

PART D
GUIDANCE SECTION 3: DATA EVALUATION

D.1 TOPIC: General comments on Section 3 of the guidance

Comment D.1.1:

This section clearly illustrates that the evaluation of the vapor intrusion pathway is complex and often requires data from multiple sources.

Response D.1.1:

Comment noted.

Comment D.1.2 (paraphrased, 1 commenter, 1 comment):

To address future concerns for potential exposures associated with soil vapor intrusion, we recommend that the NYSDOH work with the building construction industry to recommend sub-slab depressurization systems and to develop construction specifications for new construction in residential communities in or near proximity to locations that have area-wide contamination concerns.

Response D.1.2:

The State will continue to work with involved parties to recommend an appropriate course of action for addressing current and potential soil vapor intrusion exposures on a site-by-site basis. There has not been an attempt to apply the recommendations of the guidance on an industry-wide basis as suggested by the comment. (Note: Local codes of some communities may already include requirements for the installation of sub-slab depressurization systems to address concerns about radon.)

D.2 TOPIC: Factors considered when evaluating data

Comment D.2.1 (paraphrased, 1 commenter, 2 comments):

We recommend that the list of factors considered by the NYSDOH in making testing and mitigation decisions, in addition to contaminant concentrations (pages 28-35), be expanded to include the following:

- [a] overall protectiveness of public health and the environment, including the potential for impacts on children and other sensitive populations;
- [b] the potential for multiple pathways of exposure, exposure to multiple sources of contamination, and/or exposure to multiple contaminants with similar and/or additive toxic effects;
- [c] the degree of uncertainty associated with measuring sub-slab vapor and indoor air contamination at a site or in individual homes or other structures potentially impacted by a site;
- [d] the degree of uncertainty associated with fully characterizing groundwater and soil contamination, the movement of such contamination through groundwater, soil or bedrock, and predicting the impact of such contamination on indoor air;
- [e] short-term and long-term effectiveness;
- [f] implementability;
- [g] cost effectiveness, including the relative cost of mitigation as compared to monitoring;

- [h] the potential for inequitable outcomes; and
- [i] community acceptance.

The entire set of factors should be used in a fashion similar to the remedy selection criteria used under the National Contingency Plan, the State Superfund Program, and the new Brownfield Cleanup Program to assist in making agency decision-making more transparent and readily understandable to the public.

Response D.2.1:

Section 3 of the guidance provides a list of factors considered when interpreting data and deciding on the next steps of an investigation. The data evaluation process recommended by the guidance is similar to the process used in evaluating data for other media (soil, groundwater, etc.) in the State Superfund Program and other environmental programs. The factors in the comment are more like those used in evaluating potential remedies in the various cleanup programs. When mitigation of soil vapor intrusion is included in a remedy for a site in one of these programs, it will be evaluated relative to criteria like those above, just as the other components of the remedy would be.

The State strongly believes that community outreach is an essential component to the evaluation of soil vapor intrusion. As discussed in Section 5 of the guidance, there are many types of outreach techniques that may be useful in keeping the community informed and involved throughout the process. Such outreach is often effective at addressing the concerns expressed in the comment about maintaining a level of transparency.

In response to the specific factors mentioned in the comment:

- [a] The protection of public health serves as the foundation of all actions taken to address exposures related to soil vapor intrusion at sites. The potential for impacts on children and other sensitive population groups was considered when deriving the Soil Vapor/Indoor Air Decision Matrices (provided in Section 3.4 of the guidance), which are decision-making tools used at soil vapor intrusion sites. Because the matrices are risk management tools and consider a number of factors, the NYSDOH intends to assign chemicals to one of them, where appropriate. The matrices will be modified or additional matrices will be developed when a chemical's toxicological properties, background concentrations, or analytical capabilities suggest major revisions are needed. Health risks, including the potential for impacts on children and other sensitive populations are considered when we evaluate a chemical's toxicological properties.
- [b] The NYSDOH agrees that all potential exposure pathways to environmental contamination should be considered. The NYSDOH identifies and recommends ways to address these pathways as sites are investigated under the various regulatory programs. The guidance, however, is intended to provide recommendations on how to investigate and address a specific exposure pathway (soil vapor intrusion) where the exposure is primarily via inhalation. The potential for similar and/or additive toxic effects will be addressed if exposure to multiple contaminants via soil vapor intrusion becomes an issue at a site.
- [c and d] Although the evaluation of the vapor intrusion pathway is an emerging science, the guidance provides the necessary framework for dealing with the uncertainties described in the comment and gives recommendations on how to obtain representative and reliable data upon which to base decisions.

[e – i] Section 3 of the guidance presents an overview of the many factors that are considered when evaluating the data and a summary of actions recommended from a public health perspective. Some of the factors presented in the comment do not serve as the bases for these actions (e.g., relative costs, community acceptance, potential for inequitable outcomes, implementability, etc.) and have therefore not been added to the guidance as recommended. Furthermore, the NYSDOH believes the actions are both protective of public health and appropriate to addressing current and potential exposures related to soil vapor intrusion, both in the short-term and long-term.

Comment D.2.2 (paraphrased, 1 commenter, 1 comment):

The NYSDOH should provide a more substantive discussion regarding the role each factor plays in deciding whether to test or mitigate at structures (i.e., an idea of how much weight each factor is given).

Response D.2.2:

Section 3 of the guidance is intended to present an overview of many of the factors considered when evaluating the information obtained during the investigation and to provide general recommendations on appropriate next steps. As discussed throughout Section 3, appropriate actions (e.g., additional sampling, monitoring, mitigation, etc.) are determined on site-specific and building-specific bases. A prescribed universal "factor weighing system" has not been incorporated into the guidance, as this is inconsistent with the general approach and intent of the guidance.

Comment D.2.3 (2 commenters, 2 comments):

Human health risks should be considered when evaluating all vapor intrusion sampling results. The guidance only includes the consideration of human health risks in the evaluation of sub-slab vapor results (Section 3.3.2). The NYSDOH provides no explanation why human health risks are not also considered as part of the evaluation of soil vapor and indoor air concentrations. Clearly, human health risk should be included in the evaluation of all vapor intrusion results. Such an approach allows the data to be assessed objectively considering exposure concentrations, potential intake, and chemical-specific toxicity. Moreover, incorporation of human health risks into the evaluation process is important because NYSDOH does not have indoor air guidelines for most chemicals. Failing to consider human health risks will result in undue regulation and mitigation, potentially misdirecting resources away from those sites with actual human health risks.

Response D.2.3:

Human health risks are one of many factors considered when evaluating the results of a soil vapor intrusion investigation. Sections 3.3.2 - 3.3.4 of the guidance have been revised to clarify this point.

Comment D.2.4:

The guidance states that the results of individual soil vapor, sub-slab vapor, indoor air and outdoor air samples are evaluated with the consideration of several additional factors including applicable standards, criteria and guidance values. However, the guidance does not present applicable standards, criteria and guidance values.

Response D.2.4:

Applicable standards, criteria and guidance values are described in *Section 3.2.5 Applicable standards, criteria and guidance values*.

D.3 TOPIC: Sources of volatile chemicalsComment D.3.1:

The guidance should also point out that indoor air sources may impact sub-slab vapors, either through diffusion or through advection if pressure gradients are negative (downwards). Even periodic downward flow of air into the sub-slab soils could result in residual concentrations of COCs that linger well after the indoor source has been removed.

Response D.3.1:

Acknowledged. This phenomenon is mentioned in the discussion of subsurface vapors in Section 3.2.3.a of the guidance. No additional discussion has been added to the guidance.

Comment D.3.2:

Section 3.2.3: Potential sources of VOCs in outdoor air include all internal combustion engines and is not limited to automobiles and lawn mowers, as suggested in the draft guidance.

Response D.3.2:

Acknowledged. Examples of sources of volatile chemicals to the outdoor air are provided in both Section 3.2.3.c of the guidance and Table 1.3. The lists of examples are not intended to be all-inclusive. Therefore, the guidance has not been revised in response to this comment.

For additional discussions on sources of volatile chemicals to subsurface vapors, indoor air and outdoor air, see Comments B5.5, B.5.6, B.5.13, and B.5.15.

D.4 TOPIC: Background levels of volatile chemicals in airComment D.4.1 (paraphrased, 3 commenters, 3 comments):

The benefit of using published background levels in the decision-making process is not clear. For example, Section 3.3.3 on indoor air only provides options related to a background comparison. Such an approach indicates that the State is using the background values as more than screening values (as stated in Section 3.2.4). Background values should not be used to establish the site-specific remedial action objectives for abatement of intruding soil vapor. Rather, it is incumbent upon the NYSDOH to develop indoor air quality guidelines. Until such time, the NYSDEC should use relevant and appropriate guidance, such as DAR-1's Annual Guideline Concentrations, and perhaps even TOGS 1.1.1, in

addition to the "background" levels to determine the applicable site-specific no further action levels.

Response D.4.1:

Published background levels are helpful in interpreting indoor and outdoor air data, particularly in assessing whether the detection of a chemical may indicate a source that can be addressed to reduce exposures (as discussed in the Section 3.3.3 of the guidance). Background data allow for quantitative comparisons and are one tool used in a multiple-lines-of-evidence approach to data evaluation and decision-making. As such, background databases are not the sole factor for determining if additional action is necessary. The discussion in Section 3.3.3 has been revised to elaborate on the factors that are considered when evaluating indoor air results.

Air guidelines, like background values, are not used as sole determining factors in the evaluation process. As discussed in Section 3.2.5, the purpose of an air guideline is to help guide decisions about the nature of efforts to reduce exposure to a chemical. Reasonable and practical actions should be taken to reduce exposures when indoor air levels are above background, even when they are below a guideline.

DAR-1's Annual Guideline Concentrations and TOGS 1.1.1 are not appropriate for use in the evaluation of soil vapor intrusion data as suggested in the comment. Applicable standards, criteria and guidance values are discussed in Section 3.2.5 of the guidance. [See also Comment D.10.23.]

Comment D.4.2 (paraphrased, 3 commenters, 2 comments):

No information is provided on how to address chemicals without background concentrations.

Response D.4.2:

Background concentration ranges are available for many volatile chemicals. Where background data exist for a chemical, statistical measures of typical background can be calculated for it. A more detailed description of each database along with statistical measures of background levels are provided in Appendix C. If not present in the databases, additional literature research may be needed to identify background values. For chemicals where typical background ranges are not available, additional studies may be needed to establish background values. The State will evaluate the need for additional background data on a case-by-case basis.

The absence of background levels for some compounds should not preclude the collection of samples and data evaluation. As explained in the guidance, background data are just one of several tools in a multiple-lines-of-evidence approach to data evaluation and decision-making. Other factors, including those described in Section 3.2, should be considered in evaluating indoor and outdoor air data in these situations.

Comment D.4.3:

The guidance recommends priority sampling for buildings with sensitive populations (i.e., day care, hospital, etc.). The discussion of indoor background should include these types of buildings as buildings which are likely to have sources of indoor VOCs for cleaners, disinfectants, and other sources which may not be easy to eliminate prior to sampling.

Response D.4.3:

All buildings are likely to contain indoor sources of volatile chemicals, not just those buildings listed in the comment. As such, the State strongly recommends that a product inventory be completed during indoor air sampling [as discussed in the Sections 2.7.3 and 2.11.2 of the guidance]. A specific discussion as suggested in the comment has not been incorporated into the guidance, as this is inconsistent with the general approach and intent of the guidance.

Comment D.4.4 (paraphrased, 8 commenters, 8 comments):

We disagree with the proposed definition of background that would preclude the lowest 25 percent and highest 25 percent of background readings included in select databases (Section 3.2.4). These background ranges are conservative and may not be representative of certain areas, such as metropolitan areas. A more reasonable approach would be to define background as including a broader range, such as 90 percent of the measured values in databases. Alternatively, the NYSDOH should incorporate a comparison based upon other statistical measures (e.g., the arithmetic mean, geometric mean, 95th upper confidence level of the mean, minimum and maximum values, number of data points, and frequency of detection).

Response D.4.4:

Section 3.2.4 of the guidance has been revised to clarify that "background levels" are not defined as concentrations that fall within the 25th to 75th percentile range. In addition, a more detailed description of each database along with statistical measures of background levels are provided in Appendix C.

Comment D.4.5:

As discussed in the guidance, the distribution of indoor background VOCs concentrations are lognormal. As a result, VOC concentrations that are 10x or more above the 75th percentile concentration (provided in the Section 3.2.4 summary table) may be detected in a small, but significant, number of houses (i.e., 1-5%) due to background sources of VOCs. The discussion of background should be expanded to clarify that even these elevated VOC concentrations may not be indicative of vapor intrusion impacts.

Response D.4.5:

A determination that soil vapor intrusion is or is not occurring is not based on a comparison of indoor air results to background levels (whether the 75th, 90th or 95th percentile concentration) alone. As discussed in Section 3.3.3 of the guidance, the data evaluation process includes comparing indoor air, outdoor air and soil vapor concentrations in addition to reviewing household product inventory information. The likely source (e.g., indoor source, outdoor source or sub-slab vapors) of elevated indoor air levels should be uncovered during this process. Section 3.2.4 of the guidance has been revised to clarify that "background levels" are not defined as concentrations that fall within the 25th to 75th percentile range. In addition, a more detailed description of each database along with statistical measures of background levels are provided in Appendix C.

Comment D.4.6 (paraphrased, 1 commenter, 1 comment):

Section 3.2.4.a -- The NYSDOH should state that the background study of fuel oil heated homes was conducted in NYSDOH employees' homes without screening the property locations for soil vapor intrusion potential. We understand that this testing was not

originally intended to test for chlorinated VOCs. For this reason, NYSDOH employees would not have been motivated to remove VOC-containing materials.

Response D.4.6:

The NYSDOH Study of Volatile Organic Chemicals in Air of Fuel Heated Homes was conducted in the homes of volunteers, some of which were NYSDOH employees or acquaintances. Part of the selection process included screening out homes that had been affected by a past oil spill or were located near known sources of contamination. Although the protocol contained a requirement that certain activities not be carried out 24-hours prior to sample collection, there were no requirements for removing VOC-containing household products prior to sampling. We believe this is more representative of "typical" household indoor air. Although petroleum-related VOCs were a primary focus of the study, the NYSDOH also intended to obtain information on halogenated VOCs. The guidance has not been revised in response to this comment.

Comment D.4.7 (paraphrased, 2 commenters, 2 comments):

We believe the listing of background studies included in the draft guidance is too limited. The four data sets presented are limited and may be outdated, with data collected using multiple methods. The five boroughs of New York City were excluded from the NYSDOH's primary data set (Section 3.2.4.a). There is concern that the NYSDOH lacks any background levels of volatile chemicals in the air of the five boroughs of New York City.

Response D.4.7:

There are limitations to the data available in all background studies. The guidance acknowledges this and points out some of the limitations of each study in Section 3.2.4 and in Appendix C. Section 3.2.4 of the guidance has been revised to include a discussion of a fifth database: the Health Effects Institute's Relationship of Indoor, Outdoor and Personal Air. Although the older studies (Section 3.2.4.c and 3.2.4.d) could possibly be considered outdated, the databases described in the guidance are the most recent and applicable ones available that the State has had the opportunity to review.

The five boroughs of New York City were not included in the 2003 NYSDOH study, but, at this point, we have no reason to believe that indoor air levels there would be substantially different based on outdoor air sources. For instance, the NYSDEC routinely collects data on outdoor air concentrations of VOCs from its ambient air monitoring stations in New York City and across the state. They report that typical outdoor air levels of benzene in rural and urban areas are similar to or less than those reported in the 2003 NYSDOH study.

If information is available from other background studies in the five boroughs or elsewhere, it may be appropriate to use on a case-by-case basis. In these cases, the State encourages parties to discuss their proposed database with the agencies to assure that all parties understand what background data will be used during data evaluation and the basis for the site-specific decision.

Comment D.4.8 (paraphrased, 2 commenters, 2 comments):

This guidance document presents limited number of studies on background levels for volatiles (p. 29 to 32). As this is a guidance document, it is appropriate that it include representative studies of background concentrations. However, since it is guidance and not regulation, it should not preclude the consideration of other peer-reviewed, published background studies that are shown to be applicable to site specific circumstances.

