

# Letter Health Consultation

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Vapor Intrusion Data Evaluation

VALLEY PIKE VOC SITE  
(a/k/a MULLINS RUBBER PRODUCTS, INC.)

DAYTON, MONTGOMERY COUNTY, OHIO

EPA FACILITY ID: OHN000510923

**Prepared by  
The Ohio Department of Health**

MARCH 24, 2014

Prepared under a Cooperative Agreement with the  
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Agency for Toxic Substances and Disease Registry  
Division of Community Health Investigations  
Atlanta, Georgia 30333

## **Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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The Health Assessment Section  
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Under a cooperative agreement with the  
Agency for Toxic Substances and Disease Registry



September 4, 2013

Steven Renninger, On-Scene Coordinator  
U.S. Environmental Protection Agency  
Emergency Response Branch  
26 West Martin Luther King Drive (G41)  
Cincinnati, OH 45268

## **RE: Valley Pike VOC Site (Mullins Rubber Products, Inc.) Letter Health Consultation**

Dear Mr. Renninger:

In response to your request, the Health Assessment Section (HAS) of the Ohio Department of Health (ODH) evaluated the results of the joint U.S. EPA/Ohio EPA vapor intrusion investigation of the Valley Pike VOC site (aka, Mullins Rubber Products, Inc. or MRP) located in Riverside, Montgomery County, Ohio. This letter health consultation (LHC) summarizes these results and discusses the public health implications of exposure to volatile organic compounds (VOCs) from vapor intrusion from the site. In brief, the sampling results demonstrated the presence of a completed exposure pathway in the area, connecting the indoor air in area homes with the VOC-contaminated groundwater, via the vapor intrusion route. The HAS supports a U.S. EPA time-critical removal action to further delineate the vapor intrusion threat in the residential community and to mitigate any on-going exposure that is discovered during the course of the U.S. EPA investigation. This letter and accompanying toxicological evaluation (Appendix A) explain how we arrived at our conclusions.

### **Background and Statement of Issues**

The Valley Pike VOC site is located at 2949 Valley Pike in Riverside, Montgomery County, Ohio (Figure 1). The active manufacturing facility, primarily producing molded heavy-duty truck/trailer suspension bushings, is located in a mixed industrial and residential area of Riverside. This facility is bordered to the west by a commercial auto garage, to the east by a single residence and a self-storage facility, to the north by a freight lines facility, and to the south by a mobile home park located on the south side of Valley Pike. Urban density single-family residences occur along Hypathia Avenue, roughly 500 feet to the west, and extend at least as far as Pleasant Valley Avenue to the west (Ohio EPA 2013). Figure 1 shows land uses in the immediate area in this part of Riverside.

The immediate area surrounding the MRP facility is underlain by more than 100 feet of interbedded sand, gravel, and clay till. Permeable gravels occur at depths from 0–35 feet below the ground surface (bgs) (ODNR well logs). The local water table occurs roughly 20–25 feet bgs (Ohio EPA 2013). Ohio EPA reported in 2013 that tetrachloroethylene (PCE) and trichloroethylene (TCE) were detected in the groundwater. PCE was detected as high as 14,000 ppb from a shallow monitoring well GW-14 (SB-14) located on the garage property. At about

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850 feet west from this location, PCE was detected at 1,500 ppb and TCE was estimated at 23 ppb in MW-4 (SB-8), a monitoring well located on Hypathia Avenue near residential structures (Ohio EPA Removal Action Referral to U.S. EPA, May 2013). Prior to the 1960's, most homes in the area used private wells as the source of their drinking water (PHDMC, personal communication, 2013). People are not currently drinking this contaminated groundwater and obtain their drinking water from the Dayton's public water supply; however, some residents may still be using private wells for gardening or other household uses in this area. Ohio EPA speculated that there was a release of PCE from either the manufacturing facility or the immediately adjacent garage property. In a letter dated May 9, 2013, Ohio EPA requested assistance from the U.S. EPA in assessing the potential vapor intrusion risks at the Valley Pike VOC site. Vapor intrusion is the movement of vapor-phase volatile chemicals from soil and groundwater into the indoor air of homes and commercial buildings. Vapor intrusion is most likely to occur in buildings located laterally or vertically within 100 feet of volatile subsurface contaminants (U.S. EPA 2002). Previous experience with vapor intrusion sites in the same general part of north Dayton have indicated potential for significant seasonal variation in soil gas levels under impacted homes.

