gas at appropriate detection limits due to sample dilution should be evaluated for vapor intrusion at concentrations equal to one-half the method detection limit, rather than at the method detection limit as originally indicated.

Response Tracking Number: 30

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

"DTSC considers soil gas sampling to fail when subsurface air flow rates are less than 10 milliliters per minute or when vacuum of 10 inches of mercury (136 inches of water) or greater is obtained."

A 10 milliliter per minute threshold is very low. In these cases, it will take more than 2 to 3 hours to purge the sample probe and collect a 1 liter sample. This should be changed to "… air flow rates are less than 100 milliliters per minute at a vacuum of greater than 10 inches of mercury."

Additional methods to evaluate when soil gas sampling is practicable are provided in API (2005) including:

Connect a syringe fitting (e.g., a Luer-lok® fitting) and a 60-mL or larger syringe T-connector on a soil vapor probe. Pull the plunger back to the full-scale reading, hold in that position, and monitor the vacuum created and its relaxation. If the vacuum does not relax within a few minutes to an hour, it is unlikely that soil gas sampling is practicable at the site.

Also, suggest changing from "soil gas sampling to fail" to "soil gas sampling impractical"

DTSC Response to Comment:

When soil gas samples are field analyzed at a mobile laboratory, typically the samples are collected in either glass syringes or gas bulbs. These glass containers usually have a volume of less than 100 milliliters so a slow sampling rate was not considered overly burdensome. Hence, the DTSC / RWQCB soil gas guidance was written anticipating field analysis. With the use of Summa canisters, the "failure" criteria with the vapor intrusion guidance document will be revised. Also, see response no. 97.

Response Tracking Number: 31

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

"These low flow conditions must exist at numerous sampling points at a site before DTSC will consider the sampling efforts a failure."

This statement is vague and can potentially be overly burdensome. If site investigations at neighboring sites have demonstrated that low flow conditions exist at a site, then additional numerous attempts is not reasonable. This sentence is not necessary and a site-specific evaluation should be made to decide whether soil gas samples can be collected.

DTSC Response to Comment:

See response no. 296.

Response Tracking Number: 32

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

"Quantification of both (soil gas and groundwater) risks is a way of evaluating which contamination source provides the greatest health threat."

It is unclear why quantification of both soil gas and groundwater risks should be required. This comment implies that the soil gas and groundwater concentrations are not related. The soil gas data are typically collected to provide a better estimate of potential vapor migration from groundwater and therefore should be considered the more appropriate data for the vapor intrusion evaluation. For example, if the risks calculated from the groundwater data exceed a threshold but the risks from soil gas do not, then no corrective action would be necessary.

DTSC Response to Comment:

The risk associated with contaminated soil gas and groundwater should be quantified so an appropriate risk management decision can be made for vapor intrusion. Ideally, if the media are in equilibrium, the associated vapor intrusion risk should be approximately the same. If not, a reasonable risk management decision should be made as compelled by the interpretation of the data. Both lines of evidence should be considered in the decision making process and the guidance document will be revised to state this.

Response Tracking Number: 33

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

"Prior to sampling, monitoring wells should be purged to remove stagnant casing water from the well that is not representative of aquifer conditions."

No-purge sampling at petroleum hydrocarbon sites is accepted practice in many regions of California. USEPA (2004) found that there was little difference in the results between purging and not purging.

DTSC Response to Comment:

The data quality objectives are high for groundwater sampling in vapor intrusion evaluations due to potential human exposure. Accordingly, representative groundwater samples must be obtained. DTSC will consider no purge sampling if the technique yields representative samples. DTSC will entertain no purge sampling at DTSC sites, not just vapor intrusion sites, on a case-by-case basis but only after the collection of samples initially with more traditional methods. Hence, the language in the text of the vapor intrusion guidance document will be changed slightly to recommend the collection of representative samples. But it should be noted that DTSC is influenced by USEPA guidance. Yeskis and Zavala (2002) of USEPA indicate that "to safeguard against collecting a sample biased by stagnant water, specific well purging guidelines and techniques should be followed."

References

Yeskis, D., and B. Zavala. 2002. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers; Ground Water Forum Issue Paper. USEPA Office of Solid Waste Emergency, Document No. EPA 542-S-02-001. May 2002.

Response Tracking Number: 34

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 09

Public Comment:

"Other methods, such as peristaltic pumps and bailers, may cause unacceptable volatilization of chemicals."

While these techniques may cause some volatilization, no studies have been conducted to quantify the VOC losses by these sampling methods. As most groundwater samples are collected by these two methods, DTSC should verify whether the use of these sampling techniques will cause unacceptable volatilization before restricting their use.

DTSC Response to Comment:

The data quality objectives are high for groundwater sampling in vapor intrusion evaluations due to potential human exposure. Accordingly, representative groundwater samples must be obtained. Bailers should not be used when sampling for volatile organic compounds due to the potential bias introduced during sampling (Pohlmann, et al., 1990; Yeskis, et al., 1988; Tai, et al., 1991). Likewise, potential bias by peristaltic pumps may be introduced due to the negative pressure imparted onto the water column (Yeskis and Zavala, 2002). Hence, the language in the text of the vapor intrusion guidance document will be changed slightly to recommend the collection of representative samples.

References

Pohlmann, K. F., R. P. Blegen, and J.W. Hess. 1990. Field Comparison of Ground-Water Sampling Devices for Hazardous Waste Sites: An Evaluation Using Volatile Organic Compounds. USEPA Document EPA/600/4-90/028,102 pp.

Tai, D. Y., K. S. Turner, and L. A. Garcia. 1991. The Use of a Standpipe to Evaluate Ground Water Samples; Ground Water Monitoring Review, v. 11, n. 1, p. 125-132.

Yeskis, D., and B. Zavala. 2002. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers; Ground Water Forum Issue Paper. USEPA Office of Solid Waste Emergency, Document No. EPA 542-S-02-001. May 2002.

Yeskis, D., K. Chiu, S. Meyers, J. Weiss and T. Bloom. 1988. A Field Study of Various Sampling Devices and Their Effects on Volatile Organic Contaminants; Proceedings of the Second National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring and Geophysical Methods, National Water Well Association. May, 1988.

Response Tracking Number: 35

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"Soil gas, soil matrix, and groundwater should be tested for all the chemicals of concern at a site."

This seems to be out of the scope of the vapor intrusion guidance. If soil gas data is preferred, it is not clear why the other media need to be analyzed for all chemicals of concern.

DTSC Response to Comment:

The risk associated with contaminated soil gas and groundwater should be quantified so an appropriate risk management decision can be made for vapor intrusion. Ideally, if the media are in equilibrium, the associated vapor intrusion risk should be approximately the same. If not, a reasonable risk management decision should be made as compelled by the interpretation of the data. However, vapor intrusion may only be one exposure pathway among many at a site and soil matrix sampling may be warranted to evaluate dermal and ingestion exposure to soil, and to also evaluate the soil leaching to groundwater pathway. The issue of multiple exposure pathways and multiple exposure media will be further addressed in the revised guidance document,

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Response Tracking Number: 36

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"For existing or future building not to be considered a candidate for vapor intrusion, the buildings must be greater than 100 feet away laterally from subsurface contamination (USEPA, 2002a)."

The work by Abreu and Johnson (2005) and Lowell and Eklund (2004) show that the potential lateral migration is a function of contaminant depth and biodegradability. For many cases, the 100 foot lateral distance may be overly conservative. The option to determine a site-specific lateral distance for this evaluation should be included.

DTSC Response to Comment:

See response no. 280.

Response Tracking Number: 37

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 12

Public Comment:

"Evaluations of building distance from contaminant plumes should only be conducted if the movement of subsurface contamination has reached steady-state conditions."

In addition to the referenced approach proposed by Hartman (2004) to estimate the time needed to reach steady state conditions, Johnson et al. (1999) also proposed an approach to estimate this time. The Johnson et al. (1999) reference may be more useful because it considers the different diffusion rates for different soil types. This reference should be included in this section.

DTSC Response to Comment:

See response no. 83.

Response Tracking Number: 38

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 12

Public Comment:

"Buildings with preferential pathways should be evaluated for vapor intrusion even if they are further than 100 feet from the contamination."

This sentence is too vague. Many vapor intrusion sites will be located in urban areas with potential utility conduits and this statement may lead to evaluation of the vapor intrusion pathway over an excessive area.

DTSC Response to Comment:

The definition of preferential pathways will be clarified upon document revision. Specifically, in regards to preferential pathways related to the 100 foot "buffer" zone, it is appropriate to locate subsurface preferential pathways between plumes and buildings. The first step in the evaluation process would be to obtain information showing the utility corridors (sewer, water, storm water, electrical, fiber optic, cable, natural gas, and telephone) to determine if these conduits lead from the plume to adjacent buildings. If so, data collection would be warranted to determine if the soil gas of the backfill material of the conduit is contaminated. This data collection could be active or passive soil gas samples. The guidance document will be revised to state this approach.

Response Tracking Number: 39

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 15

Public Comment:

"DTSC recommends that the default attenuation factors in Table 2 be used along with the maximum detected soil gas concentration for preliminary screening evaluations."

Table 2 lists attenuation factors for soil gas to indoor air and does not include attenuation factors for groundwater data that consider the additional attenuation due to the capillary fringe. Attenuation factors for groundwater sources are presented in other guidance documents (USEPA, 2002; SFRWQCB, 2003) and it is not clear why these are not included in the DTSC Guidance. Screening level attenuation factors for groundwater measurements can be calculated using the vapor intrusion spreadsheets referenced in the DTSC guidance and should be added to Table 2. Note that the OEHHA CHHSL guidance document allows the use of a 95%UCL for soil gas for the risk screening. When sufficient data are available, the 95%UCL of the mean should be appropriate for the screening evaluation.

DTSC Response to Comment:

As noted in the comment, preliminary screening with groundwater does not include attenuation over the capillary fringe. DTSC's intent was to keep the screening approach simplistic for preliminary screening. All other screening would be deemed site-specific where attenuation over the capillary fringe could be evaluated and the contaminant source could be approximated statistically.

Statistical approximation of contaminant source terms is mentioned on page 59 of the guidance document. DTSC is receptive to the use of statistics but only when a statistically robust dataset are available. For small buildings, this may imply the collection of numerous subsurface samples, potentially an excessive number of samples, for the building.

Response Tracking Number: 40

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 14

Public Comment:

”The default attenuation factors assume the following conditions for their use in evaluating an existing or future building:”

The default attenuation factors are not dependent on the following conditions listed in this section:

* No fractures exist in the subsurface
* Groundwater is greater than 10 feet below surface grade
* Non-aqueous phase liquid (NAPL) is not present on the water table

Additionally, the occurrence of vadose zone biodegradation should not preclude the use of the default attenuation factors. The default values will simply be overly conservative in these cases and still may be used as an initial screen.

DTSC Response to Comment:

The Johnson and Ettinger model (1991) was used by OEHHA to generate the California Human Health Screening Levels (CHHSLs). The Johnson and Ettinger model, which is an algorithm meant to approximate a physical system, was developed with underlying assumptions. The intent of the list on page 14 was to capture those assumptions so that practitioners could understand the limitations associated with the application of the CHHSLs. As stated in Johnson and Ettinger (1991), the algorithm was derived assuming that no non-aqueous phase liquid (NAPL) was present at the site and that the subsurface was subject to porous flow rather than fracture flow. Hence, the only bullet that warrants removal on page 14 is the reference to the depth to groundwater.

References

Johnson, P. C., and R. A. Ettinger. 1991. Heuristic Model for Predicting the Intrusion of Contaminant Vapors into Buildings. Environmental Science and Technology, v. 25, n. 8, p. 1445 - 1452.

Response Tracking Number: 41

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 15

Public Comment:

"Quantifying human health risk from Method 5035A soil matrix samples may yield results that are biased low due to inherent VOC escape during sample collection (Hewitt, 1994; Hewitt, 1999; Likala et al., 1996, Vitale et al., 1999)."

These references do not support the position that soil matrix data using Method 5035A would result in risk estimates that are biased low. These references consider VOC losses using sampling methods other than Method 5035A. In fact, other publications by Hewitt (Hewitt, 1998a and Hewitt, 1998b) indicate that soil matrix samples are representative and correlate well with soil gas concentrations. DTSC should reconsider its objection to the use of soil matrix data and partitioning equations in the screening process.

DTSC Response to Comment:

The references will be removed (see response 21 and 289 concerning the use of soil matrix samples as a mechanism to evaluate vapor intrusion).

Response Tracking Number: 42

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 15

Public Comment:

"…sites can be screened, in certain circumstances, with only groundwater contaminant data."

This is a useful screen of site data and should remain in the guidance document.

DTSC Response to Comment:

Groundwater screening will remain in the guidance document (also see response 289).

Response Tracking Number: 43

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 16

Public Comment:

"The evaluation of vapor intrusion should not be conducted with groundwater grab samples…"

This statement is inconsistent with earlier discussion on the use of groundwater grab samples. Depth discrete grab samples can be collected at the water table interface and can be useful data for the vapor intrusion pathway evaluation (NJDEP, 2005).

DTSC Response to Comment:

DTSC currently views the acquisition of groundwater grab samples as a mechanism to determine if aquifers or water bearing units are contaminated. If not contaminated, as indicated by the grab samples, no further groundwater characterization would be warranted, as long as the grab samples were located properly relative to chemical release areas and the samples were representative of groundwater conditions. Thus, groundwater would not present a pathway for vapor intrusion if the grab sampling showed no contaminant impact. Generally, DTSC views groundwater grab samples as qualitative data rather than quantitative data. If groundwater is contaminated, as indicated by the grab sampling, monitoring well installation would be warranted. The monitoring wells would be sampled at some appropriate frequency to determine representative contaminant levels and these contaminant levels would be used in a vapor intrusion risk assessment. Accordingly, groundwater grab sampling is an interim characterization step if contamination is discovered, and this approach towards groundwater sampling will be integrated into the revised vapor intrusion guidance document.

Response Tracking Number: 44

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

”The vapor intrusion risk associated with both contaminated media should be approximately the same and risk management decisions should be based on the higher of the two values.”

The use of risk estimates from soil gas data is preferable to estimates from groundwater concentrations as the soil gas concentration reflects the attenuation due to the capillary fringe and vadose zone soils beneath the soil gas sample location plus this sample is closer to the potential receptor. It is common to find risk estimates from soil gas concentrations to be different from the groundwater-based risk estimates due to the conservative assumptions used in the vapor transport models. Using the higher of the two values for risk management decisions is not technically justified.

DTSC Response to Comment:

See response no. 15.

Response Tracking Number: 45

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

The information provided in this section is important clarification on the use of the CHHSLs and should be kept in this guidance document.

DTSC Response to Comment:

The text will not change in the revised guidance document.

Response Tracking Number: 46

Commenter Organization: American Petroleum Institute

Technical Subject: OSHA

Guidance Document Page: 17

Public Comment:

”The OSHA Permissible Exposure Limits (PELs) are not an appropriate standard for evaluating the risk associated with vapor intrusion to indoor air in California pursuant to the California Health and Safety Code.”

OSHA PELs are the relevant exposure criteria for industrial/commercial locations where access by the public is restricted (or ACGIH-TLV or NIOSH-RELs if a PEL for a chemical is not established). Congress established OSHA's authority as the lead agency to regulate occupational settings and that authority has been reaffirmed in litigation. In its 2002 Draft Vapor Intrusion Guidance, EPA clearly recognized OSHA's authority to regulate worker exposure and EPA notes that in general, "EPA does not expect this guidance to be used for settings that are primarily occupational." This position is consistent with the 1990 MOU between EPA and OSHA, in which each party agreed that EPA would refer worker health and safety issues to OSHA. The U.S. Supreme Court has held that "[t]he design of the [OSH] statute persuades us that Congress intended to subject employers to only one set of regulations, be it federal or state..." Gade v. National Solid Wastes Mgmt. Ass'n., 505 U.S. 88 (1992).

In an industrial/commercial setting where the potential soil and groundwater contamination is not related to the current employer's operations, the potentially responsible party should inform the current employer about the potential soil and groundwater contamination. At this point it is the employer's obligation to implement appropriate training (e.g., HAZCOM) and protective measures as is warranted for their employees. OSHA regulations are designed to protect employees, regardless of the source and type of potential exposure; therefore, OSHA PELs (or ACGIH-TLVs or NIOSH-RELs if a PEL for a chemical is not established) would apply.

Commercial-Only Settings: In the case of an office building with limited public access, OSHA criteria would apply. The industrial facility or facilities originating the contamination plume would notify the employers occupying the building so that the employer may be informed of the potential hazards of the work place in accordance with the OSHA HAZCOM regulations as well as adjust their worker protection per OSHA requirements as warranted.

In the case of commercial operations open to the public (such as hotels and shopping malls), OSHA criteria would apply to employees and employers as stated in the paragraph above. The exposure scenario used to determine actions necessary to protect the public (including factors such as exposure duration) should be consistent with the typical public use of the facility.

Public Facilities and Residential Settings: In the case of public facilities such as schools, libraries, hospitals, etc, and residential settings, other risk-based criteria would reasonably apply regardless of the source of the environmental contamination. Factors like exposure duration may be different between the public facilities and residences and should be considered in deciding upon appropriate criteria to apply in a given situation.

Changes in Land Use: In cases where land use changes, the land use in place after the change dictates whether OSHA or other exposure criteria would apply. For example, in a case of a limited public access commercial setting overlying potential soil and groundwater contamination, that subsequently becomes commercial with open access to the public, non-OSHA exposure criteria would likely prevail. If the land use becomes primarily an industrial/commercial occupational setting, the EPA (or state if applicable) would notify the employer of the potential contamination and the employer would implement training and worker protection consistent with OSHA regulations.

DTSC Response to Comment:

See response no. 190.

Response Tracking Number: 47

Commenter Organization: American Petroleum Institute

Technical Subject: Additional Site Characterization

Guidance Document Page: 18

Public Comment:

”The soil gas sampling should be started at 5 feet below surface grade and continue at 5 foot intervals, if possible, until the soil gas has been delineated vertically.”

It is important to characterize the contaminant distribution near the surface, but assessment of the vertical extent may not be critical for the pathway evaluation. At sites where groundwater is deep (greater than 50 feet deep), soil gas data on 5-foot intervals will not add value to the pathway evaluation in proportion to the cost and effort. Two or three depths at representative locations will be sufficient to evaluate contaminant transport in the vadose zone. The sampling intervals should be site-specific and based on site vadose zone geology.

DTSC Response to Comment:

Site-specific conditions, along with the conceptual site model (CSM), should always determine the scope of soil gas collection. DTSC’s guidance document will be revised to reflect this concept. Also, the revised guidance document will state that soil gas plumes should be delineated to appropriate risk-based levels (see response no. 204) and that soil gas samples should be collected at appropriate depths for modeling purposes. Soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade (see response no. 216). Deeper sampling would be needed for buildings with basements. Additionally, DTSC will recommend, at a minimum, that one deep boring should be drilled to characterize stratigraphy and deep soil gas at a site, and the density and frequency of soil gas collection should be based on site-specific conditions. At some sites, permanent soil gas monitoring points may be warranted (see response no. 282).

Response Tracking Number: 48

Commenter Organization: American Petroleum Institute

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

”For future buildings, the soil gas sampling should occur on a 100 foot grid, or at a higher density so there is at least one soil gas sample associated with each potential building location.”

The contaminant distribution in soil or groundwater can be used to determine the lateral distribution of soil gas samples. For example, if the groundwater plume is well characterized and there is a demonstrated correlation between soil gas and groundwater quality, then there is no need to collect a soil gas sample on 100-foot spacing if the groundwater data can be used to evaluate the vapor intrusion pathway.

DTSC Response to Comment:

The contaminant source concentration for each future building must be accurately quantified in order to evaluate the potential for vapor intrusion. If uncertainty can be alleviated through alternative sampling approaches, these alternative approaches will be acceptable to DTSC. The guidance document will be revised accordingly based upon this comment, removing reference to a specific sampling grid.

Response Tracking Number: 49

Commenter Organization: American Petroleum Institute

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

The collection of site-specific data for model input should be based on which data are most significant in terms of affecting model results and which are easiest to collect. Johnson (2005) provides crucial information on the critical parameters for modeling, thus providing insight on what additional data is worthwhile to collect.

DTSC Response to Comment:

The text in section "Physical Characteristics of the Subsurface" will be revised pursuant to Johnson (2005). DTSC will remove fraction organic carbon and grain size from the list on page 19. Also, DTSC anticipates providing the option for the evaluation of effective diffusion coefficient through in-situ measurements, similar to the option provided for air permeability, rather than relying on calculations from geotechnical measurements.

Response Tracking Number: 50

Commenter Organization: American Petroleum Institute

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

”In-situ measurements of air permeability should be conducted in the shallow vadose zone…”

This sentence needs to be clarified. Our understanding is that when air permeability measurements are collected they should be in-situ measurements from the shallow vadose zone. This has been mis-interpreted to mean that air permeability measurements should be taken. Since default values for the volumetric flow rate of soil gas into the building (Qsoil) may be used instead of calculations based on near surface soil permeability, in-situ air permeability measurements may not be necessary.

DTSC Response to Comment:

When air permeability measurements are warranted at a site, DTSC would rather have the permeability measurements determined through an in-situ procedure rather than from a laboratory bench test. DTSC will clarify the text concerning air permeability measurements and default soil gas advection rates.

Response Tracking Number: 51

Commenter Organization: American Petroleum Institute

Technical Subject: Additional Site Characterization

Guidance Document Page: 20

Public Comment:

”For large foundations greater than 5000 square feet, DTSC suggests that one subslab sample per 1000 square feet be collected.”

Sampling every 1000 square feet for very large buildings may be excessive. The number of samples should be determined on a site-specific basis. This sentence could be changed to state "For large foundations greater than 5000 square feet, additional subslab samples may be needed."

DTSC Response to Comment:

See response no. 364.

Response Tracking Number: 52

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

"The spreadsheets themselves can be downloaded from the DTSC's website."

The DTSC website currently only includes screening level versions of the USEPA Vapor Intrusion Model Spreadsheets for soil gas and groundwater. The "advanced" versions of these spreadsheets, which allow for layered geology and more site-specific inputs, should be added to the website. Additionally, to be complete the spreadsheets for soil sources should be included as well. Note that the USEPA is currently revising the vapor intrusion model spreadsheets (Dawson, 2005) and the updated version should be modified for application in California as soon as it is available.

DTSC Response to Comment:

See response no. 283.

Response Tracking Number: 53

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

"DTSC does not anticipate that many sites will have attenuation factors of less than 0.00001 for shallow soil gas."

While the listed range of expected attenuation factors is reasonable for sites when evaluating vapor intrusion using shallow soil gas data, the impact of the capillary fringe or fresh water lens may lead to lower attenuation factors for cases where groundwater sources are considered. Additionally, the reported range is reasonable for residential structures but non-residential structures may have lower attenuation factors due to higher air exchange rates. Additionally, buildings maintained at positive pressure will have much lower attenuation factors (Abreu and Johnson, 2005a). Specific reference to these circumstances (e.g., influence of the capillary fringe or elevated ventilation rates) that may lead to attenuation factors below the reported range should be added to this section.

DTSC Response to Comment:

The attenuation values within the guidance document, 0.001 to 0.00001, are a realistic range for attenuation factors for vapor intrusion into residential structures. Two technical references support the selection of this range of attenuation factors; 1) Little et al. (1992) reported that the average attenuation factor for radon is 0.002, and 2) Hers et al. (2003) reported that chlorinated solvents at five sites had empirical attenuation factors of 0.0001 (95th percentile) and 0.00001 (50th percentile). The intent of providing a range for attenuation factors within the guidance document was to provide a basis for evaluating the reasonableness of an attenuation factor for the inexperienced practitioner. Attenuation factors smaller than 0.0001 will require adequate justification which may include high air exchange rates, fresh water lenses, and lengthy capillary fringes. These influences will be mentioned in the revised guidance document.

References

Hers, I., R. Zapf-Gilje, P. C. Johnson, and L. Li. 2003. Evaluation of the Johnson and Ettinger Model for Prediction of Indoor Air Quality. Ground Water Monitoring and Remediation, v. 23, n. 1, p. 62 - 76.

Little, J. C., J. M. Daisey, and W. W. Nazaroff. 1992. Transport of Subsurface Contaminants into Buildings: An Exposure Pathway for Volatile Organics. Environmental Science and Technology, v. 26, p. 2058 - 2066.

Response Tracking Number: 54

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

”If the size of the contaminant plume is smaller than the size of the existing building, a finite contaminant source can be assumed for modeling purposes.”

The finite source model referenced in this section is not dependent on the lateral size of the source, but assumes the vertical extent of the vadose zone impacts is finite and defined. This sentence should be modified to state “If the vertical extent of the vadose zone contamination is defined, a finite contaminant source can be assumed for modeling purposes."

DTSC Response to Comment:

USEPA is currently modifying their J/E EXCEL spreadsheets and the modified spreadsheets will not include an option for a finite contaminant source, probably due to the uncertainty associated with finite source modeling. Hence, in anticipation of the revised EXCEL spreadsheet, DTSC will remove all reference to a finite source model from the guidance document and this issue should be addressed on a site-specific basis with DTSC's concurrence.

Response Tracking Number: 55

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 22

Public Comment:

”To make a site-specific evaluation for future buildings, maximum soil gas and groundwater concentrations should be used.”

Conservative assumptions have been included in the recommended modeling inputs for future buildings.

Consequently, the use of 95%UCL concentrations for the future buildings evaluation should be permitted.

DTSC Response to Comment:

See response no. 362.

Response Tracking Number: 56

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 23

Public Comment:

The guidance should provide a protocol for developing an analyte list based on the detections in soil gas and the results of the site-specific screening. This will avoid the problems associated with analyzing for and detecting common background air contaminants such as benzene, unless benzene levels in soil gas warrant its inclusion as an analyte. Because benzene is a common background contaminant and often drives risk estimates when present, it should not be included in the indoor air sampling program unless it is detected at a significant concentration in soil gas.

DTSC Response to Comment:

See response no. 319 and 322.

Response Tracking Number: 57

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

"Ambient air data that are reported as basin-wide results are not useful when evaluating vapor intrusion."

The basis for this statement is not clear – nor wise, e.g., you would always want to use outdoor air data to assess potential contributions to indoor air. The basin-wide results illustrate chemical concentrations in air that people in the area are exposed to and may be more representative than a couple of samples collected close to the target building. These data are useful in 1) communicating the concentrations measured at the site relative to area air concentrations and 2) understanding what sources could be contributing to compounds seen in indoor air.

DTSC Response to Comment:

Basin-wide results or basin-wide averages may not capture localized sources of air pollution, such as railyards, freeways, dry cleaners, factories, truck routes, and ports. These non-point sources of air pollution may degrade the local air to a greater degree than indicated by a basin-wide ambient air monitoring network. Due to this concern, DTSC recommended local ambient air sampling during indoor air testing, rather than rely on basin-wide results, to alleviate this potential problem.

Response Tracking Number: 58

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

"If utility corridors are present, the site investigation should document the presence or absence of vapor migration with or along the utility corridors…"

It is not clear why this section is included in the indoor air sampling assessment. This should be brought up in Step 2 Site Characterization.

DTSC Response to Comment:

The discussion of utility corridors will be moved to Step 2.

Response Tracking Number: 59

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

"To document that a utility corridor is not a migration pathway for the site, it should be demonstrated that soil-gas sampling yielded non-detectable concentrations of VOCs"

This requirement is unnecessary. One should only need to demonstrate is that concentrations are not detectable for the chemical of concern, recognizing also, that the pathway may not be complete if the concentrations are below indoor air (background) concentrations. The guidance also states that utility corridors should be considered a potential pathway if any of the following conditions are met:

- utility corridors intersect source
- utility corridors provide a direct pathway
- utility corridor backfill is more permeable than native soil

It would be more appropriate to state that all 3 need to be present for there to be a potential pathway.

DTSC Response to Comment:

The definition of a preferential pathway will be further defined in the revised guidance document. The definition will include a description of the physical character of a potential pathway, such as the connection of contaminant sources to buildings, and the ability to act as a pathway for vapor movement due to the physical properties of the pathway itself (permeability and effective diffusion coefficient). Also, see response no. 38 and 254.

Response Tracking Number: 60

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 26

Public Comment:

”When sampling an office building, samples should be taken in each discrete office location.”

This is an overly burdensome and unnecessary recommendation. Many office buildings may have multiple offices with no reason for vapor intrusion to vary from office to office. A site-specific plan to determine the number of sample locations is a more reasonable approach.

DTSC Response to Comment:

The guidance document will be revised to recommend that office building sampling be based on site-specific conditions. At a minimum, each air handling system within an office buildings should sampled. Also, the balance of the HVAC system should be considered when designing an indoor air sampling plan.

Response Tracking Number: 61

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

“When sampling indoor air, the target compounds should be the same compounds identified in the soil gas and groundwater.”

The guidance should provide a protocol for developing an analyte list based on the detections in soil gas and the results of the site-specific screening. The analyte list should include those compounds that pose a potential risk based on the site-specific screening only. This will avoid the problems associated with analyzing for and detecting common background air contaminants such as benzene, chloroform, and methylene chloride, unless concentrations in soil gas warrant their inclusion as analytes.

DTSC Response to Comment:

See response no. 319.

Response Tracking Number: 62

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

”Methods for collecting indoor air samples are described below.”

No discussion of TO-17, TO-13A, or analysis for PCBs or sulfur compounds is included in this section. Discussion of these methods should be added to be consistent with the chemicals that are to be considered for the vapor intrusion pathway listed in Table 1. Note that for many of these compounds, it may be difficult to collect the sample volumes required to achieve detection limits lower than the target concentrations in soil gas. Additional sample collection guidance is necessary.

DTSC Response to Comment:

Discussions of TO-4A, TO-10A, TO-13 and TO-17 will be added to the guidance document. TO-4A and TO-10A are the suggested methods for the analysis of PCBs. Likewise, DTSC will evaluate each chemical on the Table 1 list and determine which chemicals should be removed due to toxicity and vapor pressure. For those chemicals which remain on the list, an analytical technique will be provided.

Response Tracking Number: 63

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 28

Public Comment:

"For petroleum release sites, specific indicator compounds within petroleum should be evaluated for vapor intrusion exposure."

It is not clear how these indicator compounds will assist in the vapor intrusion pathway evaluation. The guidance document states that subsurface chemicals exceeding screening criteria should be analyzed in indoor air. Background sources of petroleum products will include the indicator compounds, so testing for these compounds will not likely help in the data interpretation.

DTSC Response to Comment:

Text will be added to the revised guidance document stating that risk assessments cannot be readily performed on total petroleum hydrocarbon (TPH) and that specific chemicals within TPH, which would give an indication of risk associated with TPH exposure, be identified and tested for in the subsurface (also see response no. 319).

Response Tracking Number: 64

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Assessment

Guidance Document Page: 29

Public Comment:

"The following is a general outline of responses subsequent to collecting and evaluating indoor air sampling data; however, there is a range of potential responses that can be considered."

The listed contingency plan suggests that semi-annual indoor air and soil gas sampling is recommended for cases where indoor air concentrations result in risk estimates with the range of 10-6 to 10-5. It is common to find indoor air concentrations due to background sources to result in risk estimates within the range of 10-6 to 10-5. Consequently, there would be many sites where long-term monitoring is recommended even when the vapor intrusion is not significant. Scenarios such as this demonstrate why it is important to consider the influence of background sources on the estimated indoor air risks.

DTSC Response to Comment:

See response no. 322.

Response Tracking Number: 65

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 30

Public Comment:

"The indoor air sampling workplan, which should be submitted to DTSC for review and approval…"

It is likely that this guidance will be used by other California regulatory agencies in addition to DTSC. Modify this statement to state: "The indoor air sampling workplan, which should be submitted to the lead regulatory agency for review and approval…"

DTSC Response to Comment:

This is a DTSC guidance document; therefore, in instances where DTSC is the lead regulatory agency, workplans should be submitted to DTSC for approval. However, when the guidance document is used by other agencies, departments, cities, or counties, it will be clarified in the revised guidance document that those entities should be the recipients of their respective workplan and reports.

Response Tracking Number: 66

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 30

Public Comment:

"A representative of DTSC should be present during all site visits…"

While agency staff should be notified of all site visits and may want to be present, it is unreasonable to make this a requirement.

DTSC Response to Comment:

Typically, regulatory staff attend all residential indoor air sampling events due to the sensitivity of potential human exposure and to assure that QA/QC procedures are followed. Nonetheless, the language in the guidance document will be revised to make it a recommendation that regulatory staff attend these sampling events.

Response Tracking Number: 67

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 31

Public Comment:

"A preferential pathway is a crack or opening in the building foundation, which may allow for the flow of subsurface vapors into the indoor air space."

This definition of preferential pathway is not consistent with other points in the text. These points of soil gas entry are considered in the vapor intrusion model and should not be confused with preferential pathways. Consider changing this section to refer to soil gas entry pathways.

DTSC Response to Comment:

The definition of a preferential pathway will be further defined in the revised guidance document. The definition will include a description of the physical character of a potential pathway, such as the connection of contaminant sources to buildings, and the ability to act as a pathway for vapor movement due to the physical properties of the pathway itself (permeability and effective diffusion coefficient). Also, see response no. 38 and 254.

Response Tracking Number: 68

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 31

Public Comment:

"A photograph of each sampler should be taken with the identification tag and pressure gauge visible. A second photograph and notes are taken when the sampling equipment is collected."

While photo-documentation of sampling activities is useful, photographs are not necessary to confirm field measurements (i.e., initial and final vacuum readings). These sentences should be revised to state that photographs of sampler locations are recommended.

DTSC Response to Comment:

The language concerning photographs will be revised to state that photographs can assist in the documentation of the sampling activities and should be considered on a site-by-site basis.

Response Tracking Number: 69

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 31

Public Comment:

"If the anticipated indoor air concentrations are low, then a field portable gas chromatography/mass spectrometry (GC/MS) instrument may be used to evaluate the preferential pathways."

There is no need to achieve these low detection limits for the soil gas entry pathway screening. The purpose of this screening is simply to determine if there are points with higher levels of VOC intrusion. The costs and time associated with this analysis are not typically justified as pathway screening is not necessary for building screening prior to indoor air sample collection.

DTSC Response to Comment:

If indoor air testing is warranted, secondary sources of contamination should be removed from the building prior to testing. Usually, the location of secondary sources can only be found with portable field equipment that has low detection limits (10 to 100 parts per billion). Other instruments besides a portable GC/MS may be available to achieve these detection limits. Hence, the guidance document will be revised to be less prescriptive about the choice of field analytical instruments for building screening purposes. Without the identification and removal of secondary sources of contamination, it is difficult to interpret the results of the indoor air samples.

Response Tracking Number: 70

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 33

Public Comment:

"The following should not be permitted during the sampling event…"

While the items listed in this paragraph may impact indoor air quality, it is unlikely that these will adversely affect the indoor air sampling results. For instance, if site chemicals of concern are chlorinated hydrocarbons, then the use of cosmetics indoors will not cause a bias to the sample results. This sentence should be modified to state that "The following should be avoided to the extent possible during the sampling event…"

DTSC Response to Comment:

The language will be changed in the revised guidance document pursuant to this comment. However, it should be noted that sources of indoor air contamination, such as cosmetics and cleaners, if present in high concentrations, can elevate the analytical detection limits of the target compounds. Although these consumer products may be unrelated to vapor intrusion, they could indirectly impact the ability to interpret the sampling results.

Response Tracking Number: 71

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

"If the chemicals of concern in indoor air are also present in ambient air, the outdoor air data is qualitative."

This sentence is not clear. If chemicals in indoor air are present in outdoor air, then the ambient air results should be used to evaluate the significance of the vapor intrusion pathway. For instance if indoor air concentrations are less than or not statistically different from outdoor air concentrations, then there is no indication that vapor intrusion is occurring and no additional action is warranted. This is critical for evaluating the indoor air risks, communicating indoor air results, and selecting appropriate corrective actions.

DTSC Response to Comment:

This statement will be revised - see response no. 322.

Response Tracking Number: 72

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

"Field blanks should be submitted and analyzed with the samples to provide a quality check."

Guidance on the preparation of a field blank needs to be provided.

DTSC Response to Comment:

The revised guidance document will provide information on QA/QC blanks for indoor air testing (see response no. 143).

Response Tracking Number: 73

Commenter Organization: American Petroleum Institute

Technical Subject: Statistics

Guidance Document Page: 35

Public Comment:

Use of maximum measured indoor air concentrations to calculate risk is overly conservative and inconsistent with Table 3 in this guidance that allows 95% UCL values for the site-specific screening evaluation. Use of statistically defensible representative concentrations should be allowed to evaluate indoor air sampling results.

DTSC Response to Comment:

See response no. 362.

Response Tracking Number: 74

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 35

Public Comment:

Background or ambient air sample results should be used to select constituents of concern for the risk assessment, not simply discussed in the uncertainty analysis. For example, if indoor air benzene concentrations are indistinguishable from outdoor air benzene concentrations, then benzene would be considered consistent with background and the COC selection process should consider eliminating benzene from the COC list and the subsequent risk calculations.

DTSC Response to Comment:

See response no. 178.

Response Tracking Number: 75

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

This section seems overly prescriptive in methods to mitigate vapor intrusion. Heating, ventilation, and air conditioning (HVAC) systems for many commercial buildings are operated to maintain a positive pressure in the building which provides an engineering control for the pathway. Discussion of the use of positive building pressure to mitigate vapor intrusion should be included in the guidance document. More leeway should be given to those who design mitigation systems.

DTSC Response to Comment:

Positive pressure does not always mitigate vapor intrusion exposure (see response no. 87). The guidance document will be revised to indicate that HVAC system alteration is an interim mitigation measure, hence giving leeway in initial response to unacceptable vapor intrusion exposure, but it is not considered a long-term remedy for residential structures. DTSC will consider HVAC alteration as a long-term remedy for existing commercial/industrial buildings on a case-by-case basis, particularly if the HVAC system was not operating pursuant to current building codes.

Response Tracking Number: 76

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 39

Public Comment:

"3. Routine monitoring of air, lowest accessible floor and enclosed areas of the structures of concern, and grade surface areas, to ensure there are no potentially significant changes in subsurface gas concentrations."

Soil gas monitoring is a preferable approach to evaluate whether significant changes in subsurface gas concentrations have occurred. Air monitoring should be limited and the effectiveness of the mitigation system determined through monitoring of system operating parameters (vacuum and flow rate).

DTSC Response to Comment:

DTSC agrees that the collection of soil gas data is the preferable method to evaluate the effectiveness of the removal of subsurface contaminants and the guidance document will be revised accordingly.

Response Tracking Number: 77

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 39

Public Comment:

"4. Routine monitoring of vent risers for flow rates and gas concentrations to confirm the VOC venting systems are functioning properly."

This should be limited to vacuum and flow rate monitoring of the vent risers. VOC measurements will not be useful to determine the operability of the venting system.

DTSC Response to Comment:

The monitoring of vacuum and flow rate are important in determining the operating effectiveness of a venting system. However, the important information for DTSC is the contaminant flow and concentration because the true effectiveness of a venting system is determined by the removal of contaminant mass. DTSC envisions that the gas monitoring could be conducted with portable field equipment. Also, gas monitoring might be needed because some air districts in California may require an air discharge permit if the VOC discharge exceeds regulatory thresholds.

Response Tracking Number: 78

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 40

Public Comment:

"The installation and routine monitoring of perimeter soil gas probes may be required to evaluate the potential for VOC migration during the venting of buildings."

These requirements are prescriptive and excessive. The need for perimeter monitoring should be evaluated during Step 2 Site Characterization. It is not dependent on mitigation measures.

DTSC Response to Comment:

DTSC agrees that these requirements are overly prescriptive and the guidance document will be revised. Text will be added to the guidance document concerning the need for permanent soil gas monitoring points (see response no. 127) and the monitoring associated with the future building scenario (see response no. 201 and 327).

Response Tracking Number: 79

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 41

Public Comment:

"Additionally, deed restrictions or land use covenants must include the requirement to notify utility workers or contractors that during utility installation or construction activities, these workers may contact contaminated soil and groundwater."

The risk based levels for the vapor intrusion pathway are much lower than those for a construction worker. The need to notify utility workers or contractors is outside the scope of this guidance document and should be addressed (if necessary) as part of the site corrective action activities.

DTSC Response to Comment:

Workers that contact soil and groundwater that are contaminated with hazardous substances, including hazardous waste, that is associated with corrective action must be trained pursuant to 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response [HAZWOPER]) and Title 8 CCR Section 5192 (Hazardous Waste Operations and Emergency Response). Soil and groundwater is considered contaminated when contaminant concentrations exceed residential health-based standards. Responsible parties, their designated agents, or their successors who retain contractor or sub-contractor services must inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and of any potential fire, explosion, health, safety or other hazards associated with the contaminated media of the corrective action project. Often, when land use covenants (LUCs) are used at a contaminated property to project human health, a soil management plan is also in place for the property. The soil management plan outlines the appropriate health and safety training (HAZWOPER) for any workers that may come in contact with contaminated media. Hence, it is appropriate to include information on LUCs, soil management plans, and worker health and safety in the guidance document to assist stakeholders in addressing these important issues.

Response Tracking Number: 80

Commenter Organization: American Petroleum Institute

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

"While conditions conducive to biodegradation usually exist within the vadose zone, exceptions occur in California which preclude the adoption of a policy by DTSC that petroleum hydrocarbons always degrade in the vadose zone, posing no vapor intrusion risk."

Provide a reference for the locations in California where exceptions to vadose zone biodegradation of petroleum hydrocarbons occur. Review of publicly available data suggests that a factor of 10 decrease in the attenuation factor is a reasonable conservative assumption for the impact of biodegradation for petroleum hydrocarbons (Kremesec et al., 2005). This factor of 10 is included in the SFRWQCB Effect Screening Level documentation. Note that this factor does not imply that no vapor intrusion risk will be evident at these sites, but does account conservatively for the well-documented uncertainty for the pathway evaluation of petroleum hydrocarbons. Modeling and site investigation studies demonstrate that biodegradation can result in many orders of magnitude reduction in vapor intrusion risk estimates (Abreu and Johnson, 2005; Ettinger; 2005; Gustafson et al., 2002; Lahvis et al., 1999).

DTSC Response to Comment:

See response no. 1, 179, and 330.

Response Tracking Number: 81

Commenter Organization: American Petroleum Institute

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

"Soil gas samples should be analyzed for the appropriate chemical indicators within the petroleum hydrocarbon mixture. These indicator compounds are usually benzene, ethyl benzene, toluene, xylene (BTEX), naphthalene, polynuclear aromatic hydrocarbons (PAHs) and fuel oxygenates…."

The analytical methods listed in this guidance do not address analysis of PAHs in soil gas. Note that it may be difficult to collect the sample volumes required to achieve detection limits lower than the target concentrations for PAHs in soil gas. Additional sample collection guidance is necessary.

DTSC Response to Comment:

DTSC will evaluate each chemical on the Table 1 list and determine which chemicals should be removed due to toxicity and vapor pressure. For those chemicals which remain on the list, an analytical technique will be provided. Naphthalene is listed as an analyte in both Method 8260 and TO-15, and DTSC will add an appendix to the vapor intrusion guidance document to address analytical issues specifically associated with this chemical.

Response Tracking Number: 82

Commenter Organization: American Petroleum Institute

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

"To evaluate bioattenuation of volatile petroleum hydrocarbons in the subsurface, the measured vapor concentrations with depth should be compared with the theorized vertical concentration profile."

Other biodegradation indicators (oxygen depletion, carbon dioxide generation) may be used to demonstrate the occurrence of biodegradation at vapor intrusion sites (API, 2005) and should be permitted in the guidance.

DTSC Response to Comment:

It is not DTSC's intent to exclude the collection of geochemical indicator parameters as a mechanism to document petroleum biodegradation. Johnson et al. (1999) indicates that the assessment of petroleum biodegradation should be the comparison of the observed soil gas concentrations with the expected soil gas concentrations. If there is good agreement, then biodegradation is probably not occurring. Otherwise, biodegradation is playing a significant role in the subsurface. Hence, the geochemical indicator parameters, such as oxygen and carbon dioxide, would be considered an additional line of evidence for the documentation of petroleum biodegradation. This approach is analogous to the approach used for groundwater in monitored natural attenuation (MNA) protocols, where contaminant concentrations are used to evaluate bioattenuation and the geochemical indicator parameters provide supplemental evidence (ASTM, 2004).

References

ASTM. 2004. Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites. West Conshohocken, PA. Document No. E1943-98(2004).

Johnson, P. C., M. W. Kemblowski, and R. L. Johnson. 1999. Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces: Site-Specific Alternatives to Generic Estimates. Journal of Soil Contamination, v. 8, no. 3, p. 389 - 421.

Response Tracking Number: 83

Commenter Organization: American Petroleum Institute

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

"Steady-state conditions can be inferred to exist at site if the petroleum release is at least three years old and the contaminant concentrations in groundwater have stable or decreasing trends"

An approach proposed by Johnson et al. (1999) can be used to evaluate the time to reach steady state conditions. This approach has options to consider both degradable and non-degradable compounds. The time requirement of 3 years stated in the guidance should be removed.

DTSC Response to Comment:

Pursuant to Johnson et al. (1999), near steady-state vapor concentrations can be reached in 0.05 to 50 years, dependent on subsurface conditions and chemical retardation. DTSC will remove the time requirement from the guidance document and replace it with the plot from Johnson et al. (1999) or direct readers to the paper for reference.

Response Tracking Number: 84

Commenter Organization: American Petroleum Institute

Technical Subject: Confirmation Sampling

Guidance Document Page: 42

Public Comment:

"Confirmation soil gas sampling after the completion of soil vapor extraction should take place after steady-state conditions are reached in the subsurface, which usually occurs within 12 to 16 months after system shutdown."

The basis for the 12 to 16 month time period should be presented. If the distance from source to monitoring point is small, much shorter times may be reasonable. Johnson et al. (1999) provide an approach to estimate the time for the system to reach steady state following the system shutdown.

DTSC Response to Comment:

See response no. 83.

