Health Consultation

JERRY'S PROFESSIONAL CLEANERS VAPOR INTRUSION SITE

KENT, PORTAGE COUNTY, OHIO

EPA FACILITY ID: OHN000510524

Prepared by
The Ohio Department of Health

SEPTEMBER 17, 2012

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

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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The Health Assessment Section
of the Ohio Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

SUMMARY

Introduction

The Health Assessment Section (HAS) of the Ohio Department of Health (ODH), in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), evaluated the potential impacts to residents exposed to tetrachloroethylene (PCE) near a former dry cleaners in Kent, Ohio. This public health consultation reviews the available groundwater, soil, sub-slab soil gas, and indoor air sampling data collected by the U.S. EPA to evaluate the migration of vapors beneath homes and buildings in the immediate vicinity of the former Jerry's Professional Cleaners in Kent, Ohio. HAS reached the following conclusions regarding this site:

Conclusion 1

Currently, exposures to PCE via vapor intrusion into residences in the immediate vicinity of the former Jerry's Professional Cleaners are now below levels of health concern.

Basis for decision

Vapor abatement systems in three affected homes were installed in October 2011 to reduce or eliminate the migration of vapors from the subsurface into the indoor air. A source removal action was conducted by the U.S. EPA at the site in October 2011.This should eliminate any future vapor intrusion concerns at the site.

Conclusion 2

ODH HAS concluded that past exposure to PCE via vapor intrusion into residences or commercial properties could harm people's health.

Basis for decision

High concentrations of chlorinated solvents were detected in shallow soil and groundwater samples collected from the site. ODH HAS recommended site-specific action levels of 60 parts per billion (ppb) of PCE in sub-slab soil gas and 6 ppb in indoor air for evaluating possible health hazards to building occupants. Three out of six homes within 100 feet of the property line of the former cleaners had PCE levels in the sub-slab soil gas and/or the indoor air above the site-specific screening levels provided by the ODH HAS. HAS determined that there was a potential but low cancer risk to exposed residents with a lifetime of exposure.

Next steps

No further action is recommended for this site at this time. Off-site contamination appears to be very limited in extent and vapor-impacted homes have been mitigated. Future concerns should have been eliminated as the result of the removal action conducted in October 2011 with U.S. EPA oversight.

For more information

For more information about hazardous substances identified in this report, including health effects, please see ODH chemical fact sheets and public health assessments and consultations available on-line at: http://www.odh.ohio.gov *(go to "H" and "Health Assessment Section").* You may also contact ODH by phone at 614-466-1390.

BACKGROUND AND STATEMENT OF ISSUES

Site Location and Description

The former Jerry's Professional Cleaners site is located at 1002 Franklin Avenue, Kent, Portage County, Ohio (Figure 1). The dry cleaner was in operation from at least 1956 up to 1997. The cleaners closed in 1997 following a fire. The building was demolished in 2010 following an environmental site assessment conducted by the City of Kent. The site currently consists of a vacant city lot of about 1,200 square feet located in a densely populated residential area.

High concentrations of chlorinated solvents were detected in shallow soil and groundwater samples collected from the site. Tetrachloroethylene (PCE) and breakdown compounds of dry cleaning fluids were found in the sub-slab soil gas and/or the indoor air in three out of six homes within 100 feet of the property line of the former cleaners. An additional home located 100-200 feet from the site did not show the presence of these chemicals above levels of concern. Chemicals related to the site were not found at an elementary school and a recreation center located within 600 feet of the site. However, gasoline chemicals were detected at the school, which led to a separate vapor intrusion investigation (HAS 2012).

Demographics and Land Use

As of the 2010 Census, there were 28,904 people residing in Kent, Ohio for a population density of 3,150 people per square mile. There were 11,174 total housing units at an average density of 1,218 per square mile. The area immediately surrounding the former Jerry's Professional Cleaners site is primarily a residential area. There are six residences located directly adjacent to and within a radius of 100 feet from the site. A commercial property, an elementary school, and a recreational center are located within 600 feet of the former dry cleaners site.