On June 14, 2013, ODH's HAS provided the U.S. EPA On-Scene Coordinator with screening levels and action levels to evaluate the results of vapor intrusion sub-slab soil gas and indoor air sampling for contaminants of concern at this site (Robert Frey, ODH, personal communication, 2013). Screening levels are based on a  $10^{-5}$  cancer risk and a hazard quotient (HQ) of 1.0. (The HQ is the measured concentration divided by the reference concentration or RfC.) Action levels are based on a  $10^{-4}$  cancer risk and a HQ of 10, which the U.S. EPA generally uses for time-critical removal action evaluation. Recently, the U.S. EPA has developed Regional Removal Management Levels (RMLs) for long-term exposure to individual chemicals that may be used to support the decision to undertake a removal action. RMLs are based on a  $10^{-4}$  cancer risk and/or an HQ of 3. In the case of TCE and other chemicals affecting developmental endpoints, an exceedance of an HQ of 1 can be used as justification for a removal action.

### **U.S. EPA Investigation**

Between July 8 and July 25, 2013, the U.S. EPA conducted a Vapor Intrusion Investigation at the site including sampling of groundwater, soil gas, residential sub-slab soil gas, and indoor air. A groundwater sample collected adjacent (southwest side) to the manufacturing facility showed a concentration of 20,000 ppb PCE at a depth of 22 feet bgs. The highest concentrations observed in groundwater under the neighborhood southwest of the facility ranged from 240 to 800 ppb for PCE and 24 to 47 ppb for TCE. Based on the results of nine soil gas samples collected by the U.S. EPA, PCE was detected as high as 30,000 ppb and TCE as high as 5,600 ppb in the soil gas at depths of 11 to 22.5 feet bgs.

The U.S. EPA investigation in the neighborhood included the collection of sub-slab samples at four residential properties located along Hypathia Avenue, Bushnell Avenue, and Rondowa Avenue, all north of Valley Pike and west of the MRP facility. PCE concentrations in sub-slab samples collected from four residential properties in the neighborhood ranged from 930 to 8,200 ppb, exceeding both the screening and action levels. TCE concentrations in the sub-slab soil gas ranged from 1.8 to 160 ppb, exceeding screening and action levels in three out of four homes

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tested (Table 1). The detection of PCE and TCE in the sub-slab soil gas in some of these homes indicates that vapor intrusion is possible and is likely occurring.

A PCE concentration of 31 ppb was detected in the indoor air of a home on Bushnell Avenue, exceeding the PCE screening level of 6 ppb. TCE was detected in the indoor air sample at 0.87 ppb, which exceeds the TCE screening level of 0.4 ppb (Table 2). The presence of PCE and TCE in the indoor air indicates that there is a completed pathway of exposure to PCE and TCE.

**Table 1: Sub-slab Soil Gas Sampling Results for PCE and TCE at Residential Properties Valley Pike VOC Site, July 2013**

<i>Chemical</i>	<i>Property 1 Rondowa</i>	<i>Property 2 Hypathia</i>	<i>Property 3 Rondowa</i>	<i>Property 4 Bushnell</i>	<i>Sub-slab Screening Level</i>	<i>Sub-slab Action Level</i>
PCE	930	960	1,300	8,200	60	600
TCE	85	1.8	60	160	4	40

Source: U.S. EPA 2013

Results reported in parts per billion (ppb)

PCE – tetrachloroethylene

TCE – trichloroethylene

**Table 2: Indoor Air Sampling Results for PCE and TCE at Residential Properties Valley Pike VOC Site, July 2013**

<i>Chemical</i>	<i>Property 4 Bushnell</i>	<i>Indoor Air Screening Level</i>	<i>Indoor Air Action Level</i>
PCE	31	6	60
TCE	0.87	0.4	4

