RAPID RESPONSE AND VENTILATION FOR VAPOR INTRUSION FACT SHEET

Rapid response is an interim vapor intrusion (VI) mitigation approach that may be appropriate, under certain conditions (e.g., high contaminant concentrations and sensitive populations present), prior to implementing a long-term mitigation strategy for an occupied room or building. For the purposes of this fact sheet, a rapid response is one that could be easily implemented and verified on a timescale of days to weeks, whereas a long-term mitigation strategy typically takes longer to design and implement but is more effective, practicable, and often more cost-effective to operate over a long period of time. Some technologies or mitigation methods characterized in this fact sheet as rapid may also be suitable as long-term mitigation strategies. A rapid response may be implemented prior to developing a complete VI conceptual site model. Acceptable rapid response methods can vary based on site location and building use; however, a good understanding of building occupant demographics and building use is helpful to evaluate the need and type of rapid response. For cases where vapor-forming chemicals (VFCs) are detected in indoor air at concentrations exceeding short-term exposure criteria, and there is evidence, within reason, for these VFCs to be attributable to VI and not to sources within the building, a rapid response may be required (Beringer 2017). Rapid-response actions can include administrative controls, such as relocating occupants and eliminating occupant access to the building, or engineering controls that reduce chemical vapor exposure through building ventilation or indoor air treatment or by physically preventing vapor entry into the building.

The requirement for a rapid response can vary significantly from state to state and among regulatory programs or health agencies. The criteria that may trigger the need for a rapid response and the time frame that qualifies a response as rapid also vary among jurisdictions. This fact sheet presents approaches and methods that should be considered when a rapid response has been deemed necessary.

The scope of this fact sheet is limited to scenarios where there may be an acute risk to human health from VFC exposure resulting from VI and does not include emergency situations (i.e., “call 911” situations) where, for example, combustible, explosive, or oxygen-deficient conditions may exist inside a building. If these conditions are believed to be present, the building should be evacuated and first responders should be contacted immediately.

Administrative Controls

Administrative controls are those that use policy, procedures, and/or directives intended to reduce or eliminate human exposure to the VI risk. For example, this could consist of relocating occupants or eliminating occupant access to the building.

Temporary Relocation

Temporary relocation of a building’s occupants eliminates receptor exposure to the VI-contaminated indoor air. This rapid response action typically includes a high level of public communication (see also **Chapter 3: Community Engagement**); engagement with government agencies with statutory authority to evacuate an occupied building, including private property owners; and coordination and assistance with temporary accommodations until additional interim or final mitigation measures result in improvement to indoor air quality. In some cases, an occupant may decide to temporarily relocate based on personal risk tolerance regardless of whether relocation is being mandated by a regulatory body or by a property manager (in the case of residential rental properties or commercial/industrial properties). Temporary relocation may not be required for an entire building or building population—for example, temporary workers or infrequent building users. Higher VFC concentrations can pose greater risk to sensitive populations; therefore, consideration should be given to limiting access to certain portions of the building where VI is occurring or temporarily relocating sensitive populations.

Benefits of temporary relocation include the following:

- Can be implemented very quickly
- Can be implemented irrespective of building construction or use
- Immediately eliminates building occupant exposure

Limitations and requirements of temporary relocation include the following:

- Significant building occupant disruption and potential economic hardship for commercial or industrial building owners
- Building occupant communication and coordination is necessary
- Does not address the source of VI
- Typically not accepted as a long-term mitigation strategy
- Requires some form of enforcement and confirmation mechanism
- May require relocating pets, which can limit relocation options and/or increase relocation costs

Temporary relocation often includes weighing the risk of adverse acute health effects with the risks that come with the significant disruption that temporary relocation causes. In many instances, simple measures (such as opening windows and using fans to ventilate the space) may suffice in the short term. If possible, the decision to temporarily relocate should rest with the individual after they are informed of the risks. The decision to evacuate a building should consider the concerns of individuals, if present, but ultimately it is the regulator’s responsibility to protect health and safety.

Engineering Controls

Engineering controls include methods or strategies that involve using technology or making physical changes to the building or building systems to reduce concentrations of VFCs to acceptable levels or as low as practicable if still above acceptable long-term levels. Engineering controls that could be part of a long-term mitigation strategy (e.g., a sub-slab depressurization system) are addressed in the **Active Vapor Intrusion Mitigation Systems Fact Sheet** and **Passive Vapor Intrusion Mitigation Systems Fact Sheet**.

