This document references Chapters and Sections from the ITRC Vapor Intrusion Technical and Regulatory Guidance, and Fact Sheets and Technology Information Sheets from the ITRC Vapor Intrusion Toolkit, published January 2026. These resources can be accessed at: https://itrcweb.org/vapor-intrusion-toolkit.

# PREFERENTIAL PATHWAY SEALING AND AD HOC VENTILATION TECHNOLOGY INFORMATION SHEET

*Applicability as a method of vapor intrusion rapid response*

## Overview

With respect to vapor intrusion (VI), a preferential pathway is a pathway that intersects both the vapor source and the building foundation and provides an increased flow of vapors that is more than what is expected under typical conditions (i.e., typical vapor transport through vadose zone soils). The term preferential pathway, however, is broad and makes it difficult to focus on specific features that are more likely to enhance VI into a building relative to migration through soil matrix or migration through normal, common vapor entry points, and transport pathways. The **Vapor Intrusion Preferential Pathways Fact Sheet** provides terminology to describe a conduit VI preferential pathway (conduit VIPP) and a vertical VI preferential pathway (vertical VIPP) and to describe how these features are different from standard vapor entry points or vapor transport pathways. The influence of VIPPs should be considered when evaluating the sealing of preferential pathways.

Advective flow through cracks and other openings is often the dominant VI transport mechanism, and diffusion through a concrete slab is typically a minor component of the flux of vapors into a building. If advection is the dominant VI mechanism, sealing preferential pathways can be effective for mitigating VI. Sealing preferential pathways should be implemented for all VI mitigation strategies, even when advective flow is not the dominant mechanism. Ad hoc ventilation can be another effective approach to mitigating VI. Ad hoc ventilation, which includes opening windows, doors, etc., can increase the fresh air exchange rate for a building, thereby diluting vapors as they enter a building. Sealing preferential pathways and ad hoc ventilation can often be implemented within hours to days, do not require special skills, and can be completed with readily available materials. Sealing preferential pathways and ad hoc ventilation represent a low-cost, high-return approach for mitigating VI and can typically be completed at a lower cost relative to other rapid-response measures. Keep in mind, these rapid responses are typically not sufficient as a long-term means of vapor control on their own.

## Components

This technology information sheet addresses the following:

- Sealing of cracks in floors and foundation walls, drains, conduit entry points, plumbing fixtures, etc.
- Ventilation of the area by opening doors or windows or by activating existing ventilation systems

Floor cracks or other openings, including electrical and plumbing conduits and floor drains, can be potential VI pathways. Such pathways should be identified and sealed where they are readily accessible. A variety of caulks and sealants can be used. Care should be taken to select caulks and sealants that do not contain contaminants of concern (a subset of vapor-forming compounds [VFCs] that are relevant to the site).

For better sealant support, cracks and conduit openings larger than ½ inch should be filled with a foam backer or other compatible material prior to the application of the sealant.

Sumps can be fitted with vapor-tight lids or sealed around the lid, and any piping and electrical penetrations can be sealed using a nonpermanent caulk such as silicone. Loose toilets can be re-seated with new wax rings and sealed around the base. It is also important to ensure that all plumbing traps contain an adequate amount of water to prevent sewer gas. Another maintenance tip is to put a small amount of vegetable oil in floor drains to help minimize evaporation if the floor drain is not expected to be used for long periods of time. However, note that sewer gas can be a carrier for VFCs due simply to breaks in sewer lines. Also note that utility contractors (plumbing, electrical, etc.) routinely use hollow or "chase" piping to support utilities prior to slab pours; these should be sealed if found.

In older buildings, abandoned piping can be common, and these potential vapor pathways should be cut and capped if possible. This includes water, sewer, electrical, or gas lines that are no longer in use. Underground tanks used for storage of heating fuel and all associated piping should be properly removed if no longer in use.

More generally, sealing cracks in the foundation and around utility penetrations, particularly in basement areas, should contribute to reductions in advective flow of soil vapor into the building. Sealing potential VI pathways is also part of an effective long-term VI mitigation approach.

Asking building occupants and/or their property managers to temporarily increase ventilation in occupied spaces can also be used as a rapid response measure (see the **Heating, Ventilation, and Air Conditioning Modification Technology Information Sheet).** This includes two categories:

- The first category includes the changes that can be made immediately and easily and do not require special skills or training, such as opening a building's doors and windows or using ventilation fans to bring fresh air into the building. Operation of exhaust fans should be avoided as they will depressurize the building and may exacerbate VI.
- The second category includes adjusting a building's heating, ventilation, and air conditioning (HVAC) system to increase the fresh air intake and requires some knowledge of building HVAC operations and special skills or training. Ventilation may allow occupants to stay in their building until confirmation sample results confirm ventilation efficacy. Adjusting a building's HVAC system may also be an effective long-term mitigation strategy (see **Heating, Ventilation, and Air Conditioning Modification Technology Information Sheet**).