Response Tracking Number: 85

Commenter Organization: American Petroleum Institute

Technical Subject: Table 1

Guidance Document Page: 55

Public Comment:

Provide a list of analytical techniques to be used to analyze soil gas or indoor air for each of the chemicals in this listing, particularly the chemicals that are semi-volatile (e.g., PAHs, PCBs, pesticides). Consider sample volumes and appropriate detection limits in developing this list of analyses and include sampling guidance.

DTSC Response to Comment:

An analytical technique will be provided for each chemical in Table 1.

Response Tracking Number: 86

Commenter Organization: American Petroleum Institute

Technical Subject: Table 1

Guidance Document Page: 55

Public Comment:

TBA should be removed from the list as having potential risk for vapor intrusion. The flux from groundwater will be approximately 4 orders of magnitude slower than for other VOCs (e.g., benzene).

DTSC Response to Comment:

If tertiary butyl alcohol (TBA) only occurred at petroleum release sites as a biodegradation by-product from fuel oxygenate breakdown in groundwater, DTSC would consider removing the chemical from Table 1. But TBA is a primary component of ethanol-blended gasoline (Lahvis, 2006) and was a primary component of oxygenated gasoline (Linder, 2000). Due to its occurrence as a primary component in gasoline, TBA could be in the vadose zone at petroleum release sites and not just in groundwater. Hence, removing TBA from Table 1 solely due to its diffusion coefficient in water would be inappropriate.

References

Lahvis, M. A. 2006. Maximum Potential Impacts of Tertiary Butyl Alcohol (TBA) on Groundwater from Small-Volume Releases of Ethanol-Blended Gasoline in the Vadose Zone. American Petroleum Institute, Technical Bulletin No. 22, January 2006.

Linder, S. C. 2000. Tertiary Butyl Alcohol; MTBE May Not Be the Only Gasoline Oxygenate You Should Be Worrying About. New England Interstate Water Pollution Control Commission, LUSTLine Bulletin 34, p. 18 - 20.

Response Tracking Number: 87

Commenter Organization: American Petroleum Institute

Technical Subject: Table 3

Guidance Document Page: 59

Public Comment:

Indicate that a soil gas advection rate of 5 liters per minute per 100 square meters of floor space may be used conservatively for the soil gas advection rate for existing buildings. The current American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard on building ventilation (ANSI/ASHRAE Standard 62.1-2004) indicates that single-family residences should be maintained at positive pressure under situations where humidity control is required. Additionally, heating, ventilation, and air conditioning (HVAC) systems for many commercial buildings are operated to maintain a positive pressure in the building. The site-specific screening evaluation should allow the consideration of positive pressure.

DTSC Response to Comment:

DTSC will state in the revised guidance document that site-specific screening can be conducted with a soil gas advection rate of 5 liters per minute. Use of a soil gas advection rate besides the default will be based on site-specific conditions, where in-situ air permeability measurements can be collected as indicated in Appendix I of the guidance document.

DTSC does not recommend long-term remedies for existing residential structures that rely on the operation of the HVAC system to mitigate exposure. Other types of engineering controls should be used to mitigate the vapor intrusion exposure pathway for these buildings. Additionally, positive pressurization of commercial buildings does not necessarily negate the potential for vapor intrusion. DTSC's experience with a facility in Southern California indicates that positively pressured commercial buildings are subject to vapor intrusion. Even though pressure differences across the floor slab indicated positive pressure at that building, subsurface vapors still moved into the building. It appears in this case that positive pressurization was not uniform over the foundation slab.

DTSC will consider HVAC alteration as a long-term remedy for existing commercial/industrial buildings on a case-by-case basis, particularly if the HVAC system was not operating pursuant to current building codes.

Response Tracking Number: 88

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix A

Guidance Document Page: A1

Public Comment:

DTSC should consider the use of flux chambers to evaluate the vapor intrusion for scenarios with a crawl space or basement with a bare dirt floor. In these cases, many of the concerns raised in this appendix are not applicable and the flux chamber may provide valuable data regarding the upward migration of subsurface contaminants through the vadose zone.

DTSC Response to Comment:

Flux chambers can be used as secondary lines of evidence in vapor intrusion evaluations, including deployment on earthen floors in basements and on soil in crawl spaces. When deployed in these conditions, earthen-floored basements and crawl space soil, DTSC is concerned about the flux chamber's ability to measure the advective portion of contaminant migration. Even though basements and crawl spaces may be depressurized relative to outdoor air, this does not necessarily imply that the flux chamber, upon deployment, will also be depressurized, measuring the advective portion of vapor movement. Typicaly, flux chambers measure the diffusonal movement of contaminants from the soil. As such, DTSC will modify Appendix A concerning basement and crawl space flux chamber measurements but will state that these measurements are qualitative.

Response Tracking Number: 89

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix B

Guidance Document Page: B2

Public Comment:

The significance of vadose-zone biodegradation on the vapor intrusion of petroleum compounds is well recognized and considered to a limited extent in the guidance document. Modeling and site investigation studies demonstrate that biodegradation can result in many orders of magnitude reduction in vapor intrusion risk estimates (Abreu and Johnson, 2005b; Ettinger and McAlary; 2005; Gustafson et al., 2002; Lahvis et al., 1999) and a factor of 10 decrease in the attenuation factor has been proposed as a reasonable conservative assumption for the impact of biodegradation for petroleum hydrocarbons (Kremesec et al., 2005; SFBRWQCB, 2005; NJDEP, 2005). The proposed soil gas attenuation factors should be decreased by a factor of 10 to reduce some of the well-documented conservatism for the vapor intrusion pathway evaluation of petroleum hydrocarbons.

DTSC Response to Comment:

See response no. 1, 179, and 330.

Response Tracking Number: 90

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix B

Guidance Document Page: B1

Public Comment:

A sub-slab to indoor air attenuation factor of 0.01 is overly conservative. An evaluation of measured and calculated sub-slab to indoor air attenuation factors indicates that a residential attenuation factor of 0.003 is an appropriate conservative default for the development of sub-slab screening levels. This attenuation factor is supported by VOC data from Endicott NY, by sub-slab and indoor radon measurements, by evaluation of the Johnson and Ettinger model and radon studies (Kremesec, et al., 2005; Little et al., 1992).

DTSC Response to Comment:

A subslab to indoor air attenuation factor of 0.01 in DTSC's opinion is not overly conservative. USEPA, in their 2002 vapor intrusion guidance document, recommended the use of a subslab to indoor air attenuation factor of 0.1 and DTSC felt that this number was not appropriate. The original interpretation by USEPA back in 2002 for subslab attenuation was based on a limited empirical database. As the USEPA database has grown over the years, as presented by Helen Dawson of USEPA in numerous conferences, the database indicates that an attenuation factor of 0.01 is more appropriate. DTSC adopted this attenuation factor of 0.01 rather than the "official" USEPA subslab value from their 2002 guidance document as a mechanism to develop policy based on the latest science. While other studies of subslab attenuation do exist, these studies are not as comprehensive as the USEPA database.

Response Tracking Number: 91

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix C

Guidance Document Page: C3

Public Comment:

The use of unit risk factor (URF) and reference concentration (RfC) values in the risk equations assumes an inhalation rate (IR) of 20 m3/day. While this IR may represent a typical residential scenario breathing rate over 24 hours, it is overly conservative for many worker scenarios. Adjustments for the daily inhalation rates for different receptors should be included in this appendix.

DTSC Response to Comment:

This comment states that the unit risk factor and reference concentration should be modified when using these toxicity criteria for evaluating non-residential (worker) inhalation exposure scenarios. The DTSC agrees with this comment and recommends that an industrial/commercial worker inhalation rate of 14 m3 per 8-hour work day be used to modify the residential unit risk factor and reference concentration when evaluating risks and hazards to workers.

Response Tracking Number: 92

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix D

Guidance Document Page: D1

Public Comment:

"The J/E model uses the conservation of mass principle and is based on the following assumptions:"

Note that the J/E model does not require an infinite source of contaminant mass nor a homogeneous subsurface. The vapor intrusion guidance documents references the J/E models capability to evaluate finite sources. The model can also address multiple vadose zone layers.

DTSC Response to Comment:

The bullets on Page D-1 will be revised to exclude the reference to a homogeneous subsurface and a infinite contaminant source.

Response Tracking Number: 93

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix D

Guidance Document Page: D1

Public Comment:

The definition of preferential pathways needs to be clarified. The model does consider the vapor migration through cracks and openings in the wall.

DTSC Response to Comment:

The definition of preferential pathway will be further clarified in the revised guidance document. As noted in the comment, all buildings contain preferential pathways of cracks and openings in the foundations. These types of pathways were envisioned in the construction of the J&E model and are not of concern to DTSC. Of concern to DTSC is the potential connection between subsurface plumes, either soil gas or groundwater, and buildings, particularly where buildings exist near the edge of subsurface plumes. Buildings adjacent to or laterally offset from subsurface plumes may be subject to vapor intrusion due to subsurface preferential pathways. Hence, utility corridors, such as sewer, electrical, cable, water, storm water, fiber optic, and natural gas, along other possible migration pathways, such as sand lenses and faults, should be identified in these situations to determine if these pathways lead from the plume to the adjacent buildings. If so, data collection would be warranted to determine if the pathways are contaminated with vapors.

Response Tracking Number: 94

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix D

Guidance Document Page: D2

Public Comment:

When discussing the modeling input parameters, it would be helpful to state that a default value for the advective flow rate into the building of 5 L/min per 100 m2 of floor space may be used conservatively instead of calculating from the indoor-outdoor pressure differential, crack dimensions, and soil permeability.

DTSC Response to Comment:

A section will be added to Appendix D explaining the selection of the default value of 5 liters per minute for the soil gas advective rate. Likewise, information will be provided on how to scale-up this value for larger buildings and how a site-specific soil gas advection rate can be determined for a site using in-situ air permeability measurements.

Response Tracking Number: 95

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix G

Guidance Document Page: G1

Public Comment:

"Bentonite chips should be used to fill the borehole annular space…"

Typically, the annular space around the probe is too small to allow for the use of bentonite chips. Sealing with the cement grout or bentonite slurry provides an acceptable seal for subslab sample probes.

DTSC Response to Comment:

The guidance document will mention, upon revision, that the annular space associated with a sub-slab sampling probe, in many cases, might be too small for the placement of a seal with bentonite chips. Additionally, DTSC will further mention that, when possible, sufficient annular space should be allowed so a seal can be installed. The placement of seals for sub-slab probes are critical in assuring no ambient air breakthrough upon sampling.

Response Tracking Number: 96

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix G

Guidance Document Page: G2

Public Comment:

"Care should be taken during sampling to avoid sample breakthrough from the surface of the slab."

This should be changed to state "… avoid surface air breakthrough during sampling." Also, the use of a tracer gas leak test to confirm that the subslab probe is not leaking should be included in this appendix.

DTSC Response to Comment:

Appendix G will be revised to state that sample breakthrough will be evaluated with a leak detection compound rather than state that care should be taken to avoid ambient air breakthrough.

Response Tracking Number: 97

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix G

Guidance Document Page: G2

Public Comment:

"Flow rates should not exceed 200 ml/min."

There is no basis for this low flow rate for sample collection. The samples should be collected at low vacuum, but there is no data to suggest that a sample collection flow rate of 1000 – 2000 ml/min (or even greater) biases the samples. This requirement should be removed.

DTSC Response to Comment:

The sampling flow rate in the appendix was taken from DTSC's 2003 soil gas investigation advisory. This sampling rate is recommended in the advisory to avoid potential bias of the soil gas results due to high flow rates. DTSC was concerned that flow rates higher than 200 ml/min might cause partitioning of contaminants from other phases into the soil pore space. However, higher flow rates may be appropriate as mentioned in American Petroleum Institute (2005) where a range of 17 ml/min to 1000 ml/min is recommended. Accordingly, DTSC will allow higher flow rates but 10 inches of mercury should not be exceeded upon sampling. This will allow for faster purging of large diameter soil gas probes.

References

American Petroleum Institute. 2005. Collecting and Interpreting Soil Gas Samples from the Vadose Zone: A Practical Strategy for Assessing the Subsurface Vapor-to-Indoor Air Migration Pathway at Petroleum Hydrocarbon Sites, Publication No. 4741, Novemeber 2005.

Response Tracking Number: 98

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix G

Guidance Document Page: G2

Public Comment:

"The use of Tedlar bags for collection of soil gas samples is not recommended."

Purging and sample collection using Tedlar bags is an effective method to collect the sample. However, sample storage and shipment in Tedlar bags is not recommended.

DTSC Response to Comment:

The collection of soil gas samples in Tedlar bags for analysis by an onsite mobile laboratory may be appropriate as indicated by Hartman (2006) and USEPA (2006). DTSC will recommend the use of Tedlar bags for mobile laboratory analysis in lieu of glass syringes and glass bulbs in the vapor intrusion guidance document, but there are two concerns when using Tedlar bags, as follows:

1) Tedlar bags should not be used for polynuclear aromatic hydrocarbons, such as naphthalene, due to their sorption onto the bag's surface. Hence, Tedlar bags should only be used for non-sorbing constituents.

2) Tedlar bags may contain low levels of volatile organic compounds, due to degassing of the bag's material, which may bias sampling results (Hayes et al., 2006).

Thus, Tedlar bags should only be used to delineate areas with known constituents-of-concern and the bags should be analyzed on the day of sample collection. These specific items will be addressed in the revised DTSC/RWQCB soil gas sampling advisory.

References

Hartman, B. 2006. How to Collect Reliable Soil-Gas Data for Risk-Based Applications - Specifically Vapor Intrusion; Part 4 - Updates on Soil Gas Collection and Analysis Procedures. New England Interstate Water Pollution Control Commission, LUSTLine Bulletin 53, p. 14 - 19.

Hayes, H., N. Khan, and D. Benton. 2006. Impact of Sampling Media on Soil Gas Measurements. Proceedings; Air and Waste Management Association Symposium. Vapor Intrusion: The Next Great Environmental Challenge - An Update. September 13 - 15, 2006, Los Angeles, CA.

USEPA. 2006. Assessment of Vapor Intrusion in Homes Near the Raymark Superfund Site Using Basement and Sub-Slab Air Samples; EPA/600/R-05/147, March 2006.

Response Tracking Number: 99

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix I

Guidance Document Page: I1

Public Comment:

"The occurrence of steady-state pressure is defined as less than a 50 pascals pressure change within 30 minutes." There is no need to run these tests for this long a duration. The vacuum response during these tests is very quick and they should come to steady-state conditions within a few seconds or minutes. Since the test does not need to be run for long periods of time, this definition of steady-state pressure is inappropriate.

DTSC Response to Comment:

The revision of Appendix I will indicate that the threshold pressure for steady-state is 130 pascals, not 50 pascals. The definition of steady-state conditions for the pneumatic testing was taken directly from the United States Nuclear Regulatory Commission's work at Yucca Mountain. Guzman et al. (1995) indicates that pneumatic testing should continue until "the pressure stabilizes so that it increases by not more than 1 mm Hg [133 pascals] in 30 minutes". Hence, DTSC envisions that these permeability tests should take less than one hour each.

References

Guzman, A. G., A. M. Geddis, M. J. Henrich, C. F. Lohrstorfer, and S. P. Neuman. 1995. Summary of Air Permeability Data From Single-Hole Injection Tests in Unsaturated Fractured Tuffs at the Apache Leap Research Site: Results of the Steady-State Test Interpretation. U. S. Nuclear Regulatory Commission, NUREG/CR-6360.

Response Tracking Number: 100

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix I

Guidance Document Page: I1

Public Comment:

This section needs to be edited to clarify that the permeability measurements are best taken during vapor extraction instead of vapor injection. Also, an alternate method to estimate permeability from the extraction response test (Battelle, 1996) is given by the following expression:

k=Qu ln(Rw/Rl) / HpiPw[1-(Patm/Pw)^2]

Where: Q = vapor extraction rate (m3/s) µ = gas viscosity (kg/m/s) Rw = radius of the well (m) RI = estimated radius of influence (m) H = Screen interval (m) Pw = pressure at well during extraction (kg/m/s2) Patm = atmospheric pressure (kg/m/s2).

DTSC Response to Comment:

The protocols used by DTSC for in-situ air permeability measurements were taken from work at Yucca Mountain as conducted by the United States Nuclear Regulatory Commission (USNRC). The USNRC protocols allow for the quantification of air permeability from a single well, without any assumptions concerning the radius of influence of the test itself. Most protocols for the quantification of air permeability are available from the soil vapor extraction (SVE) literature, where air permeability is determined from a two well test. A two well test involves an extraction well and an associated observation well. One well tests are also available from the SVE literature, but an assumption must be made concerning the radius of influence of the test. DTSC prefers a single well test in that it should be less expensive than a two well test and does not rely on an assumption concerning the radius of influence of the test.

Response Tracking Number: 101

Commenter Organization: American Petroleum Institute

Technical Subject: Overview

Guidance Document Page: 02

Public Comment:

"The core team should consist of a geologist, a toxicologist, and an engineer."

While skills from these areas are applicable to the vapor intrusion pathway evaluation, in many cases it will not be necessary to develop a team of specialists in these areas to conduct the assessment. We suggest that this section be modified to indicate that skills from these areas may be used in the pathway evaluation.

DTSC Response to Comment:

The text associated with the development of a core team will be changed to indicate that certain expertise may be needed during a vapor intrusion evaluation process. Please note that any workplan or report submitted to DTSC that involves characterization or mitigation of vapor intrusion should be signed by an appropriate licensed professional.

Response Tracking Number: 102

Commenter Organization: American Petroleum Institute

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"For sites where current and future land use will be restricted by a land use covenant, the soil gas sampling density can be increased as a function of the size of the future buildings pursuant to the land use covenant."

As indicated in earlier comments, this statement should not be necessary. However, the sampling density should be allowed to decrease as a function of the size of future buildings (larger buildings would lead to larger sample spacing and lower sampling density).

DTSC Response to Comment:

See response no. 125.

Response Tracking Number: 103

Commenter Organization: American Petroleum Institute

Technical Subject: Preliminary Screening

Guidance Document Page: 15

Public Comment:

"Csoil gas = Cgroundwater * Hc * Ct"

The last term in this equation should be change to Cf.

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 104

Commenter Organization: American Petroleum Institute

Technical Subject: Additional Site Characterization

Guidance Document Page: 18

Public Comment:

"For a site that does pass a preliminary screening evaluation…"

This should state "For a site that does not pass a preliminary screening evaluation…"

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 105

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 20

Public Comment:

"DTSC recommends that the USEPA version of the Johnson and Ettinger (J/E) (1991) model be used (USEPA Vapor Intrusion Model, USEPA, 2003)."

It should be made clear the DTSC recommends the use of the USEPA version of the Johnson and Ettinger (J/E) (1991) model as modified by DTSC. The USEPA is currently revising the vapor intrusion model spreadsheets (Dawson, 2005) and the updated version should be modified for application in California as soon as it is available.

DTSC Response to Comment:

See response no. 311.

Response Tracking Number: 106

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

"DTSC strongly encourages all users of these spreadsheets to review not only this Guidance, but also USEPA's User's Guide for the spreadsheets before conducting any modeling for vapor intrusion at a site (USEPA, 2003b)."

A reference to Johnson, 2005 should be included here.

DTSC Response to Comment:

The reference will be added along with the USEPA's user's guide.

Response Tracking Number: 107

Commenter Organization: American Petroleum Institute

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

"Appendix D should be read before conducting fate and transport modeling with the USEPA Vapor Intrusion Model."

A reference to Johnson, 2005 should be included here.

DTSC Response to Comment:

Reference to Johnson (2005) will be added to page 21.

Response Tracking Number: 108

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 32

Public Comment:

"Since the recommended TO-14A and TO-15 sampling methods can achieve detection limits down to 0.01 micrograms per liter…"

These methods can achieve detection limits below 0.001 micrograms per liter.

DTSC Response to Comment:

The difference between method detection limits and method reporting limits will be further clarified in the guidance document and appropriate analytical limits will be offered for both.

Response Tracking Number: 109

Commenter Organization: American Petroleum Institute

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

”Under no circumstances should indoor air samples be collected in a building not subject to vapor intrusion as a way to evaluate background concentrations.”

While very limited, there are likely circumstances when an indoor air background study described above may be conducted. For instance, the California Air Resources Board has conducted a similar study to evaluate background concentrations in portable classrooms. Change this to “Indoor air samples should not be collected in a building not subject to vapor intrusion as a way to evaluate background concentrations".

DTSC Response to Comment:

The language will be changed in the revised guidance document pursuant to this comment.

Response Tracking Number: 110

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 36

Public Comment:

The title for this section should be modified to clearly indicate that active or passive vent systems are considered.

DTSC Response to Comment:

The language will be changed in the revised guidance document pursuant to this comment.

Response Tracking Number: 111

Commenter Organization: American Petroleum Institute

Technical Subject: Mitigation

Guidance Document Page: 39

Public Comment:

Change this section title to “Long-Term Soil Gas Monitoring”

DTSC Response to Comment:

The language will be changed in the revised guidance document pursuant to this comment.

Response Tracking Number: 112

Commenter Organization: American Petroleum Institute

Technical Subject: Figure 1

Guidance Document Page: 52

Public Comment:

”Does the Site Pass a Generic J&E Evaluation?” Change this to “Does the Site Pass a Preliminary Screening Evaluation?”

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 113

Commenter Organization: American Petroleum Institute

Technical Subject: Figure 1

Guidance Document Page: 52

Public Comment:

”Does the Site Pass a Site-Specific J&E Evaluation?” Change this to “Does the Site Pass a Site-Specific Evaluation?”

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 114

Commenter Organization: American Petroleum Institute

Technical Subject: Figure 2

Guidance Document Page: 53

Public Comment:

Modify the figure to show the advective transport component of the vapor intrusion conceptual model.

DTSC Response to Comment:

This figure will be replaced with a figure showing the advective flow component of contaminant transport.

Response Tracking Number: 115

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix B

Guidance Document Page: B1

Public Comment:

"Additionally, OEHHA used toxicity factors specific to California."

The toxicity factors are not used in the calculation of attenuation factors. This sentence should be deleted.

DTSC Response to Comment:

This error will be corrected in the revised guidance document.

Response Tracking Number: 116

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix B

Guidance Document Page: B1

Public Comment:

"No vapor attenuation should be assumed over a building's crawl space."

For clarity, this should be changed to: "No vapor attenuation between the crawl space and indoor air should be assumed."

DTSC Response to Comment:

This sentence concerning crawl space attenuation will be changed in the revised guidance document pursuant to the suggested language.

Response Tracking Number: 117

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix B

Guidance Document Page: B2

Public Comment:

"Default air exchange rates for residential buildings is 0.5 air exchanges per day while commercial air exchanges are 1.0 air exchanges per day." These air exchange rates are in exchanges per hour. Edit this sentence to state: "Default air exchange rates for residential buildings are 0.5 air exchanges per hour while commercial air exchanges are 1.0 air exchanges per hour."

DTSC Response to Comment:

This error concerning units will be corrected in the revised guidance document.

Response Tracking Number: 118

Commenter Organization: American Petroleum Institute

Technical Subject: Appendix D

Guidance Document Page: D3

Public Comment:

"However, in scenarios where the intrinsic permeability of the soil is below 1.0E-9 centimeters per second squared…" This should be changed to: "However, in scenarios where the intrinsic permeability of the soil is below 1.0E-9 centimeters squared…"

DTSC Response to Comment:

This error concerning units will be corrected in the revised guidance document.

Response Tracking Number: 119

Commenter Organization: Iris Environmental

Technical Subject: General

Guidance Document Page:

Public Comment:

There are sections within the document where DTSC appears to present a prescriptive set of baseline requirements without consistently acknowledging the need to consider site-specific factors that may alter these requirements. By streamlining some of the decision points in the vapor intrusion evaluation process to provide clarity to the users of the document, DTSC may be setting a direction in which relevant site-specific factors are not contemplated, or perhaps even not allowed in the decision making process. Although we believe that the overall intent of the document is to provide baseline guidance on site characterization and vapor intrusion risk estimation, we are concerned that many sections of the document will be interpreted as absolute requirements, and over time, what is intended as guidance will be interpreted as a standard. Characterizations, evaluations, and risk management decisions that are made without strict adherence to these "requirements" may be viewed as flawed, inadequate, and without technical basis.

DTSC Response to Comment:

The intent of the guidance document is not to exclude alternative approaches for evaluating exposure or to provide prescriptive or inflexible requirements. The text of the guidance document will be enhanced to further clarify that site-specific approaches may be used, where appropriate, that deviate from the recommended method in the guidance document. When evaluating human exposure, a risk assessment workplan may be submitted to DTSC for our review and approval. In the workplan, all site-specific conditions should be explained along with any deviations from DTSC guidance documents. Also, the approaches to fate and transport modeling should be discussed, along with the selection of modeling input parameters. Hence, through the workplan approval process, stakeholders can mutually agree upon the approaches to evaluate human health threats due to vapor intrusion.

Response Tracking Number: 120

Commenter Organization: Iris Environmental

Technical Subject: General

Guidance Document Page:

Public Comment:

We believe that the overarching goal of DTSC's vapor intrusion guidance document should be to provide a solid, thorough, and well articulated baseline approach for evaluating the significance of the vapor intrusion pathway, while allowing users to depart from the baseline approach when site-specific factors support a more refined technical or alternative approach. As described in more detail below, there are many situations where the need for conducting an extensive series of soil gas investigations may be minimized by the voluntary adoption of mitigation, source removal, and/or strategic planning, design and placement of future buildings and structures. An integrated and synthetic approach to reducing potential risks from vapor intrusion should be encouraged, and the level of investigation that may be needed to support that a site is protective of human health should reflect the entirety of a particular project and site conditions. A more consistent acknowledgement of when site-specific factors and conditions would support deviating from the baseline recommendations would strengthen the technical basis of the document, and provide a more flexible, yet technically defensible basis for characterizing, evaluating, and mitigating sites impacted by vapor intrusion.

DTSC Response to Comment:

See response no. 119.

Response Tracking Number: 121

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Characterization should continue until non-detectable concentrations of VOCs are encountered in the subsurface laterally and vertically."

Sampling until non-detectable concentrations of volatile organic compounds (VOCs) are encountered represents a material change from the typical manner in which site investigations are conducted. During the site investigation process, analytical data should be gathered in a cost-effective manner, such that prudent, health protective decisions can be made. The site characterization step should provide sufficient information to understand the source(s) and magnitude of the chemical impact, and to frame the types of risk management measures that may need to be implemented in order to ensure that the site conditions (both current and future) are protective of human health and the environment. Characterization to non-detectable VOC concentrations is not always a necessary threshold for such determinations. As long as there is a reasonable understanding of the source and size of the VOC impact, and the areas of a site that exceed or are below risk-based thresholds are adequately delineated, then prudent health protective decisions can be made. Characterization to non-detectable VOC concentrations could impose potentially significant added costs, and would not necessarily provide added value to the decision-making process.

DTSC Response to Comment:

See response no. 204.

Response Tracking Number: 122

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"Deeper samples should be collected as needed to define vertical trends in vapor concentrations."

We agree that deeper samples are needed to define vertical trends in vapor concentrations; however, we believe that this section of the VIG document would be strengthened and ultimately more usable if the overall purpose of the deeper vertical samples were more fully described. Specifically, the primary purpose of the deeper samples (i.e., deeper than 5 feet below ground surface) is to provide additional data so an accurate soil gas profile can be developed. A representative and accurate soil gas profile is critical to understanding source conditions, specifically whether the source of VOCs has reached steady-state, and/or whether biodegradation is occurring. One detailed vertical profile with multiple samples (i.e., at least three, preferably more) every 5 to 10 feet in the center of the source(s) is often sufficient to adequately understand source conditions.

DTSC Response to Comment:

Site-specific conditions, along with the conceptual site model (CSM), should always determine the scope of soil gas collection. DTSC's guidance document will be revised to reflect this concept. Also, the revised guidance document will state that soil gas plumes should be delineated to appropriate risk-based levels (see response no. 204) and that soil gas samples should be collected at appropriate depths for modeling purposes. Soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade (see response no. 216). Deeper sampling would be needed for buildings with basements. Additionally, DTSC will recommend, at a minimum, that one deep boring should be drilled to characterize stratigraphy and deep soil gas at a site, and the density and frequency of soil gas collection should be based on site-specific conditions. At some sites, permanent soil gas monitoring points may be warranted (see response no. 282).

Response Tracking Number: 123

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"The minimum amount of soil gas sampling needed in the vertical direction to evaluate vapor intrusion is the collection of soil gas samples at 5 and 15 to 20 feet below surface grade."

Generally speaking, the closer the soil gas samples are collected to the ground surface, the greater the representativeness of the soil gas samples for evaluating vapor intrusion, and the lower the uncertainly in estimating the rate of vapor flux into the indoor environment. The J&E modeling approach used to estimate the vapor flux into indoor environments assumes that vapor diffusion dominates transport though the soil column from the point of sampling to below the building foundation. If one could sample effectively at the ground surface, one could bypass estimating vapor diffusion through the soil column, thereby lowering the uncertainty and improving the accuracy of modeling efforts used to predict indoor air concentrations; however, samples collected below the ground surface at depths shallower than 5 feet below ground surface (bgs) may be influenced by barometric pumping effects or breakthrough of ambient air from the surface (atmospheric impacts). Therefore, samples collected at 5 feet bgs represent the best compromise between reducing the uncertainty associated with estimating vapor diffusion through the soil column and reducing the potential for atmospheric impacts on measured soil gas concentrations. As such, vapor intrusion risk estimates using soil gas data collected at 5 feet bgs should generally be given preference over risk estimates generated using soil gas data collected at other depths. Moreover, assuming one has a reasonable understanding of source conditions (i.e., specifically whether conditions have reached steady-state and/or whether biodegradation is occurring), it may not be necessary to collect soil gas samples at 15 feet bgs from every soil gas sampling location.

DTSC Response to Comment:

See response no. 216.

Response Tracking Number: 124

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"Ideally, subsurface plumes should be delineated laterally and vertically with soil gas samples."

We concur with this statement; however, as highlighted in the previous three comments, we believe it would be helpful if the VIG document provided a more detailed discussion of why samples are collected at different depths and how the data collected from these different depths should be used to characterize the soil gas plume conditions laterally and vertically. Specifically, the VIG should explain the purpose in collecting data from different sampling depths, and how the data collected at different depths provides different information with respect to source conditions, and vapor intrusion risk. A clearer description of the specific and unique purpose of the different sampling depths will allow users to put together a sampling plan that is openly and knowingly tailored to the conditions and needs of the site, and will provide overall clarity as to how the data collected during the soil gas sampling is intended to be used in the decision-making process.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document (see response 122, 216, 271, and 289).

Response Tracking Number: 125

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"For sites seeking agency closure with unrestricted future land use, the residual concentrations of VOCs in the subsurface should be protective of residential receptors. Therefore, soil gas sampling locations should be sufficiently dense to effectively evaluate residential building scenarios. Ideally, there should be a soil gas sample for every potential future residential building. The parcel size for most residential housing tracts in California is approximately a quarter acre. Hence, soil gas sampling for future residential developments should be conducted on a quarter acre spacing."

We appreciate DTSC setting forth a default recommendation regarding the minimum number of soil gas samples for unrestricted land use closure. However, there will be many situations where this many samples will not necessarily provide added value to the decision-making process and yet would impose significant added costs. Although we acknowledge that DTSC is recommending this default sampling density specifically for sites that are requesting unrestricted future land use, we think the VIG document should be very clear and acknowledge that sampling density, even for sites requesting unrestricted land use, should be a function of factors such as (although not limited to): site history; soil and groundwater sampling results; building type; size and location of VOC source; extent of groundwater characterization (when groundwater is the source of the VOCs); and whether mitigation/engineering controls are already incorporated into the design of the product. As one example, combining extensive groundwater sampling data and limited soil gas data could give a sufficient level of source and soil gas understanding to reasonably predict that all proposed residential structures would meet indoor air screening criteria. Similarly, depending on the history of the site, and the general location of known source areas relative to future buildings, there might be areas of the site where very focused soil gas sampling is appropriate and necessary, and large areas of the site where very few soil gas samples may be needed to understand potential vapor intrusion issues. Furthermore, often times there is sufficient historical information and soil and groundwater data to support that some form of mitigation is needed and/or would be prudent. In these situations, unless extensive soil gas data is an essential component of designing an effective remedial/mitigation system, soil gas samples collected on a 100-foot grid spacing scheme may be unnecessary and excessive, particularly if the responsible party is amenable to designing and implementing an effective mitigation system. The impact that such strict and potentially binding recommendations will have on the many sites that are embarking upon the remedial phase must not be overlooked. A recommendation that soil gas sampling for future residential developments should be conducted on quarter-acre spacing could jeopardize the perceived safety of sites where remedial decisions have been made without the benefit of soil gas samples collected every 100 feet. If, for example, evaluation of site data indicate that vapor intrusion mitigation measures are prudent and appropriate for the protection of human health, then it would be most efficient to focus additional efforts on ensuring that the mitigation measures are sufficient, protective, and will remain functional over the long-term. Implementing additional characterization efforts, and collecting soil gas data according to a 100-foot grid spacing scheme when the conclusion has already been reached that mitigation measures are necessary and appropriate, would be wasteful and would provide no added value to the decision-making process.

In sum, while we appreciate DTSC setting forth a default sampling density for residential developments, we believe that the VIG should be very clear in stating that this default sampling density is just a starting point; the number and distribution of samples necessary to reach a health-protective decision, even for future unrestricted land use, will be dependent on various site-specific criteria, including (but not limited to) the factors and examples listed above.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document. When sampling for vapor intrusion, the subsurface contamination at each building, whether existing or future, must be determined with an appropriate number of sampling points. However, the density of any sampling effort should be dictated by site-specific conditions. In certain circumstances, vapor intrusion screening can be done with groundwater contaminant data (see response no. 289). Subsurface contamination, whether in soil gas or groundwater, should be sampled at a sufficient density so that the extrapolation of contaminant concentrations can be conducted with minimal uncertainty. This extrapolation of contaminant concentrations is especially critical along edges of contaminant plume where decisions will be made concerning what buildings should be subject to indoor air testing.

Response Tracking Number: 126

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

“In addition, it may be necessary to collect soil gas samples at two distinct time intervals to compensate for the effects of weather events, such as recent rainfall or barometric fluctuations.”

“We were under the impression that the Cal/EPA’s soil gas sampling guidelines were specifically developed to minimize the potential impacts of weather, and that samples collected according to the Cal/EPA guidelines would generally produce high quality data that is appropriate for use in risk assessments. Specifically, the soil gas sampling guidelines state that soil gas data should not be collected after recent rainfall events and barometric effects are likely to be minimal if samples are collected at 5 feet below ground surface and deeper.

Our concern with the way the VIG document currently reads is that it could be inferred that soil gas data collected during a single sampling event are inadequate, and provide an insufficient basis to make health protective decisions. Clearly, many decisions have been made, and will continue to be made, on the basis of a one-time soil gas sampling event, conducted appropriately and in accordance with Cal/EPA's soil gas sampling guidelines. We believe that users of the VIG document would be better informed on this issue if the document were revised to more clearly acknowledge that prudent health-based decisions can be made with soil gas data that are collected from one time interval.

DTSC Response to Comment:

See response no. 172.

Response Tracking Number: 127

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Ideally, for sites subject to vapor intrusion, permanent vadose monitoring points for sample collection should be installed to evaluate the long-term behavior of contaminated soil gas."

Installation of permanent vadose monitoring points may be appropriate for sites subject to vapor intrusion, but this will depend on site specific characteristics, including building type, chemicals of concern, soil lithology, source size, etc. Our concern is that it could be inferred from this sentence that anything short of permanent vadose monitoring points is not ideal, and that unless the long-term behavior of soil gas has been studied at a site, then prudent and knowledgeable decisions about the significance of the vapor intrusion pathway cannot be made. Therefore, we recommend that this sentence (and the other sections of the VIG document that mention permanent vadose monitoring points) be modified to reflect the need for site-specific judgment in determining whether permanent vadose zone monitoring points are necessary.

DTSC Response to Comment:

The document will be changed to indicate the site-specific conditions that warrant the need for the installation of permanent monitoring points. Such conditions warranting the installation of permanent soil gas monitoring points may include the following:

1) Groundwater is less than five feet below grade and repetitive soil gas sampling is needed to obtain representative subsurface samples.

2) Vadose zone is subject to deep barometric pressure effects (sandy conditions with deep groundwater).

3) Quantification of human health exposure indicates marginal risk (approximately 1x10-6) and further refinement of the contaminant source is needed to further refine the risk estimations.

4) Evaluate whether contamination has reached steady-state conditions in the subsurface.

5) Soil gas grab samples yield an irregular distribution of subsurface contamination.

6) Soil gas plumes have migrated offsite under residential neighborhoods.

7) Soil matrix sampling indicates a large mass of volatile organic compounds in the subsurface.

8) Evaluate the effectiveness of soil vapor extraction (SVE) systems on remediating soil gas plumes.

9) Verify the effectiveness of passive or active subslab venting systems on removing contamination under building foundations.

10) Determine whether biodegradation of petroleum vapors is occurring in the subsurface (see response no. 244).

Response Tracking Number: 128

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Soil gas data should be used to evaluate vapor intrusion to indoor air."

In general, we agree that soil gas data is the preferable form of data to evaluate vapor intrusion into indoor air. Nonetheless, in cases where the mass of the VOCs in soil or groundwater is limited, it is preferable to use soil and groundwater data (if appropriate) to determine the available mass. Once the total mass has been estimated, an expected likely maximum indoor air concentration can be calculated by assuming all of the available mass migrates into the existing or proposed building over the relevant exposure time. If the mass of the VOCs is limited (which could occur, for example, if a small spill of VOCs occurred at the surface), use of soil gas data in combination with the Johnson and Ettinger (J&E) soil gas model, as implemented by DTSC, could lead to a significant overestimate of potential risks, because this version of the J&E model assumes an infinite source of VOCs. This does not imply that soil gas data shouldn't be collected, only that in situations where the source of the VOCs is believed to be limited, the primary emphasis should be placed on estimating the mass of the VOCs through the collection of soil and groundwater data (if appropriate).

DTSC Response to Comment:

USEPA is currently modifying their J/E EXCEL spreadsheets and the modified spreadsheets will not include an option for a finite contaminant source, probably due to the uncertainty associated with finite source modeling. Hence, in anticipation of the revised EXCEL spreadsheet, DTSC will remove all reference to a finite source model from the guidance document and this issue should be addressed on a site-specific basis with DTSC's concurrence.

Response Tracking Number: 129

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Also, open areas that are covered with pavement should be sampled as a way to determine if vapors can accumulate underneath structures."

Sampling results from below paved surfaces will likely provide a very conservative estimate of predicted indoor air concentrations because the paved surface interacts with the subsurface in a manner that is different than a building structure. J&E modeling approaches used to predict indoor air concentrations typically assume a significant advective flow near the structure, an advective flow that is not present with a paved surface. The presence of an advective flow will significantly alter the expected soil gas concentration profile below a paved surface. In the absence of an advective flow, soil gas concentrations below a paved surface will likely be higher than one would expect below a structure. Therefore, the use of the soil gas concentration under a paved area to predict indoor air concentrations using the J&E Model with advective flow can result in an overestimation of the likely indoor air concentration. If readily available, soil gas data should be collected from both paved and unpaved areas to provide a range of potential soil gas concentrations for input into the J&E model, recognizing that concentrations from beneath the paved areas provide an upper-bound estimate of soil gas concentrations that may not realistically characterize future site conditions.

DTSC Response to Comment:

Recent modeling efforts associated with vapor intrusion have focused on evaluating the potential of soil gas accumulation under buildings rather than under pavement. The modeling conducted by Abreu and Johnson (2005) indicate that vapors accumulate under buildings due to building depressurization. Vapors from subsurface contaminant sources move upward towards the surface due to diffusion and then advectively accumulate under buildings due to building depressurization. Pavement is not subject to this depressurization phenomena. Hence, only diffusional movement of vapors can occur under pavement. Without this extra component of vapor movement due to depressurization, one would anticipate that vapor concentrations under pavement would be lower than under buildings. Nonetheless, DTSC's revised vapor intrusion guidance document will recommend the collection of soil gas samples at appropriate depths for modeling purposes, regardless whether the surface is paved. Soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade. Deeper sampling would be needed for buildings with basements (see response no. 172 for more information).

References

Abreu, L. D. V., and P. C. Johnson. 2005. Effect of Vapor Source - Building Separation and Building Construction on Soil Vapor Intrusion as Studied with a Three-Dimensional Numerical Model. Environmental Science and Technology, v. 39, no. 12, p. 4550 - 4561.

Response Tracking Number: 130

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

"However, in certain site-specific situations, the analytical detection limits must be set lower than five hundred times the acceptable indoor air concentrations if the estimated vapor intrusion attenuation factor dictates the change."

We concur that analytical detection limits should be based on the estimated vapor intrusion attenuation factor. In cases where the attenuation factor is greater than 500, it may be appropriate to relax the analytical detection limit. Thus, if the attenuation factor is 10,000, the analytical detection limit should be allowed to be set 10,000 times higher than the acceptable indoor air concentration, depending on the overall data quality objectives. This approach should be clarified in the text.

DTSC Response to Comment:

During site characterization, site-specific attenuation factors are not known. Hence, soil gas detection limits must be conservative and DTSC recommends the use of the attenuation factors developed by the Office of Environmental Health Hazard Assessment (2005) as the basis for developing detection limits. In some cases, where numerous chemicals exist in the subsurface, lower detection limits may be warranted due to cumulative health effects. Hence, revision of the guidance document will make specific reference to the need to lower the detection limits due to cumulative health effects.

Response Tracking Number: 131

Commenter Organization: Iris Environmental

Technical Subject: Preliminary Screening

Guidance Document Page: 11

Public Comment:

"The chemicals in Table 1 may be found at sites and are volatile and toxic enough to pose an indoor air risk."

Some of the chemicals in Table 1 cannot be detected using the TO-14A and TO-15 sampling methods recommended on page p. 7 and p. 27 for soil gas and indoor air samples, respectively. These chemicals are insufficiently volatile to be detected once they have been collected in the sampling media (they would prefer to be on the collecting media surface rather than in the air). Recent site-specific recommendations from DTSC on this issue have been that if a chemical can't be measured in soil gas using method TO-14A or TO-15, then the compound isn't considered a risk via vapor intrusion. Although we realize these were site-specific decisions, we would appreciate clarification and further explanation on chemicals that are considered volatile according to the criteria listed on Table 1, but can't be measured using TO-14A and TO-15 sampling methods.

DTSC Response to Comment:

See response no. 62.

Response Tracking Number: 132

Commenter Organization: Iris Environmental

Technical Subject: Preliminary Screening

Guidance Document Page: 11

Public Comment:

"For existing or future buildings not to be considered a candidate for vapor intrusion, the buildings must be greater than 100 feet away laterally from subsurface contamination (USEPA, 2002a)."

This statement, presented by USEPA in the cited reference, was meant to be a guideline, and was intended to be used with professional judgment. As stated by USEPA (2002a), "(100 feet) may not be appropriate for all sites (or contaminants) and, consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration." This language should be included in any discussion of the 100 foot lateral separation between plume and structure. Site-specific factors such as source geometry, depth to source, lithology, pressure sources, gravity flows, the presence or absence of paving, and (as noted in the VIG document) preferential pathways can strongly influence the distance that soil gas plumes may migrate: the actual distance can be much smaller or greater than 100 feet.

DTSC Response to Comment:

See response no. 280.

Response Tracking Number: 133

Commenter Organization: Iris Environmental

Technical Subject: Preliminary Screening

Guidance Document Page: 12

Public Comment:

"Knowing that soil gas moves by diffusion at a rate of approximately 25 feet per year (Hartman, 2004), the length of time needed for soil gas to travel from the chemical release point to the building in question can be estimated and compared to the date of the chemical release."

The rate of soil gas diffusion can vary by orders of magnitude depending on the type of chemical and soil characteristics (i.e., pore volume, moisture content, density, and organic carbon content). Using the soil and chemical specific data provided in DTSC's version of the J&E groundwater model, approximate soil gas diffusion rates vary from 90 feet per year to 0.001 feet per year across all chemical and soil types included in the model, with a median value of 5 feet per year. Given this large range of possible values, it may be more appropriate to calculate site-specific soil gas diffusion rates in order to assess whether steady-state conditions have been reached, and whether diffusive transport to the building in question is likely to occur.

DTSC Response to Comment:

See response no. 83.

Response Tracking Number: 134

Commenter Organization: Iris Environmental

Technical Subject: Site-Specific Screening

Guidance Document Page: 22

Public Comment:

"For small buildings (10 meters by 10 meters), USEPA recommends using a soil gas advection rate of 5 liters per minute. DTSC believes that this value is appropriate for California and should be used for future building scenarios. If the future building is larger than 10 meters by 10 meters, the soil gas advection rate should be proportionally increased as a function of building size. Hence, buildings larger than 100 square meters will have, for modeling purposes, soil gas advection rates greater than 5 liters per minute."

The use of a default flow rate of 5 liters per minute (liters/min) is a reasonable starting assumption, particularly for single-family residential structures. However, for structures other than single-family residential, an advective flow rate of 5 liters/min may be overly conservative. As just one example, for multifamily residential buildings with open air podium parking, soil gas advective flow into the podium parking structure is unlikely to occur. For modern commercial buildings with forced ventilation, a soil gas advection rate greater than 5 liters per minute is extremely conservative; these buildings are almost always designed to be operated under conditions of positive pressure, and therefore the average long-term advective flow rate into the building is likely to be lower than the predicted soil gas advection flow rate (i.e., the predicted flow rate resulting from proportionally increasing the flow as function of actual building size). And, although we acknowledge the role that a baseline evaluation provides (i.e., an evaluation that assumes single-family residential structures, with a default flow rate of 5 liters per minute), particularly in framing the extent and type of institutional controls that may be necessary for a given site, we believe that the VIG document needs to more frequently acknowledge that site-specific modifications to these “default” inputs should be allowed, as appropriate.