Area Geology and Hydrogeology

The Jerry's Professional Cleaners property is in a densely populated residential area on the south side of the city of Kent, just east of the south-flowing Cuyahoga River. The land in the area slopes from a bedrock hill about one mile to the east, down towards the Cuyahoga River valley about 0.5 miles to the west (USGS, Kent, Ohio 7.5 min Quadrangle). Borings made on the property indicate that the site is underlain by 1-3 feet of silty sand fill and 20+ feet of mottled moist clay with minor, discontinuous silty sand bodies 2 feet or less in thickness (EEI 2010). Most of the residences in the city of Kent are on public water and get their drinking water from surface water obtained from Lake Rockwell on the Cuyahoga River, just north of the city limits (Ohio EPA, pers. comm. 2011). Under the site, perched groundwater occurs in the shallow subsurface sand layers at depths from 15 to 20 feet below the ground surface. Groundwater flow in these sands is to the north-northwest (EEI 2010). This groundwater flow is towards residences immediately to the west and north of the site and away from the school and recreation center located about block and a half away to the south/southeast of the site. During rain events, groundwater commonly infiltrates the basement at the adjacent property to the west (Property 1) on W. Elm Street (U.S. EPA 2012).

City of Kent Investigation

The City of Kent conducted an investigation at the former Jerry's Professional Cleaners site to assess properties, known, or suspected, to have petroleum releases. In 2010, their contractor, Emerald Environmental, Inc. (EEI), tested groundwater monitoring wells and soils at various depths at the former Jerry's Professional Cleaners. Samples from three on-site monitoring wells at depths of 15 to 21 feet below the ground surface (bgs) showed PCE concentrations of 136,760; 38,740; and 678 parts per billion (ppb), respectively. In the sample of one monitoring well, MW8, the following additional chemicals were detected along with PCE (38,740 ppb): trichloroethylene (211 ppb), cis-1,2-dichloroethylene (287 ppb), vinyl chloride (3.5 ppb), 1,1,1,2-tetrachloroethane (12 ppb), and 1,2-dichlorobenzene (6.2 ppb). Trichloroethylene, cis-1,2-dichloroethylene, and vinyl chloride are degradation products of PCE (EEI 2010).

U.S. EPA Investigation and Removal Action

In September 2010, the Ohio EPA requested assistance from the U.S. EPA in conducting a site assessment and a potential time-critical removal action involving the former Jerry's Professional Cleaners site. The initial U.S. EPA plan for the vapor intrusion investigation involved approaching six property owners within a 100-foot radius from the former dry cleaners property line to gain access for slab-slab and indoor air sampling. Access was obtained and sampling was conducted in June and July of 2011 at six residential properties. Sampling results from these properties are listed in Table 1. In addition, the U.S. EPA tested an elementary school and a recreation center located within 600 feet of the site. Testing of the sub-soil gas at the school and the recreation center did not detect the dry cleaning contaminants related to this site. However, gasoline chemicals were detected at the school, which led to a separate vapor intrusion investigation and removal action by the U.S. EPA (HAS 2012).

As part of the U.S. EPA time-critical removal action, the U.S. EPA removed the source of the contamination at the dry cleaner property through the excavation and disposal of contaminated soil in October 2011. An estimated 327 tons of contaminated soil were removed and disposed of at the Michigan Disposal Waste Treatment Plant in Belleville, Michigan. Also in October 2011, the U.S. EPA installed vapor abatement systems in three homes adjacent to the site that had sub-slab or indoor air detections of PCE above site screening levels (Table 1) (U.S. EPA 2011b).

Table 1. Sub-slab and Indoor Air Sampling Results for PCE at Residential Properties near Jerry's Professional Cleaners Site, June-July 2011

Location	*Sub-slab Sample Results (ppb)*	*Sub-slab Screening Level* (ppb)*	*Indoor Air Sample Results (ppb)*	*Indoor Air Screening level* (ppb)*
Property 1	**4,300**	**60**	**19**	**6**
Property 2	**1,100**	**60**	ND (3.3)	6
Property 3	5.3	60	Not Sampled	6
Property 4	ND (0.86)	60	Not Sampled	6
Property 5	28	60	Not Sampled	6
Property 6	53	60	**11**	**6**

Source: U.S. EPA 2011

PCE = tetrachloroethylene
ppb = parts per billion
ND = not detected (reporting limit)
Bold results exceed screening levels
*Current U.S. EPA Reference Concentration (RfC) and 10^{-5} lifetime cancer risk level.