Source: U.S. EPA 2013

Results reported in parts per billion (ppb)

PCE – tetrachloroethylene

TCE – trichloroethylene

## **Public Health Implications**

The primary contaminants of concern at the Valley Pike VOC site consist of chlorinated solvents PCE and TCE. The highest indoor air concentration of PCE detected in a residential property was 31 ppb—five times above the U.S. EPA’s reference concentration (RfC) of 6 ppb. The highest indoor air concentration of TCE detected at the same residence was 0.87 ppb, more than two times the RfC and ATSDR’s minimal risk level (MRL) of 0.4 ppb. However, exposure above the RfC does not necessarily imply that these levels will cause adverse health effects. Based on occupational studies of adults exposed to PCE, the lowest level where adverse noncancer health effects can be seen is 2,200 ppb, well above the 31 ppb level detected. For TCE, the detections are below those levels likely for adverse noncancer health effects, such as

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fetal cardiac malformations (3.7 ppb), immunological effects (33 ppb), and kidney effects (5.6 ppb). However, the indoor air results meet the U.S. EPA's RML criteria of an exceedance of an HQ of 3 (or 1 for TCE) for both PCE and TCE.

Based on the highest concentrations of PCE and TCE detected in the indoor air, the combined lifetime cancer risk was estimated to be  $8 \times 10^{-5}$  or 8 in 100,000. This estimated cancer risk is considered to be low and within the target cancer risk range ( $10^{-4}$  to  $10^{-6}$ ) suggested by the U.S. EPA. For a full discussion of the toxicological evaluation, see the attached Appendix A.

## **Conclusions**

1. Breathing PCE and TCE is not expected to harm people's health because the levels of PCE and TCE detected thus far are below levels where adverse noncancer health effects occur. The estimated cancer risk is considered to be low. However, concentrations of PCE and TCE in the indoor air of one residence tested in July 2013 exceed screening levels. These concentrations exceed a non-carcinogenic hazard quotient (HQ) of 3 for PCE and a HQ of 1 for TCE, the U.S. EPA's RML decision criteria for a removal action. There is a potential but low estimated cancer risk of  $8 \times 10^{-5}$  (8 in 100,000) for residents exposed over a lifetime.
2. A completed exposure pathway exists for the inhalation of indoor air contaminants which are likely entering homes via vapor intrusion. PCE has been detected as high as 20,000 ppb in the groundwater, 30,000 ppb in the soil gas, 8,200 ppb in the sub-slab soil gas, and 31 ppb in the indoor air at one residence. TCE has been detected as high as 47 ppb in the groundwater, 5,600 ppb in the soil gas, 160 ppb in the sub-slab soil gas, and 0.87 ppb in the indoor air at the same residential property. VOCs in the sub-slab soil gas samples at the four residences sampled (two located on Rondowa Avenue, one on Hypathia Avenue, and one on Bushnell Avenue) located in the neighborhood southwest of the MRP facility were detected at levels that could affect indoor air quality. PCE levels in the sub-slab samples exceeded both screening and action levels.
3. More data is needed to conclude whether vapor migration could affect indoor air quality at other residential properties and harm people's health. At this time, only a few indoor air samples have been collected by the U.S. EPA.

## **Recommendations**

ODH HAS recommends the following:

1. Mitigate the home on Bushnell Avenue to reduce or eliminate ongoing exposures to PCE and TCE in the indoor air.
2. Sample other residences and businesses at risk of contamination via vapor intrusion.
  - a. To adequately characterize people's exposure to indoor air contaminants from vapor intrusion, concurrently collected indoor air, ambient air, and subsurface air (sub-slab or crawlspace) data is preferred.

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- b. To characterize seasonal variability, sample collection during multiple seasons, including at least one sample in the winter, is recommended.
  - c. Include results for PCE and TCE degradation products cis-1,2-DCE and vinyl chloride, unless the investigation does not indicate their presence at this site.
3. Determine the full extent of the VOC contamination, both in groundwater and soil gas.