Response D.4.8:

The guidance acknowledges the potential use of other databases in Section 3.2.4. To the extent that other background studies are representative and are used appropriately, they will be considered. These determinations are made on a site-specific basis. In these cases, the State encourages parties to discuss their proposed database with the agencies to assure that all parties understand what background data will be used during data evaluation and the basis for the site-specific decision.

Comment D.4.9:

We recommend that separate background values (see Section 3.2.4, 2nd paragraph, pp.29-30) should be provided for a variety of settings, including urban, suburban, and rural settings. The USEPA is currently conducting a review of indoor air background data sets in the recent literature. We recommend that [NYS]DOH incorporate the results of USEPA's review.

Response D.4.9:

There is not enough information available for the State to provide background values for various settings as recommended in the comment. A comparative review of suburban and rural settings from the NYSDOH 2003 study (described in Section 3.2.4.a of the guidance) has not identified statistical differences based on setting types. However, if other databases do show significant differences based on setting, they may be considered on a site-by-site basis [see Comment D.4.8]. The State will consider the EPA's review when it is available, and, if appropriate, will incorporate it into the guidance.

Comment D.4.10:

It appears that the only background studies of commercial type buildings were for office type buildings. Background studies for other types of commercial buildings (e.g., analytical laboratories, hardware stores, machine shops, automotive repair facilities) should be conducted. This information would be useful to have for these types of buildings to provide reasonable background values for industrial/commercial buildings.

Response D.4.10:

Acknowledged. As the comment suggests, background studies of office settings may not be applicable to the settings described, especially due to occupational use of chemicals. However, the State does not have plans to conduct a study of background in industrial or commercial settings at this time. The absence of background levels in these settings should not preclude the collection of samples and data evaluation. As explained in the guidance, background data are just one of several tools in a multiple-lines-of-evidence approach to data evaluation and decision-making. Other factors, including those described in Sections 3.2 and 3.4, should be considered in evaluating indoor and outdoor air data in these situations.

Comment D.4.11:

The statement that "[The tabulated] background levels may not be the same as what would be expected if indoor air were sampled in randomly selected homes" is certainly true. The NYSDOH background study is clearly not applicable to residences where residents have hobbies or home businesses that use volatile-compound-containing products. We strongly recommend that the guidance specifically allow a weight of evidence approach to background evaluations, such as described in the recent draft indoor air guidance proposed by Colorado.

Response D.4.11:

A determination that soil vapor intrusion is or is not occurring is not based on a comparison of indoor air results to background levels alone. As discussed throughout Section 3 of the guidance, background data are just one of several tools in a multiple-lines-of-evidence approach to data evaluation and decision-making. A number of additional factors, including indoor sources of volatile chemicals (Section 3.2.3.b), are also used in the evaluation process. The guidance has not been revised as recommended in the comment.

Comment D.4.12:

The datasets for background levels in indoor and outdoor air are relatively small. Is NYSDOH continuing to collect additional background data and will updates to the background ranges be made? Will there be any attempt to determine typical background ranges for compounds in soil or sub-slab vapors?

Response D.4.12:

The NYSDOH plans to test an additional set of homes that heat with natural gas to determine whether there are statistical differences and whether they are associated with heating fuel type. We are considering including sub-slab soil vapors in this study and are also considering a number of other studies to look at spatial and temporal variation of source concentration in sub-slab soil vapor. Results of these studies will be incorporated into, or used to amend, the guidance accordingly. Additionally, Section 3.2.4 of the guidance has been revised to include a discussion of a fifth database: the Health Effects Institute's Relationship of Indoor, Outdoor and Personal Air, and a more detailed description of each database along with statistical measures of background levels are provided in Appendix C.

Comment D.4.13 (paraphrased, 1 commenter, 1 comment):

We recommend providing a hierarchy of when each study should be used, or additional guidance on how a user can determine which background study is most appropriate to apply to a site. Due to the variability in the results of each study, it would be helpful to provide additional guidance on which study is best suited for application at a site investigation.

Response D.4.13:

As discussed in Section 3.2.4 of the guidance, the database or combination of databases that best represents site-specific and building-specific conditions should be used as a basis of comparison. Among the databases, the Upper Fence values from the NYSDOH Fuel Oil Study data may be used as initial benchmarks when evaluating residential indoor air and the 90th percentile values from the EPA BASE data for indoor air in office and commercial buildings. These initial benchmark values should be considered along with the overall distribution of results in the background database to characterize sampling results from a single building or from multiple buildings in a

community. Additional site-specific guidance can be obtained during discussions with the NYSDEC and NYSDOH project managers.

Comment D.4.14 (paraphrased, 3 commenters, 2 comments):

The NYSDOH should clarify that exceedance of a background indoor or outdoor air screening level does not equal a potential human health risk.

Response D.4.14:

See Comment D.4.15.

Comment D.4.15 (paraphrased, 2 commenters, 2 comments):

As part of the guidance, the NYSDOH should more clearly define the level of exposure and level of exceedance of the background concentrations, if any, that may be associated with potential human health risks.

Response D.4.15:

The potential for health effects to occur from chemical exposure depends on many variables, including the toxicity of the chemical, the duration and route of exposure and how sensitive the person is to the chemical. Assessing this information for a large number of chemicals as suggested in the comment is beyond the scope of the guidance.

Comment D.4.16:

Since the NYSDOH guidance will rely only on heating season indoor air results for decisions, the background samples used for comparison should also be from the heating season only (not heating season and non-heating season as for the NYSDOH background study of fuel oil heated homes in Appendix C). Alternatively, NYSDOH should allow decision-making based on test results from other seasons.

Response D.4.16:

In the NYSDOH 2003 study, heating and non-heating season data were not statistically different and were therefore combined into one data table. Separating the data into heating and non-heating season components would have little or no impact on the background ranges for that study. Therefore, the guidance has not been revised in response to this comment. [See also comments in Part C.5 (Topic: Time of year in which to sample).]

Comment D.4.17 (paraphrased, 1 commenter, 1 comment):

We disagree with the assertion that "Background levels are used as screening tools when determining appropriate actions to address exposure. They are not standards and are not meant to be interpreted as such" (Section 3.2.4). Background levels are more than simply screening tools in that they represent the level below which it is technically impracticable to delineate or mitigate contributions from subsurface contamination. Indoor air quality will not improve beyond background conditions.

Response D.4.17:

Comment noted.

Comment D.4.18 (paraphrased, 1 commenter, 1 comment):

Throughout Section 3.2.4 and other sections, the term "background" as related to the statistical measures would be more clearly denoted as "statistical measures of typical background" because background level varies. The guidance also should note that assuming that the statistical measures are representative of background conditions, one-quarter of properties sampled would be expected to yield indoor air concentrations exceeding the typical background statistics for any given compound.

Response D.4.18:

Acknowledged. Where appropriate, the term "background" has been revised to "statistical measures of typical background."

D.5 TOPIC: Applicable standards, criteria and guidance valuesComment D.5.1 (paraphrased, 8 commenters, 7 comments):

The guidance currently provides indoor air guideline values for only five compounds and it is unclear what values the NYSDOH intends to use for other volatile compounds. It is not reasonable for the Agencies to expect responsible parties to begin soil vapor intrusion evaluations unless guidelines are available for all compounds of concern, so that rational decisions can be made regarding the need for mitigation or monitoring, if any.

Response D.5.1:

The NYSDOH acknowledges the usefulness of guidelines in interpreting air data, and will evaluate the need for and develop additional air guideline values as necessary. The absence of guidelines for some compounds should not preclude the collection of samples and data evaluation. As explained in the guidance, air guidelines are just one of several tools in a multiple-lines-of-evidence approach to data evaluation and decision-making. Other factors, including those described in Sections 3.2 and 3.4, should be considered in evaluating indoor air data to determine what actions are appropriate for addressing exposures. The NYSDOH believes that the guidance provides a reasonable and practical approach to evaluating soil vapor intrusion.

Comment D.5.2:

Table 3.1 does not include 1,1,1-TCA; however, the applicability of Matrix 2 to this compound implies that the air guideline for 1,1,1-TCA is that same as that of PCE (100 mcg/m³).

Response D.5.2:

To imply that all chemicals assigned to Matrix 2 must have the same guideline value as PCE is inappropriate. As discussed in Section 3.4 of the guidance, the NYSDOH included two matrices in the guidance document to be used as tools in making decisions when soil vapor may be entering a building. Matrix 1 was originally developed for TCE and Matrix 2 was originally developed for PCE. Because the matrices are risk management tools and consider a number of factors, the NYSDOH intends to assign chemicals to one of them, where appropriate. The NYSDOH has not developed a specific air guideline for 1,1,1-TCA. After consideration of its toxicological properties, gaps in its toxicological database, background concentrations in indoor air and currently available analytical capabilities, the NYSDOH believes that application of 1,1,1-TCA to Matrix 2 is a reasonable and practical approach to protecting public health.

Comment D.5.3 (paraphrased, 1 commenter, 1 comment):

When the proposed air guideline values [Section 3.2.5] should be applied as opposed to those established by other regulatory agencies (i.e., OSHA, National Institute of Occupational Safety and Health (NIOSH), or American Conference of Governmental Industrial Hygienist (ACGIH) guidance values for Occupational Settings) is not clear. The NYSDOH should adopt a similar policy to that of the California Department of Toxic Substances Control (CA DTSC) with respect to the use of OSHA Permissible Exposure Limits (PELs) at active Resource Conservation and Recovery Act (RCRA) facilities.

Response D.5.3:

The guideline values discussed in Section 3.2.5 are one of the factors discussed in Section 3 of the guidance that should be considered when addressing involuntary exposures and health risks associated with soil vapor intrusion.

With respect to the use of OSHA PELs at RCRA sites, California's vapor intrusion guidance (California 2004; pages C-4, C-5, and F-1, F-2) clearly sets forth the CA DTSC policy that, for vapor intrusion sites, OSHA PELs should not be used as protective concentrations regardless of whether the exposure scenario is residential, commercial, or industrial.

"The CA DTSC regulates chemicals in the subsurface and any human exposure derived from associated contaminant migration, and OSHA regulates workspace and any associated exposure derived from an industrial process."

In California, the one exception where OSHA PEL endpoints may be considered is for operating RCRA facilities pursuant to the EPA's Environmental Indicators Program. The OSHA PELs are used only as an interim measure to evaluate buildings that house a commercial or industrial process. These buildings must house a process that involves the use of chemicals that are similar to the chemical subject to soil vapor intrusion due to prior releases to the environment. OSHA PELs are not used for final remedies at RCRA corrective action sites in California. The guidance has not been revised in response to this comment.

Comment D.5.4 (paraphrased, 1 commenter, 1 comment):

The Minimal Risk Levels (MRLs) established by the ATSDR should be considered as an appropriate exposure level between occupational standards and typical background levels when dealing with workplace soil vapor intrusion issues.

Response D.5.4:

An ATSDR MRL is "An estimate of a daily human exposure to a hazardous substance that is likely to be without applicable risk of adverse non-cancer health effects over a specified duration of exposure." They are developed to be protective of the most sensitive members of the general population. MRLs are based on non-cancer health effects only and do not consider cancer effects. In addition, MRLs are not always available for chemicals of concern (e.g., ATSDR has not developed an MRL for chronic exposure to trichloroethene in air) and, in some cases, may not have been updated or reviewed for many years.

When it is determined that a soil vapor intrusion issue should be addressed using the guidance, decision matrices are one of the risk management tools that should be used to address current and potential exposures. The matrices encapsulate the data evaluation processes and actions recommended to address exposures. Indoor air and

sub-slab vapor concentration ranges in a matrix are selected based on consideration of a number of factors including, but not limited to, the following:

- human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;
- the NYSDOH's guidelines for volatile chemicals in air;
- background concentrations of volatile chemicals in air;
- analytical capabilities currently available; and
- attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

ATSDR MRLs are included in the consideration of human health risks.

The State believes that the guidance provides a reasonable and practical approach to evaluating soil vapor intrusion impacts in workplace settings. Therefore, the guidance has not been revised in response to this comment.

Comment D.5.5 (paraphrased, 2 commenters, 2 comments):

We recommend that the guidance contain references to other sources of indoor, outdoor and soil vapor criteria developed by other state (e.g., Connecticut and California) and federal agencies (e.g., ATSDR), including the EPA Region 9 Preliminary Risk-based Concentration Table for indoor air and EPA's values established for shallow and deeper soil gas that are protective of residential land use. This information will be helpful in guiding the user to appropriate comparison values for contaminants of potential concern for soil vapor intrusion investigations.

Response D.5.5:

The State does not necessarily agree that the comparison values provided in the guidance documents of other agencies are appropriate. Therefore, references to other guidance have not been incorporated into the guidance as recommended in the comment. [See also Comment A.8.1 (default screening values).]

Comment D.5.6 (paraphrased, 1 commenter, 4 comments):

We request and recommend that the NYSDOH continue with its efforts to develop indoor air quality guidelines for volatile organic compounds, as it has done with respect to TCE, PCE, PCBs, methylene chloride and dioxin. Those guidelines could be used both to determine when exposure levels are so minimal that agency and industry environmental compliance efforts could be safely focused elsewhere, as well as to guide both agency and industry design objectives for remediation.

Response D.5.6:

The NYSDOH will continue to consider the need for guidelines for other volatile organic compounds and develop them as necessary. However, a guideline is not a threshold below which no action is taken and it is not used as the sole determinant in selecting appropriate actions for addressing exposures related to soil vapor intrusion. As discussed in Section 3.2.5 of the guidance, the purpose of an air guideline is to help guide decisions about the nature of efforts to reduce exposure to a chemical. Reasonable and practical actions should be taken to reduce exposures when indoor air levels are above background, even when they are below a guideline. [See also Part A.11 (TOPIC: Party responsible for investigating and taking action(s) to address exposures).]

Comment D.5.7 (paraphrased, 2 commenters, 2 comments):

The discussion of the guideline values in the guidance document should be expanded to include additional information on their derivation, including if they are developed for chronic, subchronic or acute exposures, if they represent not-to-exceed concentrations, if they are set at a specific carcinogenic risk level or they take into account analytical/sampling limitations, chemical hazard data considered, target risks employed, exposure assumptions and other factors.

Response D.5.7:

An expanded discussion of the derivation of the guideline values is beyond the scope of the guidance document. The bases for the guidelines can be found in the references provided in the footnotes to Table 3.1.

Comment D.5.8 (paraphrased, 1 commenter, 1 comment):

Section 3.2.5.b (air guidelines) states that "Reasonable and practical actions should be taken to reduce exposures when indoor air levels are above background, even when they are below the guideline....In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce chemical levels in indoor air to as close to background as practical."

The use of indoor air guidelines and background values separately and inconsistently is confusing. Several states in the Northeast U.S. (i.e., Connecticut, Massachusetts) incorporate background quantitatively into their numerical criteria for the vapor intrusion pathway. We recommend this approach to incorporate background values quantitatively into the derivation of indoor air guidelines, and the guideline set equal to the higher of the risk-based or background values.

Response D.5.8:

As discussed throughout Section 3 of the guidance, background data and indoor air guidelines are two of several tools in a multiple-lines-of-evidence approach to data evaluation and decision-making. They are not intended to be all-inclusive or to serve as single determinants for further action. The air guidelines themselves are not derived solely on the basis of risk-based criteria, but also consider overall uncertainties and data gaps in the toxicological database, analytical capabilities using routine effective analytical methods, and background concentrations. Thus, while the NYSDOH does consider background levels when deriving guidelines, it does not believe that guidelines should be *a priori* set to the higher of the risk-based or background levels. The NYSDOH will continue to follow the process outlined in Appendix D when developing guidelines for volatile chemicals in air.

Comment D.5.9 (paraphrased, 7 commenters, 13 comments):

For the NYSDOH to use air guideline values that are based on continuous exposure over a lifetime and in some cases (e.g., PCE) may be based on the potential for effects in children is not appropriate. Although these assumptions may be appropriate for a residential exposure scenario, they are overly protective for a commercial or industrial receptor who is likely an adult exposed only during normal working hours. The NYSDOH should take a more focused, land-use approach to establish different guideline levels for indoor air in a commercial setting as opposed to a residential setting. This distinction is justified in light the recent New York State Brownfields legislation that incorporates a land-use approach to develop the cleanup standards.

