



District Health Department #10



## Report to the Boards of Health

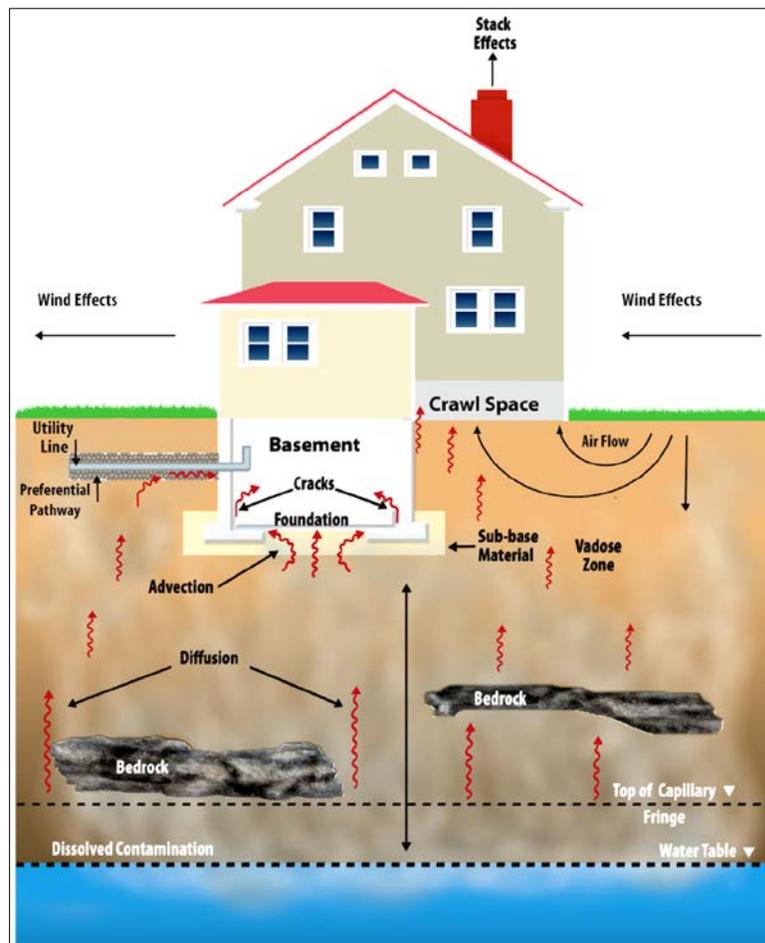
Jennifer Morse, M.D.

Medical Director

Mid-Michigan District Health Department, Wednesday, February 22, 2017  
Central Michigan District Health Department, Wednesday, February 22, 2017  
District Health Department #10, Friday, February 24, 2017

### Vapor Intrusion

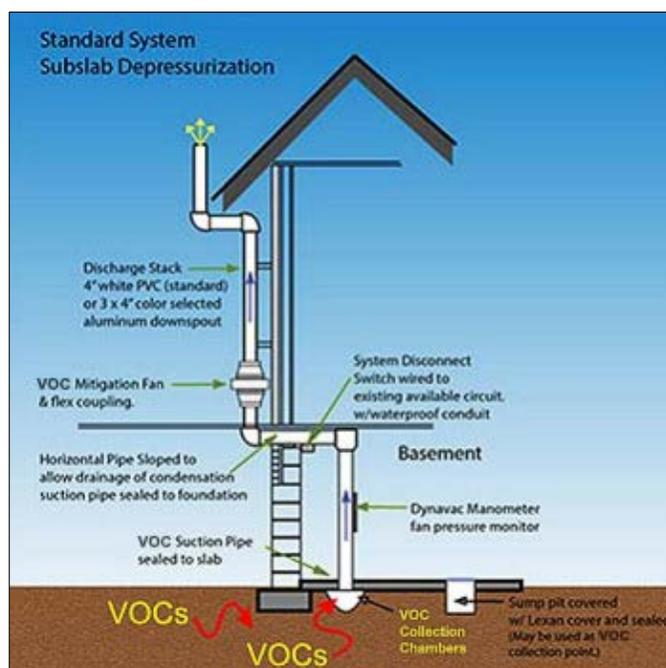
Vapor intrusion (VI) is the build-up of evaporated volatile chemicals in buildings that overlie soil or groundwater contaminated with these chemicals<sup>1</sup>. The chemicals may be directly beneath the building, or may be next to a building and spread along utility piping and trenches made for utilities<sup>1</sup>. Volatile chemicals are chemicals that evaporate easily into a vapor and enter the air. Common volatile chemicals involved in VI include tetrachloroethylene (TCE), which has long been used in dry cleaning, and benzene, which is a component of gasoline<sup>1</sup>. Often, these chemicals get into the soil and groundwater after a spill or a leak from a tank. Not all chemical spills lead to vapor intrusion. The chemical must be volatile, the soil and foundation beneath the building must allow for the intrusion, and weather conditions, such as wind, must be favorable<sup>1</sup>. Many of these chemical have negative health effects, including being linked to cancer.



