

Report of the Vapor Intrusion Subcommittee  
November 2004  
Draft

## **Background**

Although the Pa Guidance on Vapor Intrusion from Soil and Groundwater into Buildings was finalized in January of 2004, the Department encouraged the use of the draft guidance since July of 2002. Subsequent to that time, three significant issues were raised by users with respect to the implementation of that guidance. They are: 1) availability of some de minimis level of contamination in soils or groundwater vertically within 5 feet of the receptor, 2) availability of practical quantitation limits (PQLs) for substances in the vapor screen tables, and 3) availability of more flexible seasonal sampling requirements.

The Department requested that the Vapor Intrusion Subcommittee examine these issues and make recommendations to amending the now finalized guidance on Vapor *Intrusion from Soil and Groundwater into Buildings* (Jan 2004). This report is meant provide recommendations to the department and to further explain the considerations of the subcommittee in making those recommendations.

## **Members**

Annette Guiseppi-Elie	Dupont
Charles Campbell	Science Applications International Corporation
Kevin Reinert	Rohm and Haas Company (subcommittee chair)
William Dreibelbis	Penn State University
John Twardowski	DEP- NCRO (as of September 2004)
Bruce Fishman	RBR Consulting Inc.
Craig Robertson	Groundwater Sciences Corp.
Randy Roush	as department liaison with the subcommittee
Samuel Fang,	DEP as resource.

## **Issues**

### **De Minimis Issue:**

In the January 2004 final DEP vapor intrusion guidance, there are no de minimis concentrations where regulated substances are detected in soil and groundwater and there is less than 5 feet of vertical separation distance from the vapor source and the floor of the occupied building. Therefore, if a person encounters volatile regulated substances in soil or groundwater where there is less than 5 feet of vertical separation distance, the person must sample soil gas or indoor air, conduct site-specific analysis under the Statewide Health standards (SHS) or mitigate, even if the levels of the volatile regulated substances are just barely above the PQLs. Particular concerns are on regulated substances with high J-E screening values, such as acetone and ethylene glycol in soil. The residential soil screening values for these two substances are based the soil saturation concentrations. These soil saturation screening values are not available for use if there is less than 5 feet of vertical separation distance but the concentrations are just barely above the PQLs. The task of the subcommittee was to figure out how to develop the de minimis concentrations in soil and groundwater where there is less than 5 feet of vertical separation distance.

## Report of the Vapor Intrusion Subcommittee

November 2004

Draft

The subcommittee members decided that there was a need to gather some empirical data from groundwater, soils, soil gas and indoor air and do some comparisons to aid in addressing this issue. The soil and groundwater data would need to be collected from less than 5 feet. A request was made to some 2200 consultants listed as interested in the Land Recycling Program, to submit media and indoor air or soil gas analysis of substances applied to the vapor guidance screen. Only a few responses were received.

Groundwater data for TCE vs. the indoor air data was plotted from a site located in southcentral Pennsylvania. Due to the very limited data and the difficulty in trying to extrapolate a groundwater concentration from nearby monitoring wells to a receptor, a conclusion could not be drawn. The members felt that it would be difficult to come up with a de minimis level and that either modeling or IA/Soil-Gas sampling was appropriate according to the flowcharts in the guidance, even at depths less than 5 feet. In addition, if soil contamination or contaminated groundwater were above the basement floor, J&E modeling would not be appropriate in that situation. It was thought that a model based on the convective flow of soil gas or other appropriate model could still be used to develop the de minimis levels. A convective flow model was run to develop the de minimis levels for 5-10 compounds when the vapor source is less than 5 feet vertically from basement floor. De minimis levels were developed for 9 compounds when the vapor source is less than 5 feet vertically from basement floor. As a result, the empirical data was very limited and a correlation could not be developed. It was agreed to by the subcommittee to try and develop de minimis levels for 9 example compounds when the vapor source is less than 5 feet vertically from basement floor. The approach was conservative using Henry's Law equation for the groundwater and the J&E model for soil. The subcommittee members agreed that the approach was reasonable. It was agreed to by subcommittee members not to generate de minimis numbers or another table in the guidance. However, it would be advisable to discuss the issue in the text of the guidance with respect the modeling approach. After further consideration however, the subcommittee concluded that these results were not supportive of establishing generic numeric values because of the number of variables present statewide. The preferred approach was to consider whether specific variations to the J&E model based on site data could be used to address the issue.