Response D.5.9:

As a point of clarification, the NYSDOH's guidelines for TCE, PCE and methylene chloride are guidelines for these chemicals in indoor and outdoor air (i.e., air), not just indoor air and not intended for use just at soil vapor intrusion sites.

The NYSDOH takes many factors into account when developing air guidelines to ensure that they are protective of human health. These factors include, but are not limited to, a person's exposure to background levels and exposure of sensitive population groups (e.g., children, pregnant women, those with pre-existing health conditions, etc.). The development of one air guideline value instead of separate exposure-specific values (as suggested in the comment) is similar to the development of a drinking water standard for a chemical, which applies to drinking water whether the water is being consumed at the workplace or at home.

The development of one air guideline value is appropriate given the purpose of the guideline -- to help guide decisions about the nature of efforts to reduce exposure to the chemical. They do not represent a bright line between air levels that cause health effects and those that do not, and they do not represent remedial goals. Furthermore, they are not used as the sole determinant in selecting appropriate actions for addressing exposures related to soil vapor intrusion (see Section 3 of the guidance). The NYSDOH will continue to follow the process outlined in Appendix D when developing guidelines for volatile chemicals in air.

"A commercial or industrial receptor" could be a pregnant woman. Moreover, infants and children could be present in a commercial setting. Thus, the use of a guideline based on the potential health effects in children (who could also serve as surrogates for pregnant women and perhaps other sensitive adults) as a risk management tool in the soil vapor intrusion program is a necessary health-protective choice. This is readily apparent when one realizes that the purpose of the guidelines is to help guide decisions about the nature of efforts to reduce exposure. Reasonable and practical actions should be taken to reduce exposure when indoor air levels are above background, even when they are below the guidelines. The urgency to take actions increases as indoor air levels increase, especially when air levels are above a guideline. In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce levels in indoor air to as close to background as practical.

[See also Comments A.3.1 and A.3.2 (applicability of guidance in nonresidential settings).]

Comment D.5.10 (paraphrased, 2 commenters, 1 comment):

Each air guideline value developed by the NYSDOH should be based on health-based criteria, including OSHA PELs where applicable, not background or other arbitrary levels, and should be subject to public review and comment.

Response D.5.10:

Appendix D provides an overview of how the NYSDOH develops guideline values for volatile chemicals in air. We believe that this is a reasonable and scientifically valid approach that is protective of public health. As discussed in Section 3.2.5 of the guidance, each of the guidelines developed to date (including the guideline for TCE) went through a peer review process in which scientific experts outside of the NYSDOH reviewed the technical documentation that describes the scientific basis for the guideline value. The peer reviewers provided technical comments on the data and

methods used to derive the guidelines, each of which were assessed by the NYSDOH when the guidelines were finalized.

[See also Comment D.5.3 and Part A.3 (applicability of OSHA PELs), Comment D.5.9 (development of guidelines for residential and commercial settings), and Comment A.18.1 (public review of proposed air guidelines).]

D.6 TOPIC: Completed or proposed remedial actions

Comment D.6.1 (paraphrased, 2 commenters, 1 comment):

Section 3.2.6 describes how the effectiveness of remedial actions influences the evaluation of soil vapor intrusion results. However, Section 3.2.6 fails to consider potential changes in indoor air concentrations. Mitigation or remediation actions (i.e., sealing basement cracks) could reduce indoor air concentrations without a significant decrease in subsurface vapors. Under these conditions, additional sampling or other remedial actions would not be necessary. The guidance should be revised to be based on actual exposures and not only subsurface vapor concentrations.

Response D.6.1:

Section 3.2.6 of the guidance describes how on-going remedial actions (intended to remediate a source or one or more contaminated media) may affect decisions about the need for additional sampling and the selection of mitigation measures for soil vapor intrusion. Section 3.2.6 has been revised to clarify this point. The discussion is not referring to actions taken to address exposures related to soil vapor intrusion (e.g., sealing, installing sub-slab depressurization systems, etc.) or post-mitigation sampling as discussed in Section 4.

Actions taken to mitigate exposures related to soil vapor intrusion (sealing basement cracks, installing a sub-slab depressurization system, etc.) are not intended to reduce subsurface vapor concentrations. Given that soil vapor is an environmental medium of concern, remediation of the source of the vapors (either directly or indirectly) is the ultimate goal. Mitigation or other recommended actions are considered to be interim measures to address exposures until the source is remediated. Furthermore, when evaluating soil vapor intrusion, both current and potential exposures are considered. The guidance has not been revised as suggested in the comment.

Comment D.6.2:

Section 3.2.6.a: The fact that concentrations show negligible improvement post remediation could imply that contamination was not actually coming from the subsurface. This is a reasonable conclusion that has been presented by the EPA in their seminars.

Response D.6.2:

Section 3.2.6 of the guidance describes how on-going remedial actions (intended to remediate a source or one or more contaminated media) may affect decisions about the need for additional sampling and the selection of mitigation measures for soil vapor intrusion. Section 3.2.6 has been revised to clarify this point. The discussion is not referring to the results of post-mitigation sampling or confirmation testing as discussed in Section 4.3.

D.7 TOPIC: Past, current and future land and building usesComment D.7.1 (paraphrased, 4 commenters, 6 comments):

In commercial and industrial settings, current and/or past use of chemicals may impact indoor air and confound soil vapor intrusion investigations. Incremental risk due to soil vapor intrusion exposures may be negligible compared with other exposures in the workplace. The guidance should emphasize the importance of reviewing the analytical data for each structure sampled within the context of both current and historic uses of the structure.

Response D.7.1:

Agreed. The discussions presented in the following sections and tables of the guidance have been revised to emphasize both historic and current uses of volatile chemicals: Table 1.3 (alternate sources of volatile chemicals in indoor air – off-gassing), Section 2.7.2 (sub-slab vapor sampling), Section 2.7.3 (indoor air sampling), Section 3.2.3 (sources of volatile chemicals – indoor air), and Section 3.2.7 (current and future land uses).

D.8 TOPIC: Multiple exposuresComment D.8.1:

It's essential to consider all potential exposures to the types of contaminant normally evaluated for vapor intrusion because they all add to the health risk. U.S. EPA's 2001 Health Risk Assessment for TCE concluded that people exposed to "background" levels of TCE or similar compounds are more likely to be affected by additional exposures to TCE than people who receive the same TCE exposures without the "background" exposure. The chemicals, or at least their metabolic products, have an additive impact on organs such as the liver and kidneys. That is, people exposed to TCE in their indoor air alone may be less at risk than people who are also breathing PCE or TCA in their outdoor air or ingesting TCE, PCE or TCA in their drinking water.

Response D.8.1:

The NYSDOH agrees that all potential exposure pathways to environmental contamination should be considered. The NYSDOH identifies and recommends ways to address these pathways as sites are investigated under the various regulatory programs. The guidance is intended to provide recommendations on how to investigate and address a specific exposure pathway (soil vapor intrusion) where the exposure is primarily via inhalation. The potential for additive toxic effects from other exposures will be addressed on a site-by-site basis as necessary depending on the presence of other contaminants and/or exposure routes. Additional discussion related to this tissue can be found in the final *Trichloroethene (TCE) Air Criteria Document* (NYSDOH 2006b).

D.9 TOPIC: Health effects information and risk determinationsComment D.9.1 (paraphrased, 1 commenter, 1 comment):

The guidance would benefit from a discussion of the effects of various chemicals on human health (e.g. chlorinated solvents and liver damage).

Response D.9.1:

Comprehensive health effects information for chemicals that may be found in indoor air is beyond the scope of the guidance document. Therefore, the guidance has not been revised in response to this comment.

Alternate resources are available that provide this information. The NYSDOH has developed fact sheets for some chemicals that discuss potential effects related to exposure; fact sheets for TCE and PCE are included in a Appendix H of the guidance. The NYSDOH will develop fact sheets for other chemicals as warranted. Another source of information about the effects of chemical exposure is a series of fact sheets developed by the federal Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR "ToxFAQs" sheets may be found on the Internet at <http://www.atsdr.cdc.gov/toxfaq.html>.

Comment D.9.2 (paraphrased, 1 commenter, 1 comment):

We request clarification concerning the means by which the NYSDOH will ascertain the level of risk associated with a particular exposure to soil vapor intrusion, given all of the other routine daily exposures to volatile chemicals.

Response D.9.2:

As discussed in Section 3, there are "background levels" of some chemicals typically found in indoor and outdoor air, and people may be exposed to these levels on a regular basis. The NYSDOH does not intend to determine the "level of risk" associated with each potential or actual exposure. Rather, we are ascertaining the level of contribution associated with soil vapor intrusion versus other sources of indoor air contamination. This is accomplished by a comparison of indoor air, outdoor air, and sub-slab vapor results, as well as considering possible sources of volatile chemicals to the indoor air (e.g., information documented in the building questionnaire and product inventory form). On the basis of this evaluation, recommendations on how to reduce exposures (if necessary) are provided.

D.10 TOPIC: Sampling results and recommended actionsComment D.10.1 (paraphrased, 1 commenter, 1 comment):

The guidance contains a broad definition of "potential exposure" that is not fully addressed in the guidance document. This creates difficulties. For example, if sub-slab vapor samples exceed certain values for existing buildings, then monitoring or mitigation is required (due to the potential for exposure), even if the indoor air is "clean."

Response D.10.1:

See Comment B.2.3 for a discussion of the definition for potential exposures. As discussed throughout the guidance, both current and potential exposures should be considered when evaluating soil vapor intrusion. In the example scenario, there is a possibility that a building may change in the future (e.g., the structure may be altered, ventilation systems may be changed, etc.). The situation requires active management (through monitoring or other measures) to ensure that the indoor air continues to be protected against soil vapor intrusion.

Comment D.10.2 (paraphrased, 3 commenters, 3 comments):

Comparison of soil vapor data to background levels of volatile chemicals in outdoor air is inappropriate.

Response D.10.2:

The guidance recommends comparing soil vapor data with outdoor air data as a way to put some perspective on the data in the absence of standards, criteria or guidance values for volatile chemicals in soil vapor. This comparison is not intended to serve as the sole determinant as to whether or not additional actions should be taken. Such a determination also considers the results of soil vapor sampling and the results of other environmental sampling as a whole to identify trends and spatial variations and to check consistency with the site conceptual model. Section 3.3.1 of the guidance has been revised to reflect this intent.

Comment D.10.3 (paraphrased, 2 commenters, 4 comments):

As the guidance states, soil vapor results should also be "reviewed 'as a whole' to identify trends and spatial variations in the data." While individual soil vapor results may follow a "hit and miss" pattern in some cases, the overall trend may still indicate a lack of significant vapor impact. For example, if soil vapor data and patterns, supplemented by groundwater data and a knowledge of fate and transport mechanisms indicate that soil vapor impacts are unlikely to exist within 100 feet of a building, then these lines of evidence should be sufficient for a no further action decision. The EPA's soil vapor screening levels can be used as a tool to determine the likelihood. In other settings more conducive to soil vapor collection, soil vapor test results may correlate with groundwater data and should be considered at face value when making risk management decisions, including no further action recommendations.

Response D.10.3:

The State agrees that soil vapor results should be reviewed as a whole and with due consideration of the results of other environmental sampling and the conceptual site model. Section 3.3.1 of the guidance has been revised to clarify this point. In some cases, the review may indicate that soil vapor intrusion in nearby buildings is not likely. However, sampling may be recommended to demonstrate the absence of impacts and to support such a conclusion. In our experience to date, soil vapor and groundwater sampling have not been shown to be reliable tools for predicting concentrations immediately beneath a slab. Therefore, the State does not support the use of default soil vapor or groundwater screening levels, including those given in the EPA's guidance (EPA 2002), as the sole determinant to make decisions regarding the potential for exposures in nearby structures at this time. [See also Comment A.8.1 (distance criterion and screening levels).]

Comment D.10.4 (paraphrased, 1 commenter, 1 comment):

Item b of Section 3.3.1 states that soil vapor will be used to help "select the best approach to conduct sub-slab, indoor air and outdoor air sampling." The meaning of the phrase "best approach to conduct...sampling" is not clear. Does this mean a way to identify homes or buildings most likely to be impacted by the potential for vapor intrusion, or an approach to sample sub-slab vapors as an indicator for the potential for vapor intrusion, or something else? We recommend that this language be revised to more clearly state the intended use of the data.

Response D.10.4:

Acknowledged. Soil vapor sample results are considered useful tools for guiding the soil vapor intrusion investigation and for selecting buildings for sub-slab vapor, indoor air and outdoor air sampling. Section 3.3.1.b of the guidance has been revised for clarification.

Comment D.10.5:

Section 3.3.1 states that NYSDOH's experience suggests that "concentrations of volatile chemicals in sub-slab vapor samples may be substantially higher than those found in soil vapor samples at 8 feet below grade near the building." However, sub-slab sampling is intrusive and may often lead to legal complications. According to Fick's Law, the sub-slab concentration can be no higher than the source concentration. Therefore, volatile chemical concentrations measured in soil vapor samples between the source and the slab are an appropriate measure of concentrations that may potentially migrate through the slab. In addition, if high concentrations of oxygen are present around a building's slab at a shallow depth, it is highly possible that aeration beneath the slab is occurring which would cause sub-slab soil vapor concentrations to be lower than perimeter soil vapor concentrations.

Response D.10.5:

The State agrees that sub-slab vapor concentrations should be no higher than source concentrations. However, soil vapor sampling between the source and the slab has not been shown to predict concentrations immediately beneath a slab reliably. As discussed in the guidance, understanding sub-slab vapor conditions is important for evaluating potential exposures and for identifying likely sources of volatile chemicals in indoor air. Although sub-slab vapor sampling is more intrusive than soil vapor sampling, the State believes that sub-slab vapor samples are more appropriate for achieving these goals given our experiences to date.

Comment D.10.6 (paraphrased, 1 commenter, 1 comment):

Soil vapor samples should be allowed to represent sub-slab conditions when it is not practical to collect sub-slab samples (such as due to radiant floor heating) provided that the soil vapor sample is collected in close proximity and at the same depth as the slab.

Response D.10.6:

Sub-slab sampling is preferable, and, where such samples are desired, attempts should be made to collect sub-slab samples if it at all possible. If sub-slab vapor sampling is not feasible, it may be necessary to make decisions based on soil vapor data and other information known about the site. Under such conditions, conservative assumptions about the relationship between soil vapor, sub-slab vapor, and indoor air are recommended. These situations are handled on site-specific and building-specific bases. [See also Comment A.14.2.]

Comment D.10.7:

Section 3.3.2 – Sub-slab vapor: There are a number of possible actions recommended based on the outcome of sampling including no further action, additional sampling, and mitigation. Consistent with the soil vapor/indoor air matrices, a fourth possible action should be added to this list; reasonable and practical actions to identify source(s) and reduce exposures.

Response D.10.7:

Agreed. The guidance has been revised accordingly.

Comment D.10.8:

The guidance evaluation focuses entirely on comparisons between indoor air, soil vapor, and sub-slab, but it is very vague on how much difference is needed between concentrations to make a determination for additional sampling, since the matrices only use indoor air and sub-slab.

Response D.10.8:

Data evaluation for soil vapor intrusion relies heavily on comparisons. However, there is no prescribed difference (e.g., 10 %, 20%, etc.) that triggers a need for additional sampling. As discussed in Section 3 of the guidance, the need for additional sampling will depend on several factors including whether the sampling accomplished the desired goal. In general, additional sampling is recommended when more information is needed to determine the nature and extent of environmental contamination, the source of the contamination, whether there are current or potential exposures to the contamination, and what actions, if any, are needed to mitigate exposures and remediate the environmental contamination.

Comment D.10.9:

Section 3.3.3, Indoor air: The guidance states "To determine the likely cause, the following assessment is completed: a. qualitative and quantitative comparisons are made between the types and concentrations of the contaminants found in the indoor air sample(s) and those found in the outdoor air and sub-slab vapor sample;". The existence of considerable differences between the concentrations is an ideal case. More often, usually the data collected does not show clear-cut differences between the types and concentrations of contaminants found in indoor air, outdoor air and sub-slab samples. Therefore, the guidance should provide recommendations on how to use background data. Can it be subtracted from indoor air concentrations?