ODH HAS Involvement

The U.S. EPA On-Scene Coordinator (OSC) requested site-specific sub-slab screening levels from the Ohio Department of Health's (ODH) Health Assessment Section (HAS) in support of the vapor intrusion investigation in Kent, Ohio. In a letter (Appendix A) dated May 18, 2011 to the U.S. EPA OSC, the ODH HAS recommended site-specific levels for evaluating the contaminants of concern. At that time, the comparison values for residences and schools were based on a residential scenario that assumes 24 hour, 350 day, 30 year exposure and a cancer risk of 10^{-4}. Comparison values for indoor air and sub-slab soil gas for commercial/industrial (non-residential) structures were also included. In February 2012, the U.S. EPA established a Reference Concentration (RfC) of 6 ppb for PCE in indoor air. In addition, the U.S. EPA included a cancer risk estimate for inhalation exposure to PCE, where a PCE concentration of 6 ppb in air corresponds to a lifetime cancer risk of 10^{-5}.

DISCUSSION

Exposure Pathways

In order for the public to be exposed to elevated levels of chemical contaminants in and around the Jerry's site, they must first come into physical contact with the contaminated groundwater, soils or air. To come into contact with the contaminated media, there must be a completed exposure pathway. A completed exposure pathway consists of five main parts, all of which must be present for a chemical exposure to occur:

1. **A Source of Contamination** (a chemical release, landfills, and others);
2. **Environmental Transport** (the way chemicals move away from the source through air, water, soil, food chain);
3. **Point of Exposure** (a place where people come into physical contact with the chemical, e.g., soil, air, groundwater, surface water, sediment, food);
4. **Route of Exposure** (how people come into physical contact with the chemical, e.g., breathing, drinking, eating, touching); and
5. **A Population at Risk** (people likely to come into physical contact with site-related chemicals).

Physical contact with a chemical contaminant alone does not necessarily result in adverse health effects. A chemical's ability to affect a person's health is also controlled by a number of factors including:

- How much of the chemical a person is exposed to (*dose*).
- How long a person is exposed to the chemical (*duration* of exposure).

- How often a person is exposed to the chemical (*frequency*).
- How the chemical affects the body (the chemical's *toxicity*).

Other factors affecting a chemical's likelihood of causing adverse health effects upon contact include a person's:

- ✓ Past exposure to toxic chemicals (occupation, hobbies, etc.)
- ✓ Smoking, drinking alcohol, or taking certain medications or drugs
- ✓ Current health and nutritional status
- ✓ Age and gender
- ✓ Family medical history

Vapor Intrusion Pathway

Vapor intrusion is the movement of volatile chemicals and gases from soil and groundwater into the indoor air of homes and commercial buildings. VOCs can vaporize from contaminated groundwater or soil and migrate as a gas to the indoor environment of nearby buildings. Vapor intrusion is likely to occur when occupied buildings are laterally or vertically within 100 feet of volatile subsurface contaminants (U.S. EPA 2002). The U.S. EPA investigation in Kent initially focused on six residential homes located within 100 feet of the former drycleaners. The detection of PCE in the sub-slab soil gas and the indoor air in some of these homes indicated a completed exposure pathway.

Chemicals of Concern

The primary contaminant of concern at the former Jerry's Professional Cleaners site is tetrachloroethylene, also known as perchloroethylene or PCE. Breakdown products, including cis-1,2-dichloroethylene and vinyl chloride were tested for but not found in the sub-slab soil gas or the indoor air; however, they, along with PCE and TCE, were detected in the groundwater at the site.

