May 31, 2005

New York State Department of Health
Bureau of Environmental Exposure Investigation
Flanigan Square, Room 300
547 River Street
Troy, New York 12180-2216

Dear Colleagues,

We write to comment on the February 2005 Public Comment Draft of *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (hereinafter "Vapor Intrusion Guidance") as developed by the Department of Health (DOH). Our comments derive from our collective experience is assessing potential risks to human health, and in particular our experience in evaluating vapor intrusion at sites in Massachusetts and other states.

Implementation of the Vapor Intrusion Guidance will likely add considerable costs to remedial investigations at contaminated sites. Many factors influence the vapor intrusion pathway, making it difficult to evaluate and mitigate with confidence. The goal of meeting stringent risk-based standards with a high degree of certainty at all sites is, in our opinion, not justified or practical with respect to the vapor intrusion pathway. Simply put, the costs of the approach proposed in the Vapor Intrusion Guidance far outweigh the benefits it might provide. We recommend that the Vapor Intrusion Guidance embrace more reasonable risk management policies that will still protect human health with an ample margin of safety but at the same time reduce the costs it would otherwise create.

Simple Cost-Benefit Analysis

Many of the lowest (and hence most stringent) risk-based concentrations for contaminants are based on a maximum permissible increase in the risk of getting cancer. For example, DOH's target risk concentration of 5 $\mu g/m^3$ for trichloroethylene (TCE) is motivated by concerns over potential cancer risks. Typical limits on allowable incremental cancer risk, however, are not very valuable in economic terms. Assume, for argument's sake, that a decision is made to mitigate an incremental cancer risk of 10 in 1,000,000 due (theoretically) to vapor intrusion into a residence, and this risk is averted for four people. Assuming that these cancers might lead to premature death, and that value of a human life is about seven million dollars (an arguable value, but typical of that used by economists), the monetary benefit of the mitigation is:

$$4 \times (10 \div 1{,}000{,}000) \times \$7{,}000{,}000 = \$280$$

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This value is probably an overestimate of the actual benefit, given that the methods and assumptions used to estimate risk of cancer (especially for compounds not known to cause the disease in humans, either at all, or at levels reasonably close to ambient) are typically biased to over-predict. With regard to TCE, despite abundant epidemiologic study of this compound, TCE has not been established to cause cancer in humans, even at very substantial levels of exposure in workplace air in decades past, let alone at the vastly smaller levels of exposure of interest for the current topic (see, for example, Lash *et al.*, 2000, available at http://www.whitehouse.gov/omb/inforeg/2003report/325-4.pdf). Moreover, the typical costs of evaluating and mitigating the vapor intrusion pathway are much greater than this "benefit." Samples analyzed by U.S. EPA Method TO15 cost about $400 each. Many samples, collected over numerous locations and points in time, would be required at a typical site to satisfy the data confidence goals implied in the text of the Vapor Intrusion Guidance. Adding the costs of collecting the samples and interpreting the results, vapor intrusion investigations may easily require $10,000 or more, even at relatively simple sites. Remedial options are also likely to cost more than the economic benefit of the mitigation. The installation of a simple subslab depressurization system is of the order of $2,000. At $400 per sample (analysis alone), long-term monitoring is likely to be even more costly, although we suspect this option will be pursued infrequently relative to active mitigation options.

Our overall point is that economic benefits alone do not justify the costs of aggressive implementation of the Vapor Intrusion Guidance. There are admittedly other benefits (*e.g.*, "peace of mind" issues) that are not easily quantified, but there is a one to two orders of magnitude disparity between the costs of investigating and mitigating the vapor intrusion pathway and the economic benefits of its risk mitigation. In this case, risk management decisions should not err excessively on the side of caution. Put another way, the Vapor Intrusion Guidance need not (and should not) be constructed in a manner that identifies through exhaustive investigation all situations in which the vapor intrusion pathway could – under any hypothetical circumstances – present risks in excess of stringent criteria. Rather, we recommend that the Vapor Intrusion Guidance embody a philosophical approach that pursues situations where vapor intrusion is plausibly a significant threat.

Evaluation of Background Risk

Consideration of background air quality also brings into question the cost effectiveness of the Vapor Intrusion Guidance. Mitigating vapor intrusion at contaminated sites will do little to decrease the potential health risks of breathing indoor air, which contains many different chemicals due to both natural conditions and emissions from indoor sources such as heating, smoking, cooking, and use of consumer products. The consideration of a risk-based background, *i.e.*, a background based on the aggregate *risk* of all chemicals, as opposed to

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independent consideration of each individual chemical, is also a relevant perspective in residential settings. Radon, a pollutant that enters homes naturally through vapor intrusion, is typically present at concentrations that correspond to incremental cancer risk levels that are one to two orders of magnitude greater than the target risk levels deemed significant by most state regulatory agencies. Based on a recent study, the U.S. EPA estimates that exposure to radon leads to 21,000 deaths each year (see http://www.epa.gov/radon/images/radon_pooling_studies.pdf), which crudely corresponds to a risk of death of 5 in 1,000 over a 70-year lifetime.[1] Mitigating vapor intrusion risks of the magnitude of 0.001 to 0.01 in 1,000 (1 to 10 in a 1,000,000) makes very little difference in overall risks to indoor air pollution (except, of course, in the case where mitigation simultaneously decreases the risk to radon exposure, which should not be used to justify the costs of mitigating the contaminants of interest to vapor intrusion). Thus, if radon is used as one of the chemicals in the definition of background indoor air *risk*, efforts to limit vapor intrusion risks to stringent levels are not an effective means to reduce the overall risk.