The J&E model can be used as an analysis tool, in lieu of soil-gas or indoor air sampling, under the Statewide Health Standard when soil or groundwater contamination is less than five (5) feet from the building floor (regardless of whether a basement is present or not). This analysis (as part of the vapor intrusion decision matrix screen) is allowed in the context of complying with the Statewide Health Standard and must use the same toxicological factors as specified in Chapter 250, Appendix A, Table 5 (relating to Physical and Toxicological Properties of substances) and meet a target risk range of  $1.0E-05$  or HQ of 1.0, (on a substance by substance basis. In some cases it is advisable to provide site-specific parameter inputs for the J&E analysis. When site-specific parameters are used, these values must be reasonable for the site-specific situation and should include an appropriate safety factor (unless the parameter is measured at the site) as determined by the environmental professional. Justification for the choice of value must be provided. Since several factors are not independent, a sensitivity analysis is recommended to document that dependent factors are not inappropriately affected by the change, i.e., a check must be made to ensure that changes to any factor do not cause a

## Report of the Vapor Intrusion Subcommittee

November 2004

Draft

dependent factor to be unrealistic. If any of the eight sensitive J&E parameters listed below are changed, the DEP is particularly interested that careful analysis and clear justification be made for the new values. Optionally, this analysis can be done through calibration with soil gas analysis data.

### J&E Sensitive Parameters

Soil Water filled porosity  
Capillary Zone Soil water filled porosity  
Thickness of capillary zone  
Average vapor flow rate into a building  
Soil vapor permeability  
Soil to building pressure differential  
Crack to total area ratio  
Indoor-outdoor air exchange rate

The recommendation of the subcommittee was to offer guidance language for use of the J&E model variable parameters under the Statewide Health Standard (Attachment 1), in lieu of establishing de minimis numeric values.

### ***Seasonal sampling***

As the issue was presented, many site owners do not understand why indoor air and soil gas sampling has to be done in the winter and spring, especially for buildings on slabs. Also, many clients cannot get the money to do the sampling now (in the winter/spring), but they will have it available later (e.g. late spring or summer). They want to know why they cannot do the sampling at other times when the money is available. They also do not want to wait until next winter/spring to do the sampling. Many clients are accustomed to budgeting and doing fieldwork during late spring, summer, and early fall; not during the winter or early spring. As clients get accustomed to the new guidance, this issue will be less of a problem; nevertheless, it does exist now and is deterring closure of some sites. More than one DEP case/project manager has said that this issue is not flexible and sampling must be done in the winter/spring per the vapor intrusion guidance.

The subcommittee members decided that there is a need to consider other times of the year for representative soil-gas and indoor air sampling as long as there is a good technical justification. Things that need to be considered are multi-story buildings with basements and stack effects vs. slab on grade construction, negative & positive pressure systems, etc. Final Reports are being rejected because the soil gas and/or indoor air sampling are not being conducted during the winter/spring seasons.

A statistical analysis was conducted of the indoor air and soil-gas samples collected at a large remediation site. A non-parametric/sign test was used for the analysis. A summary of the indoor air data indicated that there was no statistical difference in the data that was collected in Feb and June of 2003. It was concluded that at least for this particular site, contaminant, and limited sampling that seasonality and sampling timing was not significant. The subcommittee accepted the data analysis and agreed not to make any change in the vapor guidance as to indoor air seasonality sampling. We did note that this conclusion was based on a limited number of samples and therefore comparisons. The same conclusion regarding the seasonality and sampling timing was drawn from the soil-gas data that were provide during the same timeframe of February and June of 2003. There was support for the idea that during soil-gas sampling when wet and dry

Report of the Vapor Intrusion Subcommittee

November 2004

Draft

conditions exist or during groundwater table high & low levels, these are more apt to impact the data. This concept was supported by recent data sent to the team.

PQLs/RLs- Appendix A

Appendix A of the guidance has been revised with respect to Reporting Limits (RLs). RLs and PQLs are one in the same and will be reflected in the new revised Appendix A with the new language to appear as a footnote. Appendix A includes Reporting Limits (RLs) which is comprised of a relative list of RLs (or PQLs) that are to be used for informational purposes only. Act 2 specifies that in demonstrating attainment of any standard, the concentration of a regulated substance shall not be required to be less than the practical quantitation limit set by EPA. Section 250.4 of the regulations addresses how the Department interprets this requirement in light of the SW-846 analytical methods. Since EPA does not publish Estimated Quantitation Limits (EQLs) or method detection limits for the TO-series methods, the procedure in Section 250.4(c)(2) shall be used in developing PQLs for these analytical methods. Because this method of determining a PQL is specific to a particular laboratory, and will vary from one laboratory to another, the calibration data associated with a particular data set should be included when transmitting analytical results to the Department. Labs should be consulted prior to sampling to obtain MDLs and reporting limits (or PQLs) for the compounds of interest.