Response D.10.9:

The comparison mentioned in the comment is one of several comparisons that should be made, as part of a multiple-lines-of-evidence approach, when assessing the data and determining the likely sources of volatile chemicals to the indoor air. The comparison is not used as the sole determinant. How background concentrations are used in this process is described in Section 3.3.3 of the guidance. In general, the representative background levels presented in the guidance are used for comparison purposes; subtracting them from indoor or outdoor air levels will not provide useful information. Background ranges simply provide a perspective on what levels might be expected in air samples in the absence of known environmental impacts. Comparing air levels to typical background ranges is one way of assessing whether ambient air data suggest that there is a source of volatile chemicals that could be addressed to reduce exposures.

Comment D.10.10:

Section 3.3.3, page 40, d.1.: Define "when sub-slab vapor concentrations are *relatively elevated*."

Response D.10.10:

The reference to "relatively elevated" sub-slab vapor concentrations has been removed from Section 3.3.3 of the guidance.

Comment D.10.11:

Section 3.3.3, first paragraph after c. and Section 3.3.4, fourth paragraph: Define "substantially above background levels." This is too vague and makes the evaluation process too subjective.

Response D.10.11:

The references have been removed from the document.

Comment D.10.12:

Section 3.3.3: The proposed assessment method for determining the likely cause of elevated indoor air concentrations is very general. For example, how are quantitative comparisons made between the types and concentrations of contaminants in indoor air and those in the sub-slab? What is expected for vapor intrusion? A discussion of expected sub-slab to indoor air attenuation and conservation of COC ratios between soil vapor and indoor air would be appropriate here. In item (b), how are quantitative comparisons made between indoor air results from different locations within a building? What is expected for a vapor intrusion source? In item (c), how does a comparison of indoor air results to the product inventory provide information about "building characteristics affecting indoor air quality"?

Response D.10.12:

The relative relationship between soil vapor, sub-slab vapor, indoor air and outdoor air concentrations are considered in the evaluation of soil vapor intrusion data. The discussion referenced in Section 3.3.3 of the guidance is intended to provide a general overview of the assessment because every site and every building is unique. To provide prescriptive quantities or differentials that indicate a specific source is not consistent with the intent of the guidance and may not be appropriate for all sites or buildings [see also Comment D.10.8]. For example, there is no expected attenuation factor. Data collected to date do not support universal soil vapor to indoor air or sub-slab vapor to indoor air attenuation factors to demonstrate soil vapor intrusion is occurring [see also Comment A.8.1]. In buildings where soil vapor intrusion is occurring, a decreasing gradient in concentrations of volatile chemicals in air from the basement to the upper floors may be expected. However, such a gradient may not always exist even though soil vapor intrusion is occurring. This may be because of the building's layout and airflow patterns and/or the fact that there are also contributions from indoor sources on the upper floors. Lastly, the reference to "building characteristics" has been removed from Section 3.3.3.c to reflect the intent of the comparison.

Comment D.10.13:

The ultimate intent of the evaluation of the vapor intrusion pathway is to ensure that people who inhabit residences or other buildings will not be exposed to harmful levels of VOCs in indoor air that have migrated from the subsurface into these occupied structures. Importantly, the evaluation of this pathway is related only to the presence of VOCs in environmental media that are related to a regulated "release" of oil or hazardous materials. It is vital that background sources of these same chemicals be distinguished from the

release-related sources. There should be discussion of the presence of internal gradients within the building as an indicator of whether there is a subsurface source of contamination. That is, if a subsurface environmental source is the cause of the indoor air contamination, one would expect to see higher levels in the basement/lower floors and lower levels on the upper floors.

Response D.10.13:

Acknowledged. Section 2.6.3 of the guidance discusses how indoor air samples should be collected from the basement and lowest level living space (if different from the basement). One of the reasons for this sampling is to characterize contaminant trends within the building. Section 3.3.3 discusses the comparisons between indoor air results obtained from different locations within a building (i.e. different floors) as part of the evaluation of the source of volatile chemicals in indoor air. However, the presence or absence of a gradient should not be used as the sole indicator of soil vapor intrusion. For example, while a concentration gradient may be expected, such a gradient may not always exist even though soil vapor intrusion is occurring. This may be because of the building's layout and airflow patterns and/or the fact that there are also contributions from indoor sources on the upper floors. As discussed in Section 3, this comparison is one of many comparisons made when evaluating the data as part of a multiple-lines-of evidence approach.

Comment D.10.14:

Section 3.3.3: Item (c) indicates that the contributions of indoor sources are not identifiable if the indoor air questionnaire and building inventory forms are incomplete. This is an over-generalization. Even if they are complete, there is no guarantee that indoor sources can be identified from the information gathered (e.g. because of off-gassing from flooring adhesives, carpet, pressed wood products and other furnishings and building materials). The recommendation of re-sampling "after interferences are removed" suffers from the same problems. For item (c), given that indoor air and sub slab samples are available, there are other means available for discrimination of indoor versus vapor intrusion source (e.g. COC ratios).

Response D.10.14:

Sections 3.3.3.c of the guidance identifies the incomplete or incorrectly filling out of the indoor air quality questionnaire and product inventory form as one of the more common reasons why likely sources may not be evident from a review of the data alone. While information included in the form is important for interpreting the data, the guidance does not state that sources of volatile chemicals to indoor air cannot be identified with confidence unless the form is filled out completely (as indicated in the comment). As discussed throughout Section 3, the information contained in the form is considered along with many other factors when evaluating the data as part of a multiple-lines-of-evidence approach.

The discussion of "resampling after interferences are removed" in Section 3.3.3.a is in the context of a particular example. In some cases, removing the interferences may not be practical, feasible or appropriate. However, in other cases, indoor sources have been removed and resampling has indicated whether actions to address exposures related to soil vapor intrusion are appropriate.

Comment D.10.15:

Section 3.3.3, c.: It seems that resampling should not always be required in cases where the Indoor Air Quality Questionnaire and Building Inventory form is incomplete. If there

have been little or no substantial changes within a building since sampling occurred, then a return visit to complete the form without full resampling is appropriate.

Response D.10.15:

Section 3.3.3.c of the guidance discusses the questionnaire and inventory in the context of an example of a situation where appropriate actions cannot be recommended given the information available and where resampling is typically recommended. The guidance does not recommend that resampling be conducted in all cases where the form is incomplete or incorrect. For example, resampling due to an incomplete product inventory may not be recommended if indoor air levels do not represent a concern.

However, completing the form without resampling may not be appropriate (as suggested in the comment). This determination is made on a case-by-case basis with the consideration of several factors, such as the chemical of concern, the amount of time passed since the original results were obtained, the confidence that current building conditions are still representative of those at the time the samples were collected, activities of building occupants (e.g., painting or cleaning), etc.

Comment D.10.16 (paraphrased, 2 commenters, 1 comment):

Section 3.3.3 indicates that additional sampling of indoor air may be necessary if subsurface conditions change over time, even if indoor air concentrations are below background. The conditions requiring additional sampling must be clarified.

Response D.10.16:

The comment refers to additional sampling that would be recommended based upon the results of monitoring subsurface vapor conditions. There are no prescribed conditions that would trigger a need for additional sampling. As with groundwater monitoring for the protection of a private well, additional sampling would be based upon site-specific conditions (e.g., the nature and extent of subsurface contamination, the effectiveness of remedial measures implemented or being implemented to address environmental contamination, the monitoring results to date, etc.).

Comment D.10.17 (paraphrased, 1 commenter, 1 comment):

With respect to monitoring, can the NYSDOH specify a typical frequency for sampling? This would require site-specific modification based on trends in soil vapor or other environmental monitoring data, sensitivity of receptors, etc., but it would be helpful to lay the basic framework for follow-up monitoring.

Response D.10.17:

Monitoring is typically recommended every year until contaminated environmental media are remediated or until monitoring at this frequency is no longer needed to address exposures related to soil vapor intrusion. However, as discussed in Section 3.4 of the guidance, the frequency and type of monitoring are determined on a site-specific basis, with applicable environmental data and building operating conditions taken into account.

Comment D.10.18:

The guidance states: Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure HVAC systems) are maintaining the desired

mitigation endpoint and to determine whether changes are needed. What endpoints are being considered, indoor air concentration, cancer risk, and pressure differential?

Response D.10.18:

If current building conditions appear to be preventing or minimizing soil vapor intrusion satisfactorily, then the goal of the monitoring is to make sure that the conditions continue to prevent or minimize exposures as much as possible. How these conditions are documented (e.g., physical tests, chemical tests, visual inspections, or a combination of these) is determined on a building-specific basis, with indoor air concentrations, sub-slab vapor concentrations, building features and operations, and other factors considered.

Comment D.10.19 (paraphrased, 1 commenter, 1 comment):

When indoor air data evaluation indicates the need for monitoring in accordance with the soil vapor/indoor air matrices (and the accompanying guidance text), it is not clear under what conditions monitoring can be terminated.

Response D.10.19:

In general, decisions to initiate and to terminate monitoring are made on a case-by-case basis. Monitoring may be terminated under conditions such as the following:

- when monitoring data demonstrate that soil vapor intrusion is not expected to occur;
- when environmental contamination is remediated and soil vapor intrusion is no longer a concern; or
- when other measures (e.g., installation of a sub-slab depressurization system) are taken to address exposures.

Comment D.10.20 (paraphrased, 1 commenter, 1 comment):

In lieu of on-going indoor air monitoring, an area-wide soil vapor implant monitoring program can be used in conjunction with groundwater monitoring to monitor for the presence of VOCs in the subsurface and to monitor the effectiveness of remediation of contaminated environmental media.

Response D.10.20:

Sufficient data are not yet available to demonstrate that such an approach would be appropriate at all sites. Therefore, the guidance has not been revised to incorporate the approach at this time. However, if the approach mentioned in the comment can be demonstrated to meet the monitoring objectives for a particular site, then the approach will be considered.

Comment D.10.21 (paraphrased, 1 commenter, 1 comment):

Automatic monitoring without regard to choice of abatement technology is arbitrary. The matrices also indicate that monitoring will always be required no matter what technology is employed to abate the soil vapor intrusion. This position appears completely arbitrary and capricious where new construction employs a membrane plastic liner placed under the building slab to avoid any volatiles from permeating up through the floor. With an effort like that, we cannot understand why the PRP would need to be burdened with continued indoor air sampling. We recommend that there be certain "Best Available Technology" standards that one could revert to instead of the requirement of never ending indoor air sampling.

Response D.10.21:

Monitoring is recommended to ensure conditions (e.g., building operations, mitigation actions, etc.) are continuing to address current or potential exposures associated with soil vapor intrusion. As discussed in Sections 3.4.3 and 4.4 of the guidance, and in the "Monitor" note of the matrices, the type and frequency of the monitoring is determined based on site-specific and building-specific conditions, with applicable environmental data, building operating conditions, and mitigation methods employed (including the installation of a membrane plastic liner) taken into account. In many cases, monitoring can be accomplished with physical testing, rather than chemical testing. The State believes that the recommendations on monitoring presented in the guidance are reasonable and practical. "Best Available Technology" standards have not been added as suggested in the comment.

Comment D.10.22 (paraphrased, 2 commenters, 1 comment):

Monitoring or mitigation of exposures related to vapor intrusion should be considered more than interim measures.

Response D.10.22:

Given that soil vapor is an environmental medium of concern, remediation of the source of the vapors (either directly or indirectly) is the ultimate goal. Mitigation or other recommended actions to prevent exposures related to soil vapor intrusion continue to be considered interim measures to address exposures until the source is remediated. This approach is consistent with that taken for other environmental media. For example, filters on private wells are used as interim measures to prevent exposures to contaminated groundwater while the groundwater is remediated.

Comment D.10.23 (paraphrased, 3 commenters, 3 comments):

Three commenters noted that comparison of outdoor air data to background levels of volatile chemicals in outdoor air is inappropriate because

- [a] the purpose of an investigation is to determine the extent to which volatile contamination in soil or groundwater is impacting indoor air, not to ascertain the exposure risk to chemicals in outdoor air; or
- [b] the more applicable comparison for outdoor air levels may be to those levels contained in DAR-1.

Response D.10.23:

- [a] As discussed in Sections 2.2.4 and 3.3.4 of the guidance, outdoor air sampling results are primarily used to evaluate the extent to which outdoor air may be affecting indoor air quality. They are not intended to represent a comprehensive investigation of outdoor air quality. However, people are also exposed to the outdoor air and the outdoor air results are indicative of outdoor air conditions. As such, outdoor air results are reviewed to determine whether outdoor air conditions present a potential concern that requires further investigation. The guidance has been revised to clarify the intent of outdoor air sampling. A comparison to background levels helps to put the outdoor air results into perspective and is one part of the data evaluation process.
- [b] DAR-1 provides annual and short-term guideline concentrations (AGCs & SGCs) to help guide NYSDEC air permitting decisions for facilities under 6NYCRR Part 212. Although the AGCs and SGCs are useful risk management tools for permitting purposes, they are not intended to guide decisions on how to address human

exposures. As discussed in the guidance, background levels are one tool used for this purpose.

D.11 TOPIC: Action levels

Comment D.11.1:

The guidance is vague and unclear about when remediation is necessary if vapors are detected "under the slab." Triggers for remediation and the remediation methods must be clarified further.

Response D.11.1:

The NYSDOH has developed two decision matrices that are used as risk management tools in the decision-making process. The matrices currently apply to TCE and carbon tetrachloride (Matrix 1) and PCE and 1,1,1-trichloroethane (Matrix 2). These matrices provide indoor air and sub-slab vapor concentration ranges and corresponding recommendations for action. We believe that the decision matrices provide clear guidance on the sub-slab vapor levels that will result in recommendations to mitigate or take other actions to address exposures. For compounds without matrices refer to the response to Comment D.12.4, which explains the application of the matrices to other volatile chemicals.

Methods for mitigating exposures related to soil vapor intrusion are described in Section 4 of the guidance. Other actions to reduce exposures will depend upon the source(s).

Comment D.11.2 (paraphrased, 2 commenters, 2 comments):

As presented in the matrices, 250 mcg/m³ TCE and 1,000 mcg/m³ PCE and 1,1,1,-TCA appear to be action levels for sub-slab vapor results. However, in other sections of the guidance, statements such as "New York State currently does not have any standards, criteria or guidance values for concentrations of compounds in subsurface vapors" are made. Please provide clarification.

Response D.11.2:

The NYSDOH has developed two decision matrices to be used as risk management tools in the decision-making process. These matrices provide indoor air and sub-slab vapor concentration ranges for four volatile chemicals (TCE, PCE, 1,1,1-TCA and carbon tetrachloride) and corresponding recommendations for action. The action levels presented in the matrix are not standards, criteria or guidance values. The levels are also not "action levels" in the traditional sense because (as discussed in Note 1 of both matrices) final actions are determined after considering not only the recommendations given in the matrices, but also site-specific and building-specific conditions and/or factors discussed in Section 3.2 of the guidance.

Comment D.11.3 (paraphrased, 7 commenters, 7 comments):

Actions should not be required when indoor air levels are above background, but below indoor air guidelines or health-based risk levels, especially if long-term remedies will be implemented to address the source of the vapors (e.g., soil or groundwater contamination). Please clarify why action needs to be taken in this circumstance. Additionally, the NYSDOH should specify when a background concentration should be used over an air guideline value.

Response D.11.3:

Reasonable and practical actions to identify source(s) and reduce exposures may be recommended when concentrations of volatile chemicals in the indoor air are detected at levels above background and below air guidelines. We make this recommendation because, consistent with the approach taken with other environmental media, reducing exposures wherever possible is a primary objective. However, this does not necessarily mean that the party doing the soil vapor intrusion investigation (e.g., PRP, Volunteer, etc.) is responsible for implementing the recommended actions. For example, the State does not expect a responsible party to address exposures related to releases from indoor sources alone (e.g., exposures to methylene chloride related to the storage of paint strippers in a basement).