Exposure Evaluation

With the assistance of the local health department, the U.S. EPA was able to access six homes located within 100 feet of the former Jerry's Professional Cleaners and collect samples of sub-slab soil gas and indoor air. Due to concerns expressed by community officials, an elementary school and a recreation center were also tested. Table 1 shows results for the residential properties and compares them to recommended screening levels. Two residences had sub-slab sample results above the sub-slab screening level of 60 ppb for PCE. One of those properties also had a detection of TCE in the sub-slab soil gas at a level below the screening level recommended by ODH at that time (Appendix A). The highest concentration of PCE detected in the sub-slab soil gas was 4,300 parts per billion (ppb). Two properties detected PCE in the indoor air above the recommended screening level of 6 ppb. No detections of site-related contaminants of concern (dry cleaning chemicals) were found at the school or the recreation center.

Public Health Implications

Discussion

Tetrachloroethylene (also known as perchloroethylene, PCE or PERC) is a nonflammable liquid at room temperature and is widely used for dry cleaning of fabrics and for degreasing metal parts. 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 in the environment is found most frequently in the air and less often in drinking water. PCE appears to have a low tendency 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) (see Appendix B, Tetrachloroethylene Fact Sheet).

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).

Health Effects Evaluation

Non-cancer 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. Two of the indoor air samples in the vicinity of the former Jerry's Professional Cleaners site indicated levels of PCE above EPA's RfC of 6 ppb. However, exposure to these levels, which were about two and three times the RfC, does not imply that these levels have or will cause non-cancer health effects.

Cancer Risk

Studies give some indication that exposure to PCE causes cancer in people. Data shows that long-term exposure to PCE causes liver cancer in mice and mononuclear cell leukemia and kidney cancers in rats. However, humans respond to PCE differently than mice and rats. In human population studies, PCE is suspected, but not proven, to cause various cancers, including bladder cancer, kidney cancer, and leukemia. PCE's classification as a human carcinogen is under review by the U.S. EPA. 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 human carcinogen (NTP 2011). The International Agency for Research on Cancer (IARC) has classified PCE as a Group 2A carcinogen or probably carcinogenic to humans. IARC concluded that there was sufficient evidence in animals and limited evidence in humans, based mainly on evidence of consistently positive associations

between exposure to tetrachloroethylene and the risks for esophageal cancer, cervical cancer, and non-Hodgkin's lymphoma (IARC 1995).

For the Jerry's Professional Cleaners site, HAS estimated cancer risks for those exposed to PCE through vapor intrusion using EPA's recent inhalation unit risk of 2.6×10^{-7} per $\mu g/m^3$ (microgram per cubic meter). The inhalation unit risk represents the increase in the lifetime cancer risk of an individual who is exposed to 1 $\mu g/m^3$ PCE (0.15 ppb) in air. An estimated cancer risk represents the number of possible excess cancer cases in a population due to exposure to a toxic substance, usually expressed a negative power of 10. In our calculations, we assumed an inhalation rate of 20 m^3/day, an adult body weight of 70 kg, and an exposure of 24 hours a day for a lifetime. Based on these assumptions, the estimated cancer risk due to exposure to PCE in indoor air in the home with the highest level of PCE (19 ppb = 130 $\mu g/m^3$) is calculated to be 3.4×10^{-5} or about 3 possible excess cancer cases in a population of 100,000. Another home had a PCE concentration of 11 ppb (75 $\mu g/m^3$) and an estimated cancer risk of 2×10^{-5} or 2 in 100,000. The true risk is likely to be less, considering that exposure would be intermittent and less than a lifetime (70 years).

HAS recommended health-based action levels to evaluate the results of indoor air and sub-slab soil gas for the contaminants of concern in residential and commercial properties at the Jerry's Professional Cleaners site. A screening level of 6 ppb was provided for the evaluation of PCE in the indoor air of residential structures. A sub-slab soil gas screening level of 60 ppb was provided for the evaluation of sub-slab soil gas samples, based on a 0.1 attenuation factor (Appendix A). Three out of six homes within 100 feet of the property line of the former cleaners had PCE levels in the sub-slab soil gas and/or the indoor air above the recommended screening levels (see Table 1). Two of the properties tested in the vicinity of the former Jerry's Professional Cleaners showed the presence of PCE above the indoor air screening level for PCE. Only one of the homes with a sub-slab action level exceedance also had an indoor air action level exceedance.