DTSC Response to Comment:

The guidance document will be revised to state that the default of 5 liters per minutes for the soil gas advection rate for future buildings is for non-podium type structures. However, DTSC is hesitant to change the current recommendation that the soil gas advection rate should be proportionally increased as function of building size. While new commercial and industrial buildings may be positively pressured, DTSC is reluctant to integrate requirements of building operation into the conditions for corrective action so that public health is protected. Post-construction verification of this type of corrective action requirement, where certain air exchange rates must be maintained over the life of a building, are difficult to measure and difficult to enforce. If the risk for a future commercial building is unacceptable, engineering controls such as subslab venting, along with vapor barriers, are the preferred method to protect public health rather than reliance on the heating and air conditioning system. Also, see response no. 87 concerning positive pressure as a mechanism to alleviate vapor intrusion for existing commercial and industrial buildings.

Response Tracking Number: 135

Commenter Organization: Iris Environmental

Technical Subject: Site-Specific Screening

Guidance Document Page: 22

Public Comment:

“In the finite source model, both the soil gas concentration and the amount of contaminant mass in the subsurface are needed. Hence, the VOC contaminant plume must be characterized with both soil gas samples and soil matrix samples.”

For most chemicals, a majority of the mass partitions between the soil and water portion of the soil sample. Using the soil and chemical specific data provided in DTSC’s version of the J&E groundwater model, the median partitioned mass fraction present in the vadose zone soil and water phase across all chemicals and all soil types is 98%. Accordingly, the mass of VOC present in the air phase is usually small relative to the mass present in the soil and water phases. Therefore, when determining the total mass available for transport, soil samples (and if appropriate, groundwater samples) are generally sufficient. If one is able to show that the majority of the mass of VOCs partitions into the soil and water phases, given the site-specific soil characteristics and the particular chemical, minimal soil gas samples should be required.

DTSC Response to Comment:

USEPA is currently modifying their J/E EXCEL spreadsheets and the modified spreadsheets will not include an option for a finite contaminant source, probably due to the uncertainty associated with finite source modeling. Hence, in anticipation of the revised EXCEL spreadsheet, DTSC will remove all reference to a finite source model from the guidance document and this issue should be addressed on a site-specific basis with DTSC's concurrence.

Response Tracking Number: 136

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

"When buildings exist over or near contaminated groundwater, vapor intrusion should be evaluated for this contaminant source. The risk associated with degassing of VOCs from the aquifer should be quantified. Thus, groundwater evaluation requires two steps. First, soil gas data should be collected over the areas of the contaminated groundwater, and the risk associated with the contaminated soil gas should be quantified. Second, groundwater data should be collected, and the risk associated with the contaminated groundwater should be quantified. Quantification of both risks is a way of evaluating which contamination source provides the greatest health threat."

As noted in the VIG document, use of groundwater data to calculate site-specific risks when soil gas data have already been collected is problematic because groundwater concentrations must first be converted to an estimated soil gas concentration in order to predict the resulting vapor intrusion risks. When soil gas data have been collected, and there is an infinite source, these data should be the primary data used to estimate risks from the vapor intrusion pathway; risks calculated using data from other media, such as soil or groundwater, should be evaluated qualitatively, if at all. This is not to imply that groundwater data are useless; on the contrary, comparison of the estimated soil gas vapor flux based on groundwater data and the estimated soil gas vapor flux based on directly measured soil gas concentrations can be useful in determining if site conditions have reached steady-state. Indeed, these comparisons should be standard practice for sites where groundwater contamination is present.

DTSC Response to Comment:

See response no. 32.

Response Tracking Number: 137

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 22

Public Comment:

"To make a site-specific evaluation for future buildings, maximum soil gas and groundwater concentrations should be used."

The recommendation that maximum soil gas and groundwater concentrations should be used to evaluate risks to future buildings is unnecessarily prescriptive. Further, recommending the use of maximum concentrations in a risk evaluation is not consistent with standard USEPA and Cal/EPA risk assessment protocol, where one primary goal is to characterize average lifetime exposure concentrations. The VIG document should maintain the flexibility to use statistical methods to determine representative exposure concentrations, consistent with standard risk assessment protocol. Use of maximum concentrations may be an appropriate (and cost-effective) screening tool, but should not be misconstrued to be the most appropriate or accurate method for assessing 30-year exposure concentrations and may provide an inappropriate basis for making remedial decisions. Moreover, the VIG should provide the flexibility to not only use spatially averaged concentrations, as appropriate, but also temporally averaged concentrations.

DTSC Response to Comment:

See response no. 362. Also, DTSC will add language concerning the use of temporal soil gas data. As with spatial data, the temporal dataset must be large enough to allow for appropriate statistical approximation.

Response Tracking Number: 138

Commenter Organization: Iris Environmental

Technical Subject: Site Characterization

Guidance Document Page: 15

Public Comment:

"Evaluations using groundwater data should only occur in portions of a groundwater plume where there is no evidence of non-aqueous phase liquid (NAPL) entrained within the water table aquifer."

NAPL conditions are very common, particularly at sites where hydrocarbons have impacted groundwater. The evaluation methodology for groundwater presented on page 15 of the VIG document will generally predict highly conservative estimates of the actual vapor concentration over groundwater in situations where NAPL is present. As this is conservative, it should be allowed for in the referenced screening approach (assuming, of course, that the other requirements for use of the J&E model hold). Alternatively, if NAPL is present, the pure phase vapor pressure can be assumed, and vapor concentrations present over groundwater can be calculated based on this assumption. Note that neither of our comments about NAPL would apply when fractured bedrock is present; the modeling approach used is based on an assumption of homogenous soil and such approaches are not applicable to sites with fractured bedrock.

DTSC Response to Comment:

Additional information concerning groundwater screening for vapor intrusion will be added to the guidance document. For groundwater contamination at or below one percent of the contaminant's pure-phase solubility, DTSC will recommend that the associated vapor concentration be calculated from the Henry's law constant. For sites with groundwater contamination above one percent of the contaminant's pure-phase solubility, which is indicative of NAPL (Pankow and Cherry, 1996), the pure phase vapor pressure of the contaminant, corrected by Raoult's law if the NAPL is a mixture, will be assumed to exist in the vadose zone.

References

Pankow, J. F., and J. A. Cherry. 1996. Dense Chlorinated Solvents and other DNAPLs in Groundwater. Waterloo Press, Ontario, Canada, 552 p.

Response Tracking Number: 139

Commenter Organization: Iris Environmental

Technical Subject: Indoor Air Sampling

Guidance Document Page: 30

Public Comment:

As openly discussed in the VIG document, collecting indoor air samples to assess the risk from vapor intrusion is a challenge, and is typically the last step in a vapor intrusion evaluation because of the complexity in evaluating the data (pg. 23). The VIG document contains ten pages of detailed discussion regarding how to appropriately conduct an indoor air sampling program, and how to evaluate and interpret the indoor air monitoring data (discussion beginning on page 23). For added clarity, and because this section of the document is so lengthy, we feel that this section needs to state very specifically that these indoor air sampling requirements apply and are oriented to existing buildings. We acknowledge that this point is contained in the attached Figure 1, but we fear that the text does not adequately make this distinction. We are concerned that this section could be misinterpreted by users and the community to suggest that any FUTURE building where vapor mitigation measures (including source removal) have been or will be implemented will automatically need to proceed to indoor air sampling in order to ensure that the future projections about building safety are attained. As described more fully below under section 4.0 (Mitigation), there are many available options for ensuring that future buildings are not adversely impacted by the vapor intrusion pathway. Indoor air monitoring may not be the desirable option for verifying the safety of a building or the efficacy of a remedial/mitigation plan. Clarification that the indoor air sampling discussion in the VIG document is oriented toward existing buildings will minimize the potential for misinterpretation of the detailed indoor air sampling procedures.

DTSC Response to Comment:

The language concerning indoor air sampling will be revised to state that Steps 8, 9, and 10 apply to existing buildings, and that numerous options are available to verify the successful implementation of engineering controls at future buildings.

Response Tracking Number: 140

Commenter Organization: Iris Environmental

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

"To avoid interference with background chemicals not found in the contaminated media of concern, the air analysis should be run using the selective ion mode..."

Once the data quality objectives have been set, analytical methods sufficient to achieve these objectives should be proposed. Selective ion monitoring (SIM) methods may or may not be needed, depending on the data quality objectives. Maximum flexibility should be allowed with respect to the analytic methods; requiring indoor air samples to be run using SIM analysis techniques when not needed may be wasteful and constraining.

DTSC Response to Comment:

DTSC agrees with this comment. DTSC will recommend running air samples in SCAN mode first if the site is not fully characterized or if the needed detection limits can be reached in the SCAN mode. SIM mode is only used to achieve lower detection limits and when only a few compounds warrant quantification per GC/MS run. GC/MS analysis in the SCAN mode can usually achieve at least 0.2 to 0.5 ppbv reporting levels.

Response Tracking Number: 141

Commenter Organization: Iris Environmental

Technical Subject: Indoor Air Sampling

Guidance Document Page: 33

Public Comment:

"For measuring ambient air, DTSC recommends that ambient sampling begin at least one hour, and preferably two hours, before the indoor air sampling begins. This is recommended since most buildings have an air exchange rate of 0.5 - 1.0 exchanges per hour and, thus, ambient air enters the building before indoor air sampling begins."

As a rule of thumb, an hour-long transient outdoor air concentration spike will need to be an order of magnitude greater than the indoor air level of concern before it can materially impact an eight-hour average indoor air concentration. Potential spikes of this magnitude will be well known to the sampling plan designer (i.e., rush hour). In these cases, starting ambient sampling at least one to two hours prior to sampling is prudent if the spike is likely to occur prior to the start of indoor air sampling activities. In other cases, when there are no known potential transient outdoor air concentration spikes, or when the sampling effort only requires a conservative estimate of potential indoor air concentrations, starting the ambient sample 10 to 30 minutes before the indoor air sample should be adequate. Therefore, starting the outdoor air sample less than an hour before the indoor air sample should be allowed if site-specific conditions are appropriate.

DTSC Response to Comment:

The text of the guidance document will be revised to state that ambient sample collection should start 10 to 30 minutes prior to indoor air sampling.

Response Tracking Number: 142

Commenter Organization: Iris Environmental

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

"The ambient air sample should be in an upwind location on the upwind side of the building. The sampling equipment should be located away from gasoline stations, automobiles, gasoline-powered engines, oil storage tanks, industrial facilities, or dry cleaners. The sampler should not be hung on vegetation but be placed away from wind breaks, such as trees or bushes. The sampling equipment should be at least five feet off the ground, at the approximate midpoint of the ground story level of the building, and about 5 to 15 feet away from the building."

For buildings that have forced ventilation systems with air intakes located on the building roof, it is most appropriate to place the ambient air samples on the roof. In this case, the most relevant sampling points are those that are proximate to air intake locations, even if these locations may be near or downwind of ambient sources such as gas stations. Other, nearby sources are relevant to current conditions and such ambient sources should not be avoided simply because they are possible sources of VOCs.

DTSC Response to Comment:

The revised guidance document will recommend roof sampling near air intakes for commercial and industrial buildings and that outdoor samples should be representative of site conditions.

Response Tracking Number: 143

Commenter Organization: Iris Environmental

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

"A trip blank is required to ensure that there are no impacts from these types of sources that could affect the results of the study. Once the samples are collected, they should be stored according to the method protocol and delivered to the analytical laboratory as soon as possible. Samples should not exceed recommended holding times prior to being processed by the laboratory. Field blanks should be submitted and analyzed with the samples to provide a quality check."

The utility of including both a trip blank and field blank is questionable. Porting an empty canister to and from the sampling site is unlikely to discover trip or field contamination, as no media is introduced into the canister, unlike soil or water blanks where media is introduced into the sampling receptacle. It may, however, provide insight into how well the canisters were cleaned prior to leaving the laboratory. Note that the blank sample is not a "blind" sample. The laboratory will know that this canister is the blank as it will be the only canister still at initial vacuum pressure (approximately 30 millimeters of mercury). We are unclear why two empty canisters (trip and field blank) need to travel to the sampling site and back. At most, we would recommend that the VIG document be revised to require that only one empty canister accompany the sampling canisters into the field. Note that collection of duplicate indoor air samples should be required to check the precision of the sampling approach, and this appears to be missing from the VIG document.

DTSC Response to Comment:

Summa canister field and trip blanks are not necessary and provide minimal useful information during indoor air and soil gas sampling. In the revised guidance document, DTSC will make the use of field and trip blanks optional when collecting samples in Summa canisters. However, the valves and associated pressure gauges for all Summa canisters should have a high degree of integrity. Any breach in pressure prior to sampling, as indicated by the dedicated vacuum gauge, renders the canister unfit for use. Also, stakeholders should consider the use of Summa canister trip blanks as a mechanism to evaluate a laboratory's ability to obtain zero-grade air, clean Summa canisters, and provide a canister handling process free of potential contamination.

Hence, a field blank for either soil gas sampling or indoor air sampling is only warranted for the sorbent tubes used during sample collection pursuant to TO-17. Additionally, in the revised guidance document, DTSC will state that at least one duplicate per laboratory per field day is recommended to check the precision of the sampling and analysis.

Response Tracking Number: 144

Commenter Organization: Iris Environmental

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

"All site investigations should include an evaluation of the utility corridors…If utility corridors are present, the site investigation should document the presence or absence of vapor migration within or along utility corridors by collecting active or passive soil gas samples along the corridors."

Inclusion of a utility corridor evaluation should be dependent on the indoor air study design, the predicted indoor air concentrations, etc. If indoor air sampling can demonstrate minimal levels of chemicals of concern, an extensive utility corridor evaluation would be of limited value. A utility corridor investigation should only be triggered if suggested by the site-specific situation.

DTSC Response to Comment:

The intent of a utility corridor survey is to show if structures near contaminant plumes warrant evaluation by either sampling of the soil gas in the utility corridor or by sampling of the indoor air of the structure in question (see response no. 14, 38, and 254).

Response Tracking Number: 145

Commenter Organization: Iris Environmental

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

"DTSC considers four remedies to be common for the mitigation of vapor intrusion. Three criteria were used to select the recommended mitigation measures effectiveness, implementability, and cost. Other remedies may be proposed

for
DTSC review and approval."

Although DTSC states that other remedies may be proposed for review and approval, we believe that the document needs a stronger and clearer acknowledgement that many other mitigation measures, including different combinations of those already identified by DTSC, may be equally as effective at achieving a given level of risk reduction.

DTSC Response to Comment:

The revised guidance document will further acknowledge that other remedies are available and that flexibility is needed in addressing site-specific conditions; however, DTSC will limit the discussion to those remedies currently presented but will provide additional information concerning institutional controls and operation and maintenance (O&M) of mitigation measures.

Response Tracking Number: 146

Commenter Organization: Iris Environmental

Technical Subject: Mitigation

Guidance Document Page: 39

Public Comment:

While the VIG notes that the O&M system requirements "may include" a variety of onetime and routine indoor air and venting system component monitoring, we believe that the VIG should be very clear in stating that the specific monitoring approach to ensure the efficacy of the venting system will depend on various site-specific criteria, including (but not limited to): venting system design, building size and design, and chemical action levels. As one example, a tiered compliance monitoring approach could be used where venting system 'action levels' would be developed based on model specific attenuation coefficients. Depending on the concentrations of chemicals detected in the venting system, further actions could be taken, including but not restricted to cessation of monitoring, or increasing the flows through the venting system. As long as the concentrations measured in the venting system are below applicable action levels, then there would be no need to proceed to indoor air sampling. Regardless of the monitoring approach used, the VIG should make very clear that not all of the suggested O&M requirements are necessarily needed, and that the O&M monitoring requirements should be developed on a site-by-site basis, incorporating scientific and technical flexibility as appropriate.

DTSC Response to Comment:

DTSC agrees that that the O&M monitoring requirements should be developed on a site-by-site basis and will modify the guidance pursuant to this comment.

Response Tracking Number: 147

Commenter Organization: Iris Environmental

Technical Subject: Mitigation

Guidance Document Page: 40

Public Comment:

"The installation and routine monitoring of perimeter soil gas probes may be required to evaluate the potential for VOC migration during the venting of buildings."

It is not clear what is meant by “venting."   We would appreciate clarification from DTSC on this point.

DTSC Response to Comment:

This section will be removed from the guidance document (see response no. 78).

Response Tracking Number: 148

Commenter Organization: Iris Environmental

Technical Subject: Mitigation

Guidance Document Page: 40

Public Comment:

“When removal of all volatile chemicals from the subsurface is not possible, institutional controls with their prescribed notifications, prohibitions and engineering controls must be utilized to prevent exposure due to vapor intrusion.”

We presume that the terms “all volatile chemicals” and “prevent exposure,” as used in this statement, are intended to contain a threshold of significance. That is, when removal of the significant levels of chemicals from the subsurface is not possible, engineering controls…must be utilized to prevent significant unacceptable exposure due to vapor intrusion. Alternatively, this sentence could be misinterpreted to imply that ANY level of VOCs remaining at a site will require institutional controls and deed restrictions. We recommend that DTSC clarify the language in this section of the VIG document.

DTSC Response to Comment:

The text will be revised to indicate that VOC concentrations above human health-based standards may trigger institutional and engineering controls.

Response Tracking Number: 149

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

Several references are made to the Cal EPA 2003 Advisory for ASGI regarding the need for checking leaks during soil gas and sub-slab sampling. The suggested tracer compounds in the advisory often negatively affect the TO-15 analysis. For example, the presence of the leak check compound isopropanol at a concentration well below the leak check detection limit of 10 ug/L (>4000 ppbv), may require the laboratory to severely dilute the sample so as not to overwhelm the concentrator or the GC/MS unit. As a result, the project reporting limits are compromised even when the leak check compound is below the suggested “leak criterion”. Other compounds suggested also interfere with the TO-15 analysis.

DTSC Response to Comment:

Due to concerns about the degree of sample compromise upon the detection of the leak check compound and the need to alleviate concerns about sample dilution, the vapor intrusion guidance document or the soil gas advisory will be revised to state that the concentration of a liquid leak check compound should be 1 ug/L or lower. When using a gaseous leak check compound, such as helium, the detection limits of the helium can be higher because the gaseous leak check compound does not interfere with the analytical equipment and the magnitude of the ambient air breakthrough can be quantified. DTSC anticipates adding the option of using helium as a leak check compound in the revised guidance document, recommending procedures similar to those from New York and New Jersey.

References

New York State Department of Health. 2006. Final - Guidance for Evaluating Soil Vapor Intrusion in the State of New York. Bureau of Environmental Exposure Investigation. October 2006. [http://www.health.state.ny.us/environmental/investigations/soil_gas/svi_guidance/]

New Jersey Department of Environmental Protection. 2005. Vapor Intrusion Guidance. Site Remediation and Waste Management Program and Division of Science, Research and Technology. October 2005. [http://www.state.nj.us/dep/srp/guidance/vaporintrusion/vig.htm]

Response Tracking Number: 150

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

Over-the-counter products such as shaving cream or butane lighters have the potential of introducing target VOCs into the sample causing a false positive when reporting results at ppbv levels. Several clients have successfully used Helium or SF6 as a tracer gas. Both of these alternatives do not interfere with the TO-15 analysis and are available at a high purity grade. Detection of Helium is performed in the field allowing for real time decisions on the viability of the soil gas sample.

DTSC Response to Comment:

The revised guidance document will discuss the limitations of shaving cream and rubbing alcohol as a leak detection compound which should encourage the use of alternative compounds.

Response Tracking Number: 151

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

Page 6 of the document recommends collecting duplicate samples for confirmation of the mobile laboratory's 8260B results. 8260B and TO-15 methodology may not be comparable for polar (e.g. oxygenates and alcohols) and less volatile compounds (e.g. Naphthalene). For these compounds, 8260B may result in a low bias relative to TO-15, and TO-15 provides a more accurate result.

DTSC Response to Comment:

Due to difficulties in the analysis of polar compounds and less volatile compounds with Method 8260, DTSC will recommend in the revised guidance document that other analytical methods be used (also, see response no. 221).

Response Tracking Number: 152

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

TO-17 uses a multibed sorbent tube and represents a technological improvement over the less comprehensive TO-1 and TO-2 methods. In our experience, TO-17 has replaced the need for TO-1 and TO-2.

DTSC Response to Comment:

DTSC agrees with this comment and reference to TO-1 and TO-2 will be removed, and language concerning TO-17 will be added.

Response Tracking Number: 153

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

Page 27 incorrectly states that use of the SIM mode is superior to the full scan mode since it avoids interference and exhibits less bias than full scan. While SIM provides increased sensitivity by setting the detector to observe only a specific mass, or a selection of specific masses, the detector is also “blind” to many other compounds whose ions are not monitored. Not only does SIM limit the full characterization of a soil gas sample, the lack of complete mass ion data available using full scan mode may result in inaccurate compound identification and/or quantification. Without the power of the full scan spectra to identify the interfering ions, the possibility of false positives, high bias, or false negatives increase especially when analyzing soil gas samples from uncharacterized sites. SIM mode of detection should not be employed by the analytical laboratory during the site characterization phase, and SIM should ONLY be considered if the reporting limit requirements dictate the need for SIM.

DTSC Response to Comment:

DTSC agrees with this comment. The guidance document's reference to the use of SIM will be corrected.

Response Tracking Number: 154

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

Page 27 incorrectly states that use of the SIM mode is superior to the full scan mode since it avoids interference and exhibits less bias than full scan. While SIM provides increased sensitivity by setting the detector to observe only a specific mass, or a selection of specific masses, the detector is also “blind” to many other compounds whose ions are not monitored. Not only does SIM limit the full characterization of a soil gas sample, the lack of complete mass ion data available using full scan mode may result in inaccurate compound identification and/or quantification. Without the power of the full scan spectra to identify the interfering ions, the possibility of false positives, high bias, or false negatives increase especially when analyzing soil gas samples from uncharacterized sites. SIM mode of detection should not be employed by the analytical laboratory during the site characterization phase, and SIM should ONLY be considered if the reporting limit requirements dictate the need for SIM.

DTSC Response to Comment:

See response no. 153 (duplicate entry).

Response Tracking Number: 155

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

The value of the Trip Blank is limited and does not necessarily quantify any contamination issues during transport and collection. If a target compound is detected in the Trip Blank, a possibility exists that the canister valve / brass cap leaked during transport. This fact does not translate to the remaining sample canisters included in the shipment. Each canister is unique and it is difficult to relate Trip Blank results to the data set. The Trip Blank is really a test of that individual canister integrity, evaluating both its cleanliness prior to shipment and its ability to maintain vacuum.

DTSC Response to Comment:

See response no. 143.

Response Tracking Number: 156

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 28

Public Comment:

Condensation of water in canisters when collecting TO-14A/TO-15 samples due to high humidity samples is of particular concern when utilizing a pressurized sampling system in which the sample is actively pumped into a canister such that after collection, the sample is at positive pressure. In the case of soil gas or indoor air samples, collection typically occurs using a flow controller rather than a sample pump. After collection, the sample remains at vacuum and is shipped to the laboratory. The lab typically pressurizes the sample with dry nitrogen which minimizes the issue of condensation. In our experience, if water is present in a soil gas sample, the soil probe was incorrectly placed in a saturated or near saturated zone.

DTSC Response to Comment:

DTSC agrees with this comment. The guidance document will be revised to better describe the water handling procedures.

Response Tracking Number: 157

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 28

Public Comment:

The document implies that the TO-14A and TO-15 differ in their Reporting Limit capabilities. Utilizing a GC/MS in SIM mode, TO-14A and TO-15 methods are able to reach similar reporting limits. As noted, the main difference between the methods is in the moisture management system which allows TO-15 the ability to analyze for both polar and non-polar compounds. (Of course, TO-14A also allows for detectors besides GC/MS and GC/MS SIM).

DTSC Response to Comment:

DTSC agrees and this error will be corrected in the revised guidance document.

Response Tracking Number: 158

Commenter Organization: Air Toxics, Ltd.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 28

Public Comment:

We recommend not only certifying individual canisters when performing indoor air sampling, but also all the sampling train components including the sampling cane, filter, and flow controller.

DTSC Response to Comment:

Language will be added to the guidance document to state that the sampling canes, filters and flow controllers should also be certified along with the canisters to the method reporting limit.

Response Tracking Number: 159

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Site Characterization

Guidance Document Page: 10

Public Comment:

Passive soil vapor methods consist of the burial of an adsorbent in the ground with subsequent retrieval and measurement of the adsorbent. These methods give a time-integrated measurement, and therefore reduce the uncertainty due to temporal variations. Passive soil vapor methods only yield soil vapor data in terms of mass (e.g., micrograms [ug] or in some other form of relative units), not concentration, because the amount of vapor that comes into contact with the adsorbent is unknown. Empirical studies are currently in progress to correlate results from passive samplers to actual soil gas concentrations, but the database is still limited and results inconclusive. Hence, at the present time, passive soil vapor data is considered by most agencies as a qualitative, not a quantitative, tool.

DTSC Response to Comment:

The vapor intrusion guidance document states that passive soil gas samples are qualitative and that passive samples can be used to locate contaminant plumes, plume boundaries, and preferential migration pathways. DTSC will retain this position until compelled otherwise by peer reviewed studies.

Response Tracking Number: 160

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Site Characterization

Guidance Document Page: 10

Public Comment:

Passive soil gas sampling can be an effective supplemental tool in understanding the vapor intrusion pathway. Passive methods offer a quick and relatively inexpensive method to find preferential pathways into a structure or around a structure, such as utility corridors. The composition of subsurface soil gases can be determined from passive soil samples and the location of subsurface plumes can be mapped, particularly edges of plumes to determine if contamination is near current or future buildings. Passive soil gas sampling methods can also be useful in situations where active methods may not be applicable, e.g., areas of low-permeability and high-moisture settings. Further, they are capable of detecting and reporting compounds present in very low concentrations.

DTSC Response to Comment:

See response no. 159.

Response Tracking Number: 161

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Appendix A

Guidance Document Page: A1

Public Comment:

Flux chambers are enclosures that are placed directly on the surface (ground, floor, etc.) for a period of time (generally a few hours to a few days), and the resulting contaminant concentration in the enclosure is measured. This method offers advantages over the other two methods because it yields the actual flux of the contaminant out of the ground, which eliminates some of the assumptions required when using other types of subsurface data. Little regulatory guidance exists on flux chambers and the method is relatively unknown.

The primary concern with flux chambers is whether they can be placed in the proper locations in an existing structure. In many structures, the primary entry of soil gas into the structure is through discontinuities in the floor slab (cracks, holes, sumps, etc.) and these locations are often concealed by floor coverings, walls, stairs, etc. Another concern is whether the results from a small footprint flux chamber can be extrapolated to the larger footprint of a structure.

Flux chambers can certainly be used as a qualitative tool to locate surface fluxes of VOC contamination and entry points into structures. Flux chambers may also be a suitable quantitative tool for structures with dirt floors, larger slabs in good condition with limited pipes/utilities poking through, (i.e., commercial buildings), and for undeveloped sites in warmer climates or where estimates of a future stack effect due to the building can be made.

Two types of flux chamber methods are utilized: static and dynamic. Regardless of the method used, enough chamber measurements should be collected to get a representative value over the footprint of the building (analogous to placing enough borings on a typical site), and that they are located near edges where the slab meets the footing, over any zones with cracks or conduits, and over the center of the contamination if known. In all cases, chambers should be deployed for long enough periods to enable temporal variations to be assessed, similar to indoor air measurements (8 to 24 hours depending upon the conditions; 24 hours if large temperature differences exist between day & night).

More details on the flux chamber method can be found in Hartman (2003), Kienbusch (1986), and Eklund and Schmidt (1990).

DTSC Response to Comment:

The text in Appendix A will be augmented pursuant to the this comment. Greater specificity will be provided concerning the length of deployment of flux chambers, and the number of measurements needed to obtain representative samples at a site.

Response Tracking Number: 162

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

Measurement of a conservative tracer inside and below a structure can allow a structure specific attenuation factor to be calculated. The calculated attenuation factor can then be used to estimate the indoor air concentration from the measured sub-slab soil gas concentration for the contaminant of concern. This method assumes that all contaminants in the vapor phase enter the building at equal rates from the sub-slab, a relatively safe assumption for most situations. Naturally occurring radon is the most commonly used conservative tracer. Other tracers include the chlorofluorocarbons. Complications to this technique include the presence of indoor sources of the tracer and any temporal variations. However, if sub-slab samples are being collected, concurrent analysis of radon or another tracer may prove useful and is generally not too expensive. More details on this approach including case histories are available from the EPA Office of Research and Development.

DTSC Response to Comment:

The revised guidance document will mention the use of radon as a conservative tracer to determine building-specific attenuation factors.

Response Tracking Number: 163

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

The indoor air concentration is inversely proportional to the room ventilation rate: a two-fold increase in ventilation rate decreases the indoor air concentration by two-fold. The default ventilation rates used by the EPA and many other agencies are conservative: room exchange rates of 1 every 4 hours for residences and 1 every hour for commercial buildings. For some structures, typically commercial buildings, the actual ventilation rate can be determined from the HVAC system or building design specifications. For other structures, typically residences, this information is not readily available so the ventilation rate must be measured. ASTM Method E741-00 describes a number of techniques for measuring ventilation rates using gaseous tracers such as helium or sulfur hexafluoride. The techniques are quick and relatively inexpensive. For colder climates, measurement during the cold and warm seasons may be prudent if the ventilation rate during the more conservative case (cold season) suggests unacceptable indoor air concentrations.

DTSC Response to Comment:

DTSC will add information to the guidance document concerning the ability to determine building-specific indoor air exchange rates with tracer gas. However, it should be noted that these measurements may not reflect long-term behavior of the building.

Response Tracking Number: 164

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

Measurement of the pressure gradient between the structure and outdoors can assist in interpreting measured indoor concentrations of contaminants. A correlation between indoor air concentration and relative pressure could provide information on the contaminant source. For example, if a building is over-pressured relative to the sub-surface, measured indoor concentrations might be more likely attributed to above-ground sources. Conversely, if the building is under-pressured relative to the sub-surface, measured indoor concentrations might be more likely attributed to sub-surface sources. Commercial buildings with large HVAC systems, and perhaps residences with AC units, may fall into the former category. Many structures in cold environments, especially residences, will fall into the latter category when the heaters are running. Differential pressure measurements are relatively easy and inexpensive, and can be collected continuously around the clock. However, the success of this approach likely will require multiple indoor air measurements to recognize any correlations or patterns.

DTSC Response to Comment:

Positive pressure, as measured over a building's foundation, does not necessarily preclude the possibility of vapor intrusion. DTSC has observed vapor intrusion in positively pressurized buildings. While DTSC won't discourage the collection of building pressure measurements, the data itself must not be used as the sole line of evidence for negating the possibility of vapor intrusion.

Response Tracking Number: 165

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Indoor Air Sampling

Guidance Document Page: 32

Public Comment:

As with any type of site investigation, it is difficult to reach any conclusions with any degree of confidence with only a handful of data points. Vapor intrusion data sets consisting of one soil gas and/or indoor air analysis per structure are very difficult to interpret, but the data are so expensive to collect that cost limitations often preclude multiple analyses. Real-time analyzers can be used to collect multiple, less expensive data that can be used to locate problem structures, preferential pathways into structures, and VOC sources inside the structures. Continuous analyzers that collect data automatically over a period of time can sort out background scatter and determine temporal variations both indoor and below-ground. Larger data sets allow trends in the data to be recognized and correlated to other variables such as pressure differentials, wind speed, and HVAC systems. Larger data sets allow forensic approaches to be applied.

A variety of real-time analyzers exist including hand-held logging instruments (PID, FID, TCD, IR analyzers), automated gas chromatographs, portable mass spectrometers, and the EPA's own trace atmospheric gas analyzer (TAGA).

DTSC Response to Comment:

See response no. 210.

Response Tracking Number: 166

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Evaluation of Indoor Air Samples

Guidance Document Page: 35

Public Comment:

Forensic approaches attempt to determine the source of any detected VOCs by using a chemical fingerprint that is source specific. Potential fingerprints include compound ratios (e.g., DCE/TCE), isotopes (Cl-36, C-13), and total chromatogram pattern. Larger data sets are required for trends/patterns in the data to be recognized, so less expensive analytical methods are often more useful for forensic efforts.

DTSC Response to Comment:

These forensic approaches will be integrated into the revised vapor intrusion guidance document.

Response Tracking Number: 167

Commenter Organization: H&P Mobile Geochemistry

Technical Subject: Evaluation of Indoor Air Samples

Guidance Document Page: 35

Public Comment:

A variety of weather conditions can influence soil gas or indoor air concentrations, but for most situations the effects will not be significant (the radon literature suggests that temporal variations in the soil gas are typically less than a factor of two during a season and less than a factor of 5 from season to season). For soil gas, the importance of these variables will be greater the closer the samples are to the surface and are unlikely to be important at depths at 5 feet below the surface or the structure foundation.

In some special or extreme situations, these variables might have more of an effect and collection of meteorological data can be helpful to assessing the vapor intrusion risk. As examples:

• Areas with persistent high wind speed. High wind speed can create pressure differentials around a structure causing an advective flow in the shallow soil gas around and beneath a structure. This can create a number of situations including an inflow of air into the vadose zone on the windward side of a building and an outflow of soil gas on the leeward side (EPA, 1992). Such a flow pattern can lead to higher oxygen concentrations at deeper depths on one side of a building versus the other, which is relevant at sites with hydrocarbon contamination. Recent studies by API have suggested that horizontal flow of the soil gas under slab-on-grade foundations can be rapid in areas with sandy soils, which is also likely coupled to wind speed.

• Areas with frozen ground or permafrost. The inflow of air into the vadose zone or soil gas out of the vadose zone may be restricted if the ground surface is frozen and snow-covered, so this should be noted where applicable.

• Data collection near/during major storm events. Changes in barometric pressure can create movement in the near surface vadose zone, a process known as barometric pumping. For most normal climatic conditions, the effect on soil gas concentrations will be minimal, however it may be significant near or during major storm events.

• Flux chamber surveys. It has been documented that barometric pressure, precipitation, and frozen surfaces have a direct influence on flux chamber results (Kienbusch, 1986), so it is advisable to measure these variables when employing this method.

DTSC Response to Comment:

See response no. 216. Also, the technical issues associated with flux chambers are adequately addressed in Appendix A.

Response Tracking Number: 168

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Preliminary Screening

Guidance Document Page: 18

Public Comment:

The first paragraph of Step 6 should read: "For a site that does not (emphasis added) pass a preliminary screening evaluation, a site-specific evaluation of vapor intrusion may be warranted." If the omission of "not" is in fact intentional, an explanation of DTSC's reasoning is requested.

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 169

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Figure 3

Guidance Document Page: 54

Public Comment:

The final question of the Utility Corridor Decision Tree (Figure 3) is, "Do vapors pose an acceptable risk to indoor occupants?" According to the current draft of the Guidance, if the answer to this question is "Yes," then the Guidance recommends remedial action, and if the answer is "No," then utility corridors are not of concern.

RECOMMENDATION: At the final decision of the Utility Corridor Decision Tree (Figure 3), following "Do vapors pose an acceptable risk to indoor occupants," the "Yes" and "No" should be switched. If Figure 3 is in fact completely accurate, an explanation of DTSC's reasoning behind the final decision is requested.

DTSC Response to Comment:

Figure 3 contains typographical errors and the "yes" and "no" will be switched in the revised vapor intrusion guidance document.

Response Tracking Number: 170

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

• The intended use of the Guidance is unclear. Is the Guidance a streamlined "check list" for efficient and accurate evaluation of vapor intrusion risks? Or is it a full range of technically sound options from which the project manager may choose those recommendations that are most appropriate for the site at hand?

• There is concern that the regulatory community will be overly conservative in implementing the Guidance and not apply reasonable professional discretion.

RECOMMENDATION: The Guidance should clearly state at the beginning of the Guidance the intended use of the document, including a note that the regulatory community has the authority to use their professional discretion in applying the Guidance at whatever level they deem appropriate for the site in question.

DTSC Response to Comment:

The Introduction and Scope section will be enhanced to better communicate the intent of the guidance document and to state that professional judgment and sound science should be used when making technical decisions concerning potential human exposure.

Response Tracking Number: 171

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

• The Guidance does not currently state for which regulatory agencies this Guidance is intended.

• Local agencies and CUPAs may not have the in-house expertise or staff capacity required to fully implement the Guidance.

RECOMMENDATION: Guidance should clarify exactly which agencies/authorities are expected to use this Guidance and what to do if the oversight agency does not have the staff capacity to properly implement the Guidance.

DTSC Response to Comment:

The intent of the guidance document is to assist all stakeholders in understanding and evaluating the vapor intrusion exposure pathway. Use by other state, county or local regulators is entirely optional in that other technically sound approaches may be available. If local regulators or CUPAs need assistance with vapor intrusion, DTSC, RWQCBs, and OEHHA are available for assistance. The guidance document will be revised to further clarify this intent.

Response Tracking Number: 172

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

• Current guidance to delineate to non-detect vertically and 100 ft beyond non-detect laterally is exceedingly conservative and prohibitively burdensome for many brownfield redevelopment projects.

• Many urban areas contain regional groundwater contaminant plumes that stretch for miles, making full delineation of a soil gas plume derived from a contaminated groundwater source often impractical.

RECOMMENDATION: Guidance should remove the reference (page 5) that "characterization should continue until non-detectable concentrations of VOCs are encountered in the subsurface laterally and vertically" and replace it with "characterization should continue until VOC concentrations encountered in the subsurface laterally and vertically no longer exceed appropriate risk-based screening levels." Guidance should also recommend that in situations where full lateral characterization to screening level is not possible (i.e. regional groundwater plume, lack of access to neighboring property), characterization to 100 feet from the perimeter of the (future) building is adequate.

DTSC Response to Comment:

DTSC's position regarding subsurface sampling will be clarified upon revision of the guidance document. As indicated by the guidance document, soil gas is the primary sampling method for vapor intrusion evaluations but risk management decisions should be made using all available lines of evidence. Groundwater, soil matrix, passive soil gas, crawl space, and subslab samples are examples of such lines of evidence. Subsurface delineation within a plume should continue until risk-based screening levels are obtained. For California, these risk-based screening levels can be the California Human Health Screening Levels (CHHSLs) pursuant to Senate Bill 32 if cumulative health effects are not of a concern. Once the subsurface plume is delineated to risk-based levels, a survey should be conducted of the existing and future building locations. If buildings are within 100 feet of the edge of the plume, as delineated by risk-based levels, a survey of potential conduits for preferential contaminant migration should be conducted. If conduits exist, assessment of the conduits might be warranted.

The guidance document will be revised to allow for the option to establish a site-specific lateral offset to determine a "safe" building as indicated by Abreu and Johnson (2005) and Lowell and Eklund (2004). For the future building scenario, where unacceptable contaminant levels are left in the subsurface, buildings that warrant no engineering controls would have to be at least 100 feet from the edge of health-based concentrations due to uncertainty associated with plume migration upon brownfield redevelopment. For the existing building scenario, buildings within 100 feet of health-based concentrations may warrant indoor air sampling to verify no potential exposure. The decision to test buildings near the edges of plumes should be based on site-specific conditions, such as public perception, potential for preferential pathways, results of nearby indoor air testing, and subsurface conditions (faults, lateral soil changes, etc.). This 100 foot distance may not be appropriate for all sites. The adjustment of an attenuation factor for offset from a contaminant plume may be warranted due to site-specific conditions but these attenuation factor adjustments must be made with caution. The two and three dimensional modeling as indicated by Lowell and Eklund (2004) and Abreu and Johnson (2005), respectively, have not been extensively field validated. The field experiments conducted by Christophersen et al. (2005) suggest that shallow contaminant sources at 2.5 to 4.2 feet below the ground surface can have 50 feet of lateral vapor migration from the source. Hence, the determination of site-specific offsets is best documented with field data.

Studies by Hers et al. (2006) and DiGiulio and Cody (2006) indicate that shallow soil gas measurements at 5 feet may not be indicative of soil gas concentrations under buildings. These studies suggest that soil gas samples collected at depths of 10 - 12 feet are a better indicator of vapor intrusion risk than samples collected at 5 feet. The numerical modeling conducted by Abreu and Johnson (2005) and Abreu et al. (2006) also suggests this relationship. Hence, risk quantified with shallow soil gas measurements (5 feet below grade) using the Johnson and Ettinger model might be biased low. Accordingly, DTSC's revised vapor intrusion guidance document will recommend the collection of soil gas samples at appropriate depths for modeling purposes. Soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade. Deeper sampling would be needed for buildings with basements.

If shallow groundwater conditions exist, then soil gas samples can be taken at shallower depths as appropriate, but soil gas samples taken from depths of less than 5 feet may be subject to barometric pressure effects and could be biased (Massmann and Farrier, 1992; Nilson et al., 1991; Clements and Wilkening, 1974; Elberling et al., 1998; Auer et al., 1996). Risk determinations should rely upon multiple lines of evidence, such as soil matrix samples, groundwater samples, subslab samples, and/or passive soil gas samples. The occurrence of shallow groundwater can make the collection of soil gas samples impossible. Where groundwater is less than five feet below grade, and there is a large capillary fringe associated with the water table, no-flow conditions may be encountered. Hence, after the failure of soil gas sample collection, other contaminant media must be used to evaluate vapor intrusion. In this instance, at a minimum, both groundwater and soil matrix sampling would be warranted. Other lines of evidence would be collected as needed. The risk associated with both media (groundwater and soil matrix) would be quantified and compared to evaluate contaminant equilibrium. If the risk from both media diverge significantly, a reasonable risk management decision should be made based on the weight of evidence.

Where subsurface contaminant data indicate a potential human health risk, repetitive soil gas sampling from permanent points may be warranted to document subsurface conditions. As soil gas grab samples approach risk-based concentrations, the installation of permanent monitoring points should be considered. Quantification of the contaminant source is critical for risk-based decision making. Prudence may dictate that soil gas be monitored through time, in a fashion similar to groundwater, to ascertain representative subsurface concentrations and to document contaminant plume stability. Such conditions warranting the installation of permanent soil gas monitoring points may include the following:

1) Groundwater is less than five feet below grade and repetitive soil gas sampling is needed to obtain representative subsurface samples.

2) Vadose zone is subject to deep barometric pressure effects (sandy conditions with deep groundwater).

3) Quantification of human health exposure indicates marginal risk (approximately 1x10-6) and further refinement of the contaminant source is needed to further refine the risk estimations.

4) Evaluate whether contamination has reached steady-state conditions in the subsurface.

5) Soil gas grab samples yield an irregular distribution of subsurface contamination.

6) Soil gas plumes have migrated offsite under residential neighborhoods.

7) Soil matrix sampling indicates a large mass of volatile organic compounds in the subsurface.

8) Evaluate the effectiveness of soil vapor extraction (SVE) systems on remediating soil gas plumes.

9) Verify the effectiveness of passive or active subslab venting systems on removing contamination under building foundations.

10) Determine whether biodegradation of petroleum vapors is occurring in the subsurface (see response no. 244).

11) Groundwater is subject to frequent elevation change due to tidal fluctuation or localized pumping for irrigation or municipal use.

Under unique circumstances, however, sites can be screened with contaminant data other than soil gas. Some of these situations are as follows:

1) Screening with groundwater contaminant data can be done in areas distal to the contaminant sources. These sources would include primary and secondary contaminant sources. Primary sources are tanks, pits, sumps, and impoundments (etc.) where hazardous substances were released to the environment. Secondary sources are subsurface accumulations of non-aqueous phase liquid (NAPL). 'Distal" areas would be far removed from the contaminant sources, in areas with no evidence of additional vadose zone contamination. DTSC envisions screening with groundwater data when buildings have the unfortunate circumstance of being over the leading edge of a large offsite groundwater plume. Additionally, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence.

2) The occurrence of shallow groundwater can make the collection of soil gas samples impossible. Where groundwater is less than five feet below grade, and there is a large capillary fringe associated with the water table, no-flow conditions upon soil gas sampling may be encountered. Hence, after the failure of soil gas sample collection, other contaminant media must be used to evaluate vapor intrusion. In this instance, both groundwater and soil matrix sampling would be warranted. The risk associated with both media would be quantified and compared to evaluate contaminant equilibrium. If the risk from both media diverge significantly, a reasonable risk management decision should be made based on the weight of evidence. Additionally, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence.

3) The evaluation of vapor intrusion with only soil matrix data would occur when groundwater is not contaminated, as verified through sampling, and soil gas collection failed in the field after numerous attempts due to no-flow conditions. Under this scenario, soil matrix data could be used, but only when subject to the highest data quality objectives under USEPA Method 5035. However, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence.

It should be noted that the USEPA vapor intrusion guidance document does not have soil matrix screening numbers, reflecting USEPA's uneasiness with screening site exclusively with soil matrix samples. USEPA specifically addresses soil matrix samples on page 29 of their 2002 document, stating that "soil (as opposed to soil gas) sampling and analysis is not currently recommended for assessing whether or not the vapor intrusion pathway is complete".

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Response Tracking Number: 173

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

• The Guidance recommendation to always test at both 5 feet and 15 feet is exceedingly conservative and prohibitively burdensome for many brownfield redevelopment projects.

• Shallow sampling (i.e. 5 feet) is the most accurate and should always be done, with deeper samples collected on a less frequent basis.

RECOMMENDATION: Guidance should recommend that deeper 15-20 feet samples be taken at some reasonable subset of sampling locations, or when indicated by results of shallow sampling.

DTSC Response to Comment:

See response no. 172.

Response Tracking Number: 174

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Site Characterization

Guidance Document Page: 04

Public Comment:

• The Guidance does not currently give any consideration to either remedial action plans or to product type when determining type and amount of characterization.

• In situations where the remediation plan is very aggressive (e.g. source removal) or the product type incorporates mitigation measures (e.g. podium construction), a less aggressive characterization regime than what is currently recommended in the Guidance may be adequate for protection of human health.

• The Guidance does not allow for involved parties (including the regulator) to decide on their own when they are comfortable with the amount of characterization.