If current and potential exposures related to soil vapor intrusion will be addressed concurrently (and within a reasonable timeframe) by a method selected to remediate subsurface contamination, then additional actions to address exposures (e.g., installation of a sub-slab depressurization system or monitoring) may not be appropriate. These determinations are made on site-specific and building-specific bases.

As discussed throughout Section 3 of the guidance, background data and indoor air guidelines are two of several tools in a multiple-lines-of-evidence approach to data evaluation and decision-making. Published background levels are helpful in interpreting indoor and outdoor air data, particularly in assessing whether the detection of a chemical may indicate a source that can be addressed to reduce exposures. Air guidelines are used to help guide decisions about the nature of efforts to reduce exposure to a chemical. For example, the urgency to complete actions to reduce exposures to volatile chemicals in indoor air increases with indoor air levels, particularly when air levels are above guidelines. Neither background levels nor air guidelines are intended to serve as single determinants for further action, with one preferred over the other.

Comment D.11.4 (paraphrased, 1 commenter, 1 comment):

Mitigation decisions must be based upon documented risk to human health determined by health-based criteria.

Response D.11.4:

While human health risks were considered in developing the guidance, we take a risk management approach to recommending actions for addressing exposures related to soil vapor intrusion. Furthermore, the State believes both current (i.e., documented exposures) and potential exposures should be addressed.

Comment D.11.5:

The air guidelines that the NYSDOH has adopted for TCE and PCE is a concern. The EPA for the Hopewell Precision Site during an on going extensive ground water investigation adopted a level of .38 mcg/m³ for TCE and 30 mcg/m³ for PCE as sub-slab action levels required to mitigate a home. The NYSDOH has adopted numbers that are significantly higher and based on indoor air results. It is my hope that the NYSDOH will consider following the Environmental Protection Agency's lead by adopting a more stringent action guideline.

Response D.11.5:

As a point of clarification, the site-specific actions being taken by the EPA at the Hopewell Precision Site and the concentrations of TCE and PCE corresponding to these actions are as follows:

- the EPA is applying a sub-slab vapor action level for TCE (i.e., the level at which a sub-slab depressurization system is automatically installed). This action level is 50 mcg/m³ TCE, not 0.38 mcg/m³ TCE as indicated in the comment;
- the EPA is applying a sub-slab vapor screening level for TCE (i.e., the level at which indoor air sampling will be conducted). This screening level is 2.7 mcg/m³ TCE;
- the EPA is mitigating homes where sub-slab vapor concentrations of TCE exceed the screening level and indoor air testing shows TCE is detected (i.e., greater than or equal to a TCE concentration of 0.38 mcg/m³, a detection level that the EPA believes mitigation systems can achieve at the Hopewell Precision site); and
- contrary to the comment, the EPA has not applied any sub-slab vapor or indoor air action level for PCE.

The State does not use air guidelines as the sole determinant for taking actions to address exposures related to soil vapor intrusion. In other words, the guidelines are not thresholds below which no action is taken. This is exemplified, for example, in the decision matrix for TCE (Soil Vapor/Indoor Air Matrix 1 in the guidance), which provides for response at levels of TCE in indoor air that are less than 0.25 mcg/m³.

Region 2 of the EPA, which includes New York, uses a very similar decision matrix. There have, however, been many reports that Region 2 uses a clean up number for TCE of 0.38 mcg/m³. At the Hopewell Precision site, Region 2 found that it was more efficient to install vapor mitigation systems than to carry out long-term monitoring and that when the systems were installed they could expect to achieve levels in the indoor air below the analytical detection limit of 0.38 mcg/m³ for TCE. This decision was based on cost and the ability to bring an investigation to a close, not on derived health criteria that represents any given level of exposure and therefore a given level of estimated risk. Application of this number (0.38 mcg/m³ TCE) was then stated by Region 2 program staff as the cleanup goal of the site. The number came to be reported as the Region 2 response level. Like the State, Region 2 makes decisions on a case-by-case basis.

[See Comments D.11.6, D.11.7 and D.12.2 for additional discussion about site-specific, non-health-based decisions to install sub-slab depressurization systems; Comments A.4.1, A.4.2, A.4.3, A.4.4 and A.4.5 for additional discussion about the NYSDOH's air guidelines; and Comments D.5.1 and D.5.8 for additional discussion on how air guidelines are used in data evaluation.]

Comment D.11.6:

CAE Electronics, a responsible party, agreed to fund ventilation systems in homes in Hillcrest with TCE levels as low as 0.14 micrograms per cubic meter. IBM, a responsible party, should do nothing less. The State of New York should demand nothing less. The people of this community are demanding nothing less.

Response D.11.6:

For clarification, decisions to install sub-slab depressurization systems on homes are not based on indoor air results alone (as suggested in the comment). The State has implemented a site-specific blanket mitigation approach at the Hillcrest site. As a result, homes that have never been tested may have received a sub-slab depressurization system or homes with non-detectable or low levels of TCE in their indoor air may have received systems. For houses outside of the blanket mitigation areas, the decision matrices presented in Section 3.4 of the guidance are being used as the bases for taking action. The State, not CAE Electronics, is currently paying for all activities associated with investigating and addressing soil vapor intrusion at the Hillcrest site.

A comparison of only the indoor air results of homes that have received sub-slab depressurization systems (as presented in the comment) is often misleading because numerous factors, not just indoor air results, are considered when selecting actions to address exposures related to soil vapor intrusion (see Section 3 of the guidance for additional information). The goal of soil vapor intrusion investigations is to take actions that are protective of public health. If this goal is being achieved, then the State cannot demand additional actions or take additional actions for health-based reasons. This is the case at the IBM Endicott site, where the approach being implemented is similar to that being taken at Hillcrest.

Recommending actions at a specific site is not within the scope of the guidance. To express concerns about actions being taken at a specific site or to discuss the actions, contact the NYSDEC or NYSDOH project manager for the site.

Comment D.11.7 (paraphrased, 2 commenters, 2 comments):

We request homes with TCE levels detected be vented for the following reasons:

- [a] we know mitigation units work;
- [b] installing a system is cheaper than resampling and is protective;
- [c] any home with TCE under the foundation could crack and indoor TCE levels could dramatically increase and go undetected for years and years, which could prove to be fatal for people living there and their unborn children; and
- [d] why should people, especially children who are more sensitive to TCE, be subjected to breathing this chemical?

Response D.11.7:

The guidance is intended to provide recommendations for actions that are protective of public health. Decision Matrix 1 reflects this intent for TCE. The matrix provides a summary of actions recommended from a public health perspective. The actions are both protective of public health and appropriate to addressing current and potential exposures related to soil vapor intrusion. However, as discussed in Note 1 of the matrices, actions more protective of public health than those specified within the matrix may be proposed at any time. Such approaches are usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.). As such, the decision to install sub-slab depressurization (SSD) systems at structures where TCE is detected is made on a site-specific basis with many factors considered.

Responses to the individual reasons provided in the comment follow.

- [a] SSD systems are effective at addressing exposures related to soil vapor intrusion. However, if current exposures within a home are due to indoor or outdoor sources rather than the infiltration of sub-surface vapors, then they are not an effective mitigation measure for addressing the exposure. This emphasizes the need to identify the source of chemicals detected in the indoor air before deciding to install a system.
- [b] Installation of a SSD system is an example of one protective action that may be taken to address exposures related to soil vapor intrusion. Depending upon site-specific and building-specific conditions, other actions, such as monitoring, may also be protective from a public health perspective. Matrix 1 (TCE) reflects this point.
- Experience has shown that the installation of a SSD system is not necessarily cheaper than resampling or monitoring. This may be due to building-specific conditions that need to be accommodated so that the system may be installed properly and may operate effectively. This may also be due to site-specific or building-specific conditions that are considered when determining the frequency and types of samples appropriate for monitoring or resampling.
- [c] The actions recommended in the decision matrices consider the potential for exposures to occur should building conditions change (e.g., cracks develop, HVAC systems are adjusted, etc.). Where sub-slab vapor concentrations represent a concern for future exposures, monitoring or mitigation actions are recommended. Therefore, should building conditions change, the situation would not go undetected as described in the comment.
- [d] As explained in Section 1.2 of the guidance, exposure to a volatile chemical due to vapor intrusion does not necessarily mean that health effects will occur. Whether or not a person experiences health effects depends on several factors, including the length of exposure (short-term or acute versus long-term or chronic), the amount of exposure (i.e., dose), the frequency of exposure, the toxicity of the volatile chemical and the individual's sensitivity to the chemical. The recommendations for action presented in Matrix 1 considered all pertinent toxicological and epidemiological data available for TCE (including that pertaining to children).

Comment D.11.8 (paraphrased, 2 commenters, 3 comments):

We recommend that the NYSDOH and NYSDEC adopt a policy that establishes a presumption for the mitigation of structures wherever measurable levels of VOCs are detected in sub-slab or indoor air and evidence exists that the source of such contamination may be a contaminated site. However, an exception could be made in cases where substantial evidence indicates that such levels are not due to contamination from a site; or the costs of mitigation are unreasonably high, measured levels of contamination are extremely low, and a high degree of certainty exists regarding the accuracy of such measurements. In other words, a presumption for mitigation would not eliminate the need to consider all the various factors described in the guidance that may affect vapor intrusion. In contrast to the guidance, NYSDOH and NYSDEC would be required to document fully and transparently their reasoning behind a decision not to mitigate where contamination has been found.

This recommendation is supported by the findings from the Committee's hearings across the state, which follow.

- [a] A number of protective guidelines for TCE (e.g., EPA Regions 3 and 6, Colorado, and EPA Region 9) are equal to or below the detection limit for TCE. Because detect levels

- and protective guidelines are so comparable, establishing a presumption for mitigation at detect would be comparable to acting on the most protective assumptions about TCE toxicity and exposure supported by science.
- [b] VOCs are difficult to measure accurately, both under the sub-slab and in indoor air. Given the variability of vapor intrusion and the difficulty inherent in mapping intrusion pathways accurately, it would be better to act quickly to implement mitigation measures in each structure that could potentially be affected. Money would be better spent on mitigation than on extensive air sampling and analysis.
 - [c] The costs of mitigation and monitoring are comparable, and a number of responsible parties and agencies have made risk management decisions at individual sites to mitigate at detect in order to save time and money.
 - [d] Mitigating at detect will reduce the potential for inequitable outcomes, where some residences will have their exposures mitigated but others exposed to the same level of contamination will not.
 - [e] Living with uncertainty is one of the most difficult aspects of living at or near a contaminated site. The government has a responsibility to relieve the distress associated with uncertainty to the extent practicable. Implementing mitigation where measurable levels of contaminants have been detected and can plausibly be associated with a contaminated site is a reasonable and effective approach.

Response D.11.8:

To have a policy that defaults to mitigation as recommended in the comment is not a practical approach for most volatile chemicals, as they are often found at background concentrations in indoor air and in subsurface vapors. Furthermore, the NYSDEC does not have the legal authority to implement remedial actions at soil vapor sites based solely on the mere presence of a contaminant in subsurface vapors. There must be a determination that a significant public health threat exists as a result of the contamination in order for the NYSDEC to act. Overall, the guidance provides a reasonable and practical approach to evaluating soil vapor intrusion that is analogous to the approach taken when investigating contamination in other environmental media (e.g., groundwater, soil, etc.) and addressing corresponding exposure concerns.

Responses to the individual findings provided in the comment follow.

- [a] We have continually evaluated the work and programs of others, and will continue to do so, and can say with confidence that our approach protects human health and is conservative. Matrix 1 provides a summary of actions recommended from a public health perspective. All pertinent toxicological and epidemiological data available for TCE were considered in the development of the matrix. The NYSDOH believes the actions recommended are both protective of public health and appropriate to addressing current and potential exposures related to soil vapor intrusion (including recommending actions when indoor air levels are less than 0.25 mcg/m³). Furthermore, the guidance allows for a blanket mitigation approach of installing systems on a neighborhood basis rather than on the results of individual buildings, so that mitigation is provided for homes that would not necessarily receive it by using the criteria in the matrix alone. Therefore, neither the guidance nor the matrix has been revised in response to the comment.
- [b] Although the evaluation of the vapor intrusion pathway is an emerging science, the guidance provides the necessary framework for dealing with the uncertainties described in the comment and gives recommendations on how to obtain representative and reliable data to base decisions on in a timely manner. However, measures to mitigate exposures or to remediate

subsurface vapor contamination can be considered at any time during the investigation and remediation of a site. These determinations are made on a site-specific basis. [See also Comment C.5.3 (sampling with respect to seasonal variations in sub-slab and indoor air contaminant levels).]

- [c] Experience has shown that costs associated with mitigation are not always comparable to the costs associated with monitoring. This may be due to building-specific conditions that need to be accommodated so that the system may be installed properly and may operate effectively. This may also be due to site-specific or building-specific conditions that are considered when determining the frequency and types of samples appropriate for monitoring. Therefore, the cost-benefit analysis of monitoring versus mitigating is appropriate on a building-specific or site-specific basis, especially if monitoring is protective of public health.
- [d] As with taking actions to address exposures in other environmental media (e.g., soil, groundwater, etc.), actions taken to address exposures related to soil vapor intrusion may vary from site to site in their degree of protectiveness. However, the protection of human health serves as the foundation of all actions taken at sites, and this foundation is reflected in both the guidance and the decision matrices. [See also Comment D.12.2 (variable action levels applied at sites).]
- [e] The State recognizes that living with uncertainty is difficult. The State strongly believes that community outreach is an essential component to the evaluation of soil vapor intrusion. As discussed in Section 5 of the guidance, there are many types of outreach techniques that may be useful in keeping the community informed and involved throughout the process. Such outreach is often effective at addressing the concerns expressed in the comment about maintaining a level of transparency and relieving the distress associated with uncertainty.

Comment D.11.9 (paraphrased, 1 commenter, 1 comment):

The discussion of background levels doesn't really explain the significance of ambient air concentrations of volatile contaminants. If any of these compounds are found in the air above health protective levels, then it's important to determine where they come from and to take appropriate steps to address exposures.

Response D.11.9:

Section 3.2.4 of the guidance, background levels of volatile chemicals in air, recognizes that volatile compounds may be present in both indoor and outdoor air not affected by environmental contamination. The State agrees that actions may be necessary if outdoor air results are substantially above outdoor air background concentrations or above the NYSDOH's guidelines for volatile chemicals in air. In these cases, the State will determine the appropriate next steps, including identifying potentially responsible parties. A discussion of this issue is given in Section 3.3.4.

D.12 TOPIC: Decision matrices

As mentioned in the Executive Summary, revisions were made to the Soil Vapor/Indoor Air Matrices in Section 3.4 of the guidance based on comments received on the NYSDOH's draft report entitled Trichloroethene (TCE) Air Criteria Document (NYSDOH 2005). Please see Appendix 2 for additional information.

Comment D.12.1 (paraphrased, 7 commenters, 8 comments):

The guidance should explain how the matrices were derived. The rationale for selecting all thresholds used must be clearly articulated. How background plays a role should be explained. Also, the guidance should specify what exposure scenarios were considered. Such information will also allow the matrices to be more easily applied to other chemicals.

Response D.12.1:

There is no boilerplate formula for deriving the decision matrices (e.g., by using default attenuation factors and health risks alone). Therefore, such a description has not been added to the guidance. As discussed in Section 3.4 of the guidance, the matrices are developed after the careful consideration of multiple factors, including human health risks, the NYSDOH's guidelines for volatile chemicals in air, background concentrations of volatile chemicals in air, analytical capabilities currently available, and attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations). The NYSDOH has developed two decision matrices to be used as risk management tools. To date, four chemicals have been assigned to the two matrices -- TCE, PCE, 1,1,1-TCA and carbon tetrachloride. For compounds without matrices refer to the response to Comment D.12.4, which explains the application of the matrices to other volatile chemicals.

As discussed in Section 3.2.4 of the guidance, background levels of volatile chemicals are one of the factors considered when evaluating sampling results at a site. Furthermore, they are used as the goal when taking actions to reduce exposures. These points are reflected in the matrices in that actions are recommended in the matrices even when indoor air concentrations are below applicable air guidelines. The actions recommended vary depending upon whether sub-slab vapor concentrations indicate the indoor air is likely or unlikely to be affected due to soil vapor intrusion. In addition, no further action is recommended when indoor air concentrations are comparable to background and sub-slab vapor concentrations are not expected to significantly affect indoor air quality. [See Section 3 for additional information on how background levels are considered during the data evaluation process.]