In October 2011, the U.S. EPA installed vapor abatement systems in these three homes to reduce or prevent the migration of vapors from the subsurface into indoor air spaces. Contaminated soil, saturated contaminated soil, and the three monitoring wells installed by the City of Kent contractor on the source property were excavated, removed, and disposed of. Excavation continued at depths of 8-10 feet to the water table until contaminants were no longer detected by direct-reading instruments. Clean backfill, topsoil, and gravel were brought in and used to bring the excavation to grade. Excavation was completed on October 27, 2011 (U.S. EPA 2011b). The U.S. EPA attempted to expand the investigation to six more homes. Access was obtained to sample one additional home to the north of the site. Sampling in this home conducted in March 2012 did not detect PCE in the indoor air or sub-slab soil gas above health-based screening levels. Sampling results for this home and other homes located to the north and west of the site indicate that the extent of contamination has been adequately delineated. Groundwater in the area occurs as perched, laterally discontinuous sand layers that appear to pinch out within a short distance from the site. Additional groundwater sampling downgradient from the site failed to indicate any saturated sand units with measureable amounts of groundwater (Lori Muller, U.S. EPA, personal communication, 2012). This lack of groundwater, along with the removal of

contaminated soil at the source property, indicates that PCE will no longer continue to be released to groundwater or move offsite into residential areas.

Child Health Issues

Children can be at a greater risk of detrimental health effects due to exposure to hazardous chemicals because of their smaller stature and developing body systems. Children are likely to breathe more air and consume more food and water per body weight than are adults. Children are also likely to have more opportunity to come into contact with environmental pollutants due to being closer to the ground surface and taking part in activities on the ground such as crawling, sitting, and lying down on the ground. HAS considers children and other sensitive individuals in the population when using the health-based comparison values to evaluate exposure to toxic chemicals at this site. As a result of concerns, a nearby recreation center and elementary school were included in the testing for the contaminants related to this site.

CONCLUSIONS

1. Currently, exposures to PCE via vapor intrusion into residences in the immediate vicinity of the former Jerry's Professional Cleaners are now below levels of health concern. Vapor abatement systems in three affected homes were installed in October 2011 to reduce or eliminate the migration of vapors from the subsurface into the indoor air. A source removal action was conducted by the U.S. EPA at the site in October 2011.This should eliminate any future vapor intrusion concerns at the site.

2. ODH HAS concluded that past exposure to PCE via vapor intrusion into residences or commercial properties could harm people's health. Three residences (two located on Elm Street and one on Franklin Avenue) located within 100 feet of the property line of the former cleaners showed the presence of PCE in either the sub-slab soil gas or the indoor air above recommended screening levels. HAS determined that there was a potential but low cancer risk to exposed residents with a lifetime of exposure.

RECOMMENDATIONS

No further action is recommended for this site at this time. Off-site contamination appears to be very limited in extent and vapor-impacted homes have been mitigated. Future concerns should have been eliminated as the result of the removal action conducted in October 2011 with U.S. EPA oversight.

PUBLIC HEALTH ACTIONS

Completed Actions:

1. The U.S. EPA installed vapor abatement systems in three affected homes in October 2011 to reduce or prevent the migration of vapors from the subsurface into indoor air spaces.

2. The U.S. EPA conducted follow-up indoor air sampling at the homes where systems had been installed to ensure that the mitigation is working.

3. The U.S. EPA removed the source of the contamination at the site through the excavation, removal, and off-site disposal of contaminated soil as of October 27, 2011 (U.S. EPA 2011b).

4. The U.S. EPA met and spoke with each of the six residents (landlords) whose structures were being tested and distributed ODH-produced fact sheets and provided ODH contact information if they had any questions or health concerns.

5. The U.S. EPA attempted to sample additional residences within 100–200 feet from the site to define the extent of the vapor intrusion contamination. Access was obtained to sample one additional home on Franklin Avenue. Sampling in this home conducted in March 2012 did not detect PCE in the indoor air or sub-slab soil gas above site-specific screening levels (U.S. EPA 2012).