Even if background is evaluated on a chemical-by-chemical basis, the approach presently proposed in the Vapor Intrusion Guidance is both too simplistic and overly protective (in consideration of our previous discussion of costs and benefits). For chemicals such as benzene, indoor air background is complicated by many factors that render inadequate its characterization by a single distribution of measurements. There are distinct differences in indoor air concentrations of benzene in the homes of smokers and non-smokers, and within residences with attached and separate garages. In this case, there is an important risk management decision implicit in the Vapor Intrusion Guidance – that of whom should be protected, and to what degree of confidence.

It may be impractical to differentiate background indoor air quality based on consumer preferences (*e.g.*, smokers *vs.* non-smokers), but the choice of percentiles that determine acceptable background levels is an explicit risk management decision. As proposed in the Vapor Intrusion Guidance, the DOH defines typical indoor air background concentrations for a contaminant to be within 25th and 75th percentile values of a series of measurements taken in homes with no known vapor intrusion issues. By doing so, the DOH implies that the upper 25th percentile of the measurements represent levels above acceptable background. Put another way, one in every four homes might be expected to exceed the acceptable background level, *irrespective of vapor intrusion*. As such, indoor air measurements that seek to cases in which vapor intrusion is potentially significant will demand further investigation 25% of the time. At the very least, these cases will demand additional investigation to determine the source of the

[1] The crude risk (unadjusted for complicating factors) equals 21,000 deaths per year divided by the approximate U.S. population of 300,000,000 times 70 years.

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indoor air contamination (which in many cases can be expected to be related to indoor sources, and not to vapor intrusion), and may lead to unnecessary mitigation efforts.

The choice of using the 25th and 75th percentile values to define the background range also obscures some important aspects of the background data. For example, the table of background values in the draft Vapor Intrusion Guidance lists a background range from <0.25 μg/m^3 to <0.25 μg/m^3 for TCE in residences, *i.e.*, suggesting that TCE was not detected in the indoor air of homes. However, the underlying data set found that TCE was in fact detected in indoor air in 19% of the homes tested. Hence, despite the general tendencies of decreased use of TCE, it appears to remain present in some households (perhaps because of its presence in some consumer products), but this fact is not reflected in the proposed background definition.

Again, given our previous discussion of costs, we recommend that the DOH assign a broader range to acceptable percentile range used to define background conditions, and hence eliminate up front a higher degree of "false positives" in which background indoor air conditions may be mistakenly identified as potential vapor intrusion issues. As an example of a similar need to deal with this same issue, the Massachusetts Department of Environmental Protection (DEP), in constructing its GW2 groundwater standards based on the vapor intrusion pathway, assigns background concentrations at the 90th percentile of data distributions, thereby introducing hypothetical misidentification of background in only one of ten cases. We recommend that DOH expand its definition of background in a similar manner.

Risk-Based Concentrations

The proposed Vapor Intrusion Guidance assumes *a priori* that vapor intrusion is a potentially significant issue and demands the collection of data in essence to confirm or disprove this assumption. Given the difficulty of dismissing the significance of the pathway (potentially requiring extensive measurements), the assignment of stringent risk-based concentrations as target levels is yet another factor that will lead to costly investigations and mitigations. Again, questions should be asked from the standpoint of risk management. Given the benefits to be derived from an aggressive policy on the vapor intrusion pathway (which by our previous arguments are limited economic gains and small reductions in the overall risks of background indoor air quality), does it make sense to base target concentrations on overly conservative interpretations of toxicologic or epidemiologic data?

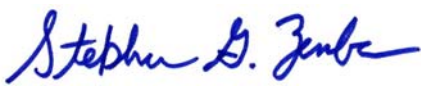
The implications of developing risk-based concentrations are especially apparent with respect to trichloroethylene (TCE), for which the DOH has established a target risk-based concentration of 5 μg/m^3. The rationale for assigning this low value – barely detectable by current methods – stems from a recent *draft* health assessment document in which the U.S. EPA has presumed that

TCE is a potent carcinogen with no safe level of exposure. This presumption is not supported by the evidence, and has not been finalized or otherwise made part of U.S. EPA health risk assessment policy (as evidenced, for example, by the fact that the "Carcinogenicity Assessment" section of U.S. EPA's Integrated Risk Information System (IRIS) entry for TCE was withdrawn in July 1989, and has yet to be replaced. Consequently, we do not feel the scientific evidence justifies the regulation of TCE at the 5 $\mu g/m^3$ proposed by the DOH, especially when viewed in the context of other uncertainties associated with the vapor intrusion pathway.

In summary, the approach proposed in the Vapor Intrusion Guidance implies an aggressive approach toward investigating and mitigating potential risks to human health Due to the risk management decisions embodied in the Vapor Intrusion Guidance, actual risks to human health will be overpredicted, and considerable resources will be devoted toward reducing risk levels that will have little public health benefit. While we endorse the pursuit of cases in which vapor intrusion is likely to be of significant consequence, we suggest that the Vapor Intrusion Guidance be modified to focus on a smaller number of sites, in part by making changes in the approaches to interpreting background and toxicological data suggested above.

Thank you for your consideration of our comments.

Sincerely,



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