RECOMMENDATION: Guidance should include language reminding regulators that they have discretion to settle on a level of characterization appropriate for the mitigation and/or reuse plan.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document. It should be noted that the intent of subsurface sampling is to quantify the contaminant source to evaluate potential human exposure. When sampling for vapor intrusion, the contaminant source for each building, whether existing or future, must be determined. However, the magnitude of any sampling effort should be dictated by site-specific conditions. Likewise, DTSC agrees, when appropriate, site characterization activities can be minimized and its resources allotted to mitigation to alleviate human exposure. The intent of the guidance document is not to exclude alternative approaches for evaluating exposure or to provide prescriptive or inflexible requirements. The text of the revised guidance document will state that site-specific conditions should dictate sampling densities, and references to specific sampling densities will be removed.

Response Tracking Number: 175

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Indoor Air Assessment

Guidance Document Page: 22

Public Comment:

• The Guidance does not currently make clear whether or not indoor air sampling is recommended for redevelopment projects.

• Indoor air sampling may not be an appropriate indicator for the health of future building occupants in cases where the existing structure is to be either dramatically altered or demolished as part of a redevelopment plan.

RECOMMENDATION: Guidance should state that indoor air sampling is not necessary if the structure in question is to be demolished as part of a redevelopment plan. In cases involving dramatic alteration of existing buildings, the Guidance should give discretion to the regulator to determine how much indoor air sampling is appropriate.

DTSC Response to Comment:

Human exposure to chemicals must be prevented in future buildings constructed on contamination. There are many options available to verify that vapor intrusion is not occurring in these buildings, such as the monitoring of permanent soil gas probes, crawl spaces or indoor air. The guidance document will be revised to state that regulators have discretion in determining the style of post-construction sampling of future buildings. Also, the issue of testing of unoccupied buildings that are slated for demolition, as a mechanism to evaluate future buildings on the site, will be removed from the guidance document due to uncertainty in the interpretation of the data. However, the guidance document will recommend the use of multiple line of evidence, as appropriate, to evaluate the future building scenario.

Response Tracking Number: 176

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

• On page 34 of the Guidance, DTSC recognizes that indoor air sampling should only focus on the chemicals found in the soil gas or groundwater.

• As it is currently written, this may include chemicals that passed the preliminary screening evaluation.

• Chemicals that passed the preliminary screening evaluation should not be considered a threat to human health through intrusion to indoor air.

RECOMMENDATION: Guidance should limit indoor air sampling to only those chemicals found in either the groundwater or the soil at levels exceeding screening level concentrations.

DTSC Response to Comment:

Indoor air testing is conducted because one or more subsurface soil gas contaminant exceeded its screening level. If one chemical fails the screening, DTSC recommends that all the subsurface contaminants are carried through the risk assessment process. The screening evaluation is viewed as a "pass / fail" type of assessment. Hence, if indoor air testing is warranted, the indoor air should be tested for all of the constituents found in soil gas. DTSC makes this recommendation due to the uncertainty associated with fate and transport modeling (Hers et al, 2003). Also, by analyzing indoor air for all of the soil gas contaminants, cumulative health effects can be determined. Plus, analysis of indoor air for all the soil gas constituents allows for the correlation of the constituents as a mechanism to understand the magnitude of vapor intrusion. The attenuation factor of each constituent should be approximately equal. If individual attenuation factors differ significantly, then secondary contaminant sources may exist in the building. Hence, constituents should not be excluded from indoor air testing due to uncertainty in fate and transport modeling, the need to evaluate cumulative health effects and the need to understand potential secondary indoor contaminant sources.

References

Hers, I., R. Reidar-Zapf, P. C. Johnson, and L. Li. 2003. Evaluation of the Johnson and Ettinger Model for Prediction of Indoor Air Quality. Ground Water Monitoring and Remediation, v. 23, n. 2, p. 119 - 133.

Response Tracking Number: 177

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Statistics

Guidance Document Page: 14

Public Comment:

• The use of maximum concentration in calculating exposure risk may lead to errors and an unrealistically conservative estimation of risk.

• The use of 95% UCL or other well-established averaging techniques would provide against the effect of random outliers while remaining protective of human health.

• Defaulting to maximum also doesn’t take into account parcelization and the phased nature of redevelopment projects.

RECOMMENDATION: Guidance should explicitly allow for the use of 95% UCL or other proven averaging techniques when there are sufficient data to characterize site conditions to determine the reasonable maximum exposure (RME) concentration with which to calculate exposure risk. Guidance should also explicitly allow for the area-specific determination of maximum concentration to reflect the phased, parcel-based nature of many redevelopment projects.

DTSC Response to Comment:

For the preliminary screening of a site for vapor intrusion, maximum contaminant concentrations should be used along with the California Human Health Screening Levels (CHHSLs). If the "hottest" portion of the contaminant plume passes a preliminary screen, then it follows that the entire plume should not pose a risk. The intent of preliminary screening is to provide an inexpensive and simple approach for evaluating risk. Other types of screening are not considered preliminary. DTSC is receptive to parcelization and statistical approximation during vapor intrusion evaluations, but use of statistical approximations is not considered to be preliminary screening and therefore should not be used at that phase. Under most circumstances, vapor intrusion associated with parcelization could be evaluated under preliminary screening.

Additional text will be added to the guidance document to further address statistical approaches. During site-specific screening, statistical approximation of the contaminant source may be appropriate. DTSC is receptive to the use of statistics but only when a statistically robust dataset are available, which usually implies the collection of at least ten samples (USEPA, 1992). For small buildings, the collection of ten subsurface samples may be cost prohibitive. Hence, DTSC envisions the use of statistics at only sites with large existing or future buildings. Rarely are the soil gas sampling locations sufficiently dense where a 95%UCL can be calculated for the contaminant source for a residential building. The collection of ten soil gas samples for one building, even a large commercial building, both spatially and temporally, is onerous and rarely done.

References

USEPA. 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Solid Waste and Emergency Response, Washington, D. C., Publication 9285.7-081, May 1992.

Response Tracking Number: 178

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

• On page 34 of the Guidance, DTSC states that ambient air in California contains numerous VOCs which should be found in both outdoor and indoor air, regardless of the occurrence of vapor intrusion.

• The guidance does not adequately allow for the inclusion of site-specific background data into the risk evaluation.

• Established methodology exists for the quantification of site-specific background (ambient) chemical concentrations.

Recommendation: Page 34 of the Guidance should be amended to state that if the level of a chemical of concern in indoor air samples is equal to or less than that found in site-specific ambient background, then the chemical of concern does not need to be mitigated for. The guidance should also state that a chemical of concern found in indoor air samples at concentrations greater than in site-specific ambient background need only be mitigated for until it reaches site-specific ambient background.

DTSC Response to Comment:

The text associated with collection and interpretation of background samples will be enhanced in the revised vapor intrusion guidance document. If subsurface sampling indicates an unacceptable human health risk, then indoor air should be tested at least twice to evaluate the seasonality of the exposure pathway. After the collection of the indoor air samples, chemical exposure is then quantified for the building. The site-specific ambient air data help guide the risk management decisions for the building to determine if corrective action is warranted. Regardless of the risk management decision concerning the results of the indoor air sampling, indoor air should always be tested for the chemicals in the subsurface. DTSC does not anticipate a situation where vapor intrusion mitigation would be warranted to reduce the indoor air concentration below the ambient levels. However, if one chemical in the indoor air analytical suite, upon two sampling events, appears to be elevated above background at unacceptable concentrations, and the occurrence of the chemical is attributed to vapor intrusion, then mitigation would be warranted.

Response Tracking Number: 179

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

• On page 41 the Guidance states that petroleum hydrocarbons are not subject to biodegradation at some sites in California, and therefore biodegradation cannot be considered when evaluating petroleum hydrocarbons for possible vapor intrusion.

• New Jersey assumes a reasonably conservative additional attenuation factor of 10 for most hydrocarbons sampled in soil gas deeper than 5 feet:

Until additional data is generated, the Department has selected an additional attenuation factor for benzene, toluene, ethylbenzene, and xylenes of 10 times the ground water to indoor air value calculated using the J&E model. Use of the additional attenuation factor assumes a minimum of 4% oxygen exists in the soil column beneath the structure. (Draft Vapor Intrusion Guidance, NJDEP, 2005, p. 130)

RECOMMENDATION: The guidance should explicitly allow for the assumption of an additional attenuation factor of 10 for petroleum hydrocarbons when based on a soil gas sample of at least 5 feet in depth.

DTSC Response to Comment:

DTSC will adopt an attenuation factor for petroleum hydrocarbons when peer-reviewed scientific publications, both theoretical and empirical, clearly describe the conditions for the occurrence and non-occurrence of biodegradation in the vadose zone, or when USEPA adopts a policy concerning the biodegradation of petroleum.

Specifically, concerning petroleum biodegradation, DTSC offers the following comments:

1) New Jersey added an additional attenuation factor of 10 for some hydrocarbons for vapor intrusion evaluations at petroleum sites. This additional factor of 10 is only used in New Jersey for benzene, toluene, ethylbenzene, and xylenes (BTEX). The use of the attenuation factor of 10 is limited to contaminant sources in groundwater and when the vadose zone oxygen content is greater than four percent. New Jersey specifically excluded other petroleum hydrocarbons, such as n-hexane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, cyclohexane, 2,2,4-trimethylpentane, methyl tertiary butyl ether, and tertiary butyl alcohol, from this factor of 10. Only the New Jersey groundwater screening levels (GWSLs) for BTEX have this additional attenuation factor. It is important to note that New Jersey did not integrate biodegradation for BTEX into their soil gas screening levels (SGSLs). Apparently, the uncertainty associated with biodegradation was too high for New Jersey to integrate any biodegradation in their SGSLs.

2) Of the 30 states that have vapor intrusion guidance documents (Plantz, 2005), only two states have integrated biodegradation in their guidance; New Jersey, and Nebraska. Hence, the preponderance of states and the USEPA

have concern with integrating biodegradation into their vapor intrusion evaluations.

3) Biodegradation of vapor-phase petroleum hydrocarbon in the subsurface does not always occur. Roggemans et al. (2001) indicated that 6 of 28 soil gas profiles yielded no indication of petroleum biodegradation. Likewise, Davis (2005) noted that 7 percent of the benzene profiles and 27 percent of the total petroleum hydrocarbon (TPH) profiles exhibited little or no subsurface attenuation. Hence, petroleum hydrocarbon can pose a vapor intrusion risk in certain circumstances.

4) The United States Environmental Protection Agency (USEPA) has not adopted a policy concerning an attenuation adjustment factor for vapor-phase petroleum biodegradation. Vescio (2005) indicated that there is a lack of consensus on this issue among stakeholders and resolution concerning the adoption of an attenuation adjustment factor would not be forthcoming.

5) Pursuant to Johnson et al. (1999), the biodegradation of petroleum usually occurs over a discrete zone within the subsurface. This discrete zone of biodegradation is called the dominant layer. The ability of the dominant layer to biodegrade petroleum vapors is a function of the oxygen and moisture content within the layer. During brownfield reconstruction, the dominant layer should not be disturbed by construction activities because disruption of the dominant layer will lessen the biodegradation potential of the subsurface. Hence, the dominant layer should not be fully or partially removed during construction. Likewise, the subsurface oxygen and moisture content of the subsurface should not be diminished to critical levels after the completion of construction. The soil moisture content of the dominant layer must remain above the wilting point; otherwise the potential for biodegradation will be reduced (Zwick et al., 1995; Holden et al., 1997). Also, the building's footprint must not limit the diffusional capacity of oxygen to migrate to the dominant layer. Abreu and Johnson (2006) have demonstrated with three-dimensional numerical modeling that a separation distance between a contaminant source and building's foundation must be at least 26 feet in order to get sufficient diffusional oxygen under a building. Accordingly, for brownfield redevelopment, the dominant layer must be sufficiently deep under a building so that oxygen is available to promote biodegradation.

In conclusion, based on the above rationale, the guidance document will not be revised as suggested by this comment.

References

Abreu, L. D. V., and P. C. Johnson. 2006. Simulating the Effect of Aerobic Biodegradation on Soil Vapor Intrusion into Buildings: Influence of Degradation Rate, Source Concentration, and Depth. Environmental Science and Technology, v. 40, n. 7, p. 2304 - 2315.

Davis. R. 2005. Making Sense of Subsurface Vapor Attenuation in Petroleum Hydrocarbon Sources. New England Interstate Pollution Control Commission LUSTLine Bulletin No. 49. March 2005. Pages 10 - 14.

Holden, P. A., L. J. Halverson, and M. K. Firestone. 1997. Water Stress Effects on Toluene Biodegradation by Pseudomonas Putida. Biodegradation, no. 8, p. 143 - 151.

New Jersey Department of Environmental Quality. 2005. Vapor Intrusion Guidance. October 2005. [www.state.nj.us/dep/srp/guidance/vaporintrusion/vig.htm]

Plantz, G. M. 2005. Opening Remarks. Severn Trent Vapor Intrusion Seminar; Edison, New Jersey. August 10, 2005.
[www.stl-inc.com/analyticalservices/specialty%20services/Vapor/VaporIntrusion.htm]

Roggemans, S., C. L. Bruce, P. C. Johnson, and R. L. Johnson. 2001. Vadose Zone Natural Attenuation of Hydrocarbon Vapors: An Empirical Assessment of Soil Gas Vertical Profile Data. American Petroleum Institute Technical Bulletin No. 15. December 2001.

Vescio, J. 2005. Update on EPA's Petroleum Vapor Intrusion Work Group Activities. Petroleum Vapor Intrusion Workshop; National Ground Water Association; Petroleum Hydrocarbon and Organic Chemicals in Ground Water, Prevention, Assessment, and Remediation Conference. Costa Mesa, August 17, 2005.

Zwick, T. C., A. Leeson, R. E. Hinchee, L. Hoeppel, and L. Bowling. 1995. Soil Moisture Effects During Bioventing in Fuel-Contaminated Arid Soils. Third International In-Situ and On-Site Bioreclamation Symposium. In-Situ Aeration, v. 3, Batelle Press, San Diego, CA.

Response Tracking Number: 180

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

• On page 16 the Guidance states that the SB 32 soil gas screening numbers (CHHSLs) may be used to evaluate the vapor intrusion pathway for sites contaminated with VOCs.

• There currently exist published CHHSLs for evaluation of soil and soil gas. There are no currently published CHHSLs for groundwater evaluation.

• The guidance does not give regulators the explicit discretion to consider the use of alternative published screening numbers in a preliminary screening evaluation and subsequent mitigation efforts.

RECOMMENDATION: Guidance should explicitly allow for the use of regionally-specific screening numbers as an alternative to CHHSLs for the purpose of a preliminary screening evaluation and subsequent mitigation efforts. The guidance should highlight the San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels ("ESLs") as one such alternative.

DTSC Response to Comment:

The attenuation factors for soil gas within the DTSC vapor intrusion guidance document were taken from the Senate Bill 32 work conducted by the Office of Environmental Health Hazard Assessment (OEHHA). While other attenuation factors are available for screening purposes, DTSC felt it was appropriate to utilize attenuation factors generated by a California state agency under a legislative mandate rather than using attenuation factors from the scientific literature or from some other source. Other screening levels can be used for preliminary screening purposes, including screening with groundwater contaminant data, if the levels are reasonable and scientifically based. While the San Francisco Regional Water Quality Control Board (SFRWQCB) does address vapor intrusion in their Environmental Screening Levels (ESLs), the ESLs are intended only as an evaluation tool for sites overseen by the SFRWQCB and their use elsewhere is subject to the discretion of the specific agency with environmental oversight. Also, the ESLs were derived to address the specific subsurface conditions in the San Francisco area and the use of ESLs in other parts of California may not be appropriate. If a CHHSL value does not exist for a given chemical, the risk-based level can be developed for the chemical using the attenuation factors from OEHHA (2005).

References

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 181

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

• The mitigation section of the Guidance does not include a remedy that incorporates building design.

• Podium construction is a well-established method for preventing the completion of the intrusion-to-indoor-air pathway in new development projects.

RECOMMENDATION: Guidance should include a mitigation scenario (i.e. “remedy”) based on building design (e.g. podium construction)

DTSC Response to Comment:

The guidance document is intended to provide a general approach for mitigation measures for buildings. The guidance document cannot take into account the many types of designs that would be encountered in the field. Site-specific conditions are extremely difficult to include in the guidance document because of the many variations of building design. The only building design which may mitigate vapor intrusion exposure is podium construction, but this style of construction is not considered a presumptive remedy. DTSC would evaluate the adequacy of podium design on a case-by-case basis with respect to vapor intrusion. The revision of the guidance document will mention podium construction as a design option which may mitigate exposure but the document will also state that it is not presumptive remedy.

Response Tracking Number: 182

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

• The two mitigation remedies based on future building construction currently in the Guidance both require the installation of a membrane system and a VOC collection system.

• In future building construction scenarios where the calculated risk to human health posed by VOCs is at the margin of acceptability, the installation of a gas barrier/membrane system without a VOC collection system may be adequate for the protection of human health.

• The installation, operation and maintenance of a passive or active venting system may be resource-prohibitive for many brownfield redevelopment projects operating at the margins of economic feasibility.

RECOMMENDATION: Guidance should include a mitigation remedy for future building construction scenarios where the calculated risk to human health posed by VOCs is at the margin of acceptability that recommends the installation of a gas barrier/membrane system without a VOC collection system.

DTSC Response to Comment:

Geotechnical calculations done by DTSC’s Engineering Services Unit indicate that even a small number of holes will dramatically reduce the effectiveness of a vapor barrier, necessitating the installation of either a passive or active venting system on all membrane systems. Also, Stark and Choi (2005) indicate that small holes in a membrane reduces its integrity. Vapor barriers will potentially develop holes or other breaches during installation or during the life of the barrier. Ground settlement is an example of a natural process that could cause such a breach. Even with only a small number of pin-size holes, the contaminant flow over the barrier would increase by many orders of magnitude. With these small holes, the effectiveness of the barrier becomes non-existent. DTSC calculations were based on a study of landfill leachate liners with 5 holes per hectare, and each hole with an area of only 3x10-6 square meters. Hence, it will continue to be DTSC's recommendation to include either passive or active venting with vapor barrier installation.

References

Stark, T. D., and H. Choi. 2005. Methane Gas Migration Through Geomembranes. Geosynthetics International, v. 12., n. 2, p. 120 -125.

Response Tracking Number: 183

Commenter Organization: Center for Creative Land Recycling Workshop

Technical Subject: Public Outreach

Guidance Document Page: 44

Public Comment:

• In 2001 DTSC published a Public Participation Policy and Procedures Manual that clearly outlines a rigorous public notification, outreach and education process applicable to all actions overseen by the department.

• The guidance does not clearly state what types of projects (existing occupied structures vs. future building) the public outreach component applies to. Outreach to building occupants should not be necessary if the building in question is to be demolished or completely vacated as part of a redevelopment plan.

RECOMMENDATION: Remove the public outreach component of the Guidance and defer to their Public Participation Manual (DTSC, 2001) for guidance.

DTSC Response to Comment:

The Public Outreach section in the vapor intrusion guidance document was meant to supplement DTSC's Public Participation Policy and Procedures Manual. Since the release of the vapor intrusion guidance document, DTSC has additional public outreach experience related to vapor intrusion. The Public Outreach section in the vapor intrusion guidance document will be rewritten to focus on the interaction with the public during soil gas and indoor air testing as related to existing buildings rather than on how to conduct a successful public meeting. Public meetings and workshops, fact sheets, and community advisory groups are adequately addressed in DTSC's Public Participation Policy and Procedures Manual. The revised vapor intrusion guidance document will instruct practitioners on the process of public outreach during data collection, both soil gas and indoor air testing, for existing buildings rather than for future buildings. Prior to indoor air testing, and even before soil gas sampling in residential streets, the public should be notified of the potential of vapor intrusion through the workshop process. Residences should be contacted by mail of the upcoming workshop. The workshop notification should also include a fact sheet describing the corrective action project. During the workshop, the issues of vapor intrusion should be presented and discussed by those potentially affected. Ideally, the first communication with a resident concerning vapor intrusion should not be knock on their door with a request to sample indoor air or to test their property for contaminated soil gas.

A brief description of the process to schedule indoor air testing is as follows:

1) Initial Individual Contact. Typically, the lead regulatory agency makes initial contact with the building occupants. This is done in person at the building in question. The resident should already be familiar with the intent of the

sampling due to the fact sheet and associated workshop. The agency's desire to test the indoor air of the building is communicated to the occupants. A pre-sampling meeting is scheduled and the fact sheet is given to the occupants again, even though it might have been mailed earlier.

2) Pre-Sampling Meeting. The sampling team arrives at the scheduled time and communicates the intent of the indoor air sampling with the building occupants. Locations of the samples, soil gas and indoor air, are discussed and mutually agreed upon with the building occupants. A list of instructions are provided to the building occupants concerning the indoor air sampling, the Building Survey Form is completed with assistance from the building occupants, and the testing is scheduled with the occupants, usually for the following week.

3) Soil Gas and Indoor Air Testing. The sampling team arrives at the scheduled time and deploys the Summa canisters. The air is screened for potential indoor contaminant sources, such as glues, paints, and cleaners, with a portable field instrument. The data associated with the Summa canisters are recorded (start time, initial pressure, canister number, etc.) and photographs are taken, as needed, to document the sampling activities. Also, soil gas samples are collected on the property if needed.

4) Communication of Results. The results of the indoor air sampling are mailed to the building occupants as soon as possible. The lead regulatory agency should contact the occupants in person or by telephone to verify receipt of the testing results. If possible, another fact sheet should be generated and mailed to the occupants along with the indoor air results.

Response Tracking Number: 184

Commenter Organization: DuPont

Technical Subject: Scope

Guidance Document Page: 02

Public Comment:

The overall approach that uses a step-wise process that includes tiers for generic as well as site-specific evaluations. Further, DuPont specifically encourages the position that the guidance is flexible in its application and can be used in a manner that does not prescribe following the steps single-mindedly, but rather using the steps as a guide as appropriate and skipping those that do not apply in a given situation.

DTSC Response to Comment:

See response no. 195.

Response Tracking Number: 185

Commenter Organization: DuPont

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

The recognition that the evaluation of vapor intrusion is an evolving field that is subject to improved scientific knowledge and that the guidance will be adjusted as new information becomes available. This is particularly important since the Guidance relies to some extent on the USEPA 2002 vapor intrusion document, which is undergoing major revisions.

DTSC Response to Comment:

DTSC is committed to updating the guidance document as new refinements and advances are made in the science of vapor intrusion. However, the revision of DTSC's guidance document is not contingent upon USEPA's revision and DTSC does not anticipate significant changes from USEPA concerning the conceptual approach to vapor intrusion evaluations.

Response Tracking Number: 186

Commenter Organization: DuPont

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

The explicit position statement that the document is only guidance and not a regulation. Hence, alternate scientifically sound and defensible methodology will be accepted. This latter is critical for the successful implementation, since as repeatedly noted the science and field knowledge about vapor intrusion continues to improve.

DTSC Response to Comment:

DTSC is cognizant that our document is guidance and not regulation, and other technically sound approaches to evaluating vapor intrusion may be available. DTSC will continue to provide this qualification in the guidance document.

Response Tracking Number: 187

Commenter Organization: DuPont

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

The clear recognition about the issues associated with indoor air sampling, particularly that concerns with background levels of chemicals of potential concern negate the potential benefit of taking direct indoor air measurements as a primary mechanism of evaluating vapor intrusion. DuPont supports the statement that indoor air samples, if collected, should only be analyzed for chemicals detected in the sub-slab soil gas. Further, we encourage the DTSC to use background as a "floor" for determining the need for additional evaluation, where risk-based targets are less than background. The CA EPA Air Toxics Board has a wide network of monitoring locations that have been active for many years and can be used to provide statistically derived values (e.g., mean, median or some upper percentile value) for a basis. While these ambient readings are not necessarily indicative of indoor air background, they can be used in conjunction with literature-based indoor air background values to make decisions about the need for additional risk-based evaluations. At a minimum, these data should be invoked on a site-specific basis before proceeding to full-blown risk assessments.

DTSC Response to Comment:

See response no. 57 and 319.

Additionally, DTSC recommends subsurface plume delineation before the collection of any indoor air samples; hence, not relying on indoor air testing as the primary mechanism for evaluating vapor intrusion. However, it should be noted that the collection of ambient air data is not a mechanism to remove chemicals of potential concern (COPCs) from the indoor air pathway analysis. All COPCs in soil gas should be evaluated for vapor intrusion. If the soil gas sampling indicates an unacceptable human health risk, then indoor air should be tested at least twice to evaluate the seasonality of the exposure pathway. After the collection of the indoor air samples, chemical exposure is then quantified for the building. The ambient air data help guide the risk management decisions for the building to determine if corrective action is warranted. Hence, COPCs in soil gas should always be evaluated in an indoor air assessment.

Response Tracking Number: 188

Commenter Organization: DuPont

Technical Subject: Site Characterization

Guidance Document Page: 09

Public Comment:

DuPont supports the position of a focus on soil gas measurements as a reasonable approach. However, we would encourage DTSC to accept both groundwater and soil matrix data not only as supplementary to soil vapor measurements but as a useful in screening out sites from further evaluation. Using a similar modeling approach proposed in this draft, other regulatory agencies (e.g., PA, MI, CT, MA) have found the use of groundwater (and soil matrix) data useful as a screening tool.

DTSC Response to Comment:

See response no. 21 and 289.

Response Tracking Number: 189

Commenter Organization: DuPont

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

The clear definition and emphasis that the screening levels are not cleanup levels. From the document:

The screening numbers required by SB 32 are not intended as mandatory cleanup standards for use by regulatory agencies that have authority to require remediation of contaminated soil. SB 32 states:

A screening number is solely an advisory number, and has no regulatory effect, and is published solely as a reference value that may be used by citizen groups, community organizations, property owners, developers, and local government officials to estimate the degree of effort that may be necessary to remediate a contaminated property. A screening number may not be construed as, and may not serve as, a level that can be used to require an agency to determine that no further action is required or a substitute for the cleanup level that is required to be achieved for a contaminant on a contaminated property. The public agency with jurisdiction over the remediation of a contaminated site shall establish the cleanup level for a contaminant pursuant to the requirements and the procedures of the applicable laws and regulations that govern the remediation of that contaminated property and the cleanup level may be higher or lower than a published screening number.

This is a critical point to make to staff as failing a screening level can often be misinterpreted as requiring mitigation.

DTSC Response to Comment:

The language from SB 32, as mentioned in the comment, is currently within the guidance document (page 16) and this language will remain in any revision of the guidance document due to its importance. While the SB 32 numbers are not intended as mandatory cleanup standards, they are risk-based and have utility in vapor intrusion evaluations.

Response Tracking Number: 190

Commenter Organization: DuPont

Technical Subject: OSHA

Guidance Document Page: 17

Public Comment:

Provide for the use of the Occupational Safety and Health Administration (OSHA) as the lead agency in addressing occupational workplace exposures. This is consistent with the USEPA 2002 Guidance, on which the DTSC has relied for many other technical positions. DuPont maintains that for workplaces regulated under the Occupational Safety and Health (OSH) Act, acceptable workplace exposure levels, as set by OSHA should be used as indoor air target concentrations. In establishing OSHA, Congress provided for it to be the lead agency to regulate occupational settings. This position has been upheld repeatedly including by the U.S. Environmental Protection Agency (USEPA) in its 1990 Memorandum of Understanding with OSHA, in which each party agreed that USEPA would refer worker health and safety issues to OSHA and in USEPA's 2002 Draft Guidance on Vapor Intrusion and follow up Fact Sheet (June 2003) as acknowledged by DTSC for Environmental Indicator Determination as well as operating facilities. However, the 2002 Guidance goes beyond the operating facilities per the DTSC definition. DuPont supports USEPA's position as outlined in the 2002 guidance. From the Guidance:

1) Occupational settings where persons are in a working situation. There may be occupational settings where persons present are employees and hazardous constituents may be intruding into the air space from the vapor intrusion pathway. Such settings could include workplaces where workers are handling hazardous chemicals (e.g., manufacturing facilities) similar to or different from those in the subsurface contamination, as well as other workplaces, such as administrative and other office buildings where chemicals are not routinely handled in daily activities. OSHA and EPA have agreed that OSHA generally will take the lead role in addressing occupational exposures. Workers will generally understand the workplace (e.g., Occupational Safety and Health Administration, OSHA) regulations (and monitoring, as needed) that already apply and provide for their protection. For example, workplaces are subject to a written Hazard Communication and Monitoring Plan.

In general, therefore, EPA does not expect this guidance be used for settings that are primarily occupational. However, employees and their employers may not be aware of subsurface contaminants that may be contributing to the indoor air environment of their workplaces, particularly since vapor intrusion may include constituents that are no longer or were never used in a particular workplace, may originate from elsewhere, or be modified by bio-degradation or other subsurface transformation processes. Therefore, we recommend that regional or State authorities notify the facility of the potential for this exposure pathway to cause a hazard or be recognized as a hazard and suggest that they consider any potential risk that may result. Any change in the future use of the building/facility might suggest a need to reevaluate the indoor air pathway.

2) Non-residential settings where persons are in a non-working situation. Non-residential buildings may need to be evaluated where people (typically non-workers – see above) may be exposed to hazardous constituents entering into the air space from the subsurface. This would include for example buildings where the general public may be present, e.g., schools, libraries, hospitals, hotels, and stores. EPA recommends the appropriate environmental (public health protection) screening levels be applied to these situations.

DTSC Response to Comment:

The Occupational Safety and Health Act (OHSA) Permissible Exposure Limits (PELs) are not an appropriate standard for evaluating the risk associated with vapor intrusion to indoor air in California. The PELs for some of the common contaminants of concern are seriously outdated and not protective.

The OSHA regulates air quality of the workplace through permissible exposure limits (PELs). The Act's current PELs regulate air contaminants that are generated in the workplace (29 C.F.R. §1910.1000). OSHA intended the PELs to regulate an employee's exposure to workplace air contaminants and not environmental air contaminants.

When Congress enacted OSHA, it gave States the option to preempt federal OSHA standards pursuant to an approved state plan (29 U.S.C. §667(b)). However, it did not state that workers covered under the Act may not be subject to any supplemental state requirements. Courts have held that State laws whose primary purpose addressed a concern other than occupational health and safety were not preempted by OSHA (Manufacturers Ass'n of Tri-County v. Knepper (1986) 801 F.2d 130, 138). In fact, the Secretary of Labor endorsed the view that an OSHA standard "should not preempt State laws addressing 'general environmental problems originating in the work place, but whose effects are outside it. . .'" (New Jersey State Chamber of Commerce v. Hughey (1985) 774 F.2d 587, 593). There is a presumption that the historic police powers of the State to regulate matters of health and safety are not to be superseded by federal regulation unless there is a clear and manifest purpose of Congress.

U.S. EPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater to Soils specifically states that the guidance is not intended to supersede State guidance (p. 4.) The draft guidance specifically recognizes that EPA's Superfund cleanup program, analogous to California's cleanup programs, generally uses an up-to-date risk-based analysis to determine the need for action and to set cleanup targets for both residential and workplaces exposure (p.3, ftn.1). The draft was never finalized and is currently undergoing what are expected to be significant revisions. DTSC expects the revised document to utilize more conservative attenuation factors and to place more reliance on professional judgment in determining when to proceed with indoor sampling.

Since U.S. EPA issued the draft guidance, EPA has asked OSHA to research the issue of whether EPA has the authority to address workplace vapor intrusion. OSHA responded that under Section 5(a)(1) of the OSHA, known as the General Duty Clause, its authority only extended to contaminants originating in the workplace (Inside EPA, 9/30/04). The clause covers areas of occupational safety and health that are not addressed by a specific standard and requires that each employer "shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm." OSHA concluded that it lacks statutory authority to prevent EPA from addressing the contamination when it does not originate from inside the facility. Vapor intrusion results when contaminants seep into the air from contaminated land and groundwater under buildings.

Response Tracking Number: 191

Commenter Organization: DuPont

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

Relinquish the prescriptive nature of some of the site characterization steps, for example,

• Specifying depths (5 feet and 15 or 20 feet) for minimum vertical sample locations. Depths and sample locations are best addressed on a site-specific basis

• Requiring delineation to non-detect for soil vapor. This is an excessive requirement particularly since other media (i.e., soil and groundwater) can be used to define the area of contamination, and soil vapor attenuation factors and screening levels are provided to conduct preliminary screening.

• Prescribing the number of soil vapor samples for future construction scenarios, specifically requiring in effect one sample per proposed single-family housing unit that will likely be one sample per quarter acre. This is excessive and best left to be determined on a site-specific basis.

• Requiring an evaluation for vapor intrusion even if chemical concentrations in soil gas are non-detectable, "for chemicals known to exist in the subsurface, whether through direct measurement or historical records review" (page 7). This may not be applicable to all sites and should be determined on a site-specific basis.

DTSC Response to Comment:

Responses are provided for each issue raised in the comment, as follows:

1) For sampling depths, see response no. 216.

2) The document will be changed to recommend delineation to the CHHSLs as derived by OEHHA (2005), see response no. 204.

3) Due to the potential for human exposure, every future building should have an associated subsurface sample.

4) Daughter products of PCE and TCE routinely have "non-detectable" concentrations due to elevated concentrations for PCE and TCE. The intent of the text in the guidance document is to remind practitioners of this occurrence. Vinyl chloride needs to be evaluated for vapor intrusion, especially when its observed in groundwater but is masked in soil gas by high detection limits (see response no. 29). The document will be changed to further clarify this situation.

References

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 192

Commenter Organization: DuPont

Technical Subject: Preliminary Screening

Guidance Document Page: 13

Public Comment:

While the default attenuation factors (AFs) provided in Table 2 are a useful starting point, a review of the available data suggest that greater attenuation is possible, and hence lower attenuation factors may be appropriate even on a default basis for existing structures. For example,

• In a series of symposiums (Subsurface Vapor Intrusion to Indoor Air, San Jose and Long Beach 2003 sponsored by Groundwater Resources Association in conjunction with USEPA, CA DTSC and WQCB), Dr. Paul Johnson (co-author of the 2002 USEPA Vapor Intrusion Guidance) and Dr. Ron Moseley (USEPA) indicated that attenuation factors are likely in the range 0.01 to 0.0001, with a value of 0.001 being a reasonable for screening purposes for soil gas. These observations were based on results from site-specific observations at a national level and formed the basis of a recommendation of an AF of 0.0001 by the San Francisco Water Quality Control Board (Feb 23, 2004) for shallow soil gas to indoor air from fine grain soils. This document also recommended an AF of 0.001 for residential properties and 0.0005 for commercial properties based modeling results for highly permeable, near surface soils and are in the range of AFs observed in conservative radon studies.

• Sub-slab to indoor air AFs are reasonably well represented by the Endicott, NY data, where observed AFs were in the range 10-2 to 10-3 (Wertz and McDonald, 2004).

• For soil gas to indoor air, AFs of 2.2 x 10-5 – 1.2 x 10-4 for less degradative hydrocarbons (like MTBE and 2,2,4-trimethylpentane) were observed at the Stafford Township, NJ site (Sanders, P. F. and Hers, I., 2004). These samples were designated as “deep”.

• Eklund (2005) suggest soil vapor to indoor attenuation is on the order of 650 times, or an attenuation factor of 0.0015. This review is attached.

In light of the ongoing debate, a soil gas to indoor air attenuation factor of 0.001 for existing buildings with basements appears reasonable.

DTSC Response to Comment:

See response no. 180.

Response Tracking Number: 193

Commenter Organization: DuPont

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

The mitigation section is overly prescriptive. Performance monitoring and routine inspection of mitigation systems should be accepted in lieu of routine air monitoring as part of mitigation system Operation and Monitoring (O&M). The need for permanent soil vapor monitoring points and perimeter monitoring of soil vapor, and the associated locations, frequencies, and depths, should be determined on a site-specific basis.

DTSC Response to Comment:

DTSC agrees that that the O&M monitoring requirements should be developed on a site-by-site basis and will modify the guidance pursuant to this comment. Text will be added to the guidance document concerning the need for permanent soil gas monitoring points (see response no. 127) and the monitoring associated with the future building scenario (see response no. 201 and 327).

Response Tracking Number: 194

Commenter Organization: DuPont

Technical Subject: General

Guidance Document Page:

Public Comment:

DuPont supports other technically sound recommendations provided by the American Petroleum Institute in their comments.

DTSC Response to Comment:

DTSC has reviewed and provided responses to all comments from the American Petroleum Institute.

Response Tracking Number: 195

Commenter Organization: DuPont

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

DuPont supports a framework that takes a tiered approach that uses multiple lines of evidence to determine the relevance of vapor intrusion from the subsurface at a given site. Some key considerations are summarized as follows:

• The framework advocates for a tiered approach that allows for the collection and use of both generic and site-specific information/data.
• The process should be iterative, i.e., start with available data and collect only additional data to meet the needs of making informed decisions.
• The proposed approach allows for a site-specific evaluation using modeling, soil gas sampling, indoor air sampling, or mitigation at any point in the process.
• Use of multiple lines of evidence that result in decisions based on a weight of evidence is considered appropriate.
• Current and future site use should be taken into account.
• Development of an accurate site conceptual model that is representative of site conditions is critical to ensure proper use of the data when evaluating the potential vapor to indoor air pathway under both generic and site-specific evaluations.
• The framework should provide for the use of screening levels in environmental media that are based on exposure scenarios, i.e., whether a site is residential, non-residential or regulated under OSHA determines the screening levels that are appropriate for the evaluation.

DTSC Response to Comment:

DTSC used a framework that takes a tiered approach in the vapor intrusion guidance document, as follows:

- The guidance document has a tiered approach that allows for both preliminary and site-specific screening.

- An iterative approach is recognized within the guidance document on page 2.

- The guidance document allows for site-specific evaluations using fate and transport modeling, soil gas sampling, indoor air sampling, or mitigation at any point in the process.

- The future building scenario is addressed on page 22.

- Development of a conceptual site model that is representative of site conditions is discussed on page 4.

- The framework for screening residential and non-residential exposure scenarios is presented along with a framework for the application of OSHA PELs.

Response Tracking Number: 196

Commenter Organization: Dupont

Technical Subject: Preliminary Screening

Guidance Document Page: 13

Public Comment:

The generic criteria are based on an assumed ratio between soil gas and the indoor air concentrations resulting from vapor intrusion of this soil gas. This ratio is called an attenuation factor (or an alpha factor). The attenuation factor takes into account the reduction in concentration with transport distance. For deep soil gas, the assumed attenuation factor is 0.01 and for shallow soil gas the assumed attenuation factor is 0.1. These attenuation factors are very, very conservative – even for screening purposes. Note that the attenuation factor used for shallow soil gas (i.e., 6 ft. bgs in our case) is exactly the same attenuation factor used for sub-slab data collected in the first few inches under a building.

As a 1st step in the Tier 3 evaluation, a more realistic – but still conservative – attenuation factor was applied to the soil gas data. First, the applicable equation is set forth:

Cindoor = Csub-slab * [Soil-gas infiltration rate / Building ventilation rate] (Eq. 1)

Second, conservative default values for the airflow rates are identified. USEPA's default value (US EPA, 2003) for soil-gas infiltration is 5 L/min (0.005 m3/min) for a residential structure with a 100 m2 (1,080 ft2) footprint. This is a conservative value, as one would expect for an USEPA default value. A typical value for building ventilation is 0.54 air changes per hour (ACH) for residential buildings in the Northeast US (US EPA, 1997). Using the USEPA default ceiling height of 366 cm for buildings with basements (US EPA, 2003), the airflow rate for the assumed building footprint is about 3.3 m3/min:

100 m2 * 3.66 m = 366 m3
366 m3 * 0.54 ACH = 198 m3/hr = 3.29 m3/min

So, Equation 1 reduces to:

Cindoor = Csub-slab * [0.005 / 3.29] = Csub-slab / 659 (Eq. 2)

The same calculation for buildings without basements using the USEPA default ceiling height of 244 cm results in an attenuation factor of 439x.

Note that the factor of 659x is based on sub-slab data rather than shallow soil gas data. For our purposes, we will assume the sub-slab = shallow soil gas, which is a conservative assumption.

A factor of 659x is quite different from using a factor of 10x. Is a factor of 659x a reasonable, but still conservative, value to use? It is. Various published attenuation factors are listed and discussed below. For clarity, the attenuation factors are shown as a positive integer, though they could just as readily be shown as their inverse or as a fraction (e.g., 333x = 0.003 = 3/1000).

The State of California suggests a factor of 500x for slab-on-grade residences and a factor of 100x for houses with basements (DTSC, 2004). These attenuation factors are for "preliminary screening evaluations" and therefore are designed to be quite conservative. The same document gives attenuation factors for commercial buildings of 1,000x for existing buildings and 2,500x for future buildings.

Johnson and Ettinger (2000) indicate that the attenuation coefficient (i.e., ratio of indoor air concentration to soil-gas concentration) varies from about 1,000x to 10,000x. Presumably, this range would be somewhat lower if only sub-slab data were considered.

Published Attenuation Factors

Source / Attenuation Factor / Comments
Olsen and Corsi / 5,900x to 18,100x / Based on field tests using SF6 tracer gas at two houses in New Jersey
Fischer, et al. / 526x to 4,000x / Based on field tests including tests using SF6 tracer gas
Johnson and Ettinger / 1,000x to 10,000x / Expected typical value based on soil-gas concentration

Paul Johnson, et al. / 1,000x / Default value based on sub-slab data
Paul Johnson, et al. / 666x / Worst-case attenuation factor
California DTSC / 500x (slab-on-grade) 100x (basements) / Default value for preliminary screening based on sub-slab data
Vic Kremensec, et al. / 333x / Suggested screening value

Paul Johnson and co-authors in an API document suggest an attenuation factor of 1,000x (Johnson, et al., 1998). They say that is value "is consistent with published data from field studies focused on the relationship between the concentration of radon in soil gas and indoor radon concentrations." The same authors re-iterated that 1,000x was a good default value in a subsequent journal article (Johnson, et al., 1999). Figure 2 of the API document shows a plot of attenuation factor as a function of effective diffusivity and distance. The maximum attenuation factor possible according to this figure is about 666x.

Another point of comparison is the recommended conservative attenuation factor of 333x for sub-slab concentrations, based on empirical field data, recently proposed for use by USEPA (Kremensec, et al., 2005). This factor is based on data from the Endicott, NY site and also is supported by data from the Redfield, CO site – two of the most studied vapor intrusion sites.

Attenuation coefficients have been reported from various field measurement programs. When evaluating data from field studies where vapor transport is being studied, however, it is important to consider the experimental design. Researchers often induce a large negative pressure during such studies to ensure seeing soil-gas infiltration at measurable rates. By inducing a large pressure gradient, the researches bias the attenuation coefficient towards a lower level of dilution. The data reported by Fischer, et al. (1996) and Olson, et al. (2000) include data collected under normal pressure gradients and therefore these studies are thought to represent the magnitude of attenuation coefficients likely to be encountered under field conditions.

Fischer, et al. (1996) measured hydrocarbons found in gasoline in ambient air, indoor air, and soil gas at two depths. They report attenuation coefficients from 2,500x (4.0x10-4) to 526 (1.9x10-3). They also used an SF6 tracer gas and report an attenuation coefficient of 4,000x (2.5x10-4) with no forced pressurization. Olson and Corsi (2001) used an SF6 tracer at two houses in New Jersey and report attenuation coefficients ranging from 18,100x (5.52x10-5) to 5,900x (1.7x10-4).

In summary, there is a range of published values for attenuation of soil gas, but the value of 659x is in line with the published values and towards the conservative end of the range. It is expected that USEPA will move to less conservative attenuation factors in the revision to the 2002 guidance document that is in progress.

DTSC Response to Comment:

See response no. 192.

Response Tracking Number: 197

Commenter Organization: Treadwell & Rollo, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"Step 3 – Is a Site a Candidate for Vapor Intrusion – Criterion One – Hence, when determining if the vapor intrusion pathway is complete at a site based on the occurrence of the chemicals in Table 1, the analytical detection limits must be appropriate (See Step 2 – Soil Gas)."

This infers than there are only appropriate detection limits for soil gas. Step 2 does not indicate detection limit criteria for soil or groundwater. Although soil gas data is preferred overall for evaluation of potential subsurface vapor intrusion, the vast majority of site assessment data available for properties at the initial screening stage are for soil and groundwater samples. Assuming an off-site source of VOCs is not present, use of soil and groundwater data together with site history/activity information should be used to evaluate whether a site is a candidate for vapor intrusion.

DTSC Response to Comment:

Typically, in vapor intrusion evaluations, groundwater detection limits are not an issue if the detection limits are near the Maximum Contaminant Levels (MCLs). For soil gas, the detection limits should be at least as low as the CHHSLs, or lower if cumulative health effects are of concern at the site. As for the use of soil matrix data, please see response no. 21 and 289.

Response Tracking Number: 198

Commenter Organization: Treadwell & Rollo, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"Step 3 – Is a Site a Candidate for Vapor Intrusion – Criterion Two – The existing or future buildings at a site must be close to subsurface contamination so that vapor migration into indoor air is possible. For existing or future buildings not to be considered a candidate for vapor intrusion, the buildings must be greater than 100 feet away laterally from subsurface contamination. "

This criterion should specify VOC concentrations or depths at which “contamination” is defined. Non-detect levels and “any depth” are not practical in cases where VOCs are present in groundwater at concentrations below MCLs or where the depth of the VOC contamination is very deep. Screening levels for soil gas, soil and/or groundwater should be considered for definition of the subsurface contamination.

DTSC Response to Comment:

The document will be changed to recommend plume delineation to the California Human Health Screening Levels (CHHSLs) as developed by OEHHA (2005). The CHHSL values are appropriate for contamination at any depth and for any site due to the conservative assumptions used to generate the values. See response no. 280 concerning building distances from contaminant plumes.

References

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 199

Commenter Organization: Treadwell & Rollo, Inc.

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

Soil gas screening levels from the Senate Bill 32 (SB32)/California Human Health Screening Levels are referenced for use in evaluating soil gas data. Because the levels are only available for a limited number of chemicals, sites with other chemicals cannot rely solely upon the SB32 levels. The guidance should be revised to indicate use of the soil gas Environmental Screening Levels (ESLs) from the San Francisco Bay Regional Water Quality Control Board as a supplemental source of screening levels. In practice, the SB32 levels cannot be completely integrated with the ESLs because of differences in air exchange and vadose zone permeability assumptions between the levels. Since DTSC-lead sites appear to require reliance on the SB32 levels, additional guidance should be provided on integration of non-SB32 levels to a screening level evaluation.