As discussed in the response to Comment D.12.8, the decision matrices are not intended to be prescriptive to a certain setting or exposure scenario, such as commercial, industrial or residential, but for environmental exposures in general.

Comment D.12.2 (paraphrased, 2 commenters, 2 comments):

Our understanding is that there is no "bright line" to separate safe (the amount of the dose you do not want to exceed) versus unsafe exposure levels and that decision matrices are used as risk management tools to determine whether "action" at a site is warranted. Our further understanding is that variable air quality action levels have been permitted on a site-by-site basis and pre-2003 sites have been separated from newer sites. We strongly believe that all citizens deserve the same degree of protection. Therefore, we respectfully request that the NYSDOH protect all of the State's residents equally by demanding remediation at consistent and conservative air quality action levels. Furthermore, we request that the decision matrices be created as conservatively as possible with the best interest of the residents in mind.

Response D.12.2:

As a point of clarification, although pre-2003 sites have been separated from newer sites, the NYSDEC and NYSDOH intend to use the guidance in the evaluation of vapor intrusion at every site in which they are involved, and recommend that the guidance be considered anywhere soil vapor intrusion is evaluated in the State of New York [see the NYSDEC's Program Policy *DER-13: Strategy for Prioritizing Vapor Intrusion Evaluations at Remedial Sites in New York* (NYSDEC 2006)].

The NYSDOH has developed two decision matrices to be used as risk management tools in the decision-making process. These matrices provide indoor air and sub-slab vapor concentration ranges for four volatile chemicals (TCE, PCE, 1,1,1-TCA and carbon tetrachloride) and corresponding recommendations for action, from a human health perspective. The actions are both protective of public health and appropriate to addressing current and potential exposures related to soil vapor intrusion. As discussed in Note 1 of the matrices, actions more protective of public health than those specified within the matrix may be proposed at any time. Such approaches are usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.). As a result, actions may vary from site to site in their degree of protectiveness. Nevertheless, the protection of human health serves as the foundation of all actions taken at sites, and this foundation is reflected in both the guidance and the decision matrices. Therefore, neither has been revised in response to the comment.

Comment D.12.3 (paraphrased, 2 commenters, 3 comments):

The draft decision matrices place too much emphasis on only two factors: sub-slab vapor and indoor air contaminant levels. As drafted, it seems that actions are clearly tied to those levels, and as a result, although additional factors to be considered are listed, those factors are afforded much less importance. Any matrices that are used in the final guidance should be clearly identified as a flexible decision-making tool that the NYSDOH will consider as one factor among many others in evaluating the needs of a site.

Response D.12.3:

The recommendations provided in the matrices are based primarily on the results of sub-slab vapor and indoor air results. This is because our experience to date has demonstrated the importance of having sub-slab vapor and indoor air data, rather than relying on other environmental data, to evaluate current and potential exposures related to soil vapor intrusion at a particular building. They are also important when selecting appropriate actions to address exposures. However, as discussed in Note 1 of both matrices, the matrices are general risk management tools used to guide decisions in the context of a particular site. In other words, they are not intended to be prescriptive or to mandate universal decisions without accounting for the multitude of site-specific and building-specific considerations. Note 1 is consistent with Section 3 of the guidance, in which a multiple-lines-of-evidence approach to data evaluation is recommended and described. Therefore, neither the matrices nor the guidance have been revised in response to this comment.

Comment D.12.4 (paraphrased, 2 commenters, 2 comments):

The guidance is incomplete in that there are matrices for only 3 compounds — TCE, PCE and 1,1,1-TCA. The guidance should explain how these matrices are applied to other VOCs, such as degradation products.

Response D.12.4:

TCE, PCE and 1,1,1-TCA were the first compounds assigned to decision matrices because our experience indicated that these compounds drive most of the decisions with respect to soil vapor intrusion at sites. If a chemical other than those already assigned to a matrix is identified as a chemical of concern during a soil vapor intrusion investigation, assignment of that chemical into one of the existing decision matrices will be considered by the NYSDOH. Assignment will be based on a review of the chemical's toxicological properties and background levels, current analytical capabilities, and any other relevant factors. If the NYSDOH determines that the assignment of the chemical into an existing matrix is inappropriate, then the NYSDOH will develop a new matrix and revise or amend the guidance accordingly. Section 3.4.2 of the guidance has been revised to clarify this process. Such a process was followed with carbon tetrachloride, which has been assigned to Matrix 1.

Comment D.12.5 (paraphrased, 5 commenters, 5 comments):

A matrix developed for a specific contaminant (TCE and PCE) being used for other contaminants is problematic. There is no evidence that the specific human health risks, data gaps, background concentrations, and analytical capabilities available for these specific contaminants will be appropriate for use with other contaminants (e.g., fitting toluene into a PCE matrix may be inappropriate). If a matrix is to be used as a decision making tool, then any matrix should be developed based on a chemical's toxicological properties and a chemical should not be "force fit" into a particular matrix.

Response D.12.5:

Because the matrices are risk management tools that consider a number of factors, not just a chemical's toxicological properties, assignment of more than one chemical to a matrix may be appropriate. The NYSDOH will make this determination based on a review of the chemical's toxicological properties and background levels, current analytical capabilities, and any other relevant factors. However, the NYSDOH does not intend to "force fit" a chemical into an existing matrix. If the NYSDOH determines that the assignment of the chemical into an existing matrix is inappropriate, then the NYSDOH will develop a new matrix.

Comment D.12.6 (paraphrased, 2 commenters, 1 comment):

The NYSDOH states the intent to divide chemicals into two classes (i.e., to assign chemicals to one of the two matrices). This approach is too broad to accommodate the range of constituents potentially present in the subsurface. For example, estimates of indoor air concentrations can be obtained from the Johnson and Ettinger Model by using the soil vapor concentrations that trigger a need for mitigation in the matrices (e.g., 250 mcg/m³ and 1,000 mcg/m³). According to these conservative estimates, the decision matrix may indicate monitoring or even mitigation in cases where predicted indoor air concentrations do not represent an unacceptable health risk or even where predicted indoor air concentrations are well below the lowest trigger levels in the matrix. The NYSDOH seems to have proposed an overly simplistic and arbitrary scheme specifically to avoid using standard risk assessment and modeling tools, as well as screening levels for individual constituents in deeper soil vapor and shallow soil vapor, that are recommended and used by other state and federal agencies.

Response D.12.6:

Our experience to date has shown that soil vapor impacts to buildings vary considerably depending on site and building conditions and do not necessarily follow

model predictions or correlate to soil vapor results. Therefore, the State does not believe that decisions based solely on modeling and/or soil vapor results are sufficiently protective of human health. Rather, sub-slab vapor and/or indoor air data are more reliable and appropriate for evaluating the potential for human exposures related to soil vapor intrusion. As such, the NYSDOH developed the matrices (in conjunction with other agencies) to provide guidance about actions that are recommended to address exposures.

The matrices reflect that the recommendations are based primarily on the results of sub-slab vapor and indoor air sampling for a particular building. They also reflect that actions may be recommended to address potential exposures, not just current exposures (as emphasized in the comment). For example, monitor or mitigate actions may be recommended even if the chemical is not detected in the indoor air or is detected in the indoor air at a concentration below applicable air guidelines. As discussed in the response to Comment D.12.5, the NYSDOH does not intend to "force fit" a chemical into an existing matrix. If the NYSDOH determines that the assignment of the chemical into an existing matrix is inappropriate, then the NYSDOH will develop a new matrix. Overall, the State believes that the guidance provides a reasonable and practical approach to evaluating soil vapor intrusion. [See also Part A.8 (TOPIC: Guidance with respect to other vapor intrusion guidance or policies).]

Comment D.12.7 (paraphrased, 4 commenters, 6 comments):

We recommend the matrix approach be abandoned. Once decision-making is reduced to a rote formula or matrix, these formulae and matrices tend to become cast in stone and regulatory staff may be very reluctant to deviate from the standard version. While a matrix evaluation may be easy to apply, the matrices do not allow for a weight of evidence evaluation and do not include the consideration of background or other sources not associated with vapor intrusion. Assuming the preferential pathways have been properly evaluated, soil vapor, sub-slab vapor or indoor air concentrations alone should be sufficient for the evaluation of potential vapor intrusion impacts. An alternative approach is to replace the matrices with tables of soil vapor/sub-slab vapor screening criteria based on acceptable indoor air concentrations multiplied by a default attenuation factor.

Response D.12.7:

As discussed in Note 1 of both matrices, the matrices are general risk management tools used to guide decisions in the context of a particular site. In other words, they are not intended to be prescriptive or to mandate universal decisions without accounting for the multitude of site-specific and building-specific considerations. Note 1 is consistent with Section 3 of the guidance, in which a multiple-lines-of-evidence approach to data evaluation is recommended and described. Blind application of the matrices by regulatory staff (as described in the comment) is not expected because staff attended training sessions in which this multiple-lines-of-evidence approach was emphasized and because such application would be inconsistent with the guidance.

With respect to the alternate approach discussed in the comment, data collected to date from the investigation of sites across New York State do not support the application of generic soil vapor/sub-slab vapor screening criteria or the application of a default attenuation factor (see the response to comment A.8.1). Therefore, the matrix approach has not been abandoned as recommended in the comment.

Comment D.12.8 (paraphrased, 2 commenters, 2 comments):

How are these matrices to be applied for commercial settings? Each matrix requires a Responsible Party to conduct mitigation if indoor air levels exceed the guidelines, which are protective of residential exposures. The notes do not mention modification of requirements for land uses other than residential. Such uses should be considered in determining whether mitigation is warranted under other land uses, such as commercial/industrial, to ensure protection of public health.

Response D.12.8:

The decision matrices are not intended to be prescriptive to a certain setting, such as commercial or residential. As discussed in Note 1 of both matrices, they are general risk management tools used to guide decisions in the context of a particular site. The matrices should be used to address involuntary exposures and their associated health risks in commercial as well as residential settings. [See also Comments A.3.1, A.3.2, and D.5.3 (applicability of OSHA standards) and D.5.9 (NYSDOH air guidelines — commercial/industrial exposures).]

Comment D.12.9 (paraphrased, 4 commenters, 3 comments):

The NYSDOH's decision matrices (i.e., Matrix 1 and 2) do not provide a rational basis for mitigation or monitoring decision-making (Section 3.4) for several reasons, including the following:

- [a] they require remedial actions in instances where indoor air concentrations are below either the state's guidance values, background levels or both,
- [b] mitigation is required in cases where the ratio of sub-slab vapor to indoor air concentrations was almost as low as 10; when empirical data presented by McDonald and Wertz (2004) show that ratios of less than 100 are most likely due to background sources,
- [c] although sufficient evidence should be required to demonstrate that soil vapor intrusion is not the source of indoor air impacts, the responsible party should not be responsible for specifically identifying and mitigating indoor or ambient air sources, and
- [d] when indoor air concentrations are higher than sub-slab concentrations, it is very possible that sub-slab vapors are being impacted by indoor air.

Response D.12.9:

The matrices are general risk management tools used to guide decisions in the context of a particular site. As discussed below in the responses to the specific reasons given in the comment, the NYSDOH believes that the actions recommended in the matrices are reasonable and protective of human health and that the matrices encompass a practical, multiple-lines-of-evidence approach to evaluating the data and selecting appropriate actions to address exposures.

In response to the specific reasons above:

- [a] As stated in the Additional Notes section of both decision matrices, the matrices are intended to recommend actions that address current and potential exposures related to soil vapor intrusion. Making decisions on the basis of indoor air results alone is inappropriate, as this approach does not address the potential for future exposures. Furthermore, actions are recommended when indoor air concentrations are below air guidelines and sub-slab vapor concentrations are elevated both because soil vapor intrusion does not always result in an exceedance of an air guideline and because air guidelines do not represent a

threshold that below which no actions are taken. [See Comments D.11.3 and D.12.10 for additional discussion on this issue.]

- [b] The data set referenced in the comment is representative of one site in New York State. Many additional site investigations have since been conducted. While some of the results collected to date are consistent with the findings of the referenced data set, many results do not support the assumption that data represent background sources and not soil vapor intrusion if the ratio of sub-slab vapor to indoor air concentrations is less than 100. The matrices reflect this point and acknowledge, in Note 1 of both matrices, that modification of the recommended actions may be appropriate depending on site-specific or building-specific conditions (e.g., if the data indicate exposures are attributable to background sources rather than soil vapor intrusion). [See also Comment A.8.1 (default attenuation factors).]
- [c] To the extent that site data and site conditions demonstrate that soil vapor intrusion is not occurring (i.e., indoor air concentrations are the result of indoor sources, outdoor sources or other non-site-related sources), the soil vapor intrusion investigation would be considered complete. Further action to address indoor or outdoor sources of volatile chemicals in the indoor air would be taken by the appropriate party, which may or may not be the party responsible for the soil vapor intrusion investigation. [See also Part A.11(TOPIC: Party responsible for investigating and taking action(s) to address exposures).]
- [d] Section 3.2.3.a of the guidance discusses indoor sources and building conditions as possible sources of volatile chemicals to the subsurface. As discussed in Note 1 of both matrices, modification of the actions recommended in the matrix may be appropriate depending on site-specific or building-specific conditions (e.g., if the data indicate that exposures are associated with indoor sources rather than soil vapor intrusion). [See also Comments D.12.12 and D.12.15 for clarification on the intent of the actions recommended in Boxes 3 and 4 of the matrices.]

Comment D.12.10 (paraphrased, 8 commenters, 8 comments):

Several commenters noted that the matrices require mitigation if indoor air concentrations are below NYSDOH indoor air guidelines, below background levels or below detection limits, and concentrations are above a certain level in sub-slab vapor. Their comments submitted on this point are summarized as follows.

- [a] Why mitigation is required in these circumstances, especially if samples are collected during the heating season, is not clear.
- [b] Mitigation should not be necessary when existing conditions are adequate to protect the building air to levels far below indoor air guidelines.
- [c] Mitigation is not warranted, especially in cases where structure characteristics would substantially limit soil vapor intrusion potential.
- [d] Under these circumstances, why monitoring is not also an option as there are no current human health risks or exposures is not clear.

Response D.12.10:

- [a] Indoor air results collected when vapor intrusion is expected to have its greatest effect on indoor air quality (e.g., during the heating season) may indicate soil vapor intrusion is not occurring or is not affecting indoor air quality above the NYSDOH's air guidelines. However, as discussed in Section 1.2 of the guidance, both current and potential exposures should be considered when evaluating soil vapor intrusion at sites. Furthermore, the NYSDOH's air guidelines do not

represent thresholds below which no actions are taken. The matrices reflect these points and summarize actions recommended, from a human health perspective, to address exposures related to soil vapor intrusion. For example, depending upon the sub-slab vapor concentration, monitoring or mitigation may be recommended to address both current exposures (e.g., indoor air concentrations are below air guidelines, but above background levels) and potential exposures (e.g., if indoor air concentrations are below background levels or not detected and sub-slab vapor levels are elevated) related to soil vapor intrusion. [See also Comments D.11.3 and D.12.9 for additional discussion on this issue.]

- [b and c] If current building-specific or site-specific conditions appear to be preventing or minimizing soil vapor intrusion satisfactorily, then additional mitigation actions may not be appropriate. These determinations are made on a case-by-case basis (as discussed in the Additional Notes section in both matrices). However, additional monitoring actions may be needed to make sure that the conditions continue to prevent or minimize exposures as much as possible (as discussed in the Monitor Note of each matrix). How these conditions are documented (e.g., physical tests, chemical tests, visual inspections, or a combination of these) is determined on a building-specific basis, with indoor air concentrations, sub-slab vapor concentrations, building features and operations, and other factors considered.
- [d] Mitigation is recommended in Boxes 13 through 15 in Matrix 1 and in Boxes 9 through 11 of Matrix 2 because sub-slab vapor concentrations represent a significant concern with respect to soil vapor intrusion should existing building conditions change. While routine confirmation that the conditions have not changed (i.e., monitoring) is appropriate in some cases (e.g., lower sub-slab vapor concentrations), mitigation is preferred in the referenced circumstances because it involves constant protection of the building.