Opening lower floor windows and opening windows on opposite sides of the building can create cross breezes that can also increase ventilation. Care should be taken when opening upper floor windows as this can potentially increase the rate of soil vapor entry due to stack effects. The stack effect is the process in which warm air rises, causing negative pressure on a building interior applied to the surface of the floor slab, resulting in a pressure differential that can exacerbate VI (USEPA 2008). Another item to keep in mind is that ventilation fans such as bathroom and kitchen fans typically only draw air out, thus potentially increasing the possibility of VI. An understanding of air exchange rates as well as an understanding of soil vapor entry rate and location is beneficial. Consideration should also be given to potential issues with humidity, mold, and combustion appliance exhaust that could arise from ad hoc ventilation.

# Advantages

The most important advantage associated with preferential pathway sealing and ad hoc ventilation is that it can be done quickly and relatively easily. Preferential pathway sealing can reduce soil vapor entry rates relatively inexpensively and should be part of all VI mitigation approaches. Preferential pathway sealing can also improve the efficacy of ventilation inside the building. In many cases, it can be accomplished with little to no interference to the building occupants, and simple plumbing upgrades can be done without a licensed plumber. The sealing of potential VI pathways will also be part of an effective long-term mitigation approach. It can also be beneficial for other non-VI building issues, such as moisture control.

## Limitations

Several limitations are associated with preferential pathway sealing and ad hoc ventilation and are summarized below:

- Preferential pathway sealing and ad hoc ventilation do not address the vapor source.
- Some sealants may contain per- and polyfluoroalkyl (PFAS) substances and other VFCs and therefore complicate data interpretation associated with future indoor air sampling.
- Some floor cracks or conduit entries may be inaccessible for sealing.
- Crack sealing may not be feasible for extremely deteriorated floors.
- Cracks may not be visible due to floor coverings such as carpet or laminate flooring.
- Ventilation (opening windows or doors) may leave occupants susceptible to undesirable outdoor conditions, including temperature extremes and biological threats.
- Ad hoc ventilation may be susceptible to human interference or create security concerns.
- Neither preferential pathway sealing nor ad hoc ventilation may be sufficient on its own to achieve short- or long-term indoor air action levels.
- Ad hoc ventilation generally is most applicable as a rapid response and is not a long-term solution to VI.
- Overall performance is subject to uncertainty. Follow-up verification testing and performance monitoring are recommended, along with the collection of multiple lines of evidence demonstrating effectiveness, although this is rarely required during rapid-response activities unless very high soil vapor or indoor air concentrations were initially observed.
- Ventilation may not be practical or cost effective in very hot or very cold conditions since existing heating and cooling systems may not be sufficient to maintain acceptable indoor temperatures during ventilation and there may be a significant cost associated with additional required heating or cooling.

## Cost Considerations

Preferential pathway sealing and ad hoc ventilation are typically inexpensive methods of mitigating VI issues. Note that preferential pathway sealing is a necessary component of all VI mitigation strategies, and ad hoc ventilation is typically used in addition to other rapid response strategies. Various types of caulking and other expandable sealant products and individual plumbing parts are typically available at most hardware stores. Additional plumbing materials and accessories such as wax rings for toilets and piping are typically inexpensive.

Although most individual components involved in crack and conduit sealing are relatively inexpensive, total costs for a significant crack and conduit sealing effort coupled with major plumbing upgrades can be significant.

The costs and sustainability of ad hoc ventilation should be considered and could vary substantially over time depending on climatic conditions.

## Special Circumstances

Potentially explosive, oxygen deficient, or other extremely hazardous environments constitute emergency situations that should be evaluated by trained professionals (i.e., fire department) prior to rapid-response activities to mitigate VI. Evacuation and temporary relocation may be necessary.

Some crawl spaces, pits, shafts, or sumps may be considered confined spaces and may require special permission, training, and equipment to enter. These areas may also need to be adequately ventilated with a blower or fan prior to entry. Federal, state, and local rules or regulations, as well as individual facility-specific rules pertaining to confined spaces, should be consulted.

## Occupant, Community, and Stakeholder Considerations

It is essential to develop and implement a site-specific community involvement plan that addresses how to win trust and gain access to properties, communicate risk to potentially exposed individuals, and minimize the disruption of people’s lives and businesses. For more details, see **Chapter 3: Community Engagement**.

# REFERENCES

USEPA. 2008. *Indoor Air Vapor Intrusion Mitigation Approaches*. U.S. Environmental Protection Agency Office of Brownfields and Land Revitalization. **https://www.epa.gov/sites/production/files/2015-09/documents/ic_ec_cost_tool.pdf**.