DTSC Response to Comment:

See response no. 180.

Response Tracking Number: 200

Commenter Organization: Treadwell & Rollo, Inc.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 23

Public Comment:

Greater emphasis should be placed on NOT collecting indoor air samples. The potential for non-subsurface sources of VOCs should be discussed. This is especially true for gasoline-related VOCs such as benzene, toluene, ethylbenzene, and xylenes, as well as consumer product-related VOCs such as tetrachloroethene (perchloroethene or PCE). Where possible, the likely range of indoor air concentrations from ambient/consumer product-based VOCs should be presented in this section. Once indoor air data is generated, estimated excess cancer risks and non-cancer hazard effects are typically estimated, regardless of the potential "background" concentrations. Outdoor ambient air sample data help identify some of the sources, but more emphasis should be added to the guidance about the typical unrealistic expectation of non-detect indoor air results.

DTSC Response to Comment:

As currently written, DTSC recommends testing indoor air after a preliminary or site-specific screening evaluation is conducted. Because outdoor air quality varies widely throughout the state, a table of anticipated outdoor air concentrations would have minimal significance to practitioners. Basin-wide results or basin-wide averages may not capture localized sources of air pollution, such as railyards, freeways, dry cleaners, factories, truck routes, and ports. Accordingly, DTSC recommends that ambient air sampling always be conducted concurrent with indoor air sampling. The guidance document will be revised to state that indoor air will usually have detectable concentrations of common air pollutants, such as benzene, so that practitioners will not be surprised by the sampling results.

Response Tracking Number: 201

Commenter Organization: Treadwell & Rollo, Inc.

Technical Subject: Mitigation

Guidance Document Page: 36

Public Comment:

Only four remedies are presented:

1.Excavation of VOC Sources
2.Existing Building Retrofit – VOC Collection and Passive Vent Systems (Without Membrane)
3.Future Building Construction - VOC Collection and Passive Vent Systems (Without Membrane)
4.Future Building Construction - VOC Collection and Active Vent Systems (Without Membrane)

For future buildings, a membrane only remedy should be considered, dependent upon concentrations of VOCs in the subsurface. This is especially true when the groundwater levels are shallow, which would preclude the installation of a sub-foundation ventilation system. Additionally, presence of automobile parking garages beneath occupied areas for higher density construction should be considered for future buildings. The ventilation requirements of the garage will have a significant influence on the potential vapor intrusion into occupied spaces. For current buildings, installation of a VOC collection system using horizontal drilling is not economically and/or technically feasible in many instances. Vapor sump collection systems modified from the radon mitigation industry should be considered as a possible remedy for current buildings. This technique has been applied in Colorado for subsurface vapor intrusion and has proven to be a cost-effective remedy. For the Operation and Maintenance of venting systems (Page 39), consideration of pressure differentials and flow rates should be considered as the primary metric for evaluation of remedy effectiveness. Relying upon indoor air sampling data may create interpretation problems from non-subsurface VOC influences, similar to indoor air sampling problems.

DTSC Response to Comment:

Responses are provided for each issue raised in the comment, as follows:

1) A vapor barrier always requires passive or active venting systems due to potential holes or breaches within the membrane (see response no. 182).

2) The monitoring of vacuum and flow rate on a subslab venting system is important in determining the operating effectiveness of the system, but contaminant concentration measurements provide information concerning the true effectiveness of the venting system by indicating that mass is being removed (see response no. 77).

3) The only building design which may mitigate vapor intrusion exposure is podium construction, but this style of construction is not considered a presumptive remedy. DTSC would evaluate the adequacy of podium design on a case-by-case basis with respect to vapor intrusion (see response no. 181).

4) Human exposure to chemicals must be prevented in future structures built on contamination. There are many options available to verify the lack of exposure in these buildings, such as the monitoring of permanent probes in the subsurface and crawl spaces or the sampling of indoor air. The guidance document will be revised to state that regulators have discretion in determining the style of post-construction sampling (see response no. 327).

Response Tracking Number: 202

Commenter Organization: Trihydro Corporation

Technical Subject: Preliminary Screening

Guidance Document Page: 11

Public Comment:

The Guidance should address the selection of chemicals of potential concern (COPC) by inserting a recommended sequence of logic (perhaps complimented with a flowchart) that can be used to defend the inclusion or exclusion of any chemical from Table 1 for further evaluation as a threat to indoor air. Following is a partial list of questions or suggestions to consider when compiling a COPC list:

a. How should semivolatile organic chemicals (SVOCs) like naphthalene be dealt with? Perhaps screen them with

Raoult's Law or Henry's Law if source concentrations are known. Inclusion of polyaromatic hydrocarbons (PAHs) in the analysis suite for soil gas is recommended on page 41, 3rd paragraph. What analytical technique should be used for PAHs given that TO-15 cannot be used for compounds larger than naphthalene?
b. Does the COPC have a screening value listed in the U.S.EPA 2002 OSWER Guidance?
c. Perhaps use the highest detect (or non-detect) values to produce an initial screening?
d. Rank COPCs detected or suspected of being present by toxicity (numerically by screening values from low to high).

DTSC Response to Comment:

Contaminants in soil that have a potential vapor intrusion risk should be evaluated during soil gas sampling. The list of chemicals in Table 1 was taken directly from USEPA's guidance document and augmented with fuel oxygenates and PCBs. DTSC will evaluate each chemical on the Table 1 list and determine which chemicals should be removed due to toxicity and vapor pressure. For those chemicals which remain on the list, an analytical technique will be provided. Naphthalene is listed as an analyte in both Method 8260 and TO-15, and DTSC will add an appendix to the vapor intrusion guidance document to address analytical issues specifically associated with this chemical.

Response Tracking Number: 203

Commenter Organization: Trihydro Corporation

Technical Subject: Site Characterization

Guidance Document Page: 04

Public Comment:

Conceptual Site Model (CSM) - The Guidance appears to be inconsistent with respect to background or ambient volatile organic compounds (VOCs) because some compounds are acknowledged to be ubiquitous (p. 34, 5th bullet) but the CSM does not include a section on characterizing ambient sources of COPCs. We suggest including a background characterization section to the CSM.

DTSC Response to Comment:

The conceptual site model (CSM) provides an understanding of the potential for exposure to hazardous contaminants at a site based on the sources of contamination, the release mechanisms, the transport media, the exposure pathways, and the potential receptors. The CSM is meant to provide a framework for the analysis of exposure, including the understanding of background concentrations on potential exposure. As such, the section "Environmental Exposure Media and Exposure Routes" will be revised to clarify sampling associated with vapor intrusion. However, it should be noted that the collection of ambient air data is not a mechanism to remove chemicals of potential concern (COPCs) from the indoor air pathway analysis. All COPCs in soil gas should be evaluated for vapor intrusion. If the soil gas sampling indicates an unacceptable human health risk, then indoor air should be tested at least twice to evaluate the seasonality of the exposure pathway. After the collection of the indoor air samples, chemical exposure is then quantified for the building. The ambient air data help guide the risk management decisions for the building to determine if corrective action is warranted. The guidance document will be revised to further clarify this approach.

Response Tracking Number: 204

Commenter Organization: Trihydro Corporation

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Characterization should continue until non-detectable concentrations of VOCs are encountered in the subsurface laterally and vertically;" and "To document that a utility corridor is not a migration pathway for the site, it should be demonstrated that soil gas sampling yielded non-detectable concentrations of VOCs."

The use of "non-detect" as a criterion for evaluating extent of contamination or compliance could be complicated because experience suggests that at the part per billion (ppb) level, some VOCs are nearly ubiquitous in ambient air and shallow soil gas. The two excerpts above are inconsistent with the statement on page 34, 5th bullet, that some compounds are ubiquitous. It is more feasible to continue sampling or characterization until some risk-based threshold is reached.

DTSC Response to Comment:

The document will be changed to recommend plume delineation to the California Human Health Screening Levels (CHHSLs) as developed by OEHHA (2005) rather than delineation to non-detectable contaminant concentrations. The CHHSL values are appropriate for contamination at any depth and for any site due to the conservative assumptions used to generate the values.

References

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 205

Commenter Organization: Trihydro Corporation

Technical Subject: Site Characterization

Guidance Document Page: 12

Public Comment:

Dr. Hartman's "diffusion speed" statement in the LUSTLine article is not supported by reference to scientific studies or to his own methods for derivation of the "25 feet per year" value. While the statement sounds reasonable, and is understood only to serve as a "rule of thumb," the important parameters used to calculate rates of diffusion should be discussed alongside.

DTSC Response to Comment:

See response no. 83.

Response Tracking Number: 206

Commenter Organization: Trihydro Corporation

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

Physical Characteristics of the Subsurface – All tests on soil gas should act with minimum affect on the subsurface. Withdrawing gas from a probe would nearly always cause less impact than injecting gas. Because soil permeability to gas can be calculated by purging probes at varying rates to measure changes in well-head vacuum, the injection method should be abandoned. The subsurface gas mixture should recover with less affect from vacuum testing because, for a properly constructed probe, the removed gas is replaced with adjacent subsurface gas. Injecting air (and associated oxygen) could cause a shift in biological activity that could make more lasting changes to the subsurface gas mixture.

DTSC Response to Comment:

The protocols used by DTSC for in-situ air permeability measurements were taken from work at Yucca Mountain as conducted by the United States Nuclear Regulatory Commission (USNRC). The USNRC protocol is valid during both injection or extraction. Hence, the appendix will be changed to acknowledge extraction as an option for the testing.

Response Tracking Number: 207

Commenter Organization: Trihydro Corporation

Technical Subject: Additional Site Characterization

Guidance Document Page: 20

Public Comment:

Last line before Step 7 – "When conducting either subslab or crawl space …"

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 208

Commenter Organization: Trihydro Corporation

Technical Subject: Site Specific Screening

Guidance Document Page: 21

Public Comment:

Attenuation Factors for Site-Specific Evaluations – Is there a weight-of-evidence approach for justifying low attenuation factors? These statements should be clarified.

DTSC Response to Comment:

Attenuation factors smaller than 0.0001 will require adequate justification based upon a weight of evidence approach (see response no. 53).

Response Tracking Number: 209

Commenter Organization: Trihydro Corporation

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

"To avoid interference with background chemicals not found in the contaminated media of concern, the air analysis should be run using SIM":

Select Ion Monitoring – In general, SIM provides less quantitative analytical reliability than other methods, though its overall reporting limits are lowest. The rationale for this statement should be clarified in the guidance. Why is SIM more reliable than other methods?

DTSC Response to Comment:

The guidance document will be revised to clarify the distinction between SIM and SCAN modes. The analytical mode (either SCAN or SIM) should be dictated by the data quality objectives for the sampling event. If full characterization is needed, then SCAN mode should be used. SCAN mode will provide a more accurate characterization of the analytes in the sample as well as a better quantification of their concentrations. Further, in SCAN mode, all compounds can be confirmed by a mass spectral library. If low detection limits are needed for only a few known compounds, then the SIM mode can be used, but SIM mode is actually biased by focusing only on select ions which can result in false positives. SIM mode should be used only after the target analytes have been confirmed by SCAN mode results with the mass spectral library.

Response Tracking Number: 210

Commenter Organization: Trihydro Corporation

Technical Subject: Indoor Air Sampling

Guidance Document Page: 31

Public Comment:

Reliability of field Gas Chromatography: Is field GC adequately reliable for part per billion measurements? Why mention it alone (e.g. pp. 31-32 for indoor air preferential pathway evaluation) rather than either with Summa can sampling alone or both, since laboratory GC/MS is the standard for ppb measurements?

DTSC Response to Comment:

A properly calibrated portable GC/MS can yield reliable measurements in the part per billion range. Other instruments, besides a portable GC/MS, may be available to achieve these detection limits but these instruments may be less reliable. When conducting indoor air sampling with Summa canisters, portable analytical instruments can add value to the sampling process. Portable equipment can determine soil gas entry points and sources of indoor air contamination unrelated to vapor intrusion (cosmetics, cleaners, paints, etc.). Due to this benefit, DTSC wants to encourage their use, in conjunction with Summa canister testing, in evaluating the quality of indoor air. Without the identification and removal of secondary sources of contamination, it is difficult to interpret the results of the indoor air samples. The guidance document will be revised to encourage field screening of buildings, but the document will also be less prescriptive about the choice of field analytical instruments to use for screening purposes.

Response Tracking Number: 211

Commenter Organization: Trihydro Corporation

Technical Subject: Indoor Air Sampling

Guidance Document Page: 33

Public Comment:

Outdoor Air Samples – Outdoor air sampling should accompany not only indoor air sampling but also any assessments of shallow (5 ft or less) soil gas, particularly in studies where vapor extrusion from a structure to the soil gas is possible.

DTSC Response to Comment:

Ambient air and indoor air could influence soil gas conditions. In some cases, ambient and indoor air could bias soil gas sampling results low if ambient and indoor air has moved into the vadose zone, displacing contaminated soil gas. Conversely, ambient and indoor air could bias soil gas sampling results high if the vadose zone is "clean". The magnitude of these biases is unknown. However, the acceptability of using shallow soil gas as a mechanism to evaluate vapor intrusion is currently under review by the USEPA (see response no. 216). Their studies suggest that soil gas samples collected at depths of 10 -12 feet are a better indicator of vapor intrusion risk than samples collected at 5 feet. Accordingly, DTSC's revised vapor intrusion guidance document will recommend the collection of soil gas samples at 10 - 12 feet for modeling purposes. Deeper soil gas samples would not be influenced significantly by ambient affects and so there would be no need to collect concurrent ambient samples while soil gas sampling.

Response Tracking Number: 212

Commenter Organization: Trihydro Corporation

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

QA/QC – Not all labs use the same kind of "trip blank." For example, one lab uses pressurized trip blanks that only have bearing on laboratory Summa can cleaning efficiency. Perhaps the QA/QC section should spell-out recommendations more specifically. For example:

a. Pressurized trip blanks for can cleaning QA
b. Evacuated trip blanks for transportation QA
c. Field blanks for field equipment cleaning QA

Items a. through c. could be all or a portion of a suggested suite of trip and field blanks.

DTSC Response to Comment:

See response no. 143.

Response Tracking Number: 213

Commenter Organization: Trihydro Corporation

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

The Johnson et al. (1998) reference as written either does not appear in the references or contains a typographical error in the year.

DTSC Response to Comment:

The reference contained a typographical error and will be corrected. The correct reference is "Johnson et al. (1999)."

Response Tracking Number: 214

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Table 1

Guidance Document Page: 55

Public Comment:

Table 1 – This list includes several other non-VOCs that are not currently included on typical soil gas analyte lists (e.g., 1,4-dioxane, organochlorine pesticides, etc).

– It is understood that EPA will be revising their guidance by reducing this list. Has DTSC contacted Helen Dawson of EPA to assess what revisions to this will be made?

– Will these chemicals be added to the DTSC Johnson-Ettinger modeling spreadsheets?

– It is recommended that additional guidance be included concerning when the vapor intrusion pathway should be evaluated for these non-VOCs (e.g., soil concentration thresholds)?

DTSC Response to Comment:

See response no. 229.

Response Tracking Number: 215

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"In addition, it may be necessary to collect soil gas samples at two distinct time intervals to compensate for the effects of weather events, such as recent rainfall or barometric fluctuations. Ideally, for sites subject to vapor intrusion, permanent vadose monitoring points for sample collection should be installed to evaluate the long-term behavior of contaminated soil gas."

– It is recommended that guidance be added regarding when soil gas samples should be collected (e.g., at least two weeks after a rainfall event?

– It is recommended that guidance be added to identify when it is preferable to have multiple measurements. It is further recommended that the guidance include conditions considered to be worst-case, so that multiple measurements during assessment would not be necessary.

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) Soil gas sample collection is not advisable during a storm due to strong barometric pressure fluctuations that occur with a storm event. Massmann and Farrier (1992) indicate that soil gas concentrations could be biased low due to atmospheric pressure changes. Hence, soil gas sampling during a storm event is not prudent. Likewise, soil gas sampling after a rainfall event is not recommended. Rainfall is an important factor in controlling the diffusion of subsurface contaminants. In tests at a simulated landfill, water was added to dry soil cells to simulate rainfall. Trace

precipitation (0.01 inches) had no effect on measured emission fluxes. Heavier rainfall (0.4 inches), however, did have an effect. The emission flux was decreased by 90 to 95 percent and the reduction in emissions lasted for over eight days (Kienbusch and Ranum, 1986). These results are consistent with other field observations (Radian Corporation, 1984). Rainfall decreases the air-filled porosity of the soil, thereby limiting diffusional transport and potentially biasing soil gas sampling results. Hence, the guidance document will be revised to state that soil gas sampling should not transpire after a significant rainfall event (1/2 inch or greater), with a potential waiting period of seven days, and that ponded water should not be present during sample collection.

2) See response no. 172.

References

Kienbusch, M., and D. Ranum. 1986. Validation of Flux Chamber Emission Measurements on a Soil Surface. Draft Report to EPA-EMSL, Las Vegas, under EPA Contract No. 68-02-3889, Work Assignment 69, June 1986.

Massmann, J., and D. F. Farrier. 1992. Effects of Atmospheric Pressures on Gas Transport in the Vadose Zone. Water Resources Research, v. 28, n. 3, p. 777 - 791.

Radian Corporation. 1984. Soil Gas Sampling Techniques of Chemicals for Exposure Assessment - Data Volume. Report to EPA-EMSL, Las Vegas under EPA Contract No. 68 -02-3513, Work Assignment 32, March 1984.

Response Tracking Number: 216

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Sample greater than 5 feet below grade to reduce the effects of barometric pumping."

– It appears to be fairly universal among the States that shallow soil gas samples be collected at 5 feet below ground surface. It is recommended that the guidance specify that shallow soil gas be collected at 5 feet below ground surface, but also include provisions for when shallower soil gas samples may be appropriate (e.g., when groundwater is present within the upper 10 feet).

– It is also recommended that the guidance include provisions for collecting shallow soil gas samples at depths greater than 5 feet below ground surface when there are subsurface obstructions at shallower depths and impacts are present at depths greater than 5 feet below ground surface.

DTSC Response to Comment:

Studies by Hers et al. (2006) and DiGiulio and Cody (2006) indicate that shallow soil gas measurements at 5 feet may not be indicative of soil gas concentrations under buildings. These studies suggest that soil gas samples collected at depths of 10 - 12 feet are a better indicator of vapor intrusion risk than samples collected at 5 feet. The numerical modeling conducted by Abreu and Johnson (2005) and Abreu et al. (2006) also suggests this relationship. Hence, risk quantified with shallow soil gas measurements (5 feet below grade) using the Johnson and Ettinger model might be biased low. Accordingly, DTSC's revised vapor intrusion guidance document will recommend the collection of soil gas samples at appropriate depths for modeling purposes. Soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade. Deeper sampling would be needed for buildings with basements.

If shallow groundwater conditions exist, then soil gas samples can be taken at shallower depths as appropriate, but soil gas samples taken from depths of less than 5 feet may be subject to barometric pressure effects and could be biased (Massmann and Farrier, 1992; Nilson et al., 1991; Clements and Wilkening, 1974, Elberling et al., 1998; Auer et al., 1996). When soil gas samples cannot or should not be collected, risk determinations should rely upon multiple lines of evidence, such as soil matrix samples, groundwater samples, subslab samples, and/or passive soil gas samples. The occurrence of shallow groundwater can make the collection of soil gas samples impossible. Where groundwater is less than five feet below grade, and there is a large capillary fringe associated with the water table, no-flow conditions may be encountered. Hence, after the failure of soil gas sample collection, other contaminant media must be used to evaluate vapor intrusion. In this instance, at a minimum, both groundwater and soil matrix sampling would be warranted. Other lines of evidence would be collected as needed. The risk associated with both media (groundwater and soil matrix) would be quantified and compared to evaluate contaminant equilibrium. If the risk from both media diverge significantly, a reasonable risk management decision should be made based on the weight of evidence. Also, see response no. 289.

References

Abreu, L. D. V., and P. C. Johnson. 2005. Effect of Vapor Source - Building Separation and Building Construction on Soil Vapor Intrusion as Studied with a Three-Dimensional Numerical Model. Environmental Science and Technology, v. 39, no. 12, p. 4550 - 4561.

Abreu, L., P. Johnson, and T. McAlary. 2006. 3D Model Simulations and Implications to Near Building Sampling. AEHS Vapor Intrusion Work Shop, San Diego. March 16, 2006.

Auer, L. H., N. D. Rosenberg, K. H. Birdsell, and E. M. Whitney. 1986. The Effects of Barometric Pumping on Contaminant Transport. Journal of Contaminant Hydrology, v. 24, p. 145 - 166.

Clements, W. E., and M. Wilkening. 1974. Atmospheric Pressure Effects on 222Rn Transport Across the Earth-Air Interface. Journal of Geophysical Research, v. 79, n. 33, p. 5025 - 5029.

DiGiulio, D., and R. Cody. 2006. Evaluation of the "Unconstrained Version" of the J&E Model and Comparison of Soil-Gas and Sub-Slab Air Concentrations at the Raymark Superfund Site. AEHS Vapor Intrusion Work Shop, San Diego. March 16, 2006.

Eberling, B., F. Larsen, S. Christensen, and D. Postma. 1998. Gas Transport in a Confined Unsaturated Zone During Atmospheric Pressure Cycles. Water Resources Research, v. 34, p. 2855 - 2862.

Hers, I., H. Dawson, and R. Truesdale. 2006. Testing Exterior Tier 3 Screening with Site Data. AEHS Vapor Intrusion Work Shop, San Diego. March 16, 2006.

Massmann, J., and D. F. Farrier. 1992. Effects of Atmospheric Pressures on Gas Transport in the Vadose Zone. Water Resources Research, v. 28, n. 3, p. 777 - 791.

Nilson, R. H., E. W. Peterson, K. H. Lie, N. R. Burkhard, and J. R. Hearst. 1991. Atmospheric Pumping: A Mechanism Causing Vertical Transport of Contaminated Gases Through Fractured Permeable Media. Journal of Geophysical Research, v. B13, p. 21,933 - 21,948.

Response Tracking Number: 217

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

"Characterization should continue until non-detectable concentrations of VOCs are encountered in the subsurface laterally and vertically. The soil gas samples should be analyzed by gas chromatography/mass spectrometry (GC/MS) methods."

– Why should vertical soil gas delineation be required? For risk assessment purposes, it is recommended that biased data at the sources and sufficient data to assess potential preferential pathways should be all that is required.

– Why would the use of non-GC/MS methods be discouraged? If the contaminants are known and the detection limits are low enough, EPA-approved GC methods should also be appropriate.

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) See response no. 122, 204, 216, and 289.

2) The USEPA 8000 series of analytical methods quantify the contaminant concentrations in solids and liquids. There are no approved 8000 series methods for air analysis. Nonetheless, the DTSC, in our Soil Gas Advisory, has allowed the use of Method 8260 for soil gas analysis. Other non-GC/MS 8000 series methods can be used for soil gas analysis, but these methods, such as Method 8021B, should be used only for routine monitoring at well characterized sites.

Response Tracking Number: 218

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"The minimum amount of soil gas sampling needed in the vertical direction to evaluate vapor intrusion is the collection of soil gas samples at 5 and 15 to 20 feet below surface grade."

– It is recommended that the guidance indicate why deeper samples would be required (see comment no. 4).

DTSC Response to Comment:

See response no. 122, 216, and 289.

Response Tracking Number: 219

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"For sites that overlie contaminated groundwater, an effort should be made to collect soil gas samples from immediately above the capillary fringe zone and half-way to the surface. For sites where the depth to groundwater is less than five feet, an attempt should be made to collect soil gas samples from beneath existing building foundations or similar settings, such as garage floors, patios, parking lots, roads, and other areas that are covered with pavement, concrete or similar material, as a mechanism to evaluate the potential for vapor accumulation."

– If sufficient shallow soil gas data is available, why would additional soil gas data above the water table be required?

DTSC Response to Comment:

The characterization approach for vapor intrusion will be further clarified in the revised guidance document. Soil gas sampling, at a minimum, should be used to determine the location and concentration of contaminant sources (see response no. 122, 216, and 289). Hence, the need to determine soil gas concentrations immediately above the capillary fringe will be limited to source characterization as dictated by site-specific conditions.

Response Tracking Number: 220

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"Soil gas samples should be collected until the soil gas contaminant plume is fully delineated and a clean zone of 100 feet beyond the extent of the soil gas plume is demonstrated (see Step 3, Criterion Two)."

– How was the 100-foot criterion developed? If delineation is complete, why would additional sampling to show a "clean zone" be required?

DTSC Response to Comment:

See response no. 280.

Response Tracking Number: 221

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

"When collecting soil gas samples with glass bulbs or glass syringes and analyzing the gas samples for VOCs by Method 8260B (USEPA, 1996) modified for air analysis with a mobile laboratory, the results of the field work should be independently confirmed through the collection of duplicate soil gas samples in Summa canisters."

– If soil gas collection using glass bulbs or glass syringes are EPA-approved sampling methods and the analytical methods used by the field laboratory are also EPA-approved, why is confirmation by another EPA-approved method or even the same method by a different laboratory required?

– Invariably, the field and confirmation sample results will be different and possibly with different detection limits, especially if the TO-14A/15 method is used. How will confirmation sample results be used?

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) The USEPA 8000 series of analytical methods quantify contaminant concentrations in solids and liquids. There are no approved 8000 series methods for air analysis. Nonetheless, the DTSC, in our 2003 Soil Gas Advisory, has allowed the use of Method 8260 for soil gas analysis. Other non-GC/MS 8000 series methods can be used for soil gas analysis, but these methods, such as Method 8021B, would be used only for routine monitoring at well characterized sites. Also, DTSC is currently developing guidance to enhance the quality of the Method 8260 soil gas protocols and DTSC plans to integrate these 8260B protocols into the revised guidance document, which should improve the quality of the 8260 results. However, there is limited research data comparing 8260B to TO-15 for soil gas analysis. TO-15 is a more appropriate analytical method for soil gas samples and DTSC recommends confirmation of Method 8260B soil gas results with TO-15. The need for TO-14A/15 confirmation sampling should be determined on a site-specific basis. For example, at well characterized sites, confirmation with TO-15 may be unnecessary; whereas, at new or poorly characterized sites, confirmation of 8260B results with TO-15 analysis would be warranted.

2) Typically, when the TO-14A/15 and the Method 8260 results don't agree, the higher of the results should be used to quantify the contaminant source.

Response Tracking Number: 222

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

"DTSC recommends that ten percent of the soil gas samples collected in the field be confirmed with Summa canisters that are analyzed using TO-14A (USEPA, 1999b), as appropriate."

– If soil gas collection using glass bulbs or glass syringes are EPA-approved sampling methods and the analytical methods used by the field laboratory are also EPA-approved, why is confirmation by another EPA-approved method or even the same method by a different laboratory required?

– Invariably, the field and confirmation sample results will be different and possibly with different detection limits, especially if the TO-14A/15 method is used. How will confirmation sample results be used?

DTSC Response to Comment:

See response no. 221.

Response Tracking Number: 223

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

"For chemicals known to exist in the subsurface, whether determined through direct measurement or historical records review, the chemicals should be evaluated for vapor intrusion even if the concentrations in soil gas concentrations are nondetectable."

– If the soil gas results are non-detect with appropriate detection limits, why should those chemicals be included in a vapor intrusion risk assessment? These chemicals should instead not be considered chemicals of potential concern for the vapor intrusion pathway. Multiple chemicals included in a vapor risk assessment at ½ the detection limit could drive risks above an acceptable risk threshold, and possibly require remediation for chemicals that were not detected.

– It is recommended that the guidance include a list of maximum detection limits for each chemical of potential concern for the vapor intrusion pathway.

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) DTSC will revise the guidance document to state that volatile chemicals that could be present on site, as indicated by subsurface testing of other media (soil matrix and/or groundwater), but have not been detected in soil gas at appropriately low detection limits due to sample dilution should be evaluated for vapor intrusion at concentrations equal to one-half the method detection limit, rather than at the method detection limit as originally indicated.

2) See response no. 352.

Response Tracking Number: 224

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

"First, soil gas data should be collected over the areas of the contaminated groundwater, and the risk associated with the contaminated soil gas should be quantified. Second, groundwater data should be collected, and the risk associated with the contaminated groundwater should be quantified. Quantification of both risks is a way of evaluating which contamination source provides the greatest health risk."

– Why would it be required that a risk assessment be conducted using groundwater data when representative soil gas data is available above the groundwater plume? The soil gas data is representative of vapor migration from both soil and groundwater impact sources. Using soil gas data reduces uncertainty of the risk estimate by eliminating the assumptions associated with estimating vapor concentrations from groundwater and upward migration from groundwater through the vadose zone.

DTSC Response to Comment:

See response no. 32.

Response Tracking Number: 225

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

"Hence, short screen lengths are preferred for monitoring wells that will be used to make vapor intrusion evaluations. Ideally, the saturated thickness in a well screen should be less than 10 feet."

– This statement appears to be inconsistent with current well construction recommendations. It does not appear to be reasonable to have different well construction recommendations for wells where groundwater sample results would be used for assessment of vapor intrusion vs. groundwater wells where the sample data is used for other purposes (e.g., groundwater quality monitoring).

DTSC Response to Comment:

See response no. 298.

Response Tracking Number: 226

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 09

Public Comment:

"When it is not possible to collect soil gas samples at a site due to low permeability conditions, vapor intrusion should be evaluated with soil matrix sample data and groundwater data, if the groundwater is contaminated."

– If there are low permeability conditions, it is recommended that the guidance include provisions for determining that the vapor pathway is incomplete.

DTSC Response to Comment:

Low permeability conditions do not necessarily preclude the possibly of vapor intrusion. If low permeability conditions exist at a site, vapor intrusion could still transpire through the diffusive movement of vapors where the advective component of movement would be minimal. As such, if soil gas samples cannot be obtained at a site, the vapor intrusion risk must be quantified through other environmental media, such as soil matrix, groundwater, subslab soil gas, crawl space air, and/or indoor air. The guidance document will be revised to clarify the alternatives (also see response no. 289).

Response Tracking Number: 227

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 09

Public Comment:

"DTSC has augmented USEPA Method 5350A procedures with additional guidance (DTSC, 2004), which summarizes all the available soil sampling options."

– The use of EPA Method 5350A is not currently required by all CUPAs/RWQCBs for all soil sampling for VOC analysis. Are there specific situations where DTSC would not require the use of EPA Method 5350A?

DTSC Response to Comment:

Soil matrix samples that are used to quantify human exposure must meet the highest of data quality standards. For sites that are contaminated with volatile organic compounds which might have potential dermal or ingestion exposure scenarios, high data quality objectives necessitate the use of Method 5035. USEPA introduced Method 5035 back in 1996 to enhance data quality and DTSC started recommending the use of Method 5035 shortly thereafter. To assist stakeholders in the implementation of Method 5035, DTSC generated Method 5035 guidance in 2004. Numerous studies have identified sampling biases and USEPA has determined that the scale of the biases can be as large as several orders of magnitude (USEPA, 1993). Non-Method 5035A sampling procedures can be used when the samples will not be used for risk assessment purposes.

References

Department of Toxic Substances Control. 2004. Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preservation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds. California Environmental Protection Agency. November 2004.

United States Environmental Protection Agency. 1993. Behavior and Determination of Volatile Organic Compounds in Soil: A Literature Review. USEPA Document EPA/600/SR-93/140.

Response Tracking Number: 228

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"The flux chamber is a qualitative tool and should not be used for risk determination because of insufficient field validation of the flux chamber for use in the evaluation of vapor intrusion to indoor air."

– It is recommended that DTSC include provisions where flux chamber testing would be the most appropriate evaluation tool, e.g., when evaluating soil gas flux for future building sites where there is impacted fractured bedrock with a thin soil veneer.

DTSC Response to Comment:

Flux chambers provide a secondary line of evidence for the evaluation of vapor intrusion and should not be used solely to evaluate the future building scenario. For bedrock sites with a thin soil veneer, the level of contamination should be quantified through soil gas, soil matrix, and groundwater sampling. The gas soil and soil matrix samples should be collected from both the bedrock and soil veneer in areas representative of lithologic conditions. To evaluate the risk associated with the contaminant source, the effective diffusion coefficient of the bedrock and soil veneer must be determined. Flux chamber measurements can be used to determine the effective diffusion coefficient of the subsurface but only when flux measurements have not been overly influenced by barometric pressure effects and temporal changes in subsurface moisture conditions. The guidance document will be revised to clarify the use of flux chambers. Subsurface vapors migrate into buildings due to both diffusion and advection but the flux chamber only measures the diffusive component of the vapor transport.

Response Tracking Number: 229

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"… and two volatile polychlorinated biphenyl (PCB) congeners (monochlorobiphenyl and dichlorophenyl)"

– It is understood that EPA will be revising their guidance by reducing this list. Has DTSC contacted Helen Dawson of EPA to assess what revisions to this will be made?

– Will these chemicals be added to the DTSC Johnson-Ettinger modeling spreadsheets?

– It is recommended that additional guidance be included concerning when the vapor intrusion pathway should be evaluated for these non-VOCs (e.g., soil concentration thresholds)?

– Addition of these chemicals would also require PCB congener analysis, which is typically not done. More typically, PCBs are analyzed for Aroclors using EPA Method 8081A. It is recommended that DTSC include the preferred method for testing the listed chemicals.

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) Chemicals will be removed from Table 1 based upon toxicity and vapor pressure. See response no. 81 and 355.

2) Chemicals remaining on the Table 1 list after document revision will be integrated into the J&E spreadsheets, by DTSC if USEPA has not done so.

3) Soil gas concentration thresholds will not be provided; hence, practitioners should evaluate each chemical individually to determine if the chemical presents a human health risk. The attenuation factors for preliminary screening can be taken from OEHHA (2005) and screening levels can also be generated using the approach in the OEHHA document. DTSC cannot generated screening values for use state-wide because of potential violation of the Administrative Procedures Act.

4) The chemicals in Table 1 were taken directly from the chemical list in USEPA's 2002 vapor intrusion guidance document, with DTSC's addition of PCBs, fuel oxygenates, and 1,4-dioxane. DTSC will evaluate each chemical on the Table 1 list and determine which chemicals should be removed due to toxicity and vapor pressure. For those chemicals which remain on the list, an analytical technique will be provided.

References

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 230

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 11

Public Comment:

"For existing or future buildings not to be considered a candidate for vapor intrusion, the buildings must be greater than 100 feet away laterally from subsurface contamination (USEPA, 2002a)."

– How was the 100-foot criterion developed? If delineation is complete, why would this buffer be considered?

DTSC Response to Comment:

The 100 foot criterion was taken from USEPA's 2002 vapor intrusion guidance document. See response 280 for information on how the offset distance of 100 feet can be modified due to site specific conditions. The "buffer" is needed to determine which structures, both existing and future, might be subject to vapor intrusion. Upon plume delineation, structures outside this "buffer" would not be considered at risk from vapor intrusion.

Response Tracking Number: 231

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Table 2

Guidance Document Page: 58

Public Comment:

Soil gas measurements from what depth?

– The table does not indicate at which soil gas depths this table is applicable. There does not appear to be any discussion in text or table regarding the depth of soil gas concentration to be used to estimate indoor air concentrations from the alpha factor.

DTSC Response to Comment:

The revised guidance document will indicate the depth to the contamination for the use of the attenuation factors on Table 2. The document will state that the attenuation factors are associated with a five foot sampling depth. Soil gas samples taken from shallower depths might be biased due to barometric pumping effects and transitory moisture conditions. Ideally, soil gas sample depths should be greater than five feet below grade for modeling purposes (see response no. 216).

Response Tracking Number: 232

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 15

Public Comment:

"Under no circumstances should the risk associated with vapor intrusion be conducted with soil matrix samples collected by non-Method 5035A procedures."

– The use of EPA Method 5350A is not currently required by all CUPAs/RWQCBs for all soil sampling for VOC analysis. Are there specific situations where DTSC would not require the use of EPA Method 5350A?

DTSC Response to Comment:

See response no. 227.

Response Tracking Number: 233

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Characterization

Guidance Document Page: 16

Public Comment:

"The evaluation of vapor intrusion should not be conducted with groundwater grab samples due to the inability to place the sampler at the top of the water table and the inability to establish temporal contaminant trends with such data."

– It is recommended that if the groundwater sample is representative of conditions in the upper water-bearing zone, then grab samples such as those collected from Hydropunch or similar techniques should be allowed. In addition, if these sample results are considered to be representative of current conditions and are considered to be worst-case (e.g., collected near the contaminant source), then it is recommended that temporal information (where concentrations would decrease overtime) may not be necessary for evaluating the vapor intrusion pathway.

DTSC Response to Comment:

See response no. 43.

Response Tracking Number: 234

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Preliminary Screening

Guidance Document Page: 18

Public Comment:

"At a minimum, soil gas samples should be collected at two locations, along opposite sides of the building. Large buildings should have more sampling points. The soil gas sampling should be started at 5 feet below surface grade and continue at 5 foot intervals, if possible, until the soil gas has been delineated vertically."

– Why should vertical soil gas delineation be required? For risk assessment purposes, it is recommended that biased data at the sources and sufficient data to assess potential preferential pathways should be all that is required.

DTSC Response to Comment:

See response no. 122 and 172.

Response Tracking Number: 235

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Appendix H

Guidance Document Page: H1

Public Comment:

"The air permeability of the vadose zone should be determined from insitu measurements rather than from laboratory measurements."

– See attached laboratory recommendations from Larry Kunkel of PTS Laboratories. (The comments were provided as a strikeout version of Appendix H. In the text of the appendix, Larry Kunkel replaced the ASTM methods for grain density and total porosity with American Petroleum Institute (API) Recommended Practice (RP) 40. Likewise, Larry Kunkel added API RP40 Native-State Air Permeability Measurement as an option for insitu permeability measurements).

DTSC Response to Comment:

Laboratory procedures for air permeability determination by API RP 40 do not potentially yield measurements that are representative of soil conditions. API RP 40 recommends that core samples be subject to a confining stress of 25 psi during analysis. This confining stress could alter the permeability of the sample by collapsing the pore space of the soil, biasing the laboratory results. Hence, DTSC recommends in-situ measurements to determine air permeability for fate and transport modeling with the J&E model for this reason.

API RP 40 also has protocols for determining grain density and total porosity but DTSC prefers to recommend the use of ASTM protocols for their determination. ASTM standards were specifically designed of geotechnical engineering purposes while API RP 40 was written to address core samples from oil reservoirs. Likewise, ASTM methods have been extensively scrutinized and peer reviewed since their inception, and are readily available to stakeholders.

Response Tracking Number: 236

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Table 3

Guidance Document Page: 59

Public Comment:

"For existing buildings, the contaminant source term should be approximated with the 95th percent upper confidence limit, which can be done with ProUCL (USEPA, 2004)."

– It is recommended that the guidance indicate that maximum concentrations can be used for screening purposes.

DTSC Response to Comment:

See response no. 177 and 362.

Response Tracking Number: 237

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Table 3

Guidance Document Page: 59

Public Comment:

"For future buildings, the maximum soil gas and groundwater concentrations should be used rather than a statistical approximation of the contaminant source."

– Why wouldn't consideration of 95% UCLs be applicable for future building footprints?

DTSC Response to Comment:

See response no. 362.

Response Tracking Number: 238

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Table 3

Guidance Document Page: 59

Public Comment:

– It is recommended that default building dimensions be provided.

– The guidance should indicate the basis for Qsoil of 5 L/min. Under what conditions is this assumption not applicable (i.e., where a lower Qsoil can be used)?

– How do the defaults for the indoor-outdoor pressure differential and the crack-to-total air ratio for existing buildings differ from the Qsoil default values for future buildings?

– When is it appropriate to use a lower indoor-outdoor pressure differential? It has been documented (as recent as the 17 August 2005 API/NGWA Vapor Intrusion Workshop) that due to climatic conditions in southern California (where windows are typically open all year around), the indoor-outdoor pressure differential for buildings is likely much lower.

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) The default building size will be mentioned in the revised guidance document on Table 3 to supplement the text on page 22. The default building size, which is 10 meters in length by 10 meters in width, is taken from USEPA's 2002 guidance document.

2) The basis for the default soil gas advective rate, which was taken from USEPA's 2002 guidance document, will be mentioned in the revised guidance document on Table 3 to supplement the text on page 22. DTSC will entertain other values for the soil gas advection rate besides the default as indicated by site-specific conditions. The overriding parameter controlling the soil gas advective rate is the air permeability of the earthen material directly under the building. Hence, the soil gas advection rate can be changed from the default as a function of in-situ air permeability testing as indicated in Appendix I.

3) Due to the difficulty in making reasonable predictions for vapor intrusion into future buildings, a soil gas advection rate of 5 liters per minute should always be used for future buildings. Hence, the indoor-outdoor pressure differential, foundation crack factor, and subsurface air permeability are not needed for the evaluation of future buildings. See response no. 362.

4) Due to the lack of empirical data associated with building depressurization in California, DTSC recommends using a building depressurization of 4 pascals for all vapor intrusion evaluations. The 2005 API / NGWA Vapor Intrusion Workshop did not publish or internet post any workshop proceedings, papers, or abstracts. Hence, the workshop is not a viable source of data for the development of state policy concerning default parameters for vapor intrusion modeling.

Response Tracking Number: 239

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Site Specific Screening

Guidance Document Page: 22

Public Comment:

"To make a site-specific evaluation for future buildings, maximum soil gas and groundwater concentrations should be used."

– Why wouldn't consideration of 95% UCLs be applicable for future building footprints?

DTSC Response to Comment:

See response no. 362.

Response Tracking Number: 240

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 26

Public Comment:

"One indoor air sampling event cannot be reasonably representative of continuous long-term exposure within a building. Multiple sampling events should be considered to characterize exposure over the long term. Hence, numerous sampling events may be required within a building before DTSC would consider "no further action" for the exposure pathway."

– It is recommended that the guidance include conditions considered to be worst case, so that multiple measurements during assessment would not be necessary.

DTSC Response to Comment:

Text will be added to the guidance document clarifying the need for multiple indoor air sampling events for a building potentially subject to vapor intrusion. At a minimum, two indoor air sampling events should always transpire to evaluate the seasonality of vapor intrusion. When the two sampling events yield a risk of less than 1x10-6, this would be a no further action scenario. A risk of greater than 1x10-4 would require immediate mitigation. If the two sampling events produce a risk between 1x10-4 and 1x10-6, additional indoor air sampling may be prudent. When in the risk range of 1x10-4 to 1x10-6, additional data collection may be warranted to better understand the temporal variation of exposure risk, as indicated by repetitive indoor air sampling. Then a risk management decision would be rendered for the building based on the weight of the evidence. In some cases, it may be more prudent to mitigate the building rather than collect additional indoor air data.

Response Tracking Number: 241

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Indoor Air Assessment

Guidance Document Page: 29

Public Comment:

"For this guidance, DTSC recommends that risks be estimated using maximum concentrations, or one-half the detection limit when a chemical of potential concern is expected to be present based on site characteristics, but which may not have been detected due to elevated detection limits for some types of air sample analyses."

– Why not consider use of 95% UCLs?

– If chemical are not detected and an appropriate detection limit is used, then it is recommended that these chemical not be considered chemicals of potential concern in the risk assessment.

– It is recommended that the guidance include a list of maximum detection limits for each chemical of potential concern for the vapor intrusion pathway.

DTSC Response to Comment:

Each comment is considered individually, as follows:

1) See response no. 362.

2) DTSC will revise the guidance to state that volatile chemicals that could be present on site, as indicated by subsurface testing of other media (soil matrix and/or groundwater), but have not been detected in soil gas at appropriate detection limits should be evaluated for vapor intrusion at concentrations equal to one-half the method detection limit.

3) See response no. 352.

Response Tracking Number: 242

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Mitigation

Guidance Document Page: 36

Public Comment:

Under what conditions, if any, would DTSC consider the installation of a vapor barrier without a VOC collection system or vent system?

DTSC Response to Comment:

A vapor barrier always requires an associated passive or active venting system. Vapor barriers will have or will develop holes or other breaches during installation or during the life of the barrier. Ground settlement would be an example of a natural process that could cause such a breach. Even with only a small number of pin-size holes, the diffusional flow over the barrier would increase by many orders of magnitude. DTSC calculated this increase in diffusional flow based on a study on landfill leachate liners with 5 holes per hectare with holes of an area of only 3E-6 square meters. Hence, small holes or breaches within a vapor barrier severely compromises its integrity.

Response Tracking Number: 243

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Land Use Covenants

Guidance Document Page: 40

Public Comment:

"Deed restrictions should be approved by DTSC legal counsel and publicly recorded in the County Recorder's Office. DTSC has approved standard Model Deed Restrictions that will reduce the work burden for all parties involved in this effort. Additionally, deed restrictions or land use covenants must include the requirement to notify utility workers or contractors that during utility installation or construction activities, these workers may contact contaminated soil and ground water."

– It is recommended that additional clarification be provided regarding how the land use covenants are being handled by DTSC.

DTSC Response to Comment:

The section on Institutional Controls and Deed Restrictions will be enhanced to further explain the regulatory requirements under Title 22 California Code of Regulations Section 67391.1. Also, for reference, numerous Land Use Covenants are currently posted on DTSC's website.

Response Tracking Number: 244

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

It appears that DTSC gives general guidance regarding how to document biodegradation, but does not indicate how it can be used to show that the vapor pathway is incomplete. It is recommended that this section include this additional guidance.