Comment D.12.11:

Note 4 on both soil vapor/indoor air matrices indicates that if samples are collected outside of the heating season, it may be necessary to resample during the heating season to evaluate exposures "accurately." We suggest modifying this language to read, "it may be necessary to resample during the heating season to assess seasonal/temporal variability." We believe that use of the word "accurately" is not consistent with typical use of the term regarding data quality objectives. Likewise under note 3, the term "extreme" care should be replaced with appropriate care.

Response D.12.11:

Acknowledged. Note 3 on both matrices have been revised as recommended. Note 4 on both matrices has been revised to state that resampling may be appropriate during "worst-case" conditions, not just the heating season [see Comment C.5.1], to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

Comment D.12.12:

The footnote for the Monitor action indicates that monitoring is an interim step to address exposures related to soil vapor intrusion until contaminated environmental media are remediated. Not all conditions in the matrix that require "monitoring" will necessarily require remediation of the environmental media. For example, if the sub-slab concentrations are below the NYSDOH guidelines, there may be no source to remediate. This footnote should be clarified.

Response D.12.12:

As a point of clarification, the matrices recommend actions to address current and potential exposures related to soil vapor intrusion. They do not dictate when remediation of subsurface environmental contamination is or is not necessary.

The use of the word "Monitor" in both decision matrices indicates (as described in the "Monitor" note) that monitoring is recommended to address exposures related to soil vapor intrusion. The exceptions are Boxes 3 and 4 in both matrices, where "Monitor" is employed in a more general sense to address exposures that may or may not be related to soil vapor intrusion. Boxes 3 and 4 of both matrices have been revised to rectify this inconsistency and to reflect the true intent of the recommendations given.

Comment D.12.13 (paraphrased, 1 commenter, 2 comments):

The matrices suggest that mitigation is required if sub-slab vapor is found at a concentration of 10 to 50 times the guidance values even when indoor air is not affected. Other studies, including data collected at the IBM Endicott site, demonstrate that attenuation factors on the order of 1,000 are appropriate for soil vapor to indoor air and in the range of 100 to 1,000 for sub-slab vapor to indoor air. Based on this information, we believe that where indoor air quality is acceptable during the heating season, only sub-slab detections in excess of 1,000 times the indoor air quality guideline warrant repeated monitoring of indoor air (and even that may be too stringent). Therefore, we request that each matrix be revised accordingly to use a 1,000x factor.

Response D.12.13:

An attenuation factor of 100:1 or greater was observed for many typical buildings sampled as part of the soil vapor intrusion investigation at the IBM Endicott site. Attenuation factors lower than 100:1 were also observed perhaps due to background or other confounding factors or due to adverse building conditions (major foundation penetrations, large pressure differentials, minimal air exchange, etc.). Since the collection of that data set, many additional soil vapor intrusion investigations have been conducted in New York State. While some of the results collected to date are consistent with the findings of the IBM Endicott data set, many results do not support the assumption that a default attenuation factor in the range of 100 to 1,000 for sub-slab vapor to indoor air is appropriate for use at all sites. The matrices reflect this point and have not been revised in response to this comment.

Comment D.12.14 (paraphrased, 1 commenter, 1 comment):

Any matrix used by the NYSDOH should include "mitigate" as an option in any quadrant where sub-slab or indoor air contamination levels are at or above detect. Other considerations can then be used to justify those situations where mitigation is not carried out.

Response D.12.14:

The NYSDOH believes the actions presented in the matrices are reasonable and protective of human health. The decision matrices are intended to summarize the actions recommended, from a human health perspective, to address exposures related to soil vapor intrusion. As discussed in Section 3.4.2 of the guidance and in Note 1 of Matrices 1 and 2, actions more protective of public health than those specified within the matrix may be proposed at any time. The commenter's proposed revision to the matrices (to use mitigation as a default action whenever a chemical is detected in either indoor air or sub-slab vapor, unless other actions can be justified) is not a

responsible approach to protecting public health. Therefore, the matrices have not been revised in response to this comment.

Comment D.12.15 (paraphrased, 1 commenter, 1 comment):

The description of the mitigate action on the decision matrices is misleading, because it implies that all boxes labeled "mitigate" are related to exposures associated with vapor intrusion.

Response D.12.15:

The use of the word "Mitigate" in both decision matrices indicates (as described in the "Mitigate" note) that mitigation is recommended to address exposures related to soil vapor intrusion. The exception is Box 4 in both matrices, where "Mitigate" is employed in a more general sense to address exposures that may or may not be related to soil vapor intrusion. Box 4 of both matrices has been revised to rectify this inconsistency and to reflect the true intent of the recommendations given.

Comment D.12.16 (paraphrased, 1 commenter, 1 comment):

The decision matrix developed by the EPA Region 2 Superfund program is based solely on health-based concentrations that are developed to protect against either carcinogenic effects or non-cancer effects, as required by CERCLA and the NCP, and the increments (i.e., attenuation factors or cancer risk levels) between columns and rows remain constant between each row and/or column and for each chemical. In comparison to the general format developed by the EPA Region 2, the NYSDOH's concentration ranges in the decision matrices do not follow a linear pattern. We recommend the NYSDOH adopt a risk-based approach, like EPA's, to developing chemical-specific matrices.

Response D.12.16:

The matrices do not follow a linear pattern because they were developed with the consideration of several chemical-specific factors (as discussed in Section 3.4.1 of the guidance document). They were not developed based on health risks and default attenuation factors alone. As discussed in the response to Comment D.12.5, because the matrices are risk management tools that consider a number of factors, not just a chemical's toxicological properties, assignment of more than one chemical to a matrix may be appropriate. The matrices reflect the goal of reducing exposures in that actions to address exposures are recommended not only when the volatile chemical is detected above the NYSDOH's air guidelines, but also when it is detected above background concentrations. The NYSDOH believes that the actions recommended in the matrices are reasonable and protective of human health and that the matrices encompass a practical, multiple-lines-of-evidence approach to evaluating the data and selecting appropriate actions to address exposures. Therefore, the NYSDOH has not adopted the approach recommended in the comment.

Comment D.12.17:

It is unclear how the proximity of a building to identified subsurface contamination would modify the recommended actions in the matrices. Does this imply that more stringent actions could be imposed for buildings, regardless of the results of the exhaustive sub-slab and indoor air testing?

Response D.12.17:

The matrices are general risk management tools used to guide decisions in the context of a particular site. As discussed throughout Section 3 of the guidance, sub-slab vapor and indoor air data do not by themselves determine whether actions are needed to address exposures related to soil vapor intrusion. Rather, these data are evaluated within a multiple-lines-of-evidence approach, in which many factors, including the proximity of a building to identified subsurface contamination, are considered. The example was intended to be representative of a situation where the sampling results may not be representative of long-term conditions (such as in the case of a recent spill) or may not be consistent with the conceptual site model. To avoid confusion, this example has been removed from the guidance.

Comment D.12.18:

We recommend that an option for site-specific risk assessment be included in the decision matrices as an option at any point in the decision process. This approach could be modeled on the "Tier 4" approach established in Title 14/Brownfield Act, which allows for site remediation to be conducted based upon site-specific risk assessments, if approved by the DEC commissioner.

Response D.12.18:

The NYSDOH considered human health risks when developing the guidance and the matrices. Section 3 of the guidance describes a risk management approach to addressing both current and potential exposures related to soil vapor intrusion that considers site-specific and building-specific conditions and is protective of human health. While site-specific risk assessment or statistical analyses of the data collected during a soil vapor intrusion investigation may be performed, decisions are not based on human health risks alone. The decision matrices have not been revised as recommended.

Comment D.12.19:

Though the guidance elsewhere mentions the possibility of remediation as a solution to vapor intrusion, the matrices and text should make it clear that in normal circumstances remediation — that is, source removal or treatment — is the only acceptable long-term solution to vapor intrusion. The response to vapor intrusion, where exposures are on-going, should include consideration of remedial technologies that accelerate removal or destruction of contamination. The matrices should clearly indicate that requirement.

Response D.12.19:

Agreed. The "monitor" note, the "mitigate" note, and Note 2 on both matrices speak to the remediation of contaminated environmental media. Therefore, no additional discussion of the topic has been added to the matrices as recommended in the comment. [See also Comment E.2.9 (source removal).]

Comment D.12.20 (paraphrased, 2 commenters, 2 comments):

Either the matrices need a list of applicable compounds in the header or an additional table should be added to cross-reference compounds with the applicable matrix. This will become especially important as the list of compounds and number of matrices grows.

Response D.12.20:

Agreed. A table (Table 3.3) showing which chemicals correspond to which matrices has been added to Section 3.4.2 of the guidance.

Comment D.12.21:

You are the only agency, Federal or State, with such a matrix requiring both types of data.

Response D.12.21:

At the time the comment period ended (May 2005), EPA Region 2 had developed similar matrices relating sub-slab vapor concentrations to indoor air concentrations and recommendations for actions. In October 2005, the New Jersey Department of Environmental Protection released their finalized soil vapor intrusion guidance. Their guidance contains a remedial decision matrix to clarify the remedial action assessment better in regard to the relationship between sub-slab vapor and indoor air data.

D.13 TOPIC: Blanket mitigation approachComment D.13.1:

Section 3.3.1: The "blanket mitigation" strategy (page 37) appears to describe the approach taken in Endicott. Homes were provided subslab ventilation system whether or not they had been tested individually. When I questioned if there is a way to know whether mitigation is working, without before-and-after monitoring, New York officials explained that they are able to verify the success of ventilation using statistical methods. That monitoring strategy is essential to blanket mitigation, and it should be explained, or at least offered as a case study, in the guidance.

Response D.13.1:

When any mitigation system is installed, its effectiveness and proper installation should be confirmed. Recommendations on post-mitigation or confirmation testing are provided in Section 4.3 of the guidance. In general, chemical testing is recommended in buildings where pre-mitigation testing was completed [see the discussion in Section 4.3.1.e], but physical testing is the primary means of confirming system operations -- whether the system was installed as part of a blanket mitigation approach or not.

A blanket mitigation approach has been applied at several sites in New York State, not just at the IBM Endicott site. The State does not intend to incorporate specific site data or approaches, into the guidance as this is inconsistent with the general approach and intent of the guidance. Therefore, the guidance has not been revised in response to the comment.

Comment D.13.2:

Regarding "blanket mitigation," it is unclear whether indoor air sampling is still required if the blanket mitigation approach is selected.

Response D.13.2:

Mitigation systems have been installed as part of a blanket mitigation approach on buildings that have not been sampled (sub-slab vapor, indoor air or outdoor air). From a health perspective, indoor air sampling is not necessary to determine whether action should be taken to address current exposures related to soil vapor intrusion because the sub-slab depressurization system will address existing and potential

exposures that may be occurring. However, indoor air, outdoor air, and sub-slab vapor samples are needed to speak to exposures related to soil vapor intrusion if the property owner wants to know. Therefore, the State recommends that sampling be offered to property owners in a "blanket mitigation" area.

D.14 TOPIC: Undeveloped parcels

Comment D.14.1:

For every undeveloped site with a potential soil vapor issue, the issue cannot be resolved until after a new building is constructed and subslab vapor is tested. This will force every new building to include a soil vapor system, whether one is actually needed or not and for developers to deal with an open-ended risk issue after substantial capital funding has been committed. This will have a negative effect on the financing and backing for many redevelopment projects, since the viability/public perception of a redevelopment project will remain uncertain and in the hands of [NYS]DOH until sites have been redeveloped.

Response D.14.1:

The guidance is not intended to limit the development of sites, but to limit the potential for human exposure to volatile chemicals related to soil vapor intrusion. If volatile chemical contamination is a concern at an undeveloped site, steps should be taken to ensure that future construction will not create a situation where occupants would be exposed to the contamination. These steps may include investigation at a later date (post-development), incorporation of measures to mitigate exposures to soil vapor intrusion in the development process, remediation of subsurface environmental contamination, etc. The best approach for redeveloping a site while addressing concerns related to soil vapor intrusion should be determined on a case-by-case basis.

Comment D.14.2 (paraphrased, 1 commenter, 1 comment):

The guidance contains a broad definition of "potential exposure" that is not fully addressed in the guidance document. This creates difficulties. For instance, on sites where buildings have not been built, only groundwater or soil vapor data can be collected. The guidance does not allow this kind of data to be used to reach No Further Action. Instead, it specifies that you must have sub-slab, indoor air, and outdoor air data. Thus, there is no way to screen out sites that do not currently have buildings.

Response D.14.2:

Soil, groundwater, and soil vapor data may be collected from such sites. If volatile chemicals are not present, the soil vapor intrusion evaluation may be considered complete. If volatile chemicals are present, steps should be taken to ensure that future construction will not create a situation where occupants would be exposed to the contamination. These steps may include investigation at a later date (post-development), incorporation of measures to mitigate exposures to soil vapor intrusion in the development process, remediation of subsurface environmental contamination, etc. and are determined on a case-by-case basis. [See also Comment B.2.3 (potential exposures definition).]

Comment D.14.3:

There needs to be a way to resolve soil vapor evaluations prior to new construction based on an evaluation of actual development plans for a site and a valid scientific review of data and applicable risk-based criteria.

Response D.14.3:

Soil, groundwater, and soil vapor data may be collected from such sites. If volatile chemicals are not present, the soil vapor intrusion evaluation may be considered complete. If volatile chemicals are present, steps should be taken to ensure that future construction will not create a situation where occupants would be exposed to the contamination. These steps may include investigation at a later date (post-development), incorporation of measures to mitigate exposures to soil vapor intrusion in the development process, remediation of subsurface environmental contamination, etc. and are determined on a case-by-case basis.

Comment D.14.4:

Although the draft guidance provides for the use of easements if a site will not be developed in the foreseeable future, it is not clear what criteria will be utilized for the investigation of such sites when development is pursued. The current draft Guidance focuses on the relationships between sub-slab vapors and indoor air contamination levels, which will not be applicable at undeveloped sites. The final Guidance should set out the criteria that will be used to determine whether there is a potential for vapor intrusion and, if so, what actions should be taken. For example, California's Vapor Intrusion Guidance provides engineering controls that need to be installed in any future buildings.

Response D.14.4:

At sites where remediation is being overseen by the State, environmental easements will be required to ensure that the evaluation of soil vapor intrusion occurs as properties are developed -- unless soil, groundwater and soil vapor data indicate the soil vapor intrusion evaluation may be considered complete (as discussed in the responses to Comments D.14.2 and D.14.3). The soil vapor intrusion guidance that exists at that time will be used in the investigation and evaluation. In our experience to date, soil vapor and groundwater sampling have not been shown to be reliable tools for predicting concentrations immediately beneath a slab or in the indoor air of a building. Therefore, the State does not support the use of default soil vapor or groundwater screening levels to make decisions regarding the potential for exposures in future buildings at this time.

Comment D.14.5 (paraphrased, 1 commenter, 1 comment):

The draft guidance requires assessment of "potential exposure" in unoccupied buildings and potential construction on vacant land (Section 2.2, pp. 7 to 8). This is a significant issue, especially at undeveloped parcels; it is unclear how one would establish likely exposure scenarios once a site is developed, raising concerns that site assessments based on potential exposures will not be applicable to actual site development. It is inappropriate to require a vapor intrusion assessment to account for unanticipated potential future uses of a site or structure. Institutional controls may be utilized as another tool, on a case-by-case basis, to prevent potential exposure and establish future use limitations. It is not necessary to consider all potential future use scenarios when investigating soil vapor. This process is currently used for soil and groundwater investigation/remediation and should also be applied to future soil vapor assessments/remedial actions.

