EMERGING SAMPLING STRATEGIES

While most vapor intrusion investigations still use conventional approaches, new research is providing a steady stream of innovative tools. These are some of the emerging methods being employed to distinguish vapor intrusion from indoor sources.

Building Pressure Control

Building Pressure Control is a method of simulating worst-case and best-case situations. Fans are used to pressurize and depressurize buildings. Sampling conducted when buildings are depressurized should represent worst-case atmospheric conditions. If vapors are not found inside at this time, then vapor intrusion is unlikely. If vapors are found indoors when buildings are pressurized to resist vapor intrusion, then indoor sources are suspect. This approach is promising, but it has not yet been widely employed. Conceivably changes in air exchange rates could weaken its accuracy.

Similarly, in buildings with centralized heating, ventilation, and air conditioning (HVAC) systems, indoor air sampling may be conducted with the system on and the system off. With HVAC running, the building is pressurized and the make-up of air among the rooms tends to be the same. With HVAC off, vapor intrusion is more likely, and there is more likely to be variation among multiple rooms or even portions of large rooms.

Real/Near-Real-Time Sampling

In this approach, sampling equipment such as EPA's TAGA bus (Trace Atmospheric Gas Analyzer), gas chromatograph/mass spectrometers such as the Hapsite®, and Electronic Capture Detectors (ECD) are capable of taking multiple samples every hour, with detection limits low enough to meet the needs of vapor intrusion investigations. With such devices it is possible to home in on indoor sources as well as to identify pathways from the subsurface, such as holes in walls and floors.

Such equipment is expensive, but the cost per sample may be reduced because many samples are taken and multiple locations are tested. Real-time samplers can be deployed remotely, using the Internet or wireless technology to report their results to a location where they can be analyzed. The TAGA and ECD can sample for a small number of analytes at once, but by the time they are brought in to most sites the compounds posing the greatest threat—thus the priority analytes—are known.

Smaller, less expensive continuous monitoring devices are under development, but it may still take some time before such equipment is on the market.

Isotope Analysis

Isotopes are forms of elements with specific atomic weights. For example, most carbon atoms have 12 neutrons, thus an atomic mass (weight) of 12. Some, however, have 13 or even 14 neutrons. Because the bond between carbon-12 and chlorine is easier to break than the bond between carbon-13 and chlorine, chlorinated hydrocarbons such as PCE or TCE where biodegradation has taken place have a greater proportion of carbon-13 than the original products. Just as paleontologists use carbon-14 fractions to date ancient fossils, vapor-intrusion investigators can use carbon-13 fractions to distinguish degraded compounds rising from the subsurface from same compounds released from "pristine" household products.

Mass Flux

Mass flux is the rate of mass flow per unit area. In vapor intrusion investigations, it refers to the quantity of vapors that may rise into a building divided by the area of the structure's footprint. Many scientists believe that mass flow monitoring is a useful tool both to overcome the variation in conventional sampling results over time and space and to estimate the contribution of indoor sources of toxic vapors compared to those rising from below.

At the simplest level, investigators calculate the mass of subsurface contamination from measured concentrations in bulk soil samples. From those estimates, they determine the upper bound in the flux of each contaminant into the building. If indoor concentrations are above what that flux can generate, then there are indoor sources.

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