A systematic approach will help you evaluate whether mitigation efforts are needed.

Is Vapor Intrusion Threatening Your Site?

By Thomas Dong

According to the U.S. Environmental Protection Agency, more than 374,000 sites nationwide may need to demonstrate to regulatory agencies that vapor intrusion does not pose a significant risk to human health. Common sites include dry cleaners, gas stations, and other properties owned/occupied by industries, municipalities, utilities, federal agencies, developers, and private owners.

The good news is that, with proper planning and appropriate technical guidance, vapor intrusion at these sites can be successfully mitigated. Consequently, many property owners have had to make two key determinations: 1) Whether vapor intrusion is an issue at their sites; and 2) Which steps should be taken to mitigate problems to ensure site safety for the environment and for current and future users.

HOW DANGEROUS IS IT?

Vapor intrusion occurs when volatile organic compounds (VOCs) in soil or contaminated groundwater volatilize, or emit vapors, and migrate through subsurface soil and into air spaces of overlying buildings. These vapors constitute a potential threat of exposure through inhalation for occupants of affected buildings.

Examples of VOCs include petroleum products, such as gasoline, and solvents used for dry cleaning and industrial processes. Vapor intrusion can involve petroleum spilled or leaked from underground storage tanks at gas stations. Unfortunately, in some cases, chemical and petroleum releases are not discovered until after contamination has migrated through the soil.

Health effects from chemical exposure vary based on individual constitution and chemicals involved. When airborne chemicals accumulate indoors, some people experience eye and respiratory irritation, headache, or nausea. In extreme cases, VOCs can amass in dwellings or occupied buildings to levels that may pose near-term safety hazards or acute health effects. Health officials are concerned about low-level

A membrane liner is being installed as a vapor intrusion mitigation mechanism beneath the foundation at a construction site.

Brownfields may require remediation prior to their use. By installing a membrane liner, the owner can help eliminate some noxious odors or other seepage.

chemical exposure over many years, as this may raise a person's lifetime risk for developing cancer.

EVALUATION

The potential for vapor intrusion generally can be assessed by collecting soil gas or groundwater samples inside or beneath buildings. Because indoor air quality changes from day to day, one round of sampling may not reveal a problem. Collecting a number of indoor air samples over a specified period may prove helpful.

A systematic approach is recommended for evaluating the potential risk of vapor intrusion at a particular site and, if required, programs to mitigate exposure should be developed. Several common strategies include:

1. Site screening and modeling. One or more sites are screened for the potential to cause vapor intrusion. This either eliminates unnecessary testing or prioritizes action at sites where a potential for contamination may exist.

2. Pathway and plume evaluation. When site screening indicates a potential for vapor intrusion, subsequent field investigations are necessary. Identifying and analyzing a site's vapor intrusion pathway—the route of migration from subsurface to interior space—can help owners and operators evaluate whether vapor intrusion is an issue at their site.

3. Soil vapor samples. Since a variety of VOC sources may be present at some sites, testing will not necessarily confirm that VOCs in indoor air derive from contamination in nearby soils. Instead, soil vapor samples may be taken from beneath a building's foundation (called subslab samples) to see if vapors have reached the building.

4. Source identification. Great care must be exercised when conducting indoor air tests to ensure that miscellaneous background sources are properly considered.

PROACTIVE SOLUTIONS

The most common mitigation system is a flexible membrane liner installed beneath the foundation of a building, and combined in some cases with a passive venting system to allow vapor build-up to be evacuated. If properly installed, a membrane liner can mitigate the effects of vapor intrusion and reduce indoor air action levels.

Potential costs and liabilities associated with vapor intrusion impacts can be high. Being proactive allows site owners and operators to remain in control of the process from the beginning, thereby saving time and money. The benefits of a proactive approach include: development of defensible technical arguments, reduction of liability and risk, and smoother real estate transfers. A seasoned environmental consultant specializing in vapor intrusion issues can help walk owners through the steps necessary to achieve these benefits.

EPA GUIDANCE

Vapor intrusion is a rapidly developing field of science and policy. The EPA's Office of Solid Waste and Emergency Response has issued a draft guidance document (Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils) that provides current technical and policy recommendations on determining if a vapor intrusion pathway poses an unacceptable risk to human health at cleanup sites. This guidance document:

- Replaces the December 2001 Resource Conservation and Recovery Act (RCRA) document of the same name
- Does not supersede state guidance
- Is suggested where structures are within 100 feet of contaminated soil/groundwater
- Consists of a step-by-step evaluation process
- Contains multiple "no further action" decision points within the process
- Incorporates modeling and other indirect forms of evaluation into the process.

According to the EPA, this guidance document is not intended to provide recommendations for delineating the extent of risk or eliminating risk. It is suggested for use at RCRA Corrective Action sites, National Priorities List and Superfund Alternative sites, and brownfield sites, but is not recommended for use at Subtitle I Underground Storage Tank sites at this time. For more information, visit www.epa.gov/correctiveaction/eis/vapor.htm. **PW**

—Dong is director of environmental services for the Long Beach, Calif., office of SCS Engineers.