REPORT PREPARATION

This Public Health Consultation 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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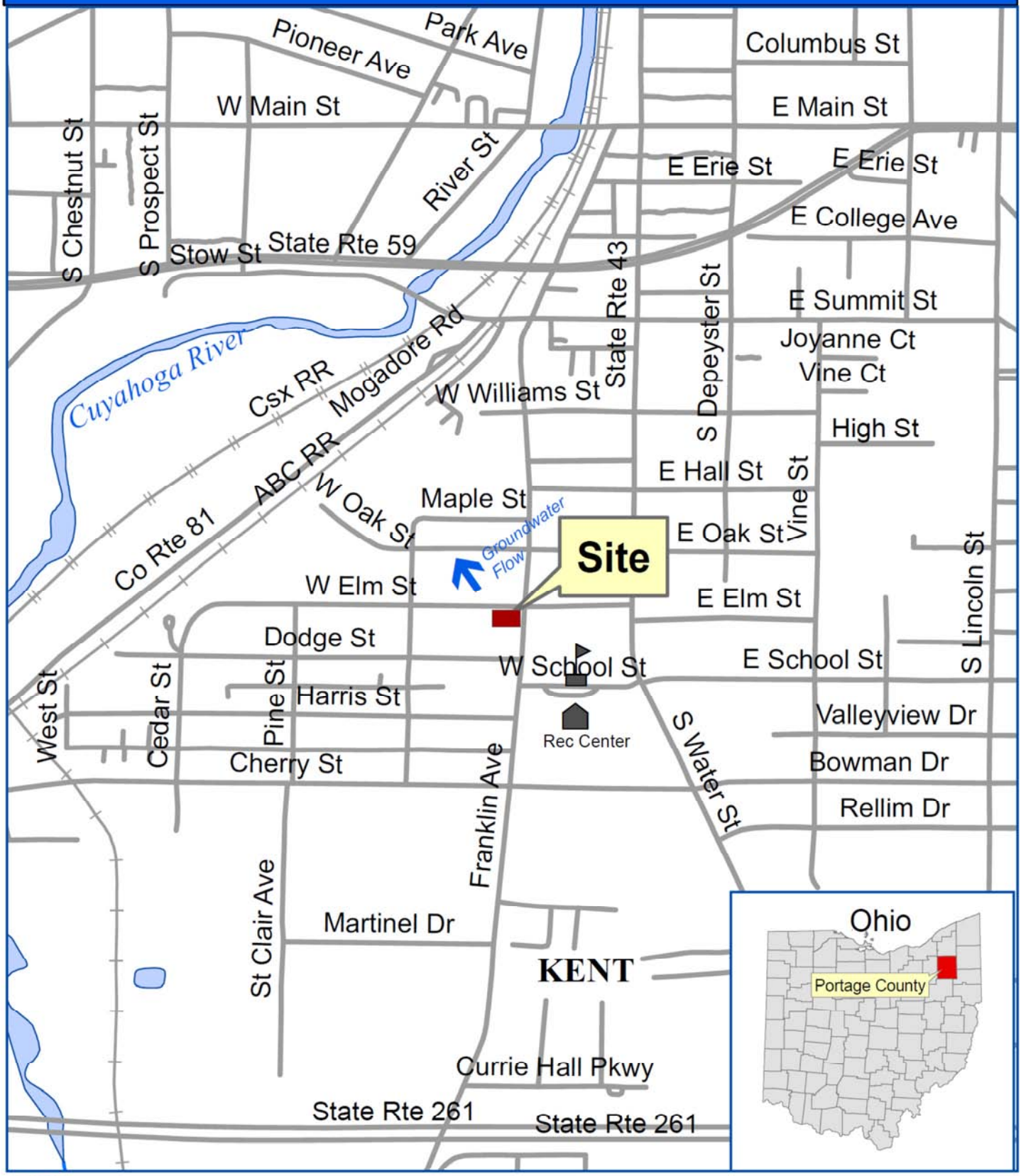
Figure 1. Jerry's Professional Cleaners
Site Location Map



Appendix A.