Sincerely,

Robert Frey, PhD  
Chief, Health Assessment Section, Ohio Department of Health

RF:jk

Figure 1. Immediate Area Map



## Appendix A. Toxicological Evaluation

### *Tetrachloroethylene (PCE)*

Tetrachloroethylene (also known as perchloroethylene, PCE or PERC) is a nonflammable liquid at room temperature and is widely used for dry cleaning fabrics and for degreasing metal parts. Other major uses of PCE are as a solvent in some consumer products and in the production of other chemicals. It evaporates easily into the air and has a sharp, sweet-smelling odor. Most people can smell PCE in air at levels in excess of 1,000 parts per billion (ppb). PCE is frequently found in air as well as in groundwater and surface water. It does not appear to bioaccumulate in fish or other animals that live in water. People are typically exposed to PCE from occupational sources, consumer products, and environmental sources (for example, industrial releases). Much of the PCE that gets into surface water and soil evaporates into the air, where it is broken down by sunlight into other chemicals or brought back to the soil and water by rain. Because PCE can travel down through soils quite easily, it can make its way into underground water, where it may remain for a long time. Under oxygen-poor conditions over time, bacteria will break down some of the PCE that is in soil and groundwater into breakdown products including 1,2-dichloroethylene and vinyl chloride (Vogel and McCarty 1985).

PCE has been recently characterized by the U.S. EPA as “likely to be carcinogenic to humans” by all routes of exposure. Although exposure to PCE has not been directly shown to cause cancer in humans, the U.S. Department of Health and Human Services has determined that PCE may reasonably be anticipated to be a carcinogen (NTP 2011). The International Agency for Research on Cancer (IARC) has classified PCE as a Group 2A carcinogen—probably carcinogenic to humans (limited human evidence, sufficient evidence in animals) (IARC 1995).

PCE was identified as a chemical of concern in contaminated drinking water (along with the chlorinated solvent trichloroethylene) in environmental exposure studies of populations in Woburn, Massachusetts, selected towns in New Jersey, and Camp Lejeune in North Carolina. The Woburn, Massachusetts study (Lagakos et al. 1986) and the New Jersey study (Fagliano et al. 1990) have associated exposure to these chemicals through ingestion of contaminated water with increased levels of leukemia in specific populations within these communities.

### Noncancer Health Effects

In February 2012, the U.S. EPA established a reference concentration (RfC) of 6 ppb for PCE. The RfC is an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is unlikely to have deleterious effects during a lifetime of exposure. One indoor air sample at a residential property located in the neighborhood of the Valley Pike VOC site indicated a PCE concentration of 31 ppb, which is above the U.S. EPA’s RfC of 6 ppb. However, exposure to these levels, which were about five times the RfC, does not necessarily imply that these levels will cause noncancer health effects. The levels where adverse health effects may occur, called the lowest observed adverse health effect levels (LOAELs) for PCE, include a LOAEL of 2,200 ppb for neurotoxicity involving color vision and 8,300 ppb for neurotoxicity involving reaction time and cognitive effects.

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## Cancer Risk

The U.S. EPA recently updated its health risk assessment for PCE in February 2012 (U.S. EPA Integrated Risk Information System or IRIS). The inhalation unit risk (IUR) was determined to be  $2.6 \times 10^{-7}$  per  $\mu\text{g}/\text{m}^3$ . The IUR is the excess lifetime cancer risk estimated to result from continuous exposure to a substance at a concentration of  $1 \mu\text{g}/\text{m}^3$  (microgram per cubic meter) in air. Based on the U.S. EPA's IUR, ATSDR has derived a Cancer Risk Evaluation Guide (CREG) of  $3.8 \mu\text{g}/\text{m}^3$  or 0.57 ppb. CREGs are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in one million persons exposed over a lifetime.