<sup>1</sup> Agency for Toxic Substances and Disease Registry. (n.d.). *Vapor Intrusion*. Retrieved February 17, 2017 from [https://www.atsdr.cdc.gov/docs/atsdr\\_vapor\\_intrusion.pdf](https://www.atsdr.cdc.gov/docs/atsdr_vapor_intrusion.pdf).

The risks from vapor intrusion and the health effects from the involved chemicals have been known for some time. The guidance documents “Vapor Intrusion Pathway: A Practical Guideline”<sup>2</sup> and “Vapor Intrusion Pathway: Investigative Approaches for Typical Scenarios”<sup>3</sup>, were written 10 years ago by the Interstate Technology and Regulatory Council (ITRC) Vapor Intrusion Team. This team was composed of representatives from 19 state environmental agencies, 12 environmental companies, and 4 federal agencies (including the EPA). Since that publication, more is understood about VI. The 2012 EPA document “Conceptual Model Scenarios for the Vapor Intrusion Pathway”<sup>4</sup> describes a model utilizing calculations based on sub-slab (beneath the foundation) and exterior soil gas concentrations to estimate the indoor air concentration of vapors.

In December 2015, the Michigan Office of Regulatory Reinvention (ORR) introduced revisions to the Environmental Contamination Response Activity, or Michigan’s Environmental Cleanup Criteria, which utilizes the 2012 EPA calculation models<sup>5</sup>. A second public hearing regarding this proposed revision was held October, 2016. In this proposed revision, there are three tiers of calculations that can be performed, based on the specificity of the data utilized<sup>5</sup>. These changes in assessments have already led to re-investigation of known contaminated sites in Michigan. Four VI sites have been successfully redeveloped in Michigan, with the fifth site in Big Rapids currently undergoing mitigation (interventions to decrease the amount of vapor to make it safe).



There are 7,544 leaking underground storage tanks in Michigan that have not been completely cleaned up<sup>6</sup>. These may or may not be causing vapor intrusion and there may be vapor intrusion caused by other spills. There is no clear list of vapor intrusion sites in Michigan. Michigan Department of Environmental Quality (DEQ) is re-assessing sites and working on mitigation strategies if needed. If levels are dangerously high, evacuation orders may need to be issued.

