ITRC Technology Information Sheet

Vapor Intrusion Mitigation Team | December 2020

Preferential Pathway Sealing and Ad Hoc Ventilation Rapid Responses

ITRC has developed a series of technology information sheets that summarize building mitigation technologies related to vapor intrusion. The purpose of this technology information sheet is to describe approaches that can often be used preliminarily to mitigate the vapor intrusion pathway and require little to no specialized training. This sheet provides general applicability and considerations, typical configurations, advantages and limitations, and cost considerations.

Overview

Advective flow through cracks and other openings can be the dominant mechanism of vapor intrusion, and diffusion through a concrete slab is a minor component of the flux of vapors into a building. If advection is the dominant vapor intrusion mechanism, sealing preferential pathways can be effective for mitigating vapor intrusion. 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 vapor intrusion. 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 vapor intrusion and can typically be completed at low cost relative to other rapid response. Keep in mind, these rapid responses are intended to be just that, and 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 constitute potential vapor intrusion pathways. Such pathways should be identified and sealed whenever they are readily accessible. A variety of caulks and sealants can be used. 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 also 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 VOCs 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 generally contribute to reductions in advective flow of soil gas into the building. Sealing potential vapor intrusion pathways should therefore be part of an effective long-term vapor intrusion mitigation approach.

Temporarily requesting building occupants and/or their property managers to increase ventilation in occupied spaces can also be used as a rapid response measure (see ***HVAC Modification Technology Information Sheet***). This includes two categories:

- The first category includes those changes that can be made immediately, easily, and do not require special skills or training, such as opening a building's doors and windows or turning on existing ventilation fans that bring fresh air into the building.
- The second category includes adjusting a building's 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 ***HVAC 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. 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 and underneath the foundation. 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

There are several limitations associated with preferential pathway sealing and ad hoc ventilation, which can be summarized as follows:

- Preferential pathway sealing and ad hoc ventilation do not address the vapor source.
- Some sealants may contain VOCs and therefore complicate 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.
- Overall performance is subject to uncertainty. Follow-up verification testing and performance monitoring are recommended along with the collection of other lines of evidence demonstrating effectiveness, although this is rarely required during rapid response activities unless very high soil gas or indoor air concentrations were initially observed.

Cost Considerations

Preferential pathway sealing and ad hoc ventilation are typically inexpensive methods of mitigating vapor 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 for less than $10 each. New toilets or sump systems can be more expensive, ranging from $50 to a few hundred dollars. Additional plumbing materials and accessories such as wax rings and piping are typically inexpensive.

While most individual components involved in crack and conduit sealing are relatively inexpensive, total costs for a significant crack and conduit sealing coupled with major plumbing upgrades can be in the thousands of dollars.

The costs and sustainability of ad hoc ventilation are typically limited to any increase in building heating or cooling costs that may result from high fresh air exchange.

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 vapor intrusion. Evacuation and temporary relocation may be necessary.

Some crawlspaces, 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, among other things, 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 ITRC's ***Public Outreach during Vapor Intrusion Mitigation Fact Sheet***.

Resources

- American Association of Radon Scientists and Technologists (AARST). *Soil Gas Control Systems in New Construction of Buildings*, AARST/ANSI Standard CC-1000, Hendersonville, NC, 2018
- Interstate Technology Regulatory Council (ITRC), Vapor Intrusion Pathway: A Practical Guideline, Washington, D.C., January 2007.
- Interstate Technology Regulatory Council (ITRC), Petroleum Vapor Intrusion, Fundamentals of Screening, Investigation, and Management, October 2014.
- United States Environmental Protection Agency (EPA*), Engineering Issue: Indoor Air Vapor Intrusion Mitigation Approaches*, USEPA, Washington DC, 2008
- Washington State Department of Ecology Toxics Cleanup Program. *Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*. Publication no. 09-09-047. February 2016.

Related Links:

For more information and useful links about ISM technologies, go to http://www.itrcweb.org/.

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