Response D.14.5:

Section 2.2 of the guidance discusses the types of samples that are collected to investigate the soil vapor intrusion pathway, why the samples may be collected (i.e., what the results are used for), and generally when they are collected relative to one

another. As discussed in Section 2.3, the State recognizes that a delay in the investigation of undeveloped parcels may be appropriate given the uncertainties associated with predicting the likelihood for exposure based on groundwater, soil and soil vapor data. Section 3.6 includes a discussion of the use of institutional controls. Both Sections 2.3 and 3.6 have been revised to include unoccupied buildings in the discussion. As discussed in Section 3.2.7, past, current and future lands uses (including land uses dictated by using institutional controls) should be considered when evaluating the investigation data and determining appropriate actions for further investigation or measures to address exposures. However, if current or future uses are unknown or are unrestricted, an approach that assumes residential use should be taken. Overall, the State believes that the guidance provides a reasonable and practical approach to evaluating soil vapor intrusion that is analogous to the approach taken when investigating contamination in other environmental media (e.g., groundwater, soil, etc.) and addressing corresponding exposure concerns.

Note: For undeveloped parcels, institutional controls can be used to ensure that proper precautions are taken for future development. Actions taken to minimize or prevent exposures typically do not preclude the site from being used for a desired purpose or from being developed. Furthermore, the costs associated with installing a system at the time of a building's construction are often considerably less than the costs associated with retrofitting a system to the building after construction is completed. Section 1.5 of the guidance has been revised to emphasize these points.

Comment D.14.6 (paraphrased, 1 commenter, 2 comments):

Many contracts are structured so that a developer will only agree to develop a property once the owner has received a No Further Action Decision or Certificate of Completion from the State. There appears to be no avenue for issuance of a No Further Action Letter or Certificate of Completion for undeveloped sites. Therefore, implementation of this guidance will have significant impact on development of undeveloped properties in New York State. The guidance should provide a method for site closure for undeveloped properties.

Response D.14.6:

This guidance is intended for use in all of the State's environmental remediation programs, as well as for any other sites where soil vapor intrusion is a concern. The circumstances under which various milestones may be reached in remedial programs (such as a No Further Action letter or Certificate of Completion) depend on the program. In general, no further action or completion determinations will depend upon the nature and extent of subsurface contamination, what actions have been or are being taken to address exposures related to the contamination, and what actions have been or are being taken to address the environmental contamination. [See also Part D.15 (TOPIC: Site close-out — no further action or completion determinations).]

Note: For undeveloped parcels, institutional controls can be used to ensure that proper precautions are taken for future development. Actions taken to minimize or prevent exposures typically do not preclude the site from being used for a desired purpose or from being developed. Furthermore, the costs associated with installing a system at the time of a building's construction are often considerably less than the costs associated with retrofitting a system to the building after construction is completed. Section 1.5 of the guidance has been revised to emphasize these points.

Comment D.14.7:

New development at potential vapor intrusion sites should not depend solely upon mitigation, be it vapor-resistant membranes or ventilation, to minimize the hazards of vapor intrusion. There is no guarantee that such mitigation will continue effectively over the life of the hazard. Therefore, maximum practical remediation should be required before structures are built. This approach is not only more health protective, but it may also be more cost effective over the life of the hazard.

Response D.14.7:

The State agrees that remediation of environmental contamination is the ultimate goal. The guidance emphasizes that mitigation or other recommended actions to prevent exposures related to soil vapor intrusion are considered to be interim measures to address exposures until contaminated environmental media are remediated, or until the action is no longer needed. Concurrent remediation and development of a site may be possible. The timing of remedial and site development activities (concurrent, consecutive, mixed, etc.) is determined on a site-specific basis.

Comment D.14.8 (paraphrased, 1 commenter, 1 comment):

The guidance's preference for monitoring and/or mitigation any time vapors will potentially exceed background will inhibit the much-needed development of brownfield sites. As the NYSDOH is aware, the Legislature has made the redevelopment of brownfield sites a priority. We recommend that absolute limitation on development absent abatement be limited to residential uses. Institutional controls that limit the use of such areas to industrial or commercial applications appear to be a sensible alternative to mandatory abatement.

We further recommend that the guidance be amended to ensure that NYSDEC is responsible for determining whether and what institutional controls are necessary, and that, for the purpose of soil vapor intrusion, such measures are only necessary if there is demonstrated contamination by soil vapor concentrations found to exceed, or are reasonably anticipated to exceed, guidelines in indoor air.

Response D.14.8:

The guidance is not intended to limit the development of sites, but to limit the potential for human exposure to volatile chemicals related to soil vapor intrusion. If volatile chemical contamination is a concern at an undeveloped site, steps should be taken to ensure that future construction will not create a situation where occupants would be exposed to the contamination. These steps may include investigation at a later date (post-development), incorporation of measures to mitigate exposures to soil vapor intrusion in the development process, remediation of subsurface environmental contamination, etc. The guidance does not place a limitation on development absent abatement (i.e., mandatory abatement) as stated in the comment. The best approach for redeveloping a site while addressing concerns related to soil vapor intrusion should be determined on a case-by-case basis. This determination should consider future land use; however, industrial and commercial uses may not change a recommendation for actions to address exposures related to soil vapor intrusion (as suggested in the comment). [See also Comments A.3.2 and D.5.9.]

At sites where remediation is overseen by the State, the NYSDEC, in consultation with the NYSDOH, is ultimately responsible for determining what institutional controls are necessary and for ensuring that those controls remain in place as long as they are necessary -- regardless of the environmental media. Furthermore, there are no prescribed concentrations of volatile chemicals in soil vapor that trigger a need for

institutional controls. Therefore, the guidance has not been amended as recommended in the comment.

Comment D.14.9:

Use of environmental easements should pertain to vacant buildings as well as undeveloped parcels.

Response D.14.9:

Agreed. Section 3.6 of the guidance has been revised accordingly.

D.15 TOPIC: Site close-out — no further action or completion determinations

Comment D.15.1 (paraphrased, 3 commenters, 3 comments):

The guidance needs to provide clear criteria for a "no further action" determination. The current guidance only provides for this in the final step of the investigation process; exit criteria need to be provided at each step of the investigation.

Response D.15.1:

Overall, no further action determinations are made once the nature and extent of subsurface vapor contamination and any exposures associated with the contamination are identified and addressed appropriately. This is analogous to the investigation and remediation of other environmental media (e.g., groundwater, soil, etc.). With respect to soil vapor intrusion at a specific building, "no further action" is generally appropriate when the evaluation indicates that soil vapor intrusion is not occurring and the potential for it to occur is not expected. Sections 1.5, 2.5 and 3 (including Section 3.4, the decision matrices) of the guidance describe data and site characterization information needed to determine the appropriate next step at a given site. [See also Part A.17 (TOPIC: Exit strategies).]

Comment D.15.2 (paraphrased, 1 commenter, 2 comments):

Please clarify if it is the NYSDOH's intent that no further action is only recommended if volatile chemicals are not detected in indoor air. If it is, why?

Response D.15.2:

The guidance describes actions to reduce exposures and protect human health and does not indicate who is responsible for taking these actions. As indicated in the decision matrices, actions to take reasonable and practical actions to identify source(s) and reduce exposures may be recommended when concentrations of volatile chemicals are detected in the indoor air. However, this does not necessarily mean that the party doing the soil vapor intrusion investigation (e.g., PRP, Volunteer, etc.) is responsible for implementing the recommended actions. For example, the State does not expect a responsible party to address exposures related to releases from indoor sources alone (e.g., exposures to methylene chloride related to the storage of paint strippers in a basement). With respect to soil vapor intrusion at a specific building, "no further action" is generally appropriate when the evaluation indicates that soil vapor intrusion is not occurring and the potential for it to occur is not expected. [See also Part A.11 (TOPIC: Party responsible for investigating and taking action(s) to address exposures).]

Comment D.15.3 (paraphrased, 2 commenters, 2 comments):

Section 3.3.2, as well as Section 3.4.3 and Matrix 1 and 2, all suggest that no further action can only be achieved if VOCs are not detected in indoor air. This decision will then be dependent on analytical method, laboratory, and improvements in detection limits over time. It would be more appropriate to allow no further action decisions if VOCs could not be discerned from a) a conservative background table value or b) the building-specific background levels based on the weight of evidence, or were less than a risk-based concentration, whichever was highest.

Response D.15.3:

As discussed throughout Section 3 of the guidance, many factors, not just indoor air data, are considered when determining whether additional actions (if any) are appropriate. Therefore, a "no further action" decision with respect to a specific building would not be made on the basis of indoor air data alone, regardless of how indoor air levels compare to background levels or guidance values. The guidance has not been revised in response to this comment. [See also Comment D.15.2.]

Comment D.15.4 (paraphrased, 1 commenter, 2 comments):

Section 3.4.3 states that no further action is warranted "when the volatile chemical is not detected in the indoor air sample and the concentration detected in the corresponding sub-slab vapor is not expected to substantially affect indoor air quality." No further action may be appropriate in other situations as well. No further action may be warranted if it is determined that the PRP is not responsible for the contamination which is affecting indoor air quality or that other indoor sources of volatiles are presenting more of a risk to human health. No further action also seems to be appropriate when volatile chemical concentrations in the indoor air are less than half of the NYSDOH's guidelines. No further action may be warranted where the responsible party has demonstrated that sub-slab vapor concentrations are below guidance values and there are low concentrations in indoor air. Responsible parties should not be required to pay for an elaborate monitoring program, particularly when both sub-slab and indoor air concentrations are below guidance values.

Response D.15.4:

We believe reasonable and practical actions should be taken to reduce exposures when indoor air levels are above background, even when they are below a guideline. However, the detection of a volatile chemical in the indoor air does not necessarily mean that the party doing the soil vapor intrusion investigation (e.g., the PRP, Volunteer, etc.) is responsible for implementing actions recommended to address exposures (see Comment D.15.2). With respect to soil vapor intrusion at a specific building, "no further action" is generally appropriate when the evaluation indicates that soil vapor intrusion is not occurring and the potential for it to occur is not expected. As discussed throughout Section 3 of the guidance, many factors, not just indoor air data, are considered during this evaluation.

Comment D.15.5 (paraphrased, 1 commenter, 1 comment):

The recommended minimum reporting limits for "no further action" for TCE (0.25), PCE (3.0) and 1,1,1-TCA (3.0) are significantly less than the 75th percentile of the EPA BASE background data for commercial buildings. Thus, a high percentage of tested commercial buildings with background levels of VOCs would be expected to require multiple rounds of testing prior to a no further action decision.

Response D.15.5:

As stated in Section 3.3.3 of the guidance, "if the results are comparable to background levels, then no further action to address *current* human exposures is appropriate. However, additional sampling may be appropriate if samples were collected at times when soil vapor intrusion is not expected to have its greatest effect on indoor air quality..., the potential for exposures related to soil vapor intrusion should be monitored based on the sub-slab vapor results..., and/or subsurface conditions change over time (e.g., due to the migration of contaminated groundwater or vapors)."

Furthermore, the detection of a volatile chemical in the indoor air at a level above background does not necessarily mean that the party doing the soil vapor intrusion investigation (e.g., PRP, Volunteer, etc.) is responsible for implementing actions recommended to address exposures (see Comment D.15.2). [See also Comment D.15.3.]

Comment D.15.6 (paraphrased, 1 commenter, 2 comments):

The guidance does not provide for a "no further action" option even when site contamination (VOCs in groundwater, soil, soil vapor) has been established to be in steady concentrations (i.e., asymptotic levels).

Response D.15.6:

If volatile chemicals are present in the subsurface, even at steady state concentrations, then there is a continuing potential source of volatile chemicals to soil vapor. A no further action determination under these circumstances will depend upon the nature and extent of subsurface contamination, what actions have been or are being taken to address exposures related to the contamination, and what actions have been or are being taken to address the environmental contamination. Therefore, the guidance has not been revised in response to this comment.

Comment D.15.7:

The current guidance provides criteria for no further action based only on the observed relationship between measured sub-slab and indoor air VOC concentrations. As a result, it appears that both sub-slab and indoor sampling will be required at all sites where vapor intrusion investigations are conducted. In order to limit the scope of vapor intrusion investigations at sites where preliminary investigation results clearly indicate no potential for vapor intrusion impacts, additional criteria for no further action should be provided based on i) source characterization, ii) measured soil gas concentrations, and iii) evaluation of indoor VOC concentrations relative to typical background.

Response D.15.7:

To the extent that site data and site conditions demonstrate that soil vapor intrusion is not occurring or is not expected to occur, the soil vapor intrusion investigation would be considered complete. The types of samples included in a soil vapor intrusion investigation are typically determined on a site-specific basis. However, if existing site data indicate that the potential for soil vapor intrusion exists, structure sampling (including the collection of sub-slab soil vapor, indoor air and outdoor air samples) is typically appropriate. The guidance has not been revised in response to this comment. [See also Comments A.8.1, C.2.1, C.3.3, C.19.2, and D.15.3.]

Comment D.15.8 (paraphrased, 11 commenters, 12 comments):

The State should rely more heavily on soil vapor sample data and/or use soil vapor data to reach "no further action" decisions.

Response D.15.8:

Data collected to date at the investigation of sites throughout New York indicate that soil vapor concentrations do not follow a traditional "plume-like" pattern, can be highly variable across a site, and cannot accurately and reliably be used to predict or model expected sub-slab vapor or indoor air concentrations. Therefore, use of soil vapor data as a single determinant for additional investigation is not considered to be protective of public health. Rather, as discussed in Section 3 of the guidance, evaluation of soil vapor intrusion data involves a multiple-lines-of-evidence approach considering contamination in all environmental media and other site-specific conditions. [See also Comment D.15.1.]

Comment D.15.9:

We recommend that "no further action" decisions should be permitted if soil vapor concentrations predicted by properly conducted, site-specific modeling are confirmed (in select locations) by actual soil vapor data, and these concentrations are below EPA (2002) soil vapor screening levels, adjusted for non-residential building construction, air exchange rates, and building volume, or other factors, if applicable.

Response D.15.9:

The use of any model, in conjunction with soil vapor sampling, to justify taking "no further action" at sites without the collection of sub-slab vapor or indoor air samples is not recommended at this time. Rather, sub-slab vapor and/or indoor air data are more reliable and appropriate for evaluating the potential for human exposures related to soil vapor intrusion. Our experience to date has shown that soil vapor impacts to buildings vary considerably depending on site and building conditions and do not necessarily follow model predictions or correlate to soil vapor results. Therefore, the State does not believe that decisions based solely on modeling and/or soil vapor results are sufficiently protective of human health. The guidance has not been revised as suggested in the comment.

Comment D.15.10:

The draft guidance contains no specificity on how soil vapor sample results will be evaluated and how sites will get closed-out, except if VOCs are not detected in soil and groundwater. The "gray areas" in interpreting results will tend to keep sites in the system for on-going evaluation, at considerable expense, when there is no conclusive evidence that an actual soil vapor impact will ever be exhibited.

Response D.15.10:

Soil vapor results are not used as the sole determinant for closing out a site. Rather, the results are reviewed with the consideration of other factors, as discussed in Section 3 of the guidance. Recommendations for additional actions (investigation, mitigation, remediation, etc.) will depend upon site-specific and building-specific conditions. The guidance is intended to encourage the completion of soil vapor intrusion evaluations as efficiently and effectively as possible, not to keep sites in a never-ending cycle of investigation.

Comment D.15.11:

This guidance should address sites in the Voluntary Cleanup Program or Brownfields Cleanup Program and under what circumstances a No Further Action Letter or Certificate of Completion will be issued if completion of groundwater remediation is not a viable option (such as in the case of regional groundwater contamination), or if soil vapor issues cannot be resolved until after a building is constructed.

Response D.15.11:

The guidance is intended to present generic steps and strategies that may be applied when approaching an investigation of soil vapor intrusion. The State recommends that the guidance be considered anywhere soil vapor intrusion is evaluated in the State of New York, whether the evaluation is undertaken voluntarily by a corporation, a municipality, or private citizen, or whether it is performed under one of the state's environmental remediation programs. To incorporate discussions of specific environmental programs, or program requirements, into the guidance would be inconsistent with the general approach and intent of the guidance. Therefore, the guidance has not been revised as suggested in the comment.

The circumstances under which a "no further action letter" or "certificate of completion" is issued will depend upon the specific environmental program. In general, no further action or completion determinations will depend upon the nature and extent of subsurface contamination, what actions have been or are being taken to address exposures related to the contamination, and what actions have been or are being taken to address the environmental contamination. [See also Comments D.14.2 and D.14.6.]