DTSC Response to Comment:

The section in the guidance document on the biodegradation of petroleum hydrocarbons will be enhanced to include additional specificity on documenting biodegradation in the subsurface and the quantification of the associated health risk effect. DTSC will recommend the approach by Johnson et al. (1999) for the evaluation of petroleum vapors. Johnson et al. (1999) indicates that the assessment of petroleum biodegradation should be the comparison of the observed soil gas concentrations with the expected soil gas concentrations. If there is good agreement, then diffusion, not biodegradation, is likely the dominant transport attenuation mechanism. Otherwise, biodegradation is playing a significant role in the subsurface. If biodegradation is playing a significant role, pursuant to Johnson et al. (1999), the subsurface zone responsible for the biodegradation should be documented. In Johnson et al. (1999), this "zone of biodegradation" is called the dominant layer. Documentation of the dominant layer would include the depth to the zone, thickness of the zone, concentrations of petroleum, oxygen, and carbon dioxide through the zone, and the lithologic character of the zone. In many cases, the dominant layer would degrade all the petroleum vapors, negating the possibility of vapor intrusion. Hence, for petroleum sites, soil gas collection would focus on areas stratigraphically above and below the dominant layer and any health risk would be quantified from the petroleum vapors that managed to migrate through the dominant layer. Also, practitioners may find it advantageous to install permanent soil gas monitoring probes to demonstrate, through repetitive sampling, that bioattenuation is indeed occurring at a site.

Also, see response no. 1, 179, and 330.

References

Johnson, P. C., M. W. Kemblowski, and R. L. Johnson. 1999. Assessing the Significance of Subsurface Contaminant

Vapor Migration to Enclosed Spaces: Site-Specific Alternatives to Generic Estimates. Journal of Soil Contamination, v. 8, no. 3, p. 389 - 421.

Response Tracking Number: 245

Commenter Organization: Haley & Aldrich, Inc.

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 42

Public Comment:

"If future development activities at a site can potentially affect the "zone of biodegradation," DTSC will consider that the zone does not exist at the site for the evaluation of vapor intrusion. Activities that might affect the "zone of biodegradation" include, but are not limited to, the removal of the zone for building construction, alteration of subsurface moisture conditions and the disruption of atmospheric oxygen migration by the placement of buildings or pavement at the surface."

– It appears that DTSC generally does not allow for the consideration of biodegradation of petroleum hydrocarbons beneath future building footprints. It is requested that additional clarification be provided for the assessment of the vapor pathway for petroleum hydrocarbons.

DTSC Response to Comment:

The biodegradation section of DTSC's guidance document will be enhanced to include additional specificity on documenting biodegradation in the subsurface for the future building scenario. Pursuant to Johnson et al. (1999), the biodegradation of petroleum usually occurs over a discrete zone within the subsurface. This discrete zone of biodegradation is called the dominant layer. The ability of the dominant layer to biodegrade petroleum vapors is a function of the oxygen and moisture content within the layer. During brownfields reconstruction, the dominant layer should not be disturbed by construction activities because disruption of the dominant layer will lessen the biodegradation potential of the subsurface. Hence, the dominant layer should not be removed during construction. Likewise, the subsurface oxygen and moisture content of the subsurface should not be diminished to critical levels after the completion of construction. The soil moisture content of the dominant layer must remain above the wilting point; otherwise the potential for biodegradation will be reduced (Zwick et al., 1995; Holden et al., 1997). Also, the building's footprint must not limit the diffusional capacity of oxygen to migrate to the dominant layer. Abreu and Johnson (2006) have demonstrated with three-dimensional numerical modeling that a separation distance between a contaminant source and building's foundation must be at least 26 feet in order to get sufficient diffusional oxygen under a building. Accordingly, for brownfields redevelopment, the dominant layer must be sufficiently deep under a building so that oxygen is available to promote biodegradation. Also, see response no. 1, 179, and 330.

References

Abreu, L. D. V., and P. C. Johnson. 2006. Simulating the Effect of Aerobic Biodegradation on Soil Vapor Intrusion into Buildings: Influence of Degradation Rate, Source Concentration, and Depth. Environmental Science and Engineering, In Press.

Holden, P. A., L. J. Halverson, and M. K. Firestone. 1997. Water Stress Effects on Toluene Biodegradation by Pseudomonas Putida. Biodegradation, no. 8, p. 143 - 151.

Johnson, P. C., M. W. Kemblowski, and R. L. Johnson. 1999. Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces: Site-Specific Alternatives to Generic Estimates. Journal of Soil Contamination, v. 8, no. 3, p. 389 - 421.

Zwick, T. C., A. Leeson, R. E. Hinchee, L. Hoeppel, and L. Bowling. 1995. Soil Moisture Effects During Bioventing in Fuel-Contaminated Arid Soils. Third International In-Situ and On-Site Bioreclamation Symposium. In-Situ Aeration, v. 3, Batelle Press, San Diego, CA.

Response Tracking Number: 246

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Scope

Guidance Document Page: 1

Public Comment:

First and foremost, it defines vapor intrusion as simply an indoor air problem. But vapor intrusion responses should be based upon conceptual site models that consider all sources, all pathways, and all receptors. Low level toxic air contamination in the outdoor air shouldn't be treated as acceptable background, but as the result of contamination subject to full characterization and possible remedial response. Venting indoor contamination outdoors may be necessary, but it is not a complete solution.

DTSC Response to Comment:

The guidance document will further stress that all exposure pathways must be considered at chemical release sites, not just the vapor intrusion pathway. The guidance document will also recommend the quantification of the outdoor risk due to the flux of vapor from the subsurface. Additionally, the guidance document states that an air discharge permit from the local air pollution control district may be needed when venting the subsurface under a building to mitigate vapor intrusion exposure.

Response Tracking Number: 247

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 23

Public Comment:

The Guidance is biased against indoor air sampling because, it says, it is costly, time-consuming, and requires the cooperation of residents. It fails to recognize that many residents, with good scientific evidence, don't accept conclusions based upon models. They want to know what they're breathing. Under the right conditions, the process should allow project managers to proceed directly to indoor air measurements. This wouldn't eliminate the need for soil gas sampling, but it would accept the notion that actual measurements, not models, are the final word.

DTSC Response to Comment:

DTSC will further emphasize that indoor air sampling can be conducted immediately after a preliminary screening with the California Human Health Screening Levels. Typically, indoor air testing is conducted because subsurface soil gas concentrations exceed screening levels (preliminary or site-specific screening levels). Indoor air should be tested for all the constituents found in soil gas. By analyzing indoor air for all the soil gas contaminants, cumulative health effects can be determined. Also, analysis of indoor air for all the soil gas constituents allows for the correlation of the constituents as a mechanism to evaluate vapor intrusion. Attenuation factors for each constituent should be similar, providing evidence if secondary contaminant sources exist inside a building. Indoor air sampling should transpire, ideally, after the subsurface has been characterized and soil gas contaminants are documented to exist under or near a building.

Response Tracking Number: 248

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 29

Public Comment:

The table on page 29 is the primary place in the Guidance that comes close to suggesting a generic action level. On the positive side, it distinguishes the concentrations that would trigger monitoring from the levels that would prompt actual engineering controls. On the other hand, if these guidelines are used as actual action thresholds, mitigation will never occur. That is, unless I'm reading the guidance improperly, for engineering controls to be applied at a state-led site, indoor vapor levels would have to exceed the concentrations corresponding to the one-in-ten-thousand additional lifetime cancer risks using state toxicity standards. For TCE, which has a state standard of about 1 microgram per cubic meter in residential air, corresponding to a one excess cancer among a million people, it would take readings of 100 micrograms per cubic meter, and such levels very rarely occur inside homes. The document does make it clear that actual cleanup levels must be determined through standard regulatory processes, such as the National Contingency Plan, but even as a suggestion the weak threshold is disturbingly unprotective.

DTSC Response to Comment:

The table on page 29 was only meant to guide the response action associated with the first two indoor air sampling events and the revised guidance document will further emphasize this very important point. When the first two sampling results indicate a risk between 1x10-4 and 1x10-6, more data collection may be warranted rather than immediate mitigation of the building. The additional data collection may be justified to determine if the data are subject to temporal variations. After the evaluation of temporal variations, a risk management decision would be rendered for the building based on the repetitive data. An appropriate risk standard for the exposure would be determined, and then, based on that standard, either the building would be mitigated or deemed not at risk. In some cases, it may be more prudent to mitigate the building rather than collect additional indoor air data and the guidance document will be revised to state this. Also, language will be added to the guidance document to state that multiple indoor air sampling events may be necessary based on site-specific conditions.

Response Tracking Number: 249

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Site Specific Screening

Guidance Document Page: 22

Public Comment:

This guidance document's discussion of future buildings (p. 22 and pp. 37-39) is a step forward, but it's not enough. Communities need clearer guidance about where and how it is safe to place homes, schools, or other structures above shallow groundwater or soil contamination. Reasonable steps to eliminate the sources of vapor intrusion should be taken before construction, because engineering controls, while likely to be effective in the short run, require monitoring, possible operation and maintenance, and contingency planning should they fail. In California, periodic earthquakes or other geologic forces are likely to create cracks in otherwise impermeable foundations. That is, engineering controls should not be viewed as a substitute for maximum practical cleanup, including innovative methods of accelerated treatment, before construction.

DTSC Response to Comment:

DTSC's revised guidance document will stress that subsurface remediation is good environmental stewardship and preferred over the use of engineering controls to mitigate human exposure in future buildings. However, under the circumstances where future commercial and industrial buildings are constructed over contamination, a vapor barrier always requires passive or active venting due to potential holes or breaches within the membrane (see response no. 182). Also, the monitoring of venting systems should include vacuum, flow, and contaminant concentration measurements (see response no. 77). There are many options available to verify the lack of exposure in future buildings, such as the monitoring of permanent probes in the subsurface and crawl spaces or the sampling of indoor air. The guidance document will be revised to state that regulators have discretion in determining the style of post-construction sampling (see response no. 327). The monitoring requirements for future buildings would be incorporated into land use covenants. These covenants are agreements between DTSC and the responsible party which outline the specific requirements for public health protection. Pursuant to Title 22 CCR Section 67391.1, DTSC is responsible for the implementation and enforcement of the covenants.

Response Tracking Number: 250

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 44

Public Comment:

Vapor intrusion investigations not only rely upon general public support, but they require the permission and cooperation of people whose homes and businesses are being sampled. Residents may be subject to repeated intrusion. They may need to root through their cupboards, basements, and garages to find and remove toxic household products. They may even be asked to allow drilling through their floors. And if contamination is found, they may face the inconvenience and noise of ventilation systems that may need to operate indefinitely.

Winning continuing cooperation requires an extra effort of community relations. One doesn't want to be in the position of knocking on someone's door for the first time and saying, "I'm from the government, and I'd like to drill a hole in your floor". In some communities, regulators should consider partnering with local organizations that regularly work with people in the neighborhood, who speak the language, and who share the culture. Of course, before requesting permission to sample, it's important to determine who – the tenant, landlord, homeowners' association, etc. – is authorized to give permission for each proposed action.

Another valuable community relations tool is the community advisory group, which allows representative members of the local community to develop gradually the expertise to understand the vapor intrusion project. This makes it easier for residents to open up their homes to testing, and it helps the community provide constructive advice. It also creates a group of people capable, when it is merited, of re-assuring their neighbors when/where those neighbors are skeptical of the statements of government officials.

DTSC Response to Comment:

The need for a community advisory group and interaction with existing local organizations will be further emphasized in the revised guidance document. Also, see response no. 183 for more information concerning public outreach.

Response Tracking Number: 251

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

The language on page 5 that soil gas characterization should continue, laterally and vertically, until there are no detections is important. Since there is no magic concentration level that determines the likelihood of vapor intrusion, it's best to map the entire plume.

DTSC Response to Comment:

The language concerning the importance of three-dimensional plume characterization will remain in the guidance document and the characterization approach for vapor intrusion will be further clarified in the revised document (see response no. 122 and 172).

Response Tracking Number: 252

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

The call for high sampling densities on page 6 seems good, but the concept should be expanded to intensify groundwater sampling. Reliance on interpolation may be inadequate, because the density of sampling required to characterize groundwater plumes isn't sufficient to support vapor intrusion investigations. For example, just west of the MEW Superfund Study Area in Mountain View, there's a home somewhere near the 5 ppb TCE-in-groundwater contour, and it has significant vapor intrusion. When our Community Advisory Group looked at the basis for that contour line, we found monitoring wells, at some distance, with concentrations of 50 ppb and 1 ppb. This example suggests that the 100-foot -from-contamination boundary for air testing should be moved out, because of the uncertainty over where the edge of the plume lies, or more sampling locations should be used to determine it.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document. When sampling for vapor intrusion, the contamination for each building, whether existing or future, must be determined with an appropriate number of sampling points. However, the density of any sampling effort should be dictated by site-specific conditions. In certain circumstances, vapor intrusion screening can be done with groundwater contaminant data (see response no. 289). Subsurface contamination, whether in soil gas or groundwater, should be sampled at a sufficient density so that the extrapolation of contaminant concentrations between sampling points can be conducted with minimal uncertainty. This extrapolation of contaminant concentrations is especially critical along edges of contaminant plumes where decisions will be made concerning what buildings should be subject to indoor air testing.

Response Tracking Number: 253

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

The requirement that analytic detection limits for soil gas not exceed 500 times the indoor air goal seems obvious, but I've seen less careful approaches. So I'm glad that it is expressed here.

DTSC Response to Comment:

See response no. 130 and 352.

Response Tracking Number: 254

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Preliminary Screening

Guidance Document Page: 14

Public Comment:

The assumptions for using default attenuation factors, on page 14, include "Preferential pathways do not exist." However, it appears that preferential pathways are common, unless buildings have been specifically designed and constructed to resist vapor intrusion. There should be a requirement to disprove the presence of such pathways before default factors are used. In the absence of such proof, investigations should include indoor air sampling as well as soil gas sampling. (See #2 above.)

DTSC Response to Comment:

As noted in the comment, all buildings contain preferential pathways. The need for preferential pathway evaluation should be based on site-specific conditions. Of concern to DTSC is the potential connection between subsurface plumes, either soil gas or groundwater, and buildings, particularly where buildings exist near the edge of subsurface plumes. Buildings adjacent to or laterally offset from subsurface plumes may be subject to vapor intrusion due to subsurface preferential pathways. Hence, utility corridors, and other possible migration pathways, should be located in these situations to determine if utility conduits lead from the plume to the adjacent buildings. If so, data collection would be warranted to determine if the soil gas of the backfill material for these conduits is contaminated. This data collection could be active or passive soil gas samples. Also, see response no. 14, 38, and 93.

Response Tracking Number: 255

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Preliminary Screening

Guidance Document Page: 15

Public Comment:

The restriction of screening based upon groundwater sampling to downgradient areas (page 15) also makes sense, though it must be acknowledged that source areas are often unrecognized.

DTSC Response to Comment:

The language will be added to the guidance document to state that the sources of groundwater contamination under residential neighborhoods might not be known and that efforts should be undertaken to locate these sources.

Response Tracking Number: 256

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Preliminary Screening

Guidance Document Page: 17

Public Comment:

It is good that the guidance reinforces the requirement to report all releases, not just those exceeding SB 32 screening numbers (p. 17).

DTSC Response to Comment:

This text will not change in the revised guidance document.

Response Tracking Number: 257

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

The default attenuation factor (p. 19) should be based upon the maximum likely exposure, not the average, because it's more important to test homes or other structures that might have vapor intrusion than to avoid sampling units which might not be impacted.

DTSC Response to Comment:

The default attenuation factor mentioned on page 19 is used for evaluating the vapor intrusion of subslab soil gas into indoor air. The attenuation factor was taken from USEPA's empirical database. The value of 0.01 represents a conservative interpretation of that database and the value is not meant to represent median or mean interpretations of that database, but an upper limit of that database.

Response Tracking Number: 258

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

The statement (page 24) that ambient data shouldn't be used to reduce the indoor air impacts is appropriate. Furthermore, it would help to have a clear distinction between "ambient" air, which may be affected by subsurface contamination in the neighborhood (through subslab venting, treatment system off-gassing, and direct vapor releases), and "background" measurements, which should be taken some distance from known sources.

DTSC Response to Comment:

The guidance document will be revised to state that ambient air samples should not be influenced by subsurface contaminant plumes, and that the outdoor air samples should be collected from upwind locations.

Response Tracking Number: 259

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

The discussion on utility corridors (also on p. 24) is very helpful.

DTSC Response to Comment:

The discussion of utility corridors will be further clarified in the revised document (see response no. 14, 38, and 254).

Response Tracking Number: 260

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 26

Public Comment:

The placement of sampling locations within residences (page 26) should consider potential internal pathways. There is a home in Hopewell Junction, New York, where the upstairs registers greater TCE concentrations than the downstairs. Apparently the contamination is rising through the walls.

DTSC Response to Comment:

See response no. 261.

Response Tracking Number: 261

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Assessment

Guidance Document Page: 24

Public Comment:

Furthermore, in buildings with multiple attached units, indoor air sampling should occur in each ground-floor unit, and depending upon the structure, units on other levels. If a single unit among several attached units has a preferential pathway, it can collect vapors from the entire structure and thus magnify a modeled concentration that is based upon single unit calculations. Unless preferential pathways are transparent, sampling a single unit (or a small percentage of units) in such structures is akin to Russian Roulette. A non-detect or low-detect result in one, or even several units may miss high concentrations in other units.

DTSC Response to Comment:

The guidance document will be revised to address this situation. When multi-story residential units are subject to indoor air testing due to potential vapor intrusion, the guidance document will recommend that all floors be tested.

Response Tracking Number: 262

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Sampling

Guidance Document Page: 30

Public Comment:

The concern for privacy (page 30) is good, but that should not be used to hide problems from the public at large. There should be a requirement for public disclosure of all air sampling results. Specific addresses should be disclosed only if a resident agrees, except that prospective buyers and tenants should be notified in any case. Public disclosure should be built into the broader program of public involvement.

DTSC Response to Comment:

The language concerning the confidentiality of the indoor air sampling results will be further clarified in the revised guidance document. The indoor sampling data for a given site are made available to the public through many mechanisms. One of which is a public repository of site documents, usually located at the local library or city hall. Also, in the near future, DTSC plans to post all site reports on the internet using the Envirostor database. Concerning confidentiality, DTSC instructs responsible parties and their associated consultants not to identify individual property occupants and their addresses in the sampling reports. The building locations are shown in the reports along with the analytical data. Real estate disclosure laws require land owners and their renters to disclose this information to prospective buyers and DTSC does not perform these disclosures.

Response Tracking Number: 263

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Sampling

Guidance Document Page: 31

Public Comment:

The section on identifying preferential pathways (page 31) is strong, but it could be strengthened more by expanding the discussion of real-time field sampling that may be used to home in on such pathways. Real-time and near-real-time sampling devices, such as EPA's Trace Atmospheric Gas Analyzer (TAGA) have proven effective for this purpose. The TAGA - and presumably similar equipment - can be used to identify preferential pathways and confounding sources such as household products. It can also correlate concentrations with meteorological conditions such as wind, temperature, and atmospheric pressure.

DTSC Response to Comment:

DTSC will further emphasize in the revised guidance document the need for real-time sampling results from portable analytical equipment prior to and during indoor air sampling with Summa canisters. A properly calibrated portable GC/MS can yield reliable measurements in the part per billion range. Other instruments, besides a portable GC/MS, may be available to achieve these detection limits but these instruments may be less reliable. When conducting indoor air sampling with Summa canisters, portable analytical instruments can add value to the sampling process. Portable equipment can determine soil gas entry points and sources of indoor air contamination unrelated to vapor intrusion (cosmetics, cleaners, paints, etc.). Due to this benefit, DTSC wanted to encourage their use, in conjunction with Summa canister testing, in evaluating the quality of indoor air. Without the identification and removal of secondary sources of contamination, it is difficult to interpret the results of the indoor air samples. The guidance document will be revised to encourage field screening of buildings but the document will also be less prescriptive about the choice of field analytical instruments to be used for screening purposes.

Response Tracking Number: 264

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Indoor Air Sampling

Guidance Document Page: 32

Public Comment:

The statement that indoor air sampling should be done in an environment representative of normal use (page 32) is also good. On the one hand, the sampling of vacant, unheated units (as the Navy has done at Moffett Field's Orion Park Housing Area) may miss climate control-induced vapor flows. On the other hand, the sampling of commercial buildings with no active air conditioning may intensify the concentration of vapors, as at the MEW site in Mountain View. (As a sampling technique, that may be effective, because it magnifies the problem, but there may need to be an adjustment when risk is assessed, if the building is designed only to be used with ventilation systems on.)

DTSC Response to Comment:

The intent of indoor air sampling is to obtain data that are representative of building conditions during human occupancy. The revised guidance document will further emphasize this very important point.

Response Tracking Number: 265

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Mitigation

Guidance Document Page: 37

Public Comment:

The section on Vent Riser design (p. 37) is good, but it could be improved with a brief discussion of ways to ensure that vented vapors not be aimed at neighbors' homes - assertedly the case in some homes in Endicott, NY - or the air conditioning intakes on commercial buildings.

DTSC Response to Comment:

The text concerning vent risers in the guidance document will be revised to indicate that vented vapors should not be aimed at other homes and buildings or at air conditioning intakes on commercial buildings.

Response Tracking Number: 266

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Mitigation

Guidance Document Page: 40

Public Comment:

I don't have the expertise to know whether the discussion of surface paving (page 40) is sufficient, but I'm glad that it has been included in the document.

DTSC Response to Comment:

This text will not change in the revised guidance document (see response no. 129).

Response Tracking Number: 267

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Mitigation

Guidance Document Page: 40

Public Comment:

The language on institutional controls (p. 40) is original and good. I suggest, though, that language be added to promote cooperation between environmental regulators and local officials. Local officials, in the approval of zoning, issuance of building permits, and review of California Environmental Quality Act (CEQA) documents, are the first line of defense in preventing inappropriate use or activities on contaminated property. Mountain View has pioneered this approach, including vapor intrusion mitigation in its CEQA approval of a recent residential development, but it was only able to do so after U.S. EPA experts reviewed technical documents. Such cooperation should be the standard - that is, it should not rely upon individual initiative. Among Mountain View's commendable initiatives, it is requiring point-of-marketing disclosure at a new housing site as part of CEQA approval. State disclosure laws notify buyers only at closing. That's too late.

DTSC Response to Comment:

The language on institutional controls is meant to conceptually communicate the intent of the controls. More detailed information on institutional controls can be found in other DTSC guidance. The guidance document will be revised to stress that coordination and cooperation with local officials and agencies is paramount to the success of institutional controls and that additional information on institutional controls can be found in other guidance documents.

Response Tracking Number: 268

Commenter Organization: Center for Public Environmental Oversight

Technical Subject: Appendix F

Guidance Document Page: F1

Public Comment:

The explanation (p. C-4 and Appendix F) why OSHA Permissible Exposure Levels don't generally apply in vapor intrusion investigations is very helpful.

DTSC Response to Comment:

No response needed.

Response Tracking Number: 269

Commenter Organization: Hewlett-Packard Company

Technical Subject: Indoor Air Assessment

Guidance Document Page: 29

Public Comment:

As it is written, Step 7 - Site-Specific Screening Evaluations - recommends conducting indoor air sampling (Step 8) if the J&E Model screening for any of the VOCs present in soil gas results in a cancer risk exceeding 1 x10-6 or an HI greater than 1. In Step 8 - Indoor Air Sampling Assessment - the guidance states that the analyte list for indoor air sampling should include all analytes detected in soil gas. By including all detected compounds in soil gas as analytes for indoor air sampling, the Guidance is missing an important step to screen out VOCs that are detected at such low levels in soil gas so as not to represent a potential indoor air risk due to vapor intrusion.

DTSC Response to Comment:

See response no. 319.

Response Tracking Number: 270

Commenter Organization: Hewlett-Packard Company

Technical Subject: Indoor Air Assessment

Guidance Document Page: 29

Public Comment:

Step 8 of the Guidance should state that only VOCs that are detected at concentrations that exceed a risk of 1 x 10-6 or an HI greater than 1 based on the J&E Model Screening should be included as analytes for indoor air samples. If multiple VOCs are present in soil gas, then the risk threshold for each compound could be adjusted accordingly to account for cumulative risk from multiple compounds.

DTSC Response to Comment:

See response no. 319.

Response Tracking Number: 271

Commenter Organization: Western States Petroleum Association

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

Site Characterization - We recommend that the Site Characterization section be amended as follows:

• Use of soil matrix data should not be summarily dismissed when no soil vapor data has been collected.

• Lateral and vertical delineation should be to screening levels not to non-detect levels.

• Sampling density and distribution requirements should be limited to achieving adequate evaluation of the vapor intrusion pathway; the goal is not to delineate the vapor plume.

• Potential lateral vapor mitigation should take into account biodegradation and depth to source; not simply be a default of 100-foot distance.

DTSC Response to Comment:

Item 1: See response no. 21 and 289.

Item 2: See response no. 204.

Item 3: Three dimensional plume delineation is advantageous for numerous reasons beyond vapor intrusion evaluations, as follows: 1) source areas can be determined, 2) areas for remediation can be established, 3) potential contaminant impact to groundwater can be ascertained, and 4) preferential stratigraphic pathways can be evaluated. Also, see response no. 122.

Item 4: See response no. 1, 179, 280, and 330.

Response Tracking Number: 272

Commenter Organization: Western States Petroleum Association

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

We believe that the state of knowledge (studies by LLNL for the SWRCB) is that vadose zone aerobic biodegradation of petroleum hydrocarbons is common and significant. WSPA recommends that an additional decrease by a factor of 10 be allowed to the attenuation factor for biodegradable compounds.

DTSC Response to Comment:

See response no. 1, 179, 245, and 330.

Response Tracking Number: 273

Commenter Organization: Western States Petroleum Association

Technical Subject: Indoor Air Sampling

Guidance Document Page: 33

Public Comment:

WSPA recommends that indoor air testing for compounds commonly found in background should be based on concentrations of these compounds detected in soil gas. In many cases, background levels of indoor air contaminants may not be related to soil vapor intrusion, but could lead to long term monitoring or mitigation when soil vapor intrusion is not significant.

DTSC Response to Comment:

See response no. 319.

Response Tracking Number: 274

Commenter Organization: Western States Petroleum Association

Technical Subject: Preliminary Screening

Guidance Document Page: 18

Public Comment:

The California Human Health Screening Levels (CHHSLs) are the only screening levels referenced in the guidance document. WSPA recommends that the document allow the use of other appropriate screening levels -- for example the San Francisco Bay ESLs.

DTSC Response to Comment:

See response no. 180.

Response Tracking Number: 275

Commenter Organization: Atlantic Richfield Company

Technical Subject: General

Guidance Document Page:

Public Comment:

DTSC should provide supporting references on its website. There is a lack of supporting information readily available for the serious reviewer. Many of the references are obscure reports that are difficult to obtain, even at research institutions. Others references are for conference presentations. In the future, all references used in these documents should be available online at the DTSC's website.

DTSC Response to Comment:

References authored by USEPA and DTSC are currently available on our respective websites. Likewise, the abstracts and slides from the conferences and symposiums referenced in the guidance document are available on the internet, usually through the hosting organization or through iavi.rti.org. Scientific journal articles are available through the University of California and California State University library systems.

Response Tracking Number: 276

Commenter Organization: Atlantic Richfield Company

Technical Subject: General

Guidance Document Page:

Public Comment:

DTSC should consider reorganizing the document. The current version of the document tends to mix procedural recommendations with technical issues. For example, much of the information on sampling in the soil gas and indoor air sections could easily be moved to appendices.

DTSC Response to Comment:

Some technical information will be moved into the appendices. For example, laboratory issues will be moved into an appendix. DTSC will move other information into the appendices as appropriate for clarity.

Response Tracking Number: 277

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

DTSC should reconsider the level of effort needed in Step 2. The level of effort proposed in Step 2 seems inappropriate for some sites, especially those not located above a source. At the top of Page 6, DTSC recommends collecting soil vapor samples at 5 and 20 feet and immediately above the capillary fringe of contaminated groundwater in order to define the vapor plume. Yet, in Step 5, the screening evaluation allows the use of groundwater data to evaluate vapor intrusion when away from the source area. While the level of effort required in Step 2 might be appropriate in the source area, it would not be very cost effective for screening offsite, away from the source. Typically, when groundwater is impacted, offsite wells are installed to define the extent of contamination. The groundwater data from these wells would be sufficient for screening purposes.

DTSC Response to Comment:

Site characterization language will be further clarified in the revised guidance document. See response 122 and 172.

Response Tracking Number: 278

Commenter Organization: Atlantic Richfield Company

Technical Subject: Appendix D

Guidance Document Page: D1

Public Comment:

DTSC should consider providing more information about the Johnson & Ettinger model. An appendix should be dedicated to the Johnson & Ettinger model. It should include a description of the model in both conceptual and mathematical terms and sample spreadsheets for both residential and commercial receptors. It should also provide tables giving the parameter values for the screening and site-specific evaluations, including the bases for the values selected. We recommend that DTSC use the new US EPA spreadsheets that Helen E. Dawson and Paul Johnson previewed at the “Integrating Observed and Modeled Vapor Attenuation Workshop” in San Diego in March 2005.

DTSC Response to Comment:

The intent of Appendix D was to provide a broad overview of the Johnson and Ettinger model and was not meant to discuss the mathematical nuances of the algorithm. More importantly, in Appendix D, DTSC wanted to justify the selection of the recommended input parameters for site-specific screening in California. These California-specific input parameters are shown in Table 3 of the guidance document. It should be noted that preliminary screening for vapor intrusion, pursuant to the current guidance document, requires no site-specific data except for the maximum soil gas vapor concentration. The preliminary screening attenuation factors are provided by DTSC and the technical basis for these attenuation factors can be found in OEHHA (2005). DTSC anticipates that any revised spreadsheets by USEPA will include a comprehensive user’s manual so that DTSC can limit the amount of information in the guidance document on the J&E model. Any new spreadsheets by USEPA will be recommended for use within California once DTSC integrates the California-specific toxicity factors.

References

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 279

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 09

Public Comment:

DTSC should consider reevaluating its position on the use of soil matrix data.

In this guidance, the DTSC appears to have taken the position that soil matrix data is unacceptable in assessing indoor air exposures. This seems to contradict DTSC's earlier position as stated in its comments to the U.S. EPA regarding its 2002 draft guidance: "For the reasons given above, and because site cleanup levels are historically stated in units corresponding to bulk soil concentrations (e.g., mg/kg), DTSC recommends that the Guidance provide appropriate discussion on the judicious use of bulk soil data and partitioning assumptions."

We concur with DTSC's earlier position on the judicious use of soil data. Most site investigations involve extensive soil sampling because these data can be used to assess multiple pathways, including direct contact or ingestion, potential impact to groundwater due to leaching, and vapor migration. In addition, these data provide a much better idea of the masses of contaminants present and their locations. Finally, soil concentrations are often used as remediation goals. Soil gas data offer none of these benefits. The references cited by DTSC do not support its position that soil matrix data using Method 5035A would result in risk estimates that are biased low. Hewitt (1994) simply showed that soil samples collected in storage bottles resulted in VOC losses much greater than those collected using syringes similar to what is called for in 5035A. Hewitt (1999) found that while core barrel samples had substantial VOC losses, En Core and VOA vial samples showed no appreciable losses under normal collection, shipping, and storage procedures. Likala et al (1996) found that VOC losses from samples placed in wide-mouth jars were much greater than for samples collected in methanol containing VOA vials. Vitale et al (1999) compared VOC losses for soil sampling techniques and concluded that inherent variability in actual soil samples made it difficult to prefer one method to another.

Two other papers by Hewitt indicate that soil matrix samples are representative and correlate well with soil vapor concentrations. Hewitt (1998a) used lab experiments to show that there was a very strong correlation between vapor and bulk soil concentrations, concluding that soil vapor data could be used to predict bulk soil concentrations in the field. Hewitt (June, 1998) conducted filed studies that showed a very strong correlation between in situ soil vapor concentrations and soil sample concentrations.
The DTSC should reconsider the use of soil matrix data or provide a more scientifically defensible position as to why only soil gas data are acceptable.

DTSC Response to Comment:

DTSC's comment on USEPA's 2002 guidance document concerning soil matrix sampling was intended to request further clarification from USEPA about the circumstances under which soil matrix samples could be used to evaluate vapor intrusion. Back in 2002, DTSC was formulating policy on this issue and turned to USEPA as a venue for understanding. Realizing that further clarification from USEPA would not be forthcoming in the form of a revised guidance document, DTSC addressed the issue internally and presented our position in the vapor intrusion guidance document. DTSC's position was also influenced by the resolution of this issue by other states. Also, human health risk calculated from soil matrix samples will be biased low due to inherent VOC escape during the sample collection process. Likewise, soil matrix data increases the uncertainty in the quantification of the human health risk due to partitioning assumptions.

Response Tracking Number: 280

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 11

Public Comment:

DTSC should consider adding an attenuation adjustment factor for lateral sources. Currently, the guidance states that buildings within 100 feet laterally of a source should be evaluated; yet, no information is given as to how these sites should be modeled during screening. An initial screening step could assume that the source is directly beneath the building, but at a depth equal to the diagonal distance from the edge of the building to the edge of the source. A better approach would be to develop attenuation adjustment factors for various combinations of soil type, depth and lateral distance to the source, and building type.

The work by Abreu and Johnson (2005a) and Lowell and Eklund (2004) show that the potential lateral migration of contaminants diffusion in the vadose zone is a function of contaminant depth and degradability. For many cases, the assumed 100-foot lateral distance between vadose-zone impacts and a potential receptor may be overly conservative. Additionally, recent vapor intrusion guidance from some other states has taken into consideration aerobic biodegradation which reduces the investigation distance criterion. For example, in order to take into consideration aerobic biodegradation, the New Jersey Department of Environmental Protection's (NJDEP) 2005 Draft Vapor Intrusion Guidance utilizes an investigation distance of 30 feet for sites with petroleum-related groundwater contamination; provided that non-aqueous phase product is not present. The option to determine a site-specific lateral distance for this evaluation should be included in the guidance.

DTSC Response to Comment:

The guidance document will be revised to allow for the determination of a site-specific lateral offset for existing buildings rather than rely exclusively on the 100 foot default distance from USEPA. For the existing building scenario, buildings within 100 feet of contamination, as defined by health-based concentrations, may warrant indoor air sampling to verify no potential exposure. The decision to test buildings near the edges of plumes should be based on site-specific conditions, such as public perception, potential for preferential pathways, amount of pavement in the area, results of nearby indoor air testing, and subsurface conditions. In some instances, the 100 foot distance may not be appropriate due to subsurface conditions. When determining site-specific offsets for the existing building scenario, the approaches from Lowell and Eklund (2004) and Abreu and Johnson (2005) can be used. However, determinations of site-specific offsets must be made with caution. The two and three dimensional modeling as indicated by Lowell and Eklund (2004) and Abreu and Johnson (2005), respectively, have not been extensively field validated. The field experiments conducted by Christophersen et al. (2005) suggest that shallow contaminant sources at 2.5 to 4.2 feet below the ground surface can have 50 feet of lateral vapor migration from the source. Hence, the determination of site-specific offsets is best documented with field data.

For the future building scenario, where unacceptable contaminant levels are left in the subsurface upon brownfield redevelopment, buildings that warrant no engineering controls would have to be at least 100 feet from the edge of health-based concentrations. While this approach may be conservative, it compensates for the uncertainty about soil gas migration upon building construction due to pavement placement and orientation of subsurface conduits (preferential pathways).

References

Abreu, L. D. V., and P. C. Johnson. 2005. Effect of Vapor Source - Building Separation and Building Construction on Soil Vapor Intrusion as Studied with a Three-Dimensional Numerical Model. Environmental Science and Technology, v. 39, no. 12, p. 4550 - 4561.

Christophersen, M., M. Broholm, H. Mosbaek, H. Karapanagioti, V. Burganos, and P. Kjeldsen. 2005. Transport of Hydrocarbons from an Emplaced Fuel Source Experiment in the Vadose Zone at Airbase Vaerlose, Denmark. Journal of Contaminant Hydrology, v. 81, p. 1 - 33.

Lowell, P. S., and B. Eklund. 2004. VOC Emission Fluxes as a Function of Lateral Distance from the Source. Environmental Progress, v. 23, n. 1, p. 52 - 58.

Response Tracking Number: 281

Commenter Organization: Atlantic Richfield Company

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

DTSC should consider adding an attenuation adjustment factor for biodegradable organics. DTSC's position on biodegradation of organics is that "While conditions conducive to biodegradation usually exist within the vadose zone, exceptions occur in California which preclude the adoption of a policy by DTSC that petroleum hydrocarbons always biodegrade in the vadose zone, posing no vapor intrusion risk. Therefore, petroleum hydrocarbons at sites in California must be evaluated for the possibility of vapor intrusion." No references are provided to support this position. The DTSC has concluded that biodegradation of hydrocarbons can only be considered for site-specific evaluations, and it can be considered only under very limited conditions supported by extensive sampling and analysis.

Kremesec, et al. (2005) have suggested that screening level attenuation factors through the vadose zone for petroleum hydrocarbons be reduced by a factor of at least 10 to account for biodegradation. They provide numerous references on studies that support their position (Roggemans et al., 2001, Abreu and Johnson, 2005b; Ettinger and McAlary; 2005; DeVaull et al., 2002; Lahvis et al., 1999). New Jersey has recently adopted this factor and US EPA has publicly stated that they will include a biodegradation factor in their next recommendations.

We agree that site screening for petroleum hydrocarbons include an adjustment factor of at least 10 to account for biodegradation. The type of testing recommended by the DTSC would be applied in site-specific evaluations.

DTSC Response to Comment:

See response no. 1, 179, 245, and 330.

Response Tracking Number: 282

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

The quantification of both soil gas and groundwater risks is not necessary. This requirement implies that the soil gas and groundwater concentrations are not related when in fact they typically are correlated. Soil gas data are often collected to provide a better estimate of potential vapor migration from groundwater and therefore should be considered the more appropriate data for the vapor intrusion evaluation. For example, if the risks calculated from the groundwater data exceed a threshold but the risks from soil gas do not, then no corrective action would be necessary. The use of risk estimates from soil gas data is preferable to estimates from groundwater concentrations. It is common to find different risk estimates due to the conservative assumptions used in the vapor transport models. Using the higher of the two values for risk management decisions is not technically justified.

DTSC Response to Comment:

The risk associated with contaminated soil gas and groundwater should be quantified so an appropriate risk management decision can be made for vapor intrusion. If the media are in equilibrium, the associated vapor intrusion risk should be approximately the same. If not, a reasonable risk management decision should be made as compelled by the interpretation of the multiple lines of evidence.

DTSC's position regarding subsurface sampling will be clarified upon revision of the guidance document. As indicated by the guidance document, soil gas is the primary sampling method for vapor intrusion evaluations but risk management decisions should be made using all available lines of evidence. Subsurface delineation within a plume should continue until risk-based screening levels are obtained. For California, these risk-based screening levels can be the California Human Health Screening Levels (CHHSLs) pursuant to Senate Bill 32 if cumulative health effects are not of a concern. Once the soil gas plume is delineated to risk-based levels, a survey should be conducted of the existing and future building locations. If buildings are within 100 feet of the edge of the plume, as delineated by risk-based levels, a survey of potential conduits for preferential contaminant migration should be conducted. If conduits exist, assessment of the conduits might be warranted.

Studies by Hers et al. (2006) and DiGiulio and Cody (2006) indicate that shallow soil gas measurements at 5 feet may not be indicative of soil gas concentrations under buildings. These studies suggest that soil gas samples collected at depths of 10 - 12 feet are a better indicator of vapor intrusion risk than samples collected at 5 feet. The numerical modeling conducted by Abreu and Johnson (2005) and Abreu et al. (2006) also suggests this relationship. Hence, risk quantified with shallow soil gas measurements (5 feet below grade) using the Johnson and Ettinger model might be biased low. Accordingly, DTSC's revised vapor intrusion guidance document will recommend the collection of soil gas samples at appropriate depths for modeling purposes. Soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade. Deeper sampling would be needed for buildings with basements.

If shallow groundwater conditions exist, then soil gas samples can be taken at shallower depths as appropriate, but soil gas samples taken from depths of less than 5 feet may be subject to barometric pressure effects and could be biased (Massmann and Farrier, 1992; Nilson et al., 1991; Clements and Wilkening, 1974, Elberling et al., 1998; Auer et al., 1996). Risk determinations should rely upon multiple lines of evidence, such as soil matrix samples, groundwater samples, subslab samples, and/or passive soil gas samples. The occurrence of shallow groundwater can make the collection of soil gas samples impossible. Where groundwater is less than five feet below grade, and there is a large capillary fringe associated with the water table, no-flow conditions may be encountered. Hence, after the failure of soil gas sample collection, other contaminant media must be used to evaluate vapor intrusion. In this instance, at a minimum, both groundwater and soil matrix sampling would be warranted. Other lines of evidence would be collected as needed. The risk associated with both media (groundwater and soil matrix) would be quantified and compared to evaluate contaminant equilibrium. If the risk from both media diverge significantly, a reasonable risk management decision should be made based on the weight of evidence.

Where subsurface contaminant data indicate a potential human health risk, repetitive soil gas sampling from permanent points may be warranted to document subsurface conditions. As soil gas grab samples approach risk-based concentrations, the installation of permanent monitoring points should be considered. Quantification of the contaminant source is critical for risk-based decision making. Prudence may dictate that soil gas be monitored through time, in a fashion similar to groundwater, to ascertain representative subsurface concentrations and to document contaminant plume stability. Such conditions warranting the installation of permanent soil gas monitoring points may include the following:

1) Groundwater is less than five feet below grade and repetitive soil gas sampling is needed to obtain representative subsurface samples.

2) Vadose zone is subject to deep barometric pressure effects (sandy conditions with deep groundwater).

3) Quantification of human health exposure indicates marginal risk (approximately 1x10-6) and further refinement of the contaminant source is needed to further refine the risk estimations.

4) Evaluate whether contamination has reached steady-state conditions in the subsurface.

5) Soil gas grab samples yield an irregular distribution of subsurface contamination.

6) Soil gas plumes have migrated offsite under residential neighborhoods.

7) Soil matrix sampling indicates a large mass of volatile organic compounds in the subsurface.

8) Evaluate the effectiveness of soil vapor extraction (SVE) systems on remediating soil gas plumes.

9) Verify the effectiveness of passive or active subslab venting systems on removing contamination under building foundations.

10) Determine whether biodegradation of petroleum vapors is occurring in the subsurface (see response no. 244).

11) Groundwater is subject to frequent elevation change due to tidal fluctuation or localized pumping for irrigation or municipal use.

Under unique circumstances, however, sites can be screened with contaminant data other than soil gas. Some of these situations are as follows:

1) Screening with groundwater contaminant data can be done in areas distal to the contaminant sources. These sources would include primary and secondary contaminant sources. Primary sources are tanks, pits, sumps, and impoundments (etc.) where hazardous substances were released to the environment. Secondary sources are subsurface accumulations of non-aqueous phase liquid (NAPL). "Distal" areas would be far removed from the contaminant sources, in areas with no evidence of additional vadose zone contamination. DTSC envisions screening with groundwater data when buildings have the unfortunate circumstance of being over the leading edge of a large offsite groundwater plume.

2) The occurrence of shallow groundwater can make the collection of soil gas samples impossible. Where groundwater is less than five feet below grade, and there is a large capillary fringe associated with the water table, no-flow conditions upon soil gas sampling may be encountered. Hence, after the failure of soil gas sample collection, other contaminant media must be used to evaluate vapor intrusion. In this instance, both groundwater and soil matrix sampling would be warranted. The risk associated with both media would be quantified and compared to evaluate contaminant equilibrium. If the risk from both media diverge significantly, a reasonable risk management decision should be made based on the weight of evidence. Additionally, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence.

3) The evaluation of vapor intrusion with only soil matrix data would occur when groundwater is not contaminated, as verified through sampling, and soil gas collection failed in the field after numerous attempts due to no-flow conditions. Under this scenario, soil matrix data could be used, but only when subject to the highest data quality objectives under USEPA Method 5035. However, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence.

It should be noted that the USEPA vapor intrusion guidance document does not have soil matrix screening numbers, reflecting USEPA's uneasiness with screening sites exclusively with soil matrix samples. USEPA specifically addresses soil matrix samples on page 29 of their 2002 document, stating that "soil (as opposed to soil gas) sampling and analysis is not currently recommended for assessing whether or not the vapor intrusion pathway is complete".

References

Abreu, L. D. V., and P. C. Johnson. 2005. Effect of Vapor Source - Building Separation and Building Construction on Soil Vapor Intrusion as Studied with a Three-Dimensional Numerical Model. Environmental Science and Technology, v. 39, no. 12, p. 4550 - 4561.

Abreu, L., P. Johnson, and T. McAlary. 2006. 3D Model Simulations and Implications to Near Building Sampling. AEHS Vapor Intrusion Work Shop, San Diego. March 16, 2006.

Auer, L. H., N. D. Rosenberg, K. H. Birdsell, and E. M. Whitney. 1986. The Effects of Barometric Pumping on Contaminant Transport. Journal of Contaminant Hydrology, v. 24, p. 145 - 166.

Clements, W. E., and M. Wilkening. 1974. Atmospheric Pressure Effects on 222Rn Transport Across the Earth-Air Interface. Journal of Geophysical Research, v. 79, n. 33, p. 5025 - 5029.

DiGiulio, D., and R. Cody. 2006. Evaluation of the "Unconstrained Version" of the J&E Model and Comparison of Soil-Gas and Sub-Slab Air Concentrations at the Raymark Superfund Site. AEHS Vapor Intrusion Work Shop, San Diego. March 16, 2006.

Eberling, B., F. Larsen, S. Christensen, and D. Postma. 1998. Gas Transport in a Confined Unsaturated Zone During Atmospheric Pressure Cycles. Water Resources Research, v. 34, p. 2855 - 2862.

Hers, I., H. Dawson, and R. Truesdale. 2006. Testing Exterior Tier 3 Screening with Site Data. AEHS Vapor Intrusion Work Shop, San Diego. March 16, 2006.

Lowell, P. S., and B. Eklund. 2004. VOC Emission Fluxes as a Function of Lateral Distance from the Source. Environmental Progress, v. 23, n. 1, p. 52 - 58.

Massmann, J., and D. F. Farrier. 1992. Effects of Atmospheric Pressures on Gas Transport in the Vadose Zone. Water Resources Research, v. 28, n. 3, p. 777 - 791.