OHIO DEPARTMENT OF HEALTH

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John R. Kasich / Governor

Theodore E. Wymyslo, M.D. / Director of Health

May 18, 2011

Lori Muller
On-Scene Coordinator
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25089 Center Ridge Rd. (ME-W)
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RE: Action Levels for the former Jerry's Professional Cleaners site

Dear Ms. Muller:

Per your request, presented below are our recommendations for health-based guidance to evaluate the results of indoor air and sub-slab samples for the contaminants of concern in residential and commercial properties in Kent, Ohio. The contaminants include tetrachloroethylene (PCE), trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), trans-1,2-DCE and vinyl chloride.

Table 1 presents the screening levels for residential structures in micrograms per cubic meter ($\mu g/m^3$) and parts per billion (ppb). The residential screening levels should also apply to daycare centers and schools. In the evaluation of sub-slab soil gas samples, a 10-fold attenuation factor was assumed. Concentrations below theses levels would not be considered a health concern. If indoor air concentrations were found to be above these levels, then an intervention strategy for reducing these levels should be initiated. Such a strategy should include the consideration of source control and installation of a vapor abatement system to reduce the migration of vapors from the subsurface into indoor air spaces.

Table 1. Residences/Schools

Chemical	*Indoor Air Action Level (10^{-4})**		*Sub-slab Action Level (10^{-4})***	
	$\mu g/m^3$	*ppb*	*$\mu g/m^3$*	*ppb*
PCE	41	6	410	60
TCE	120	22	1,200	220
Cis-1,2-DCE***	35	8.8	350	88
Trans-1,2-DCE	63	16	630	160
Vinyl chloride	16	6	160	60

*Values were obtained from the U.S. EPA November 2010 Regional Screening Levels (10^{-4} risk)
**A factor of 10 was applied to the indoor air values to obtain the sub-slab values
***Values for cis-1,2-DCE were obtained from the U.S. EPA 2002 Subsurface Vapor Intrusion Guidance

Our recommendations presented in Table 1 are based a residential scenario that assumes that an adult resident is exposed for 24 hours per day for 350 days per year over a period of 30 years. Screening levels for carcinogens (vinyl chloride) and suspect carcinogens (PCE and TCE) are based on a 10^{-4} cancer risk. The screening levels for cis-1,2-DCE and trans-DCE are based on non-cancer

risk. Screening levels for residential exposure were taken from the U.S. EPA November 2010 RSLs (Industrial Air values), except for cis-1,2-DCE. Screening levels for cis-1,2-DCE were not available in the 2010 RSL tables, therefore, the target indoor air and sub-slab concentrations for cis-1,2-DCE were obtained from the U.S. EPA 2002 Subsurface Vapor Intrusion Guidance.

Table 2 provides corresponding values for non-residential buildings – spaces that are not used for residences or where children are not continuously present. Non-residential buildings include commercial businesses and public buildings, churches, non-manufacturing businesses, and industries where these chemicals are not used as part of the manufacturing process.

Table 2. Non-residential Buildings

Chemical	*Indoor Air Action Level (10^{-4})**		*Sub-slab Action Level (10^{-4})***	
	$\mu g/m^3$	*ppb*	*$\mu g/m^3$*	*ppb*
PCE	210	31	2,100	310
TCE	610	110	6,100	1,100
Cis-1,2-DCE***	180	44	1,800	440
Trans-1,2-DCE	320	81	3,200	810
Vinyl chloride	280	110	2,800	1,100

* Values were obtained from the U.S. EPA November 2010 Regional Screening Levels (10^{-4} risk)
** A factor of 10 was applied to the indoor air values to obtain the sub-slab values
*** Values for cis-1,2-DCE obtained from the U.S. EPA 2002 Subsurface Vapor Intrusion Guidance (a factor of 5.04 was applied to the residential screening level)

The non-residential screening levels were derived by multiplying the residential values by 30/25 years x 350/250 days/year x 24/8 hours/day or 5.04. To be consistent, this factor was also used to obtain the screening level for cis-1,2-DCE and trans-1,2-DCE for non-residential buildings, instead of using the industrial air values listed in the RSL table. Vinyl chloride, however, is unique in that the RSLs were derived differently by U.S. EPA, including the calculation of the industrial air RSLs, since vinyl chloride is one of 12 chemicals determined by the U.S. EPA to be carcinogenic by a mutagenic mode of action.