Because the screening level and the CREG for PCE were exceeded in the indoor air sample from a residence, the cancer risk for an adult resident was calculated using the U.S. EPA's IUR ( $2.6 \times 10^{-7}$  per  $\mu\text{g}/\text{m}^3$ ) and the maximum PCE concentration detected in the indoor air at this site (31 ppb =  $210 \mu\text{g}/\text{m}^3$ ). Estimates of excess cancer risk are expressed as a proportion of the population that may be affected by a carcinogen during a lifetime of exposure. For example, an estimated risk of  $1 \times 10^{-6}$  predicts the probability of one additional cancer, over background, in a population of 1 million. Cancer risk can be estimated using the equation below:

$$\text{Cancer Risk} = \text{Inhalation Unit Risk} \times \text{Air Concentration}$$

where,

$$\begin{aligned} \text{Cancer Risk} &= \text{estimated cancer risk (unitless)} \\ \text{Inhalation Unit Risk} &= (\mu\text{g}/\text{m}^3)^{-1} \\ \text{Air Concentration} &= \mu\text{g}/\text{m}^3 \end{aligned}$$

Cancer risk =  $2.6 \times 10^{-7}$  per  $\mu\text{g}/\text{m}^3 \times 210 \mu\text{g}/\text{m}^3 = 5.5 \times 10^{-5}$ . This represents about 6 possible excess cancer cases in a population of 100,000 over a lifetime of exposure. The actual or true risk is likely to be less because exposure is likely to be intermittent and less than a lifetime (70 years). The estimate of cancer risk calculated above is within the cancer risk range ( $10^{-4}$  to  $10^{-6}$ ) suggested by the U.S. EPA. This level of risk is considered a low level of risk.

### ***Trichloroethylene (TCE)***

The primary industrial use of trichloroethylene (TCE) has been the degreasing of metal parts and its use has been closely associated with the automotive and metal-fabricating industries from the 1950's through the 1970's. It is an excellent solvent for removing greases, oils, fats, waxes, and tars. As a solvent it was used alone or blended with other solvents. These solvents were also added to adhesives, lubricants, paints, varnishes, paint strippers, pesticides, and cold metal cleaners. When in surface soils, TCE will transform from a liquid to a gas faster than many other VOCs. It has been shown that the majority of the TCE spilled on soils close to the surface will vaporize into the air. When TCE is released into the air, it reacts relatively quickly in the presence of sunlight and oxygen, with about half of it breaking down to simpler compounds in about a week. TCE doesn't stick well to soil particles unless the soils have high organic carbon content. TCE is known to be only slightly soluble in water, but there is ample evidence that

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dissolved TCE remains in groundwater for a long time. Studies show that TCE in water will rapidly form a gas when it comes into contact with air. In a sand and gravel aquifer, TCE in the groundwater would rapidly vaporize into the air spaces between adjacent soil grains. Studies indicate that it would then disperse by two primary routes; first, diffusion through the soil air spaces and then be re-adsorbed by groundwater or infiltrating rainwater, or second, it would migrate as a gas to the surface and be released to the atmosphere. The primary means of degradation of TCE in groundwater is by bacteria. A breakdown product by this means is vinyl chloride (VC), a known human carcinogen (Vogel and McCarty 1985), however, VC has not, to date, been detected in either groundwater or soil gas at this site.

### Non-Cancer Health Effects

In September 2011, the U.S. EPA published a reference concentration (RfC) of 0.4 parts per billion (ppb) for chronic (long-term) inhalation exposure to TCE. The RfC is based on decreased thymus weight in female mice and increased fetal cardiac malformations in rats, with uncertainty (safety) factors built in. The chronic RfC of 0.4 ppb for TCE derived by the U.S. EPA has now been adopted as the ATSDR chronic-duration inhalation MRL for TCE (ATSDR 2013). The effect level for fetal cardiac malformations, based on a human equivalent concentration (HEC) derived from rat studies, is 3.7 ppb for three weeks during pregnancy. With an uncertainty factor of only 10 applied to the effect level for fetal heart impacts, concentrations of TCE of about three times greater than the RfC/MRL may become a concern for health effects. The effect level for TCE for immunological effects is 33 ppb. A supporting study of lower confidence indicated kidney effects at an affect level of 5.6 ppb (U.S. EPA IRIS). The highest indoor air concentration of TCE detected in the residential neighborhood of the Valley Pike VOC site was 0.87 ppb, about two times the RfC/MRL, but below levels likely for short-term noncancer health effects (fetal cardiac malformations, immunological effects, and kidney effects).