Nilson, R. H., E. W. Peterson, K. H. Lie, N. R. Burkhard, and J. R. Hearst. 1991. Atmospheric Pumping: A Mechanism Causing Vertical Transport of Contaminated Gases Through Fractured Permeable Media. Journal of Geophysical Research, v. B13, p. 21,933 - 21,948.

Response Tracking Number: 283

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

DTSC should consider revising its online spreadsheets for the J& E model. Until just recently, the DTSC had six screening versions of Johnson & Ettinger model – 3 for groundwater and 3 for soil gas. It now has two versions, one for groundwater and one for soil gas. Advanced versions for soil and groundwater can be obtained by e-mail from Thomas F. Booze, Ph.D., at DTSC. On the EPA website, there are eight versions that can be downloaded – 4 screening programs for groundwater, soil, soil vapor, and NAPL, and 4 advanced programs for groundwater, soil, soil vapor, and NAPL. While similar, the models are all different. For example, the advanced soil versions allow the use of more site-specific data and a finite source, while the simple versions do not. All of the models have default values for the air flow rate through the building. For all of the EPA versions, the airflow rate for slab on grade is 2.54E4 cm3/sec. For the DTSC screening versions, the airflow rate is 3.39E4 cm3/sec. For the DTSC advanced versions, it's 5.63E4 cm3/sec. Similarly, there are differences in some of the physical-chemical parameters and toxicity criteria.

Because DTSC recommends site-specific evaluations, it should provide the spreadsheets necessary for doing them. Advanced spreadsheets should be added for soil, soil gas, NAPL, and groundwater sources. They should be similar to the EPA's versions, with input for at least three soil layers. Input should also include building dimensions, either an airflow rate or exchange rate, and floor crack dimensions. In addition, as discussed above, screening versions for soil concentrations should be added.

Also, the DTSC should modify its J&E model spreadsheets to handle multiple chemicals. Currently, if one has 15

VOCs, then one must run the model fifteen times. This change would also allow the spreadsheet to calculate total risks and hazards. It would also enable evaluations of various remedial alternatives and cleanup levels. Modifications would take about 30 minutes per spreadsheet, and it would save time and paper.

Finally, DTSC should develop procedures for updating the spreadsheets. The latest modification dates should be on its website and in the spreadsheet names so that users can tell whether they have the latest version without downloading and opening them every time they want to use them. In addition, new toxicity criteria should be added as soon as possible after being adopted by the State or U.S. EPA. As indicated previously, we recommend that DTSC adopt the new US EPA spreadsheets that Helen E. Dawson and Paul Johnson previewed at the "Integrating Observed and Modeled Vapor Attenuation Workshop" in San Diego in March 2005.

DTSC Response to Comment:

As mentioned in the comment, USEPA is currently modifying their J/E EXCEL spreadsheets. When available, DTSC will modify the spreadsheets pursuant to California input parameters and place them on our webpage. As indicated by USEPA, there will no longer be a screening version and an advanced version of their spreadsheet. The USEPA revised spreadsheets will only have two contaminant source media in the spreadsheet, soil gas and groundwater. Hence, USEPA has removed soil matrix and NAPL as contaminant sources for modeling purposes. DTSC will make a greater effort to denote changes to the model on our webpage rather than annotating changes just in the spreadsheet itself. Also, DTSC routinely receives risk evaluations where the spreadsheets have been modified by stakeholders to accommodate numerous chemicals.

Response Tracking Number: 284

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

DSTC should reconsider some of its sampling recommendations. The level of sampling recommended by DTSC may be excessive at times. The number and location of samples should be developed in consultation with the lead agency based on site-specific considerations. DTSC should realize that many of its recommendations/directives could be quite costly, without adding substantively to one's knowledge of the site. Many of these concerns are addressed below in the specific comments.

DTSC Response to Comment:

The intent of the guidance document is not to exclude alternative approaches and the revised guidance document will state this. Site-specific conditions, along with the conceptual site model (CSM), should always determine the scope of soil gas collection. Also, the revised guidance document will state that soil gas plumes should be delineated to appropriate risk-based levels (see response no. 204) and soil gas samples should be collected right above contaminant sources when the sources are within 10 feet (3 meters) of the surface. For deep contaminant sources, soil gas samples should be collected at least 10 feet (3 meters) below grade (see response no. 216). Deeper sampling would be needed for buildings with basements. Additionally, DTSC will recommend, at a minimum, that one deep boring should be drilled to characterize stratigraphy and deep soil gas at a site, and the density and frequency of soil gas collection should be based on site-specific conditions. See response no. 282 for more information about site characterization.

Response Tracking Number: 285

Commenter Organization: Atlantic Richfield Company

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

Is DTSC asserting authority over all possible vapor intrusion sites? It is assumed that most environmental agencies will use this guidance. However, throughout the document, there are requirements for submittals to DTSC and its approval. Such references to the "DTSC" should probably be modified to the "lead agency." Or, is DTSC going to assert authority over all possible vapor intrusion sites?

DTSC Response to Comment:

The guidance document was generated as a DTSC guidance document for use on DTSC-lead sites. The document was not meant to assert our authority over all vapor intrusion issues in California. The guidance document is available for use by any local, county or state agency as they deem appropriate and the guidance document will be revised to reflect this intent.

Response Tracking Number: 286

Commenter Organization: Atlantic Richfield Company

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

DTSC states, "Other technically equivalent procedures may exist, and this Guidance is not intended to exclude alternate approaches or methodologies. Hence, users of this guidance document are free to use other technically sound approaches." In fact, the Guidance essentially precludes other scientifically defensible approaches, such as the use of bulk soil data and applying a default attenuation factor for biodegradation of petroleum hydrocarbons.

DTSC Response to Comment:

The guidance document only precludes approaches that are technically unreasonable. Scientific studies have limited the utility of some technical approaches for evaluating vapor intrusion. For example, the use of soil matrix data as a sampling technique for the quantification of contaminant source terms is inappropriate. The analytical results from soil matrix samples are biased low due to vapor loss as indicated by USEPA in SW-846 for Method 5035A. Likewise, soil gas results obtained from soil matrix samples are subject to uncertainty due to the assumptions made for contaminant partitioning. These two issues, vapor loss and partitioning uncertainty, make soil matrix sampling a less than ideal technique for the quantification of contaminant sources. See response no. 1, 179, 245, and 330 concerning default attenuation factors for petroleum hydrocarbons.

Response Tracking Number: 287

Commenter Organization: Atlantic Richfield Company

Technical Subject: Scope

Guidance Document Page: 01

Public Comment:

The fifth bullet states, "What is the human health risk associated with vapor intrusion?" DTSC uses this type of language throughout the document. It would be more accurate to label the risks as "theoretical."

DTSC Response to Comment:

DTSC agrees that the term "human health risk" should have a modifier to denote the uncertainty associated with the quantification of risk. Accordingly, DTSC will add "estimated" to the term "human health risk" in the revised guidance document.

Response Tracking Number: 288

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 04

Public Comment:

It is unclear from the last sentence of paragraph on page 4 whether DTSC wants a separate CSM for vapor intrusion or whether the overall CSM should include the vapor intrusion pathway. This should be clarified.

DTSC Response to Comment:

A conceptual site model (CSM) is warranted for every DTSC project. A separate CSM is only needed for vapor intrusion exposure if the pathway was not included in the site-wide CSM. The guidance document will be changed to reflect this intent.

Response Tracking Number: 289

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

Page 5, paragraph 2 is unclear as to DTSC's exact position regarding the use of soil gas and other media data. In several instances, DTSC states that soil gas is preferred or recommended, implying that other data can be used. It also states that converting soil or groundwater data to soil gas concentrations via partitioning equations is unacceptable. This latter position contradicts DTSC's later use of groundwater concentrations in both screening Steps 5 and 7. DTSC cites the U.S. EPA's preference for soil gas data; however, the EPA does allow the use of both soil and groundwater data as input when evaluating vapor intrusion.

Guidance should be given as to when it is best to collect soil vapor samples so as to minimize the need for additional rounds of sampling.

It is unclear as to what is meant by "subject to vapor intrusion" in the last sentence in this paragraph. Does this mean where there is a possible impact or a known impact. Permanent vapor wells should only be installed where there are changing conditions that could possibly generate unacceptable risks in the future.

DTSC Response to Comment:

DTSC's position regarding subsurface sampling will be clarified upon revision of the guidance document. Under unique circumstances, sites can be screened with contaminant data other than soil gas. Some of these situations are as follows but it should be noted that risk management decisions should be made using all available lines of evidence, such as subslab, passive soil gas, and indoor air sampling results.

1) Screening with groundwater contaminant data can be done in areas distal to the contaminant sources. These sources would include primary and secondary contaminant sources. Primary sources are tanks, pits, sumps, and impoundments (etc.) where hazardous substances were released to the environment. Secondary sources are subsurface accumulations of non-aqueous phase liquid (NAPL). "Distal" areas would be far removed from the contaminant sources, in areas with no evidence of additional vadose zone contamination. DTSC envisions screening with groundwater data when buildings have the unfortunate circumstance of being over the leading edge of a large offsite groundwater plume.

2) The occurrence of shallow groundwater can make the collection of soil gas samples impossible. Where groundwater is less than five feet below grade, and there is a large capillary fringe associated with the water table, no-flow conditions upon soil gas sampling may be encountered. Hence, after the failure of soil gas sample collection, other contaminant media must be used to evaluate vapor intrusion. In this instance, at a minimum, both groundwater and soil matrix sampling would be warranted. The risk associated with both media would be quantified and compared to evaluate contaminant equilibrium. If the risk from both media diverge significantly, a reasonable risk management decision should be made based on the weight of evidence. Additionally, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence.

3) The evaluation of vapor intrusion with only soil matrix data would occur when groundwater is not contaminated, as verified through sampling, and soil gas collection failed in the field after numerous attempts due to no-flow conditions. Under this scenario, soil matrix data could be used, but only when subject to the highest data quality objectives under USEPA Method 5035. However, subslab sampling and/or passive soil gas sampling may be warranted as additional lines of evidence when using soil matrix data.

The USEPA vapor intrusion guidance document does not have soil matrix screening numbers, reflecting USEPA's uneasiness with screening sites exclusively with soil matrix samples. USEPA specifically addresses soil matrix samples on page 29 of their 2002 document, stating that "soil (as opposed to soil gas) sampling and analysis is not currently recommended for assessing whether or not the vapor intrusion pathway is complete".

Where subsurface contaminant data indicate a potential human health risk, repetitive soil gas sampling from permanent points may be warranted to document subsurface conditions. As soil gas grab samples approach risk-based concentrations, the installation of permanent monitoring points should be considered. Quantification of the contaminant source is critical for risk-based decision making. Prudence may dictate that soil gas be monitored through time, in a fashion similar to groundwater, to ascertain representative subsurface concentrations and to document contaminant plume stability

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Response Tracking Number: 290

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

It is unclear as to why DTSC believes that soil gas should be sampled at a minimum of two depths – 5 and 15 to 20 feet bgs. The depths at which to sample soil gas should be selected based on site-specific conditions, in consultation with the oversight agency. In some cases, one sample may be sufficient; for others, two might not be enough.

DTSC Response to Comment:

See response no. 216.

Response Tracking Number: 291

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

It appears that DTSC is recommending a minimum of three soil vapor samples above contaminated groundwater – one at 5 feet, one above the capillary fringe, and one halfway to the surface. No rationale is given. Again, the depths at which to sample soil gas should be selected based on site-specific conditions, in consultation with the oversight agency.

DTSC Response to Comment:

The guidance document will be revised to state that soil gas collection should be based on site-specific conditions. The revised guidance document will not reference specific sample densities. However, sampling depths and sampling approaches will be recommended in the revised document (see response no. 172, 216, and 289).

Response Tracking Number: 292

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

It is unclear as to why the soil gas plume needs to be evaluated until a 100-foot clean zone is defined. This would require two clean samples in every direction, which would be very costly. Why not simply sample until the data indicate there is no longer a significant risk?

DTSC appears to be misinterpreting the EPA guidance. First, the EPA guidance states quite clearly that 100 feet "may not be appropriate for all sites (or contaminants)". Second, the 100-foot distance is to sources, such as contaminated groundwater, not to any detected soil gas location.

DTSC Response to Comment:

The guidance document will be revised to recommend plume delineation to the California Human Health Screening Levels (CHHSLs) as developed by OEHHA (2005) rather than plume delineation to non-detectable contaminant concentrations. The CHHSL values are appropriate for contamination at any depth and for any site due to the conservative assumptions used to generate the values. Also, the document will be revised to allow for the option to establish a site-specific lateral offset to determine a "safe" building location as indicated by Abreu and Johnson (2005) and Lowell and Eklund (2004) but these studies have not been extensively field validated. Hence, the determination of site-specific offsets is best documented with field data. See response no. 280 for more information.

References

Abreu, L. D. V., and P. C. Johnson. 2005. Effect of Vapor Source - Building Separation and Building Construction on Soil Vapor Intrusion as Studied with a Three-Dimensional Numerical Model. Environmental Science and Technology, v. 39, no. 12, p. 4550 - 4561.

Lowell, P. S., and B. Eklund. 2004. VOC Emission Fluxes as a Function of Lateral Distance from the Source.

Environmental Progress, v. 23, n. 1, p. 52 - 58.

Office of Environmental Health Hazard Assessment. 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil. Integrated Risk Assessment Section. November 2004 (January 2005 Revision).

Response Tracking Number: 293

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

DTSC does not state why only EPA Method 8260B should be used. This GC/MS method is not needed if the contaminants are known. DTSC should allow the use of GC methods that are often cheaper and can have lower detection limits for situations where the contaminants are known. This approach is in keeping with the DTSC/CRWQCB-LA advisory for active soil gas investigations.

The need for confirmation with Summa canisters is an unnecessary expense. If the mobile laboratory is certified and it uses the appropriate methods and quality control, then confirmation samples should not be needed.

DTSC Response to Comment:

The USEPA 8000 series of analytical methods quantify contaminant concentrations in solids and liquids. There are no approved 8000 series methods for air analysis. Nonetheless, the DTSC, in our Soil Gas Advisory, has allowed the use of Method 8260 for soil gas analysis. Other non-GC/MS 8000 series methods can also be used for soil gas analysis, but these methods, such as Method 8021B, would be used only for routine monitoring at well characterized sites. Also, DTSC is currently developing guidance to enhance the quality of the Method 8260 soil gas protocols and DTSC plans to integrate these 8260B protocols into the revised guidance document. However, there is limited research data comparing 8260B to TO-15 for soil gas analysis. TO-15 is a more appropriate analytical method for soil gas samples and DTSC recommends confirmation of Method 8260B soil gas results with TO-15. The need for TO-14A/15 confirmation sampling should be determined on a site-specific basis. For example, at well characterized sites confirmation with TO-15 may be unnecessary; whereas, at new or lesser characterized sites, confirmation of 8260B results with TO-15 analysis would be warranted.

Response Tracking Number: 294

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

DTSC states, “For chemicals known to exist in the subsurface whether determined through direct measurement or historical records review, the chemicals should be evaluated for vapor intrusion even if the concentrations in soil gas concentrations [sic] are non-detectable.” The DTSC then recommends using the VOC detection limits for calculating risks. First, why not use half the detection limits for risk calculations, since that is what is typically used in risk assessments by DTSC and OEHHA? Second, there is no basis for this overly conservative approach. For sites with multiple VOCs, it is quite likely that this approach will result in estimated risks that are unacceptable even when some or all of the chemicals are not present.

For example, this could easily happen if all of the groundwater and the soil gas VOC concentrations were non-detects. According to this approach and what is stated on page 8, both sources would be evaluated. If this were done for enough chemicals, it is possible that the cumulative risks could exceed an acceptable level, even when no chemicals are present.

DTSC Response to Comment:

See response no. 29.

Response Tracking Number: 295

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

The use of risk estimates from soil gas data is preferable to estimates from groundwater concentrations. It is common to find risk estimates from soil gas concentrations to be different from the groundwater-based risk estimates due to the conservative assumptions used in the vapor transport models. Using the higher of the two values for risk management decisions is not technically justified.

DTSC Response to Comment:

The risk associated with contaminated soil gas and groundwater should be quantified so an appropriate risk management decision can be made for vapor intrusion. Ideally, if the media are in equilibrium, the associated vapor intrusion risk should be approximately the same. If not, a reasonable risk management decision should be made as compelled by the interpretation of the data.

Response Tracking Number: 296

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

The statement “These low flow conditions must exist at numerous sampling points at a site before DTSC will consider the sampling efforts a failure” is vague and can potentially be overly burdensome. If site investigations at neighboring sites have demonstrated that low flow conditions exist at a site, then additional numerous attempts is not reasonable. This sentence is not necessary and a site-specific evaluation should be made to decide whether soil gas samples can be collected.

DTSC Response to Comment:

This issue concerning soil gas sampling will be further clarified in the revised guidance document. Soil gas collection should be attempted at a site regardless of the sampling outcome at nearby sites. Subsurface conditions can change laterally over small distances due to lithology and moisture variations. Likewise, geotechnical grading at a site can alter the condition of the shallow subsurface. Hence, a reasonable number of soil gas sampling attempts should be made before sampling is abandoned at a site. Additionally, the installation of permanent soil gas sampling probes should be considered at low-flow sites because moisture conditions may be transitory.

Response Tracking Number: 297

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

It is unclear why quantification of both soil gas and groundwater risks should be required. This comment implies that the soil gas and groundwater concentrations are not related. The soil gas data are typically collected to provide a better estimate of potential vapor migration from groundwater and therefore should be considered the more appropriate data for the vapor intrusion evaluation. For example, if the risks calculated from the groundwater data exceed a threshold but the risks from soil gas do not, then no corrective action would be necessary. It is unclear why DTSC wants to also use groundwater data when DTSC often states in the guidance that soil vapor data are superior to groundwater data for evaluating the vapor intrusion pathway.

DTSC Response to Comment:

See response no. 32.

Response Tracking Number: 298

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

Screening wells to sample only the top 10 feet of an aquifer would be ideal. While this might be practical in locations with nearby constant hydraulic heads, such as near a bay, it would be impractical in many other locations. For example, groundwater elevations in the Los Angeles basin have changed as much as 10 feet over the last decade. Wells installed during low groundwater years would have screens collecting water from as much as 10 feet below the groundwater surface in high years. While wells installed during high groundwater years would be dry in low years. Typically, wells are installed with screened intervals of 20 to 30 feet to allow for these variations and to collect representative samples. Investigators should be allowed to use the same wells to monitor water quality and to collect data for vapor intrusion evaluations. Professionals, in consultation with the lead agency, should be allowed to select the appropriate screen lengths to allow for local variations in depth to groundwater.

DTSC Response to Comment:

The data quality objectives are high for groundwater sampling in vapor intrusion evaluations due to potential human exposure. Accordingly, representative groundwater samples must be obtained or the quantification of the human health risk will be biased low. Thus, groundwater monitoring wells should ideally have short well screens, otherwise uncontaminated or marginally contaminated water at the bottom of the well will dilute the sample. Groundwater wells should be screened only within the upper few feet of the water table because the contamination right at the top of the water table is responsible for driving vapor intrusion risk. However, many wells are not screened as such and a screen length of 10 feet was viewed as a reasonable compromise. For wells with longer screens, certain sampling methods can evaluate the upper portion of screened intervals, such as low flow purging procedures or the use of passive diffusion bags. The revised guidance document will recommend these techniques as procedures to address long screen intervals.

Response Tracking Number: 299

Commenter Organization: Atlantic Richfield Company

Technical Subject: Table 1

Guidance Document Page: 55

Public Comment:

DTSC should state its criteria for adding additional chemicals to USEPA's original list for Table 1. Specifically, why were several fuel oxygenates, monochlorobiphenyl, and dichlorobiphenyl added to the list of VOCs? Also, why was 1,4-dioxane added? It has a Henry's law constant (~5E-6) that is below the EPA's cutoff of 1E-5. In addition, field experience has shown that 1,4-dioxane is not as easily removed from soils as VOCs when using vapor extraction. Also, analyzing for 1,4 dioxane would often incur additional costs, with little likelihood of finding any significant levels in the soil vapor. If the USEPA does not consider 1,4-dioxane a VOC, why should DTSC?

DTSC Response to Comment:

See response no. 355.

Response Tracking Number: 300

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 11

Public Comment:

The basis for including buildings within 100 feet of subsurface contamination is from the USEPA's 2002 draft guidance. However, it is unclear how that value was derived by the USEPA. The work by Abreu and Johnson (2005) clearly shows that the potential impact from laterally located sources is dependent on depth and distance. For many cases, the 100 foot lateral distance may be overly conservative.

DTSC Response to Comment:

See response no. 280.

Response Tracking Number: 301

Commenter Organization: Atlantic Richfield Company

Technical Subject: Statistics

Guidance Document Page: 14

Public Comment:

It is unclear why DTSC is recommending that the maximum soil gas concentrations should be used for screening. If there are sufficient data available, it would seem that the 95% UCL of the mean could be used if lower than the maximum, as long as the sample density is sufficient. It should be noted that the OEHHA CHSSL guidance allows the use of the 95% UCL for soil vapor.

DTSC Response to Comment:

See response no. 362.

Response Tracking Number: 302

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 15

Public Comment:

The references cited by DTSC do not support its position that soil matrix data using Method 5035A would result in risk estimates that are biased low. Hewitt (1994) simply showed that soil samples collected in storage bottles resulted in VOC losses much greater than those collected using syringes similar to what is called for in 5035A. Hewitt (1999) found that while core barrel samples had substantial VOC losses, En Core and VOA vial samples showed no appreciable losses under normal collection, shipping, and storage procedures. Likala et al (1996) found that VOC losses from samples placed in wide-mouth jars were much greater than for samples collected in methanol containing VOA vials. Vitale et al (1999) compared VOC losses for soil sampling techniques and concluded that inherent variability in actual soil samples made it difficult to prefer one method to another.

In fact, two other papers by Hewitt indicate that soil matrix samples are representative and correlate well with soil vapor concentrations. Hewitt (1998a) used lab experiments to show that there was a very strong correlation between vapor and bulk soil concentrations, concluding that soil vapor data could be used to predict bulk soil concentrations in the field. Hewitt (June, 1998) conducted filed studies that showed a very strong correlation between in situ soil vapor concentrations and soil sample concentrations.

DTSC should reconsider its objection to using soil matrix samples and partitioning equations in the screening process. It should be noted that the partitioning equations give upper bound, steady-state estimates of soil gas concentrations, while soil vapor concentrations can be variable, especially closer to the surface. As long as the soil samples are collected using methods that have minimal VOC losses, such as USEPA Method 5035A, they should enable good estimates of VOC vapor concentrations in source areas.

DTSC Response to Comment:

The references will be removed. See response 21 concerning the use of soil matrix samples as a mechanism to evaluate vapor intrusion.

Response Tracking Number: 303

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

No supporting information is given as to why groundwater grab samples cannot be used in the screening process. Samples collected using a hydropunch/geoprobe are certainly more discreet than those collected from wells screened over 10-foot intervals as recommended in the guidance. EPA has advocated this approach in public forums on the topic.

DTSC Response to Comment:

See response no. 43.

Response Tracking Number: 304

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 16

Public Comment:

There appears to be confusion within the regulatory and regulated community regarding the applicability of the California Human Health Screening Levels (CHHSLs). The information provided in this section is important clarification on the use of CHHSLs and should be kept in this guidance document.

DTSC Response to Comment:

This text will not change in the revised guidance document.

Response Tracking Number: 305

Commenter Organization: Atlantic Richfield Company

Technical Subject: Preliminary Screening

Guidance Document Page: 18

Public Comment:

On page 18, paragraph 3, DTSC appears to be providing options if the screening fails. This doesn't agree with either the language in the Executive Summary or the logic in Figure 1. This needs to be clarified. It should be made clear that, as shown in Figure 1, one can skip Step 6 and go directly to Step 7 if one has sufficient site data.

DTSC Response to Comment:

The text of the Executive Summary will be revised to further clarify the options if preliminary screening fails.

Response Tracking Number: 306

Commenter Organization: Atlantic Richfield Company

Technical Subject: Additional Site Characterization

Guidance Document Page: 18

Public Comment:

It appears that the first sentence in Step 6 should read, “For a site that does not pass a preliminary screening evaluation…. The preliminary screening is conservative enough to account for various soil properties, therefore soil physical data or sub-slab vapor collection should not be necessary.

DTSC Response to Comment:

This typographical error will be corrected.

Response Tracking Number: 307

Commenter Organization: Atlantic Richfield Company

Technical Subject: Additional Site Characterization

Guidance Document Page: 18

Public Comment:

The collection of soil gas samples at 5-foot intervals could be excessive, especially for non-degradable VOCs or away from the source area. The sampling intervals should be site-specific, determined in consultation with the oversight agency based on attributes such as site geology.

DTSC Response to Comment:

See response no. 47, 172, 216, and 289.

Response Tracking Number: 308

Commenter Organization: Atlantic Richfield Company

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

While DTSC recommends in situ air permeability measurements, it should be made clear that the values in the J&E spreadsheets can be used if the soils are well characterized.

DTSC Response to Comment:

A soil gas advection rate of 5 liters per minute should be assumed for modeling purposes if site-specific air permeability values are not available. There is too much uncertainty in determining an air permeability value for a site from a field description of the soil. Only site-specific data, as quantified through direct measurement, should be used in models for evaluating human exposure.

Response Tracking Number: 309

Commenter Organization: Atlantic Richfield Company

Technical Subject: Additional Site Characterization

Guidance Document Page: 20

Public Comment:

Sampling every 1,000 square feet could be excessive for large industrial buildings, which can be hundreds of thousands of square feet. The number of samples collected should be site-specific, determined in consultation with the oversight agency.

DTSC Response to Comment:

See response no. 364.

Response Tracking Number: 310

Commenter Organization: Atlantic Richfield Company

Technical Subject: Additional Site Characterization

Guidance Document Page: 20

Public Comment:

It is unclear why the USEPA and DTSC believe that the VOC concentrations in a crawl space would be the same as in the living space. This assumes that the crawl space is part of the living space or is being used as a return air plenum for the HVAC system, which is highly unlikely. Pesticide application studies have shown that crawl space concentrations are much higher than living space concentrations (e.g. Wright et al, 1988). In addition, the USEPA's indoor air exposure model, "MCCEM," ignores crawl spaces in its calculations. DTSC should review the literature to determine an appropriate attenuation factor for crawl spaces and provide justification for its assumption.

DTSC Response to Comment:

Crawl space air quality is assumed to be equal to indoor air quality in the DTSC guidance document. The basis for this assumption is two-fold, as follows:

1) USEPA assumed no attenuation of air quality from a building's crawl space to indoor air in their 2002 vapor intrusion guidance document.

2) Empirical data collected by USEPA (Dawson, 2004) indicates minimal attenuation of crawl space air.

The Multi-Chamber Concentration and Exposure Model (MCCEM) was developed by Versar, Inc., for USEPA as a model that estimates indoor concentrations for chemicals released from products in residences. Hence, MCCEM has minimal utility in evaluating crawl space air quality associated vapor intrusion.

References

Dawson, H. 2004. USEPA's Vapor Intrusion Database Evaluation. Presentation at the 14th Annual West Coast Conference on Soils, Sediments, and Water, Association of Environmental Health and Science; Vapor Intrusion Attenuation Workshop sponsored by the United States Environmental Protection Agency. San Diego, California. March 15 - 18, 2004.

United States Environmental Protection Agency. 2001. Multi- Chamber Concentration and Exposure Model (MCCEM), Version 1.2. Office of Pollution Prevention and Toxics (OPPT). February, 2001. [http://www.epa.gov/oppt/exposure/pubs/mccem.htm]

United States Environmental Protection Agency. 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Office of Solid Waste and Emergency Response. November 29, 2002.

Response Tracking Number: 311

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Specific Screening

Guidance Document Page: 20

Public Comment:

DTSC recommends the use of the USEPA versions of the J&E model. Later DTSC's versions are recommended. This should be clarified, especially since they have Cal-EPA toxicity criteria and different default criteria than the USEPA's versions. We recommend that DTSC adopt the new US EPA spreadsheets that Helen E. Dawson and Paul Johnson previewed at the "Integrating Observed and Modeled Vapor Attenuation Workshop" in San Diego in March 2005.

DTSC Response to Comment:

The distinction between the two spreadsheets will be clarified in the revised DTSC guidance document. When available, DTSC will modify the new USEPA spreadsheets pursuant to California toxicity factors and place them on our webpage.

Response Tracking Number: 312

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site-Specific Screening

Guidance Document Page: 21

Public Comment:

DTSC states that they have modified the toxicity criteria in the USEPA's versions of the J&E model. However, there are other differences, such as the air exchange rate and the crack ratio. In addition, it should be noted that currently there are only two basic versions of the J&E model on DTSC's website, one for soil vapor and one for groundwater. Missing are advanced versions that allow for multiple soil layers and more control over building input parameters. DTSC should include the same versions of the J&E model as the USEPA.

DTSC Response to Comment:

See response no. 283.

Response Tracking Number: 313

Commenter Organization: Atlantic Richfield Company

Technical Subject: Table 3

Guidance Document Page: 59

Public Comment:

Table 3 contains input parameters for the site-specific evaluation. Unfortunately, unlike the EPA's versions, the DTSC's versions of the J&E model are not easily modified to accommodate site-specific input, such as building dimensions.

DTSC Response to Comment:

USEPA is currently revising their vapor intrusion spreadsheets. DTSC will modify the text of the guidance document to allow the use of these new spreadsheets and DTSC will input the parameters from Table 3 into the new spreadsheets when the spreadsheets become available.

Response Tracking Number: 314

Commenter Organization: Atlantic Richfield Company

Technical Subject: Appendix D

Guidance Document Page: D3

Public Comment:

Justifications for several of the selected parameters are given in Appendix D. DTSC uses a crack to total area ratio, η, of 0.005, while the USEPA uses 0.0004 for slab on grade buildings. In fact, OEHHA used 0.0004 when it calculated the CHHSLs for soil vapor.

The use of a constant crack ratio tends to become troublesome for large buildings. If one uses the DTSC's default value of 0.005 for the crack area ratio for a 500 x 1000 foot building, one ends up with a crack area of 2,500 sq. ft. If one assumes that the crack is only on the perimeter, one ends up with a crack that is almost 1 foot wide, which is absurd. If one assumes that the cracks are on 20-foot centers and increase the airflow based on the total length of the cracks of about 50,000 feet, one ends up with a soil airflow rate of about 1,900 liters/min, which seems a little high. Since airflow at the building perimeter will tend to prevent flows to interior cracks, it is recommended that the DTSC consider a constant crack width along the perimeter and not use a constant area to crack ratio.

DTSC Response to Comment:

Foundations naturally have void space due to cracks, control joints, expansion joints, utility stub-ups, floor sumps, floor drains, and elevator shafts. DTSC was compelled to conclude, based on the scientific literature, that an appropriate crack-to-total area ratio for buildings in California is 0.005. DTSC was further compelled to remove the relationship between crack-to-total area ratio and building perimeter because the crack percentage of a building's foundation should not be a function of a building's perimeter. The coupling of these two parameters is inappropriate. By making the crack-to-total area ratio independent of a building's perimeter, vapor intrusion risk becomes independent of building size. Thus, for large buildings, if the perimeter void space becomes large, say one foot wide, this is simply an artifact of the mathematical model used to approximate the soil gas advection rate. Using a perimeter space of less than one foot in this case would underpredict the potential risk.

Soil gas advection rates should be large for large buildings. A building of 500 by 1000 feet should have an advection rate of approximately 2,300 liters per minutes unless otherwise suggested by site-specific conditions (in-situ air permeability measurements). An advection rate of 2,300 liters per minute is simply the proportional increase of flow relative to the default building size of 10 by 10 meters.

Response Tracking Number: 315

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Specific Screening

Guidance Document Page: 21

Public Comment:

The paragraph about how to evaluate buildings where the plume is smaller than the building is confusing. While the advanced models of the J&E models allow for finite sources to account for depleting sources over time, they aren't formulated to handle various plume sizes.

DTSC Response to Comment:

USEPA is currently modifying their J/E EXCEL spreadsheets and the modified spreadsheets will not include an option for a finite source. Hence, in anticipation of the revised EXCEL spreadsheet, DTSC will remove all reference to a finite source model from the guidance document.

DTSC will provide language in the revised guidance document to address and clarify the approach for small subsurface plumes. When a subsurface plume under a building is smaller than the building's footprint, DTSC will allow an associated correction to the J/E model. The correction is proportional based on the ratio of the plume area under the building to the area of the building. The attenuation factor for the subject building should first be determined assuming the subsurface plume's area is equal to or greater than the building's area. The attenuation factor is then multiplied (corrected) by the ratio of the plume size to building size.

Response Tracking Number: 316

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Specific Screening

Guidance Document Page: 22

Public Comment:

DTSC's offers no references for the uncertainties it lists for future buildings. In response to comments, OEHHA's supporting document for its CHHSLs evaluated new buildings with engineered fill. The results were attenuation factors that average about 1/2 to 1/3 of the values for existing buildings. DTSC should consider adopting an attenuation adjustment factor for new buildings with engineered fill that is more compact than existing site soils.

DTSC Response to Comment:

Construction activities will alter the subsurface as developers comply with the soil compaction and soil bearing requirements within the International Building Code. Most sites will require some earthwork to provide a geotechnically sound building pad for construction. These alterations of the subsurface can be integrated into site-specific modeling.

The difference between the OEHHA attenuation factors for existing buildings and future buildings is due to the depth to the vapor contamination. OEHHA felt that the depth to contamination would be deeper for the future building scenario due to the addition of engineered fill at the site. Hence, for the future building scenario, the contaminant source is 30 centimeters deeper than the source used for the existing building. When conducting site-specific screening for a future building, the site-specific depth to contamination should be used. This issue will be further clarified in the revised guidance document.

Response Tracking Number: 317

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Specific Screening

Guidance Document Page: 22

Public Comment:

DTSC uses its previous statement to justify the use of the maximum soil gas and groundwater concentrations for new buildings. There is no basis for this approach. New buildings can be placed on native soils in cut areas or on compacted soils in fill areas. However, for most new buildings, especially commercial/industrial ones, the soils are usually disturbed and recompacted. DTSC should permit use of the lower of the maximum or 95% UCL of the mean, as is done for other exposure pathways.

DTSC Response to Comment:

See response no. 362.

Response Tracking Number: 318

Commenter Organization: Atlantic Richfield Company

Technical Subject: Site Specific Screening

Guidance Document Page: 22

Public Comment:

It is unclear what is meant by proportionally scaling up of the soil advection rate for large buildings. Because it assumes that bulk flow enters at the perimeter seem of a building, one would also assume that scaling would be done by multiplying the default value by the ratio of the perimeter of the larger building to that of the default building. This needs to be clarified. The equation used to calculate Qs should be added to either the text or possibly Appendix D.

DTSC Response to Comment:

A linear proportional scale-up for the soil gas advection rate for the future building scenario is a reasonable approach for evaluating larger buildings. Vapors intrude into buildings along any available foundation opening, not just the floor-wall perimeter seam. Vapors will move through foundation cracks, concrete control joints, utility entry points, elevator shafts, floor drains, and floor sumps. DTSC was compelled to remove the relationship between crack-to-total area ratio and building perimeter because the crack percentage of a building's foundation is not a function of a building's perimeter. The coupling of these two parameters is inappropriate. By making the crack-to-total area ratio independent of a building's perimeter, the magnitude of vapor intrusion risk becomes independent of building size. Soil gas advection rates should be large for large buildings. A reasonable mechanism to evaluate buildings larger than 10 meters by 10 meters is to proportionally correct the soil gas advection rate based upon the building's footprint. An example of proportional scale-up for the soil gas advection rate as a function of future building size will be provided in Appendix D.

Response Tracking Number: 319

Commenter Organization: Atlantic Richfield Company

Technical Subject: Indoor Air Assessment

Guidance Document Page: 27

Public Comment:

The guidance should provide a protocol for developing an analyte list based on the detections in soil gas and the results of the site-specific screening. This will avoid the problems associated with analyzing for and detecting common background air contaminants such as benzene, unless benzene levels in soil gas warrant its inclusion as an analyte. Because benzene is a common background contaminant and often drives risk estimates when present, it should not be included in the indoor air sampling program unless it is detected at a significant concentration in soil gas.

DTSC Response to Comment:

Indoor air testing is conducted because subsurface soil gas concentrations exceed screening levels (preliminary or site-specific screening levels). Hence, indoor air should be tested for all the constituents found in soil gas and the indoor air testing can be limited to only those constituents. By analyzing indoor air for all the soil gas contaminants, cumulative health effects can be determined. Also, analysis of indoor air for all the soil gas constituents allows for the correlation of the constituents as a mechanism to evaluate vapor intrusion. Volatile subsurface contaminants move at approximately the same rate. Hence, attenuation factors for each constituent should be similar and the ratio of the contaminant concentrations in soil gas and indoor air should be the same. Otherwise, secondary sources of contamination may exist within the subject building due to lifestyle choices or due to poor ambient (outdoor) air quality. The guidance document will be revised to further clarify this important issue.

Response Tracking Number: 320

Commenter Organization: Atlantic Richfield Company

Technical Subject: Indoor Air Assessment

Guidance Document Page: 26

Public Comment:

This is an overly burdensome and unnecessary recommendation [to sample each discrete office space. Many office buildings may have multiple offices with no reason for vapor intrusion to vary from office to office. A site-specific plan to determine the number of sample locations should be developed.

DTSC Response to Comment:

See response no. 60.

Response Tracking Number: 321

Commenter Organization: Atlantic Richfield Company

Technical Subject: Indoor Air Assessment

Guidance Document Page: 28

Public Comment:

It is not clear how these indicator compounds will assist in the vapor intrusion pathway evaluation. The guidance document states that subsurface chemicals exceeding screening criteria should be analyzed in indoor air. Background sources of petroleum products will include the indicator compounds, so testing for these compounds will not likely help in the data interpretation.

DTSC Response to Comment:

See response no. 319. Also, text will be added to the revised guidance document stating that risk assessments cannot be readily performed on total petroleum hydrocarbon (TPH) and that specific chemicals within TPH, which would give an indication of risk associated with TPH exposure, such as benzene, toluene, ethylbenzene and xylene (BTEX) for gasoline and naphthalene for diesel fuel, be identified and tested for in the subsurface.

Response Tracking Number: 322

Commenter Organization: Atlantic Richfield Company

Technical Subject: Indoor Air Assessment

Guidance Document Page: 29

Public Comment:

The listed contingency plan suggests that semi-annual indoor air and soil gas sampling is recommended for cases where indoor air concentrations result in risk estimates with the range of 10-6 to 10-5. It is common to find indoor air concentrations due to background sources to result in risk estimates within this range. Consequently, there would be many sites where long term monitoring is recommended even when vapor intrusion is not significant. This illustrates the influence of background sources on the estimated indoor air risks.

DTSC Response to Comment:

The text associated with collection and interpretation of background samples will be enhanced in the revised vapor intrusion guidance document. If subsurface sampling indicates an unacceptable human health risk, then indoor air should be tested at least twice to evaluate the seasonality of the exposure pathway. After the collection of the indoor air samples, chemical exposure is then quantified for the building. The site-specific ambient air data help guide the risk management decisions for the building to determine if corrective action is warranted. Regardless of the risk management decision concerning the results of the indoor air sampling, indoor air should always be tested for the chemicals in the subsurface. DTSC does not anticipate a situation where vapor intrusion mitigation would be warranted to reduce the indoor air concentration below the ambient levels. However, if one chemical in the indoor air analytical suite, upon two sampling events, appears to be elevated above background at unacceptable concentrations, and the occurrence of the chemical is attributed to vapor intrusion, then mitigation would be warranted.

Response Tracking Number: 323

Commenter Organization: Atlantic Richfield Company

Technical Subject: Indoor Air Sampling

Guidance Document Page: 33

Public Comment:

If the garage is attached, cars should be preferably removed and certainly not operated within the garage during the test. Emissions contain significant levels of VOCs, especially during ignition.

DTSC Response to Comment:

DTSC will add language in the revised guidance document to state that structures with attached garages present sampling challenges and that vehicle usage should be minimized and all stored fuels and chemicals should be removed. Also, as appropriate, the indoor air in attached garages should be sampled.

Response Tracking Number: 324

Commenter Organization: Atlantic Richfield Company

Technical Subject: Indoor Air Sampling

Guidance Document Page: 34

Public Comment:

Guidance on the preparation of a field blank needs to be provided.

DTSC Response to Comment:

A field blank is only necessary for sorbent tubes (TO-17) and the guidance document will be changed to reflect this (see response no. 143).

Response Tracking Number: 325

Commenter Organization: Atlantic Richfield Company

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

This whole section seems to be overly prescriptive in how to prevent or minimize vapor intrusion. More leeway should be given to those who design remedial systems. The ASTM has recently developed an engineering Controls standard that should be utilized to address this issue.

DTSC Response to Comment:

The revised guidance document will further acknowledge that other remedies are available and that flexibility is needed in addressing site-specific conditions but DTSC will limit the discussion to those remedies currently presented. Also, DTSC will provide reference to the ASTM document.

Response Tracking Number: 326

Commenter Organization: Atlantic Richfield Company

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

It is unclear why DTSC should have oversight of mitigation measures. Numerous agencies have as much capability in this area as DTSC. It should be sufficient for the work to be done by a registered Civil Engineer under the direction of the lead agency.

DTSC Response to Comment:

Review and approval of vapor intrusion mitigation measures is the responsibility of the lead regulatory oversight agency. It was not the intent of the vapor intrusion guidance document to imply that DTSC is the sole agency in California responsible vapor intrusion mitigation and this issue will be clarified in the revised guidance document. However, it should be noted that DTSC, when requested, will assist other regulatory agencies as appropriate with corrective action projects.

Response Tracking Number: 327

Commenter Organization: Atlantic Richfield Company

Technical Subject: Mitigation

Guidance Document Page: 39

Public Comment:

It is unclear when permanent monitoring is recommended. For example, if a soil vapor barrier system is installed, then there should be no need for permanent monitoring of soil gas. There is already an admission that the levels are too high.

DTSC Response to Comment:

When structures are built over unacceptably high soil gas concentrations, engineering controls, and associated post-construction monitoring, will be warranted. Post-construction monitoring is needed in order to ensure the effectiveness of the engineering control. A vapor barrier system must remain effective over a building's lifespan and its effectiveness warrants documentation to evaluate potential exposure. Vapor barriers can develop holes or other breaches during installation. Likewise, ground settlement is a natural process that could cause a breach. Liners can also be damaged during structural repair or remodeling of a building. To verify the effectiveness of a barrier, indoor air samples can be collected or air space between the barrier and foundation can be sampled. These barrier / foundation samples would be collected using sampling ports installed at the time of construction. These sampling ports could be horizontal pipes installed under the foundation that exit to the building's exterior for easy access. The guidance document will be revised to further clarify this important issue.

Response Tracking Number: 328

Commenter Organization: Atlantic Richfield Company

Technical Subject: Mitigation

Guidance Document Page: 39

Public Comment:

It is unclear why VOCs by TO-14A, methane oxygen, and carbon dioxide are specified for monitoring. Constituents and analytical methods should be selected in consultation with the lead agency based on specific site conditions.

DTSC Response to Comment:

The guidance document will be revised to recommend that the selection of chemicals subject to analysis should be based on site-specific conditions.

Response Tracking Number: 329

Commenter Organization: Atlantic Richfield Company

Technical Subject: Mitigation

Guidance Document Page: 40

Public Comment:

DTSC's recommended perimeter monitoring program is prescriptive and seems excessive. If the site characterization indicates no potential problem, then this item seems unnecessary. If the source is expanding, such as with contaminated groundwater, then other data, such as from groundwater monitoring wells could be sufficient to monitor a potential problem. Again, the need and implementation of such a system should be discussed with the lead agency.

DTSC Response to Comment:

See response no. 78.

Response Tracking Number: 330

Commenter Organization: Atlantic Richfield Company

Technical Subject: Petroleum Biodegradation

Guidance Document Page: 41

Public Comment:

No references are given to support the DTSC's position that there are exceptions to biodegradation occurring. If there are specific types of sites or conditions DTSC believes would preclude the assumption of biodegradation, then it should describe them. The literature (Kremesec, 2005) shows that a default attenuation adjustment factor of 0.1

would be conservative. At a minimum, DTSC should consult with the USEPA and EPA OUST as to what its position is on this topic.

DTSC Response to Comment:

Biodegradation of vapor-phase petroleum hydrocarbon in the subsurface does not always occur. Roggemans et al. (2001) indicated that 6 of 28 soil gas profiles yielded no indication of petroleum biodegradation. Likewise, Davis (2005) noted that 7 percent of the benzene profiles and 27 percent of the total petroleum hydrocarbon (TPH) profiles exhibited little or no subsurface attenuation. Hence, petroleum hydrocarbon can pose a vapor intrusion risk in certain circumstances.

The United States Environmental Protection Agency (USEPA) has not adopted a policy concerning an attenuation adjustment factor for vapor-phase petroleum biodegradation. Vescio (2005) indicated that there is a lack of consensus on this issue among stakeholders and resolution concerning the adoption of an attenuation adjustment factor would not be forthcoming.

DTSC will adopt an attenuation factor for petroleum hydrocarbons when peer-reviewed scientific publications, both theoretical and empirical, clearly describe the conditions for the occurrence and non-occurrence of biodegradation in the vadose zone, or when USEPA adopts a policy concerning the biodegradation of petroleum.

References

Davis. R. 2005. Making Sense of Subsurface Vapor Attenuation in Petroleum Hydrocarbon Sources. New England Interstate Pollution Control Commission LUSTLine Bulletin No. 49. March 2005. Pages 10 - 14.

Roggemans, S., C. L. Bruce, P. C. Johnson, and R. L. Johnson. 2001. Vadose Zone Natural Attenuation of Hydrocarbon Vapors: An Empirical Assessment of Soil Gas Vertical Profile Data. American Petroleum Institute Technical Bulletin No. 15. December 2001.