Engineering controls listed in this section offer benefits, including the following:

- Reduction or elimination of building occupant exposure
- Ability to be incorporated into or provide benefit for long-term mitigation strategy

These controls have the following limitations or requirements:

- Building occupant communication and coordination is necessary
- These controls do not remediate the source of VI
- Mild to moderate disruption for building occupants

Ad Hoc Ventilation

Ad hoc ventilation can often be done immediately and easily and does not require special skills or training. Opening a building's doors and windows or placing portable fans oriented to doors and windows to direct air out of a building are examples of ad hoc ventilation. This type of rapid response is typically short-lived or significantly limited in areas and times of year when climate control is required for building occupancy. Consideration should be given to how ad hoc ventilation may change heating, ventilation, and air conditioning (HVAC) system operation, potentially exacerbating VI in other areas of the building. Consideration should also be given to potential issues with humidity, mold, and combustion appliance exhaust that could arise from ad hoc ventilation. See the **Preferential Pathway Sealing and Ad Hoc Ventilation Technology Information Sheet** for additional information.

Indoor Air Treatment

Temporarily placing indoor air purification units (APUs) in occupied spaces to filter VFCs in indoor air is also an option that may allow an occupant to stay in their space while a long-term mitigation strategy is put in place (Schumacher et al. 2017; USEPA 2018a; 2018b). Several APUs available on the market have demonstrated the ability to remove VFCs from indoor air using technologies such as carbon adsorption, photocatalytic oxidation, ozone generation, and chemisorption (USEPA 2018a; 2018b) (see the **Indoor Air Treatment Technology Information Sheet** for additional information.

The ability of APUs to improve indoor air quality is a function of indoor air volume and the airflow rate capabilities of the device, allowing indoor air VFCs adequate time to adsorb onto carbon media or react with other catalysts. The ability of APUs to improve and maintain indoor air quality relies on properly sizing a device for each building area or room, maintaining a power source, and providing routine carbon media replacement at a sufficient interval to maintain VFC removal. See the **Indoor Air Treatment Technology Information Sheet** for additional information.

Preferential Pathway Sealing

Preferential pathways, in general, are pathways that intersect both the vapor source and the building foundation and provide for an increased flow of vapors that is higher than expected under normal conditions (i.e., vapor transport through vadose zone soils). The term preferential pathway, however, is broad and can make it difficult to focus on specific features that are more likely to enhance the migration of VFCs 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 how these features are different from standard vapor entry points or vapor transport pathways. The influence of VIPPs should be considered when evaluating actual or potential preferential pathway features to seal.

Floor cracks or other openings, including electrical and plumbing conduits and floor drains, can constitute potential VIPPs. Such pathways should be identified and sealed whenever they are readily accessible to reduce advective flow of soil vapor into the building. Sealing these potential VI pathways can typically be done quickly. Sealing will also be beneficial for and likely be part of an effective long-term mitigation approach (NJDEP 2021; USDOD 2009). See the **Vapor Intrusion Preferential Pathways Fact Sheet** and the **Preferential Pathway Sealing and Ad Hoc Ventilation Technology Information Sheet** for additional information.

HVAC Modification

It may be possible to mitigate VI by adjusting a building's HVAC system to increase the fresh air intake and/or pressurize the building. Unlike ad hoc ventilation described in the **Preferential Pathway Sealing and Ad Hoc Ventilation Technology Information Sheet**, this type of response requires some knowledge of building HVAC operations and special skills, certifications, and/or training. Ventilation and HVAC modification may allow occupants to stay in their building until confirmation sample results verify ventilation efficacy. See the **Heating, Ventilation, and Air Conditioning Modification Technology Information Sheet** for additional information.

Other Considerations

Rapid response is an interim VI mitigation approach easily implemented and verified on a timescale of days to weeks prior to implementing a long-term mitigation strategy for an occupied room or building. After implementation of a rapid response, efforts should transition to planning and implementing a more permanent, long-term mitigation strategy.

Verification Testing

Follow-up verification testing / performance monitoring of a rapid response may be appropriate prior to the implementation of a long-term mitigation approach when the severity of the conditions warrant it (e.g., high contaminant concentrations, sensitive populations). Verification testing across differing seasonal conditions is typically not necessary given the timescale of rapid response approaches; however, more than one round of verification testing should be considered if weather conditions change considerably during implementation of a rapid response. Depending on the regulatory framework, indoor air testing may be recommended or required (see **Chapter 7: Sampling and Analysis**). In addition to indoor air testing, other verification testing may be useful. Regular monitoring of equipment, such as HVAC units or indoor APUs, should be conducted to verify operation.

Costs

The costs and sustainability of implementing rapid response actions depend on a variety of factors, including the size of the building, the number of occupants, and building construction. If temporary relocation is required in a commercial or industrial setting, significant business costs could be incurred from lost production or sales. If ventilation and air treatment are implemented, then capital costs may be incurred for equipment. Ongoing operation and maintenance costs (e.g., electricity, granular activated carbon change outs, increased air conditioning) may also be incurred until the long-term mitigation strategy can be implemented.

Community Engagement

It is essential to develop and implement a site-specific community engagement 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. Instances that require immediate action should be broached in a more succinct directive without causing undo panic. Transparency in expedited responses may require communicating incomplete information with follow-up as more information becomes available. The increased anxiety from immediate action situations may require repeating information multiple times with multiple follow-ups to directly affected individuals. For more details, see **Chapter 3: Community Engagement**.

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