Hello, this is Kevin O'Donovan, and I'd like to welcome you to the National Institute of Environmental Health Sciences Superfund Research Program monthly Research Brief podcast.

This month, we're discussing the use of field data and numerical modeling to assess vapor intrusion risk.

The Research Brief, Number 257, was released on May 4, 2016, and was written by SRP contractor Sara Mishamandani in conjunction with SRP-supported researcher Kelly Pennell.

A recent Superfund Research Program study reveals that measurements of chemical concentrations in groundwater may not be a good indicator of whether the chemicals are seeping into buildings and contaminating indoor air. The findings provide insight into how an approach incorporating multiple lines of evidence, including soil gas measurements and a 3-D model, can be used to better evaluate exposure risks from vapor intrusion into homes and buildings.

Vapor intrusion involves the movement of contaminants from beneath a home or a business up into the air inside the building. The vapor source is typically contaminated groundwater and often contains concentrations of chlorinated solvents, such as tetrachloroethylene and trichloroethylene. Because of the complexities associated with characterizing vapor intrusion, the U.S. Environmental Protection Agency recommends that decisions about vapor intrusion risks be based on a multiple-lines-of-evidence approach that incorporates data from various sources, such as field data, modeling, and other pertinent site information.

To gain a better understanding of how multiple lines of evidence can inform vapor intrusion risk assessments, researchers led by Dr. Kelly Pennell from the University of Kentucky SRP Center collected field data throughout a neighborhood that was located near a contaminated groundwater plume. Researchers from the Boston University SRP Center and the Brown University SRP Center also were involved in this collaborative study.

The field study included homes in a Metro Boston neighborhood adjacent to a former chemical handling facility, which operated between 1955 and 2002. During that time, the soil and groundwater became contaminated with chlorinated solvents, with tetrachloroethylene being the predominant chemical. As part of regulatory-driven sampling that had been previously conducted at the site, the indoor air concentrations measured in homes did not support the common vapor intrusion conceptual model used by practitioners. Researchers sought to better characterize the vapor intrusion pathways and investigate reasons for discrepancies between the conceptual vapor intrusion model and field observations.

The researchers evaluated groundwater and indoor air concentrations previously measured as part of regulatory activities at the site. They then collected and evaluated five new rounds of field sampling data collected over one year. The field data, which included soil gas concentrations measured in the subslab (underneath building foundations) and adjacent to buildings (collected in yards and driveways), groundwater concentrations, indoor air concentrations, along with soil geological properties, were evaluated as multiple lines of evidence.

The researchers collected these field data measurements using regulatory-relevant sampling approaches so that the results of their study had real-world relevance. Then, using a 3-D vapor intrusion modeling approach previously developed by the research team, they calculated the effect of various site-specific features on the vapor intrusion process. The 3-D model provides information about the soil gas concentrations throughout the subsurface, making it useful for interpreting data collected during vapor intrusion investigations. The results of this study highlight the value of using physical models in combination with field data as part of the multiple-lines-of-evidence approach to improve decisions made at vapor intrusion sites.

When using the multiple-lines-of-evidence approach, the researchers found that the soil gas concentrations at the vapor intrusion sites were much lower than expected compared to the classic conceptual model. Field data results showed a steep gradient in soil gas concentrations near the groundwater surface. However, as the depth decreased, soil gas concentration gradients also decreased. The researchers discovered tetrachloroethylene transport was limited by a subsurface feature that was located deeper than 7 feet below the ground. While the collected data could not describe the exact nature of this feature that limited tetrachloroethylene transport, the model did provide evidence that it was significantly altering soil gas concentration profiles, and they hypothesize that soil moisture played an important role.

Vapor intrusion can occur in large communities where hundreds of homes are affected. This study shows that relying only on groundwater concentrations to assess vapor intrusion exposure is not appropriate. It also provides novel insights about comparisons between data collected using common field sampling techniques and well-established vapor intrusion models. It also shows how incorporating physical models with soil gas concentration data can inform classic conceptual models and improve risk management decisions. As a result, these findings are timely and relevant to researchers, practitioners, and regulatory agency staff addressing vapor intrusion.

If you'd like to learn more about this research, visit the Superfund Research Program website at www.niehs.nih.gov/srp. From there, click on "Who We Fund" and follow the links to the University of Kentucky research summary. If you have any questions or comments about this month's podcast or if you have ideas for future podcasts, contact Maureen Avakian at avakian@niehs.nih.gov.

Join us next month as we discuss more exciting research and technology developments from the Superfund Research Program.