### Cancer Risk

The U.S. EPA recently characterized TCE as “*carcinogenic in humans by all routes of exposure.*” This conclusion is based on convincing evidence of a causal association between TCE exposure in humans and kidney cancer (U.S. EPA 2011). The International Agency for Research on Cancer (IARC) has recently classified TCE as carcinogenic to humans (Group 1) (Guha 2012). The National Toxicology Program (NTP) determined that TCE is “reasonably anticipated” to be a human carcinogen (NTP 2011).

Occupational exposure to high levels (greater than 100,000 ppb) of TCE in air, based on analyses of seven studies of worker populations, was associated with excess incidence of liver cancer, kidney cancer, non-Hodgkin’s lymphoma, prostate cancer, and multiple myeloma in these workers. The strongest evidence for linking cancer in these workers to TCE exposure is for the first three of these cancers (NTP 2011). Agreement between human and animal studies supports the conclusion that TCE exposure may result in the development of kidney cancer. High doses are needed to cause liver toxicity and cancer in lab animals. Differences with regard to how humans and animals process TCE in the liver suggests that humans would be less susceptible to liver cancer from TCE exposures than the lab animals (NAS 2006).

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The health effects, including increased cancer risks, from chronic exposure to low levels (single digit ppb range) of TCE in air and/or drinking remain poorly-documented and largely unknown. ATSDR has recently derived a Cancer Risk Evaluation Guide (CREG) of 0.045 ppb for exposure to TCE over a lifetime. This represents an estimated contaminant concentration that would be expected to cause no more than one additional excess cancer in one million persons exposed over a lifetime.

The U.S. EPA recently updated its health risk assessment for trichloroethylene in September 2011 (U.S. EPA 2011). The inhalation unit risk (IUR) was determined to be  $4.1 \times 10^{-6}$  per  $\mu\text{g}/\text{m}^3$ . Using this value and the highest indoor air concentration of TCE ( $0.87 = 4.7 \mu\text{g}/\text{m}^3$ ) detected in a residence at the site, cancer risk from exposure to TCE can be estimated with the formula: Cancer risk =  $4.1 \times 10^{-6}$  per  $\mu\text{g}/\text{m}^3 \times 4.7 \mu\text{g}/\text{m}^3 = 1.9 \times 10^{-5}$ . This represents about 2 possible excess cancer cases in a population of 100,000 over a lifetime of exposure. The cancer risk may be slightly underestimated, as age dependent adjustment factors (ADAFs)—specific to the kidney cancer portion of the overall risk—were not applied in this estimate. The actual or true risk is likely to be less because exposure is likely to be intermittent and less than a lifetime (70 years). The estimated cancer risk calculated is within the target cancer risk range ( $10^{-4}$  to  $10^{-6}$ ) suggested by the U.S. EPA.

### ***Mixture Assessment***

Exposures to mixtures of both PCE and TCE are likely to be additive in nature in producing nervous system effects or noncancer and cancer kidney or liver effects (ATSDR 2004). The noncancer risk can be calculated using the hazard quotient (HQ). The HQ is the measured concentration divided by the RfC. The summation of HQ values for individual chemicals is referred to as the Hazard Index (HI). Based on the highest concentrations detected for both chemicals in the indoor air as of July 2013, the HI is estimated to be 7.3. The combined cancer risk due to exposure to both PCE and TCE is estimated to be  $8 \times 10^{-5}$  or 8 in 100,000.

### ***Child Health Considerations***

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

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## **Report Preparation**

This Letter Public Health Consultation for the Valley Pike VOC site was prepared by the Ohio Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved agency methods, policies, and procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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