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Vapor intrusion: The solutions and your choices as property owner or buyer

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Vapor intrusion into indoor airspace is a public health concern that is regulated by both federal and state agencies. In recent years, there has been increased regulatory understanding of the importance of solving this nationwide problem due to emerging information on the carcinogenic potential of some compounds such as trichloroethene (TCE). Therefore, occupied building owners or purchasers need to be aware of this potential problem that may require investigation and potentially mitigation and remediation. Vapor intrusion occurs when volatile organic compounds (VOCs) such as solvents, gasoline, or fuel oils are released to the subsurface from spills, leaking underground storage tanks and piping, or septic leaching fields. Once in the soil and/or groundwater the VOCs volatilize and can migrate upwards and sideways through soil and/or underground utilities and enter the indoor air spaces of structures at and near the release location posing a risk to human health in affected buildings. This article summarizes the steps a property owner or property buyer should follow to maintain regulatory compliance and to ensure the health and safety of building occupants and also summarizes potential solutions to permanently eliminate vapor intrusion.

As a building owner, if you suspect or discover that vapor intrusion into your building indoor air space is occurring, you should immediately have the condition investigated by an environmental professional. There may be a condition that must be reported to the state regulatory authority within a required reporting time. There may also be a regulatory timeline for mitigation of the vapor and elimination of the source of the vapor. Your environmental professional can recommend and perform required regulatory notifications and ensure that regulatory compliance is maintained. Additionally, your professional can perform site monitoring and assess the potential risks to occupants of affected buildings. If it is determined that human health risks may be present due to vapor intrusion, your professional should recommend mitigation measures to stop vapor intrusion from occurring and remediation measures to eventually eliminate and permanently solve the problem.

There are various methods of mitigation that can be used to prevent the vapor from entering the indoor air space. These methods include installation of a physical barrier either beneath on or top of a concrete floor slab or various methods of creating a low air vacuum with minimal air flow below or above the flooring to capture the VOCs before they can enter the indoor air. The latter approach is similar to a radon system and is referred to as a Sub-Slab Depressurization System (SSDS). Periodic monitoring will be required to ensure that the selected mitigation measure has successfully eliminated vapor intrusion and to ensure that human health is being effectively protected.

Mitigation measures can be relatively inexpensive to implement, depending on the site, and may be needed to improve indoor air quality and minimize health risks to building occupants. However, most mitigation measures are not sufficient to achieve regulatory closure and will not eliminate requirements for costly long-term site monitoring and reporting. Regulatory closure can usually only

be accomplished by passive or active remediation that permanently removes or destroys the VOCs in the subsurface.

Passive remediation measures include monitored natural attenuation (MNA) in which natural surface processes destroy VOCs. However, MNA can take years to destroy VOCs, and mitigation measures will likely be required to prevent vapor intrusion until VOCs in soil and/or groundwater are destroyed.

Active remediation measures that can be utilized near and under buildings to remove/destroy VOCs in the subsurface, eliminate the risk of vapor intrusion, and result in regulatory closure include soil vapor extraction (SVE) and in-situ chemical oxidation (ISCO). SVE typically employs the use of a relatively powerful high air flow vacuum blower to remove VOCs from subsurface soils and carbon filters to remove VOCs from the recovered air. SVE can be implemented quickly and can often be used instead of the installation of a physical barrier or a lower flow air flow system as a vapor intrusion mitigation measure. ISCO involves the introduction of non-toxic compounds to the subsurface to quickly and safely destroy VOCs in groundwater and can be particularly effective when VOCs volatilizing from groundwater have caused vapor intrusion. SVE and ISCO are safe, minimally disruptive to site operations, and can be used together at sites where VOCs in soil and groundwater have caused vapor intrusion. Both ISCO and SVE can quickly eliminate VOCs at their source and should be considered to reduce both the on-going risks that are posed by the contaminants remaining in the subsurface and the total project cost.

The property owner or buyer and their environmental professional must develop an exit strategy from the problem and make a decision to either mitigate or to eliminate through remediation the contaminant(s) in the soil and/or groundwater that are causing vapor intrusion to the indoor air space. The basis for this decision usually involves considerations of human health risks, regulatory pressure, public perception, financial risk, project cost, and timing with regards to business operations and/or future plans for the property involving a sale or redevelopment. One common strategy is to mitigate with an SSDS and allow the groundwater VOCs to subside through MNA. Sometimes this is the strategy that makes the most sense when all factors are considered. However, this strategy may end up costing the owner more due to long-term monitoring costs. An effective shorter-term strategy is to achieve a permanent solution through implementation of remediation utilizing SVE and ISCO. Public awareness of vapor intrusion problems and control of public perception may also be a factor of concern for the owner. In the end, the choice to either temporarily mitigate vapor intrusion or to permanently eliminate the vapor intrusion via destruction of those organic compounds at their source rests with the owner.

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