

Vapor Intrusion: Regulators Concerned About Potentially Volatile Situation

According to popular legend, Abraham Lincoln's director of the Patent Office recommended closing the office on the grounds that "nothing was left to be invented." Whether that's true or not, one might think that the environmental area should be relatively stable because "nothing is left to be regulated."

Such is not the case — there is a new, emerging environmental concern euphemistically referred to as "vapor intrusion" or "VI" that should be considered by many property owners. The concept behind the concern is quite simple and has been known for decades: under certain circumstances, gases from the soil or groundwater can migrate through the soil and penetrate into nearby buildings. Radon infiltration, for example, has been an identified concern in residential buildings since 1984. Infiltration from underground storage tanks, even to the extent of creating potentially explosive conditions, has also been a known concern for years.

The current concern though, began with a series of well-publicized incidents, mostly in Colorado and involving chlorinated solvents, where potentially high-risk concentrations of those substances were detected in the indoor air in homes above a contaminated groundwater plume. The trepidation arose when those reports combined with three other current environmental trends: risk-based cleanup criteria; the development of mathematical models to calculate potential indoor air concentrations; and "brownfield" reuse and redevelopment activities that were putting structures on top of sites where some contamination remained in place.

As a result, vapor intrusion has become a red-hot topic among regulators. At least a dozen conferences or workgroups have been conducted on the topic, and according to a recent report thirty-nine of forty-three states surveyed said that vapor intrusion is a "current concern" and is "being addressed." On top of this, EPA recently promulgated a draft guidance document that, if issued in current form, will markedly change the federal approach to vapor intrusion issues.

Scientific Background

The general scientific concepts underlying the current focus on vapor intrusion are not complicated: volatile constituents from soil or groundwater contamination migrate upward through the vadose zone and eventually infiltrate into basements, crawl spaces, or even structures themselves, usually through porous building materials, cracks in foundations, or utility entrances. Then, depending on ventilation rates within the structure, these contaminants can accumulate, sometimes to levels that pose a threat to human health.

Various models exist to predict the resulting indoor air concentrations based on concentrations in underlying groundwater or soil gases. The most common of these models is the "Johnson-Ettinger"

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model, but all of them are highly dependent on site specific data about the conductivity of the soil to gas movement, the amount of biological degradation that occurs, and the infiltration rate to the overlying structures.

To overcome the need for such highly particular site-specific data, regulatory agencies are taking one of two common approaches. One is to establish default screening values for groundwater, or less commonly, soil gas, below which it is assumed that vapor intrusion will not be an issue. As one might expect, there is a wide variation in these screening levels. For example, the vapor intrusion screening level for benzene concentrations in groundwater ranges from 14 ug/L to 5600 ug/L, depending on the state.

The other approach, which yields a similar endpoint, is to establish default "attenuation factors." These are the presumed reduction in concentration between the medium and the indoor air. Such attenuation factors range from 1/10 to 1/1000, depending on the point of measurement and the disposition of the regulatory agency. In other words, a soil gas concentration 1 mg/m³ would be presumed to result in an indoor air concentration of 0.1 to 0.001 mg/m³, again depending on the jurisdiction. (Using the default attenuation factor for groundwater would start with the groundwater concentration multiplied by the Henry's coefficient to calculate the equilibrium soil gas concentration, and then proceed as above.)

The problem with either the screening values or the default attenuation factors is that they all embody highly conservative assumptions. Using the models is not likely to be any better since, absent a wide range of usually unknown and unknowable site specific parameters, the default inputs to the model are equally conservative. Nevertheless, there is no widespread agreement as to whether the models over-predict or under-predict actual indoor air concentrations. The most often heard suggestion in this respect is that the predicted indoor air concentrations may be high for VOCs and low for chlorinated compounds, but that conclusion has not yet been widely validated.

Unfortunately, actual measurements do not easily solve the problem either. Measuring indoor air concentrations is fraught with confounding problems, including ambient air interferences, the presence of multiple alternative indoor sources, a high degree of day-to-day variability, and the lack of established protocols. Measurement of soil gas levels seems to be the preferred alternative, although it too suffers from a number of disadvantages, and still requires one to use the potentially conservative attenuation factors.

Three-Step Process for Addressing Vapor Intrusion Concerns

So what should interested parties be doing? We have generally recommended that our clients follow the three-step process outlined below. Before addressing that process, though, it is worthwhile to remember that the matters discussed below are likely to involve issues of potential regulatory or tort liability. Therefore, especially if there appear to be significant concerns, it may be desirable to use outside counsel to establish protections under the attorney work-product doctrine.

1. **Does the property present the potential for vapor intrusion?** Anyone who owns property with significant levels of contamination in soil or groundwater under or near structures, especially residential structures, is a candidate for focused consideration as to whether the emerging vapor intrusion issue is a potential concern. Such properties may have threshold-level contamination because of unremediated contamination already on the premises, because of impacts migrating from adjoining property, or even because of residual levels remaining from a prior cleanup. In any such case, we recommend that the owner seek legal advice on how to proceed.
2. **If the property presents a potential vapor intrusion concern, determine if the concern is real.** For obvious reasons, this step is one that must be undertaken carefully. Asking, for example, if I've been accumulating hazardous concentrations of toxic constituents in my tenants' living spaces is a question that one might understandably be reluctant to ask. For both legal and moral reasons, however, if the inquiry has to be made, there's nothing to be gained, and much to be lost, by ignoring the question. The good news is that in the overwhelming majority of

instances, it appears that there will not be an actual risk and the matter can safely be put to rest. And for more good news, even if there is an actual risk, the corrective measures (such as sealing basement walls, closing gaps in utility entrances, even placing impermeable barriers) are relatively easy and inexpensive.

3. **Be sophisticated in the legal and technical resources employed in the inquiry.** Vapor intrusion is an emerging issue, with little in the way of established methods for risk evaluation or technical assessment. The liability issues are substantial, both in terms of regulatory compliance and potential toxic tort actions. There are relatively few experts in the area.

In many ways, the emerging concern over vapor intrusion may prove to be much ado about nothing. Except in relatively rare cases (such as high levels of chlorinated organics located in close proximity to residential structures), it is likely that most sites either have no actual vapor intrusion problems or the problems can be easily addressed. En route to that hopefully cheery end-point, though, property owners should be prepared for some trouble and expense in ruling out the problem, dealing with regulatory agencies, or assuring anxious occupants.

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