Vescio, J. 2005. Update on EPA's Petroleum Vapor Intrusion Work Group Activities. Petroleum Vapor Intrusion Workshop; National Ground Water Association; Petroleum Hydrocarbon and Organic Chemicals in Ground Water, Prevention, Assessment, and Remediation Conference. Costa Mesa, California, August 17, 2005.

Response Tracking Number: 331

Commenter Organization: Atlantic Richfield Company

Technical Subject: Confirmation Sampling

Guidance Document Page: 42

Public Comment:

There is no basis for the blanket statement that confirmation sampling should take place in 12 to 16 months after the remedial system is shutdown. Johnson et al (1999) derived a formula to estimate the time to reach quasi-steady-state. However, this theoretical time varies substantially with soil and chemical parameters and distance from the source. For example, the estimated time to near steady state could be as short as a few days if the samples are collected in the source area or directly above the capillary fringe.

Waiting over a year is very impractical where new development is planned, such as at brownfield redevelopment sites.

The time between stopping remedial activities and sampling should be site-specific, determined in consultation with the oversight agency.

DTSC Response to Comment:

See response no. 83.

Response Tracking Number: 332

Commenter Organization: Atlantic Richfield Company

Technical Subject: Reporting

Guidance Document Page: 42

Public Comment:

The DTSC should reconsider its position on submitting all laboratory reports. Submittal of all laboratory data may be impractical for most sites, where investigations have been ongoing for years. Unless collected specifically for the risk assessment, this data has usually already been reviewed by the lead agency.

DTSC Response to Comment:

Laboratory reports are routinely submitted to DTSC as a mechanism to demonstrate the quality of the analytical data. Most site characterization activities are conducted in phases with subsequent reporting to DTSC. The reports associated with the phases of assessment usually include the laboratory reports. The intent of the language in the guidance document is not to require the resubmittal of all this data, but to reiterate to practitioners that all laboratory reports associated with vapor intrusion need to be submitted to DTSC. Occasionally, DTSC does not receive these reports. Many vapor intrusion evaluations submitted to DTSC do not include the laboratory reports for the soil gas samples, geotechnical samples, and indoor air samples. Hence, in the revision of the vapor intrusion guidance document, the intent of the laboratory submittals will be further clarified.

Response Tracking Number: 333

Commenter Organization: Atlantic Richfield Company

Technical Subject: Reporting

Guidance Document Page: 43

Public Comment:

It is assumed that the results of the sensitivity analysis should be reported in the uncertainty section of the risk assessment.

DTSC Response to Comment:

DTSC is flexible in the style of format of a vapor intrusion report. The intent of the language in the guidance document was to indicate what information should be included in a vapor intrusion report and not to dictate the reporting format. Hence, the sensitivity analysis could be a stand-alone section in the report or included in the uncertainty section and the guidance document will be revised accordingly.

Response Tracking Number: 334

Commenter Organization: Atlantic Richfield Company

Technical Subject: Figure 2

Guidance Document Page: 53

Public Comment:

Figure 2 does not show the advective flow component.

DTSC Response to Comment:

The figure will be replaced with a figure also showing the advective flow component.

Response Tracking Number: 335

Commenter Organization: Atlantic Richfield Company

Technical Subject: Appendix J

Guidance Document Page: J1

Public Comment:

It is doubtful that anyone would sign an access agreement that holds DTSC's agents harmless from any and all damages due to sampling.

DTSC Response to Comment:

The access agreement in Appendix J is an example and can be revised due to site-specific conditions.

Response Tracking Number: 336

Commenter Organization: Lockheed Martin

Technical Subject: Administrative Procedure Act

Guidance Document Page:

Public Comment:

The interim final "Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air" (revised February 7, 2005) was prepared "through the efforts" of fifteen named "individuals at the Department of Toxic Substances Control." Guidance at ii. "Additional assistance was provided" by three individuals at the San Francisco Regional Water Board, United States EPA and the Office of Environmental Health Hazard Assessment. Id. There is no indication in the Guidance that any other individual was involved in its preparation. It does not appear that there was any public participation in the drafting of the Guidance. It does not appear that any of the parties who would be subject to the Guidance and who are "in the best position. . . to inform the agency about possible unintended consequences of' the Guidance were involved in its drafting. It does not appear that workshops with interested stakeholders were conducted as part of the process of drafting the Guidance. And it does not appear that the provisions of the California Administrative Procedure Act were followed in connection with the drafting of the Guidance.

DTSC Response to Comment:

See response no. 338 and 340.

Response Tracking Number: 337

Commenter Organization: Lockheed Martin

Technical Subject: Administrative Procedure Act

Guidance Document Page:

Public Comment:

DTSC has not provided for the early and continuous involvement of the stakeholders interested in the subject matter of the Guidance, including real estate developers, property owners, brownfields redevelopers, lenders, redevelopment agencies and municipalities.

DTSC's Public Participation Manual ("Manual") states that: "It is DTSC's policy to create a dialogue with all stakeholders to ensure that their concerns and priorities are incorporated into each project. DTSC policy mandates a proactive public participation program that encourages community involvement by providing for the free flow of information to and from the community, as well as identifying and considering community concerns." Manual, ch. 2, p.3.

The Public Participation Manual also states that: "If the program is to achieve maximum effectiveness, the public must be informed early and consistently throughout the process, and DTSC must remain open to public input." Id.

Finally, the Public Participation Manual states that: "It is DTSC's policy that the public is involved early and continuously in its decision-making process." Id., ch. 2, p.4.

DTSC's own policy documents require that it involve all stakeholders early, consistently and continuously in its decision-making processes. There was apparently no involvement of stakeholders involved in the subject matter of the Guidance up to this point. Public comments are now being solicited with the Guidance in "interim final" form. This does not comply with DTSC's policy that stakeholder involvement occur "early and consistently." DTSC should conduct workshops with the stakeholders and open the process to full public input. There are stakeholder concerns that the Guidance as currently drafted will discourage the redevelopment of previously commercial and industrial properties. A regulatory agency has a duty to comply with its own policies and failure to comply with those policies will invalidate the agency action. Mountain Lion Foundation v. Fish & Game Commission, 16 Cal. 4th 105 (1997).

DTSC Response to Comment:

See response no. 340.

Response Tracking Number: 338

Commenter Organization: Lockheed Martin

Technical Subject: Administrative Procedure Act

Guidance Document Page:

Public Comment:

The Guidance is a guideline, criterion, bulletin, or manual that is intended to apply generally and serves to interpret and/or make specific the law enforced or administered by DTSC. As a result, the Guidance constitutes a "regulation" within the meaning of California law and is invalid unless promulgated pursuant to the California Administrative Procedure Act.

The California Supreme Court has stated that:

"No state agency shall issue, utilize, enforce, or attempt to enforce any guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule, which is a regulation, unless the guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule has been adopted as a regulation."

Tidewater, 14 Cal.4th at 570 citing Gov't Code § 11340.5(a).

The California Supreme Court went on to say that the law:

"defines 'regulation' very broadly to include 'every rule, regulation, order, or standard of general application or the amendment, supplement, or revision of any rule, regulation, order or standard adopted by any state agency to implement, interpret, or make specific the law enforced or administered by it, or to govern its procedure.'" Id. at 571.

Finally, the California Supreme Court set forth a test, which states that a regulation:

"has two principal identifying characteristics. First, the agency must intend its rule to apply generally, rather than in a specific case. * * * Second, the rule must 'implement, interpret, or make specific the law enforced or administered by [the agency] or to govern its procedure.'" Id. citing Gov't Code § 11342(g).

The Guidance is a "regulation" within the meaning of California law and was not promulgated pursuant to the California Administrative Procedure Act. DTSC clearly intends to "issue" a guideline, namely the Vapor Intrusion Guidance, and intends to "utilize" that guideline. Further, the Vapor Intrusion Guideline is a "standard of general application" that DTSC is adopting to "implement" or "make specific" the law "administered" by it. It is clear that DTSC intends the Guidance to apply "generally" as that term is used by the Supreme Court-the Guidance is not intended to apply to a specific case or a specific site but is intended to apply to vapor intrusion generally.

The Guidance states as follows: "Please recognize that this guidance document is not regulation. This Guidance does not impose any requirements or obligations on the regulated community but provides a technical framework for evaluating vapor intrusion." Guidance at [page] 1. There are two problems with this statement. First, saying that something is "not regulation" does not make it so. Second, and most importantly, the "test" that DTSC puts forward for determining whether the Guidance is a regulation - i.e., whether the guideline "impose[s] any requirements or obligations on the regulated community" - is not the correct test. The correct test is the test enunciated by the California Supreme Court, quoted above. Under the Supreme Court's test, the Guidance is a regulation. In any event, the Guidance does impose requirements on the regulated community.

DTSC Response to Comment:

DTSC's Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (12/15/04) is a guidance document and not a regulation. It is not a rule of general application nor is it intended to implement, interpret or make specific the law enforced or administered by DTSC. The Guidance does not impose any requirement or obligations on the regulated community but provides a technical framework for evaluating vapor intrusion. It is written in terms of applying certain principles and guidance on a case-by-case basis. There is text in the current guidance document on page 1 that states this.

Response Tracking Number: 339

Commenter Organization: Lockheed Martin

Technical Subject: Administrative Procedure Act

Guidance Document Page:

Public Comment:

Many of these requirements are stated in the precatory form ("should" or "may") instead of the mandatory form ("must" or "shall"). However, there is little doubt that DTSC intends that what it says the regulated community "should" do must, in fact, be done if cleanup projects are to be deemed completed and property readied for occupation.

Further, many of these requirements are stated in the mandatory form. For example:

• "The CSM [conceptual site model] is part of all site investigations. "Guidance at [page] 4. This language makes it clear that the conceptual site model is, in fact, a requirement.

• "Soil gas data are recommended over other data, such as soil matrix and groundwater data, because soil gas data represent a direct measurement of the contaminant that will migrate into the indoor air. In order to evaluate vapor intrusion, soil matrix and groundwater data must be converted to vapor concentrations using assumptions about the partitioning of the contaminant into the gas phase. While partitioning equations are readily available, using them increases the uncertainty in evaluating vapor intrusion. DTSC views this increased uncertainly as unacceptable in any indoor air evaluation." Guidance at [page] 5. This language makes it clear that use of soil gas data is, in fact, a requirement.

• "The minimum amount of soil gas sampling needed in the vertical direction to evaluate vapor intrusion is the collection of soil gas samples at 5 and 15 to 20 feet below surface grade. This language makes it clear that samples at these two depths is, in fact, a requirement.

• "DTSC considers soil gas sampling to fail when subsurface air flow rates are less than 10 milliliters per minute or when vacuum of 10 inches of mercury (136 inches of water) or greater is obtained. These low flow conditions must exist as numerous sampling points before DTSC will consider the sampling efforts a failure." Guidance at [page] 7. This language makes it clear that sampling fails pursuant to a very specific and prescriptive test set forth in the Guidance and that this test is a requirement.

• "For existing or future buildings not to be considered a candidate for vapor intrusion, the buildings must be greater than 100 feet away laterally from subsurface contamination." Guidance at [page] 11. This language makes it clear that whether buildings must be evaluated subject to the Guidance is determined by a very specific and prescriptive test and that this test is a requirement.

• "Under no circumstances should the risk associated with vapor intrusion be conducted with soil matrix samples collected by non-Method 5035A procedures." Guidance at 15. This language makes it clear that use of Method 5035A is a requirement.

Pursuant to the test set forth by the California Supreme Court, the Guidance is a "regulation" which must be promulgated (if at all) according to the California Administrative Procedure Act. Further, and contrary to what DTSC states at the outset of the Guidance, the Guidance imposes numerous requirements on the regulated community.

DTSC Response to Comment:

See response no. 16 and 338.

Response Tracking Number: 340

Commenter Organization: Lockheed Martin

Technical Subject: Administrative Procedure Act

Guidance Document Page:

Public Comment:

DTSC did not conduct multiple face-to-face meetings with the regulated community through all phases of the development of the Guidance. DTSC did not first hold a public forum and then proceed to meet with small work groups to discuss the regulated community's questions and concerns.

The Guidance itself states that:

"The optimal time to begin creating a trusting relationship is prior to fieldwork. The introductory meeting should explain the site investigation process and facilitate the collection of information from the community regarding their issues and concerns. As the investigation continues, the affected community should receive regular updates through fact sheets and telephone calls on the current findings and future activities. During these updates DTSC will continue to receive questions and comments from the affected community. To aid in what could be a long-term relationship, these questions and concerns must be addressed as they arise. This continuing dialogue helps to ensure that the community is aware of the facts and is prepared for future activities, such as interim actions and indoor vapor investigation." Guidance at [page] 44.

The Guidance also states that:

"The inevitable intrusion of indoor air sampling into the personal lives of community residents and business representatives requires multiple face-to-face meetings through all phases of data collection. * * * Each meeting should be conducted in candor and with empathy, thereby providing factual information to the community and creating trust. Information should be solicited from the community members on their preferences for these meetings. However, based upon experience, most community members require individual meetings and telephone discussions to fully address their questions. Based upon this, if the project entails working with a large number of residents and businesses, the first meeting should be held as a public forum and then breaking into small work groups to further discuss the community's questions and concerns." Id.

As the above-quoted passages make clear, DTSC requires significant public outreach at all stages of the vapor intrusion investigation process. Conversely, DTSC itself has engaged in essentially no public outreach in the development of its Guidance. DTSC's vapor intrusion investigation process states that "the optimal time to begin creating a trusting relationship" is before the work begins. Guidance at [page] 44. Conversely, DTSC has advanced to the stage of circulating a 45-page "interim final" Guidance before seeking input from the regulated community. DTSC's vapor intrusion investigation process states that an introductory meeting should be held to collect "information from the community regarding their issues and concerns." Id. Conversely, DTSC has largely completed the Guidance before seeking information from the regulatory community regarding its issues and concerns.

DTSC's vapor intrusion investigation process "requires multiple face-to-face meetings through all phases of data collection." [d. Conversely, DTSC has conducted no face-to-face meetings during the development of the Guidance. DTSC's vapor intrusion investigation process states that "the first meeting should be held as a public forum and then breaking into small work groups to discuss the community's questions and concerns." Id. Conversely, no public stakeholder meeting was held and no workshops were conducted in the development of the Guidance.

Public outreach has its pluses (e.g. the community's concerns are aired and these concerns can be taken into consideration) and its minuses (e.g. it tends to lengthen the process and the party conducting the work loses some measure of control over the work). When it comes to parties investigating vapor intrusion, DTSC has decided that robust public outreach is desired. When it comes to its own work of drafting the Guidance, DTSC has decided that minimal public outreach is sufficient. DTSC should be consistent in its approach to public outreach and should re-start the process of developing a vapor intrusion guidance by holding a public meeting with the regulated community followed by workshops with stakeholders to address their issues regarding vapor intrusion.

DTSC Response to Comment:

As the Commenter correctly notes, DTSC's Guidance Document provides for significant public outreach and involvement throughout the vapor intrusion investigation process. In drafting the Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air, DTSC sought assistance from U.S. EPA, the San Francisco Regional Water Quality Control Board and the Office of Environmental Health Hazard Assessment within Cal/EPA. Once a draft was completed, DTSC sent the draft to significant stakeholders to obtain comments. DTSC views the guidance as a "working draft" that is being beta tested through use at various sites in California.

Response Tracking Number: 341

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

Guidance on the collection/use of soil gas data from less than 5 feet bgs (below ground surface) would be very useful. There are many sites where groundwater is shallower than 10 feet and even within 5 feet of ground surface.

DTSC Response to Comment:

See response no. 122, 172, 216, 271, and 289.

Response Tracking Number: 342

Commenter Organization: Lockheed Martin

Technical Subject: References

Guidance Document Page: 46

Public Comment:

The guidance cites many conference presentations and/or posters, which have not been peer reviewed. In order to ensure that the best science is utilized, DTSC should base its guidance only on peer-reviewed published scientific literature. Non-peer reviewed conference presentations and/or posters should be viewed as interim products that may contain mistakes and may be substantially revised before they are finally published in the peer reviewed literature.

DTSC Response to Comment:

Only two references in the vapor intrusion guidance document are from conferences and these two conference presentations are sound enough to guide policy. The first presentation was from Helen Dawson of USEPA concerning attenuation over foundation slabs. USEPA, in their 2002 guidance document, recommended the use a factor of 0.1 for attenuation of subslab vapors over a slab-on-grade foundation. Empirical data collected by USEPA since 2002 has shown that this attenuation factor is probably too large. Helen Dawson has communicated this in numerous conference presentations and DTSC has adopted 0.01 as a subslab attenuation factor in the vapor intrusion guidance document. When USEPA re-issues their revised guidance document, DTSC is confident that the subslab attenuation factor will be less than 0.1. The second conference presentation cited by DTSC concerned polychlorinated biphenyls (PCBs). Brian Davis of DTSC provided technical assistance on a vapor intrusion site where the chemicals-of-concern were PCBs. The PCBs at this site migrated from the subsurface into an indoor air space and the result of the study were presented as a poster at a conference. Based on this work, DTSC included PCBs in Table 1 of our vapor intrusion guidance document which lists the chemicals that might present a vapor intrusion risk.

References

Davis, B. K., and M.J. Wade. 2003. Risk Assessment of Polychlorinated Biphenyls at Hazardous Waste Sites. The Toxicologist, Supplement to Toxicological Sciences 72:394. Abstract Number 1912.

Dawson, H. 2004. Comments on Empirical Data / Methods. Presentation at the 14th Annual West Coast Conference on Soils, Sediments, and Water, Association of Environmental Health and Science; Vapor Intrusion Attenuation Workshop sponsored by the United States Environmental Protection Agency. San Diego, California. March 15 - 18, 2004.

Response Tracking Number: 343

Commenter Organization: Lockheed Martin

Technical Subject: Site Specific Screening

Guidance Document Page: 20

Public Comment:

The guidance focuses on use of the Johnson and Ettinger model for the evaluation of vapor intrusion to indoor air and does not appear to allow the use of other fate and transport models. Under certain circumstances, the Johnson and Ettinger Model may not be the most appropriate tool for the evaluation of vapor intrusion (see, for example, Comment 27 below [DTSC no. 371]). This should be recognized in the guidance.

DTSC Response to Comment:

The introduction to Step 7 will be revised to state that other fate and transport models may be available for the evaluation of vapor intrusion and should be considered on a case-by-case basis.

Response Tracking Number: 344

Commenter Organization: Lockheed Martin

Technical Subject: Scope

Guidance Document Page: 02

Public Comment:

The guidance states "For sites with existing buildings, Steps 1 through 11 apply. For sites with proposed buildings, Steps 1 through 3, 5, 6, 7, and 11 apply." This is potentially confusing. It would be easier to follow if the protocols for existing and future buildings were described in separate sections entirely; e.g., "for sites with existing buildings, see the steps outlined in Section 1; for buildings with proposed buildings, see the steps outlined in Section 2."

DTSC Response to Comment:

The guidance document originally addressed the future building scenario in a separate section but the bulk of the text associated with the section was largely a reiteration of the existing building scenario. For the sake of brevity, the two scenarios were combined. To address any confusion, the text in the guidance document will be revised to enhance clarity and separate figures for the existing building scenario and future building scenario will be added to the revised guidance document.

Response Tracking Number: 345

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 04

Public Comment:

The guidance states "For the vapor intrusion pathway, exposure to subsurface contamination is best characterized through collection of soil gas samples. When there is known or potential groundwater contamination, water samples should also be collected to evaluate the aquifer's ability to degas VOCs, which potentially may cause a vapor intrusion risk." The recommendation to collect groundwater samples (in addition to soil gas samples) seems unnecessary, since the soil gas data is the most relevant measurement for evaluation of vapor intrusion risk.

DTSC Response to Comment:

Subsurface contamination warrants appropriate three-dimensional characterization so that the impact to human health and the environment can be quantified. Subsurface sampling activities should document contaminant source concentrations and verify potential contaminant migration pathways pursuant to the conceptual site model (CSM). Typically, these subsurface sampling activities include the collection of soil matrix, soil gas, and groundwater samples. When contaminants have migrated to groundwater, the nature and extent of groundwater contamination should be delineated. Upon plume characterization, the risk associated with each contaminated media should then be quantified. When evaluating vapor intrusion at a site with both soil gas and groundwater contamination, the vapor intrusion risk should be quantified for both environmental media. Ideally, if the media are in equilibrium, the associated vapor intrusion risk should be approximately the same. If not, a reasonable risk management decision should be made as compelled by the interpretation of the data. Both lines of evidence should be considered in the decision making process and the guidance document will be revised to state this.

Response Tracking Number: 346

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

The guidance states "it may be necessary to collect soil gas samples at two distinct time intervals to compensate for the effects of weather events, such as recent rainfall or barometric fluctuations." For sites that are near the coast with shallow groundwater, the change in tide will also lead to changes in groundwater elevation. This will, in turn, lead to changes in the concentrations of VOCs in soil gas. Therefore, it is recommended that DTSC add a statement here about the effect of tidal pumping on soil gas concentrations and ensuring that sampling is performed appropriately to account for tidal pumping.

DTSC Response to Comment:

The guidance document will be revised to indicate caution concerning soil gas sampling in tidally influenced areas; DTSC will direct readers to Erskine (1991) so that the area of tidal influence can be determined before sampling.

References

Erskine, A. D. 1991. The Effect of Tidal Fluctuation on a Coastal Aquifer in the UK. Ground Water, v. 29, n. 4, p. 556 - 562.

Response Tracking Number: 347

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

The guidance recommends that soil gas data collection should not be performed following significant rainfall events.

While this recommendation is valid for samples collected outdoors or beneath small to average size buildings, it may not be applicable to soil gas samples collected beneath large buildings, where little to no infiltration is likely to occur.

DTSC Response to Comment:

Soil gas sample collection is not advisable during strong barometric pressure fluctuations that occur with a storm event. Massmann and Farrier (1992) indicate that soil gas concentrations could be biased low due to atmospheric pressure changes. Hence, soil gas sampling during a storm event is not prudent. There is minimum scientific information on the affects of barometric pressure change on soil gas under buildings. Hence, until there is more information, DTSC is hesitant about stating that soil gas under building foundations is not influenced by atmospheric pressure changes and that representative samples can always be collected regardless of storm events.

References

Massmann, J., and D. F. Farrier. 1992. Effects of Atmospheric Pressures on Gas Transport in the Vadose Zone. Water Resources Research, v. 28, n. 3, p. 777 - 791.

Response Tracking Number: 348

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 05

Public Comment:

This guidance recommends that the Cal-EPA Soil Gas Advisory (2003) be followed for tracer gases. However, the tracer gases recommended in the Cal-EPA (2003) guidance are natural constituents of petroleum and may occur at petroleum release sites, natural gas fields, and oil fields. In these locations, the tracer gas (e.g., isobutene) can be detected and the results could be misinterpreted as a leak. It would be helpful if DTSC could recommended different tracers for use for petroleum sites. For example, a tracer gas such as helium could be used. Field helium detectors are available with low detection limits.

DTSC Response to Comment:

The Cal EPA 2003 Soil Gas Advisory, which DTSC is currently updating, states in Section 2.4 that pentane, isopropona, isobutene, propane, and butane can be used as leak detection compounds and the Advisory does not necessarily preclude the use of helium.

Response Tracking Number: 349

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

The guidance states "For sites that overlie contaminated groundwater, an effort should be made to collect soil gas samples from immediately above the capillary fringe zone and half-way to the surface." This should be made more explicit to state that if there are multiple groundwater units, and the contamination is in a deeper groundwater unit, then it is not necessary to sample to the deeper unit for vapor intrusion modeling. Only the shallowest groundwater unit should be sampled as this is the most valid measurement for evaluation of vapor intrusion to indoor air.

DTSC Response to Comment:

The site characterization language will be revised to state that only the first water bearing zone encountered in the subsurface has the potential to produce a vapor intrusion risk. While deeper water bearing units might be contaminated, potential VOC degassing from these units is potentially blocked by shallower water bearing zones. Hence, characterization activities associated with vapor intrusion should focus on the first water beaing unit in the subsurface.

Response Tracking Number: 350

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

The guidance recommends that soil gas samples be collected every quarter acre, based on the typical size of a residential lot. For very large developments (e.g., 500 acres), this could lead to a very large number of samples. We request that DTSC include a lower sampling density for larger sites in the guidance.

DTSC Response to Comment:

See response no. 47.

Response Tracking Number: 351

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 06

Public Comment:

The guidance recommends that duplicates be collected for soil gas if the soil gas is analyzed using method 8260B and that the duplicates be analyzed using TO-14A or TO-15. If the 8260B detection limits are acceptable for risk assessment purposes, then there does not appear to be any reason to have duplicates analyzed with TO-14A or TO-15.

DTSC Response to Comment:

See response no. 221.

Response Tracking Number: 352

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

The guidance recommends that "the analytical detection limits [for soil gas] should be no higher than five hundred times the acceptable indoor air concentrations." The ease of use of this document would be increased if DTSC could provide a table with maximum recommended analytical detection limits for soil gas.

DTSC Response to Comment:

The text will be revised in the guidance document to state that the detection limits for soil gas sampling can be the California Human Health Screening Numbers (CHHSLs) if cumulative health effects are not of a concern. This means that soil gas detection limits are readily available for 16 volatile chemicals due to the development of soil gas CHHSLs by the Office of Environmental Health Hazard Assessment (OEHHA) pursuant to Senate Bill 32. For chemicals not on the OEHHA list, the detection limits can be determined from the attenuation factors in the OEHHA document once the protective indoor air concentrations are known for the site. Protective indoor air concentrations can be determined using the procedures in Appendix C of the vapor intrusion guidance document. Unfortunately, state-wide screening numbers, along with associated analytical detection limits, cannot be provided in the revised guidance document because of potential violation of the Administrative Procedures Act.

Response Tracking Number: 353

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 07

Public Comment:

The guidance states "If groundwater is encountered during the collection of soil gas samples and it appears that the contamination is in close proximity to the water table, groundwater grab samples should be collected pursuant to USEPA (1997a) to evaluate the potential contaminant impact to the aquifer." Did DTSC intend to state impact to or from the aquifer?

DTSC Response to Comment:

The intent of the statement was to suggest that groundwater characterization is warranted if the contaminant release has migrated downward near the groundwater. One would be compelled by the soil contaminant concentrations and contaminant location relative to the groundwater to determine if groundwater characterization is warranted.

Response Tracking Number: 354

Commenter Organization: Lockheed Martin

Technical Subject: Site Characterization

Guidance Document Page: 08

Public Comment:

For sites with contaminated groundwater, the guidance recommends that both soil gas and groundwater be sampled. Further, the guidance recommends that the risks from both media should be presented, risk management decisions based on the higher of the two, and that if the two risk estimates differ greatly, an explanation of this should be provided. While both should clearly be presented, the soil gas data seems more appropriate as the basis for risk management decisions. This is because of the uncertainty in modeling vapor diffusion through soils and soil gas data can show the real limits of diffusion through soil from a groundwater source.

DTSC Response to Comment:

See response no. 32.

Response Tracking Number: 355

Commenter Organization: Lockheed Martin

Technical Subject: Table 1

Guidance Document Page: 55

Public Comment:

Table 1 in the guidance lists chemicals that, if detected at the site, indicate that vapor intrusion should be evaluated. However, several of the chemicals on that list are traditionally not evaluated as volatiles under USEPA (1996) guidance. For the Nonvolatiles in Table 1, we have used the latest version of SL-SCREEN from USEPA (with default exposure and toxicity values; soil parameters indicated below) to compare the saturation concentrations of the nonvolatiles with their risk-based concentrations. For four of the nonvolatiles in Table 1, the saturation concentrations are well below the risk based concentrations, indicating that these chemicals will never pose a risk from indoor vapor inhalation (highlighted on the table below). Additionally, the soil gas analytical methods recommended by DTSC (e.g., TO-15 and 8260) do not analyze for any of the chemicals on the table below. As the current guidance cannot be used to determine indoor vapor intrusion for the chemicals on the table below, DTSC should provide additional guidance on how to sample, analyze, and model indoor vapor intrusion for these chemicals.

DTSC Response to Comment:

The chemicals in Table 1 were taken directly from the chemical list in USEPA's 2002 vapor intrusion guidance document, with DTSC's addition of PCBs, fuel oxygenates, and 1,4-dioxane. Because the analysis of pore saturation for the four chemicals in question is so compelling (chrysene, dibenzofuran, endosulfan, and methoxychlor), DTSC will evaluate each chemical on the Table 1 list and determine which chemicals should be removed due to toxicity and vapor pressure. For those chemicals which remain on the list, an analytical technique will be provided. See response no. 81.

Response Tracking Number: 356

Commenter Organization: Lockheed Martin

Technical Subject: Table 1

Guidance Document Page: 55

Public Comment:

Table 1 indicates that if di- and mono-chlorobiphenyls are detected in soils or groundwater at site, then the vapor intrusion pathway should be evaluated for these chemicals. However, soil gas analytical methods do not analyze for these chemicals and the vapor phase migration of these chemicals cannot be modeled due to lack of physical chemical properties for use in the Johnson and Ettinger model. In addition, there are no published toxicity values in IRIS, OEHHA's toxicity criteria database, HEAST, or the PRO tables for these two chemicals (which are constituents of Aroclor 1221 and 1232). It is respectfully requested that these chemicals either be dropped from Table 1 or DTSC provide the missing data.

DTSC Response to Comment:

It is DTSC's position that it is appropriate to leave PCBs as a chemical-of-concern for vapor intrusion evaluations in the revised guidance document due to DTSC's prior experiences with PCB vapor intrusion. As such, DTSC will add information to the revised guidance document concerning analytical methods for PCB quantification, J&E model approaches, and toxicity factors. See response no. 62.

Response Tracking Number: 357

Commenter Organization: Lockheed Martin

Technical Subject: Preliminary Screening

Guidance Document Page: 14

Public Comment:

The guidance states "DTSC recommends that the default attenuation factors in Table 2 be used along with the maximum detected soil gas concentration for preliminary screening evaluations. Default attenuation factors are provided for three foundation configurations; slab-on-grade, crawl space, and basement." For situations where the site conditions do not fit the assumptions of the default attenuation factors, the decision to use default attenuation factors should be made after consultation with DTSC staff as a conservative first step in the evaluation of vapor intrusion.

DTSC Response to Comment:

The text will be added to the guidance document stating that conditions not covered by the default attenuation factors should be addressed in consultation with DTSC or the lead regulatory agency.

Response Tracking Number: 358

Commenter Organization: Lockheed Martin

Technical Subject: Preliminary Screening

Guidance Document Page: 15

Public Comment:

The guidance states that groundwater data is usable if "contaminant trends in individual groundwater monitoring wells are adequately established with an appropriate amount of sampling." It is requested that a more specific criterion be provided to determine when sampling can be finished. For example, four sampling rounds could be used to adequately establish trends.

DTSC Response to Comment:

The amount of data needed to establish a contaminant trend is based on site-specific conditions and, hence, it is inappropriate to be overly prescriptive in the approaches for data collection and analysis.

Response Tracking Number: 359

Commenter Organization: Lockheed Martin

Technical Subject: Preliminary Screening

Guidance Document Page: 08

Public Comment:

For confined or semi-confined aquifers, installing a well screen across the water table can be problematic, particularly in light of the requirement that well screens be shorter than 10 feet. The determination of whether or not the groundwater data is representative should be based upon the nature of the contaminant of concern and the demonstration that the monitoring wells are constructed properly, given the site-specific nature of the subsurface.

DTSC Response to Comment:

The point where contaminants partition from the groundwater to soil gas occurs at the saturated - unsaturated interface. Hence, to evaluate the vapor intrusion of groundwater contaminants, representative samples must be obtained at this interface, whether this interface is unconfined, semi-confined or confined. The guidance document will be revised to clarify the location of groundwater sample collection.

Response Tracking Number: 360

Commenter Organization: Lockheed Martin

Technical Subject: OSHA

Guidance Document Page: 18

Public Comment:

The guidance states "various operations at RCRA and non-RCRA sites are directly regulated by OSHA (e.g., spray booths, plating operations, etc.), and this Guidance does not apply to those specific operations." This is difficult to interpret. It might be more clearly stated as follows: "For businesses in which the primary source of indoor vapors is within the building (and not a subsurface source), indoor air sample results may be compared to the OSHA PELs and this Guidance does not apply."

DTSC Response to Comment:

The text in the guidance document will be revised pursuant to the language in this comment.

Response Tracking Number: 361

Commenter Organization: Lockheed Martin

Technical Subject: Preliminary Screening

Guidance Document Page: 06

Public Comment:

If soil gas samples are collected at multiple depths, it seems that the most appropriate soil gas concentration to use in the screening is the value detected at shallowest depth interval, as this is what will migrate into a building. Using higher concentrations from deeper intervals may over-estimate indoor air concentrations.

DTSC Response to Comment:

See response no. 122, 172, 216, 271, and 289.

Response Tracking Number: 362

Commenter Organization: Lockheed Martin

Technical Subject: Site Specific Screening

Guidance Document Page: 21

Public Comment:

Step 7 allows for the contaminant source term to be approximated with the 95thpercent upper confidence limit for existing buildings but still requires the maximum concentration for future buildings. This latter requirement does not seem appropriate since this step is intended "to simulate site conditions using reasonable, site-specific input parameters."

DTSC Response to Comment:

Making a reasonable prediction of vapor intrusion into future buildings with the J/E model is difficult. Hers, et al. (2003) states that, "when quality site-specific data is available for both soil properties (e.g., moisture content) and building properties (e.g., ventilation rate, mixing height), it may be possible to reduce the uncertainty in attenuation factor to approximately one order of magnitude." Due to the inability of the J/E model to predict any better than one order of magnitude, DTSC adopted a conservative approach for the future building scenario. This conservative approach included the use of maximum subsurface concentrations for risk determinations and the use of a default value of 5 liters per minute for the soil gas advection rate. Ideally, for the future building scenario, there should be at least one soil gas sample per building footprint and that observed concentration should be used in the fate and transport modeling, which is, by default, the maximum concentration. If there is more than one soil gas sample per building, the maximum concentration should still be used. Rarely are the soil gas sampling locations sufficiently dense where a 95%UCL can be calculated for the contaminant source for an individual building. The minimum number of samples usually needed to statistically approximate a contaminant source is ten (USEPA, 1992). The collection of ten soil gas samples for one building, even a large commercial building, both spatially and temporally, is onerous and rarely done.

The use of maximum soil gas concentrations for the future building scenario will be clarified in the guidance document pursuant to this response.

References

Hers, I., R. Reidar-Zapf, P. C. Johnson, and L. Li. 2003. Evaluation of the Johnson and Ettinger Model for Prediction of Indoor Air Quality. Ground Water Monitoring and Remediation, v. 23, n. 2, p. 119 - 133.

USEPA. 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Solid Waste and Emergency Response, Washington, D. C., Publication 9285.7-081, May 1992.

Response Tracking Number: 363

Commenter Organization: Lockheed Martin

Technical Subject: Additional Site Characterization

Guidance Document Page: 19

Public Comment:

The guidance recommends that the air permeability of soils in the vadose zone should be determined from in-situ measurements. However, the in-situ methods are stated to be "complex and requiring specialized equipment" (USEPA 2004). If the results of the laboratory methods and the in-situ method are not significantly different, then we recommend that the laboratory tests be used.

DTSC Response to Comment:

Soil cores taken for laboratory analysis for air permeability are subject to confining pressures that are not usually indicative of subsurface conditions. These larger than usual confining pressures may collapse the pore space in the core, biasing the laboratory results. The equipment necessary for in-situ permeability measurements are readily available but may be difficult to deploy in the field. However, due to the potential criticality of the data for determining human health risk, DTSC would prefer in-situ measurements over laboratory measurements. If the measurement of in-situ conditions is too burdensome for stakeholders, then a default value of 5 L/min should be used for the soil gas advection rate.

Response Tracking Number: 364

Commenter Organization: Lockheed Martin

Technical Subject: Additional Site Characterization

Guidance Document Page: 20

Public Comment:

The guidance states "For large foundations greater than 5,000 square feet, DTSC suggests that one subslab sample per 1,000 square feet be collected." We recommend that DTSC allow a lower sampling density for buildings over 15,000 ft sq.

DTSC Response to Comment:

Upon document revision, DTSC will specify that two subslab samples, at a minimum, are warranted for each building. The text for additional samples for larger buildings will be changed to recommend that an appropriate number of samples be collected so that subslab conditions can be adequately represented.

Response Tracking Number: 365

Commenter Organization: Lockheed Martin

Technical Subject: Additional Site Characterization

Guidance Document Page: 20

Public Comment:

Although the guidance states that crawlspace and indoor air concentrations should be the same, there is some evidence showing that crawl spaces can have higher concentrations than indoor air (see Olson and Corsi (2001) for some examples). Thus, using crawlspace measurements as a surrogate for indoor air will over-estimate risks. It is recommended that crawl space data not be used as a surrogate for indoor air.

DTSC Response to Comment:

The DTSC's crawl space attenuation factor was taken from USEPA's empirical database and DTSC is biased towards the interpretations from USEPA. While crawl space concentrations may be slightly higher than indoor air concentrations in some cases, it is DTSC's position that a crawl space attenuation factor of 1.0 is appropriate for screening purposes. Crawl space sampling is a viable alternative to indoor air sampling. Crawl spaces are not usually subject to secondary sources of indoor air contamination due to lifestyle choices and crawl space sampling can be less invasive.

Response Tracking Number: 366

Commenter Organization: Lockheed Martin

Technical Subject: Site Specific Screening

Guidance Document Page: 22

Public Comment:

It should be made clearer that the air permeability parameter is not used for future building scenarios. For future buildings, Qsoil is defined as a default parameter, varying only based on building size. However, for the current building scenario, Qsoil is calculated based on many parameters, including air permeability and soil water-filled porosity. As noted in USEPA (2004), Qsoil can vary by several orders of magnitude. More empirical studies measuring Qsoil at sites with finer-grained soils would be useful in evaluating the realistic bounds on Qsoil.

DTSC Response to Comment:

The guidance document will be revised to state that air permeability measurements are not warranted for the future building scenario. Unfortunately, very few studies are available to provide bounds on the soil gas advection rate.

Response Tracking Number: 367

Commenter Organization: Lockheed Martin

Technical Subject: Indoor Air Sampling

Guidance Document Page: 32

Public Comment:

The guidance states that "during the pre-sampling site visit, these sources [i.e., consumer products] can be identified and either sealed or removed prior to indoor air sampling." However, it is unclear how this could be accomplished at industries that use volatiles as part of their daily routine; e.g., metal degreasers or drycleaners or maintenance facilities. It would be good to re-state here that indoor air sampling is not feasible for businesses where there are sources of indoor vapors from activity within the building.

DTSC Response to Comment:

The language in the guidance document will further clarify this issue. An operating facility that has an industrial process that uses the same chemicals that exist in the subsurface presents a unique situation concerning risk assessment associated with vapor intrusion. Pursuant to the California Health and Safety Code, chemical releases in California should be characterized and mitigated based upon the risk of exposure to human and ecological receptors. Hence, for vapor intrusion sites, potential adverse effects to humans should be evaluated in terms of acceptable exposure, which is usually a cancer risk of 1x10-6. If the subsurface assessment indicates that an unacceptable risk may exist, indoor air testing at the industrial facility will not be a viable option to further document or validate the health impacts. In these situations, where the subsurface chemicals are used at the site, the site mitigation process would proceed without the benefit of indoor air testing. Additionally, it should be noted that many industrial sites have office space which house workers that are not directly involved in the manufacturing process. These workers are not usually health and safety trained pursuant to OSHA requirements. Hence, the spaces occupied by these workers could be tested as a mechanism to determine the potential for vapor intrusion.

Response Tracking Number: 368

Commenter Organization: Lockheed Martin

Technical Subject: Statistics

Guidance Document Page: 33

Public Comment:

Ambient air in most metropolitan areas already represents an unacceptable risk. Indoor vapor concentrations will be at least as high as ambient concentrations, even if the building is not over a plume. Thus, risks from indoor vapor inhalation should only lead to further action if indoor vapor concentrations exceed ambient concentrations. It can readily be determined if indoor vapor concentrations are elevated over ambient. To do so, a minimum of 4 ambient air samples should be collected from the site at the same time as indoor air samples and the indoor and outdoor air results should be compared using a t-test or Mann-Whitney U test as appropriate.

DTSC Response to Comment:

The revised guidance document will provide additional information concerning the use of statistics to approximate exposure. The t-test and the Mann-Whitney tests are viable methods for population-to-population comparisons, but usually these tests cannot be used for vapor intrusion evaluations. Most residential indoor air sampling is limited to the collection of two samples per structure which restricts the use of t-test and Mann-Whitney testing. Typically, the ambient data is pooled and statistically approximated and then this pooled ambient value is compared to the maximum result from each individual structure. However, if the indoor air data are statistically robust, DTSC is receptive to the use of statistics.

Response Tracking Number: 369

Commenter Organization: Lockheed Martin

Technical Subject: Indoor Air Sampling

Guidance Document Page: 33

Public Comment:

The guidance states that several types of consumer products should not be used during sampling; e.g., materials containing VOCs (dry markers, white out, glues, etc.) or cleaning, waxing or polishing of furniture or floors. However, these types of products may continue to release volatiles for several days after being applied. Therefore, DTSC should consider changing their recommendation to "these products should not be used or applied at the site for at least one week prior to indoor air sampling." Further, painting and the installation of linoleum can potentially lead to elevated indoor vapor concentrations for longer periods of time.

DTSC Response to Comment:

The public is usually notified well in advance of indoor air testing (see response no. 183). Fact sheets are mailed to residents that indicate indoor air testing is pending and general instructions for the residents are provided at that time concerning the use of consumer products. About one week prior to the indoor air testing, each resident is contacted in person to schedule the testing and to further explain the use of consumer products. Also, written instructions in English and non-English, as appropriate, are provided at that time. Then, at the time of canister deployment, the resident is again asked about consumer products and the indoor air is screened using a portable analytical device. Hence, there are at least three opportunities to discuss the use of consumer products with residents prior to the indoor air sampling. DTSC will further clarify this approach upon revision of the guidance document.

Response Tracking Number: 370

Commenter Organization: Lockheed Martin

Technical Subject: Mitigation

Guidance Document Page: 35

Public Comment:

The guidance states "While specific remedies are not discussed here for sites where vapor intrusion yields low indoor air VOC concentrations, a combination of enhanced interior ventilation systems, conduit seals, utility trench dams, and other easily installed improvements should be considered for these types of scenarios." With sufficient air exchange, increased ventilation rates should mitigate higher VOC concentrations in indoor air, as well. Further, underperforming heating, ventilation and air-conditioning (HVAC) systems could also be the cause of elevated indoor air VOC concentrations and repairing, or upgrading underperforming HVAC systems may mitigate the problem. We request that this be added to the guidance.

DTSC Response to Comment:

The guidance document will be revised to acknowledge the underformance of HVAC systems in commercial buildings. However, increasing the amount of air exchange in a building beyond the routine operation of the HVAC system is not deemed an appropriate long-term mitigation measure to alleviate vapor intrusion (see response no. 87). As noted in the comment, the HVAC system of a commercial building should not be underperforming. If vapor intrusion is occurring in a commercial building with an underperforming HVAC system, the HVAC should be repaired and then the building should be re-tested to verify that vapor intrusion has been alleviated. As for residential buildings, alteration of the HVAC system should not be considered as a mitigation measure.

Response Tracking Number: 371

Commenter Organization: Lockheed Martin

Technical Subject: Appendix B

Guidance Document Page: B1

Public Comment:

The guidance states "the attenuation factors for residential buildings with crawl spaces, whether they are future or existing structures, are equal to the attenuation factors for slab-on-grade structures." Tetra Tech is currently working on validating models that it has developed that show that buildings with crawl spaces have higher indoor vapor concentrations than buildings with either slab-on-grade construction or basements. The higher indoor vapor concentrations in buildings with crawl spaces may be expected as the cement in foundation acts as a vapor barrier in slab-on-grade building and buildings with basements; without a cement vapor barrier, vapor migration is unimpeded. At present, no default attenuation factors for buildings with crawl spaces are available, but DTSC should recognize that they may be higher than for slab-on-grade buildings or buildings with basements.

DTSC Response to Comment:

DTSC specified no vapor attenuation from crawl spaces to indoor air in the guidance document. DTSC was influenced by USEPA's position on this subject. USEPA assumed no attenuation of air quality over a building's crawl space in their 2002 vapor intrusion guidance document and empirical data collected by USEPA (Dawson, 2004) indicates minimal attenuation over crawl spaces. Any changes to the default attenuation factor for crawl spaces must be based upon the scientific literature. DTSC will be compelled to change the default attenuation factors as indicated by peer-reviewed theoretical and empirical studies. Hence, until those studies are available, the crawl space air quality is assumed to be equal to indoor air quality.

References

Dawson, H. 2004. USEPA's Vapor Intrusion Database Evaluation. Presentation at the 14th Annual West Coast Conference on Soils, Sediments, and Water, Association of Environmental Health and Science; Vapor Intrusion Attenuation Workshop sponsored by the United States Environmental Protection Agency. San Diego, California. March 15 - 18, 2004.

United States Environmental Protection Agency. 2002a. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Office of Solid Waste and Emergency Response. November 29, 2002.

Response Tracking Number: 372

Commenter Organization: Lockheed Martin

Technical Subject: Appendix B

Guidance Document Page: B1

Public Comment:

The default attenuation factors provided in Appendix B incorporate the assumption of a relatively small amount of indoor-outdoor air exchange and these low air exchange rates are recommended for use in vapor modeling in Appendix D. The values assumed are 0.5 and 1.0 air changes per hour for residential and commercial buildings, respectively. However, recent OEHHA (2004) guidance recommends an air exchange rate of 4.7 air changes per hour for all schools in California. This value may also be appropriate for other situations and results in lower risk estimates.

DTSC Response to Comment:

For the quantification of the vapor intrusion risk at school sites, the revised DTSC guidance document will direct stakeholders to OEHHA (2004). The air exchange rates for residential and commercial buildings will remain as 0.5 and 1.0 air changes per hour, respectively, until OEHHA revises their 2004 document concerning the California Human Health Screening Levels (CHHSLs).