<sup>2</sup> The Interstate Technology & Regulatory Council Vapor Intrusion Team. (2007, January). *Vapor Intrusion Pathway: A Practical Guideline* (Rep.). Retrieved on February 17, 2017 from <http://www.itrcweb.org/GuidanceDocuments/VI-1.pdf>

<sup>3</sup> The Interstate Technology & Regulatory Council Vapor Intrusion Team. (2007, January). *Vapor Intrusion Pathway: Investigative Approaches for Typical Scenarios* (Rep.). Retrieved February 17, 2017, from <http://www.itrcweb.org/GuidanceDocuments/VI-1A.pdf>

<sup>4</sup> Conceptual Model Scenarios for the Vapor Intrusion Pathway (2012, February). Retrieved February 17, 2017, from <https://www.epa.gov/sites/production/files/2015-09/documents/vi-cms-v11final-2-24-2012.pdf>

<sup>5</sup> Bolin, J. (2016, June 07). Vapor Intrusion: The New Tiered Approach under Michigan's Part 201. Retrieved February 17, 2017, from <http://www.dragun.com/2016/06/07/vapor-intrusion-new-tiered-approach-michigans-part-201/>

<sup>6</sup> Michigan Department of Environmental Quality (MDEQ). (n.d.). Storage Tank Information Database. Retrieved February 17, 2017, from [http://www.deq.state.mi.us/sid-web/LUST\\_Search.aspx](http://www.deq.state.mi.us/sid-web/LUST_Search.aspx)

One challenge in dealing with air vapor levels is interpretation of results. Measurements can be given in units of  $\mu\text{g}/\text{m}^3$ , ppbv, and ppmv and these measurements may need to be compared to each other.

Measurements and conversions		
ppmv	=	1000 ppbv
ppbv	=	$24.45 \times \mu\text{g}/\text{m}^3 \div \text{molecular weight}$
$\mu\text{g}/\text{m}^3$	=	$0.0409 \times \text{ppb} \times \text{molecular weight}$
Example		
Tetrachloroethylene (PCE) Commercial Action Level		
180 $\mu\text{g}/\text{m}^3$ = 69 ppbv = 0.069 ppmv		

Another challenge is knowing how accurate the estimated air vapor levels are when using soil concentrations to perform calculations. This is a particularly concern if local public health officials are asked to make and enforce decisions regarding evacuation and safety to occupy if only given calculated estimates based on soil levels. However, according to the 2013 DEQ Guidance Document for the Vapor Intrusion Pathway, air samples should be collected after the soil samples indicate the need for an assessment of immediate risk<sup>7</sup>. If a sub-slab soil gas concentration exceeds the immediate response activity screening levels for a chemical, even after just one event, then further assessment for mitigation should begin. In some cases, this assessment phase is skipped and mitigation is started as quickly as possible.

This has likely been the most confusing report written in the past 16 months. That is probably because VI is extremely confusing to the author and many who have suddenly had to deal with them. Given that there are so many more sites still to be addressed in Michigan, efforts are underway for MDHHS, local public health, and MDEQ to collaborate and communicate more about how to handle these situations.

## Recommendations

1. Be aware of what a vapor intrusion is and what can be done about it; see [https://www.atsdr.cdc.gov/docs/atsdr\\_vapor\\_intrusion.pdf](https://www.atsdr.cdc.gov/docs/atsdr_vapor_intrusion.pdf) and [https://www.atsdr.cdc.gov/docs/atsdr\\_vapor\\_investigation.pdf](https://www.atsdr.cdc.gov/docs/atsdr_vapor_investigation.pdf)
2. For accurate information about toxic substances, such as chemicals that cause vapors, see The Agency for Toxic Substances and Disease Registry at <https://www.atsdr.cdc.gov/substances/index.asp>
3. If you would like to see how a sub-slab soil vapor sample is taken using a vapor pin, see the Vapor Intrusion Sampling video provided by MDEQ at <https://www.youtube.com/watch?v=XWwTOXaP5vs&feature=youtu.be>

<sup>7</sup> Michigan Department of Environmental Quality (DEQ), Remediation and Redevelopment Division. (2013, May). *Guidance Document FOR THE VAPOR INTRUSION PATHWAY*. Retrieved February 17, 2017, from [http://www.michigan.gov/documents/deq/deq-rrd-VIGuidanceDoc-May2013\\_422550\\_7.pdf](http://www.michigan.gov/documents/deq/deq-rrd-VIGuidanceDoc-May2013_422550_7.pdf)