If you have any questions regarding these values, please contact me.

Thank you.

Sincerely,

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

RF/jk

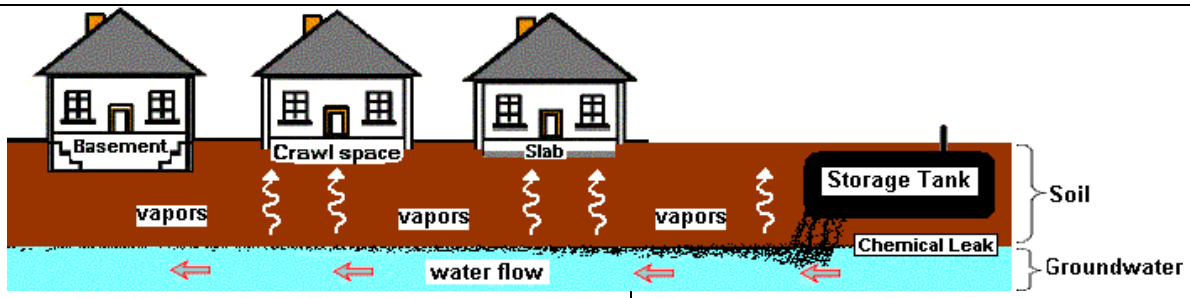
Appendix B. Fact Sheets

Bureau of
Environmental Health
Health Assessment Section

"To protect and improve the health of all Ohioans"

Vapor Intrusion

Answers to Frequently Asked Health Questions



What is vapor intrusion?

Vapor intrusion refers to the vapors produced by a chemical spill/leak that make their way into indoor air. When chemicals are spilled on the ground or leak from an underground storage tank, they will seep into the soils and will sometimes make their way into the groundwater (underground drinking water). There are a group of chemicals called volatile organic compounds (VOCs) that easily produce vapors. These vapors can travel through soils, especially if the soils are sandy and loose or have a lot of cracks (fissures). These vapors can then enter a home through cracks in the foundation or into a basement with a dirt floor or concrete slab.

VOCs and vapors:

VOCs can be found in petroleum products such as gasoline or diesel fuels, in solvents used for industrial cleaning and are also used in dry cleaning. If there is a large spill or leak resulting in soil or groundwater contamination, vapor intrusion may be possible and should be considered a potential public health concern that may require further investigation.

Although large spills or leaks are a public health concern, other sources of VOCs are found in everyday household products and are a more common source of poor indoor air quality. Common products such as paint, paint strippers and thinners, hobby supplies (glues), solvents, stored fuels (gasoline or home heating fuel), aerosol sprays, new carpeting or furniture, cigarette smoke, moth balls, air fresheners and dry-cleaned clothing all contain VOCs.

Can you get sick from vapor intrusion?

You can get sick from breathing harmful chemical vapors. But getting sick will depend on:
How much you were exposed to (dose).
How long you were exposed (duration).
How often you were exposed (frequency).
How toxic the spill/leak chemicals are.
General Health, age, lifestyle: Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

VOC vapors at high levels can cause a strong petroleum or solvent odor and some persons may experience eye and respiratory irritation, headache and/or nausea (upset stomach). These symptoms are usually temporary and go away when the person is moved to fresh air.

Lower levels of vapors may go unnoticed and a person may feel no health effects. A few individual VOCs are known carcinogens (cause cancer). Health officials are concerned with low-level chemical exposures that happen over many years and may raise a person's lifetime risk for developing cancer.

How is vapor intrusion investigated?

In most cases, collecting soil gas or groundwater samples near the spill site is done first to see if there is on-site contamination. If soil vapors or groundwater contamination are detected at a spill site, environmental protection and public health officials may then ask that soil vapor samples be taken from areas outside the immediate spill site and near any potential affected business or home. The Ohio Department of Health (ODH) does not usually recommend indoor air sampling for vapor intrusion before the on-site contamination is determined.

(continued on next page)

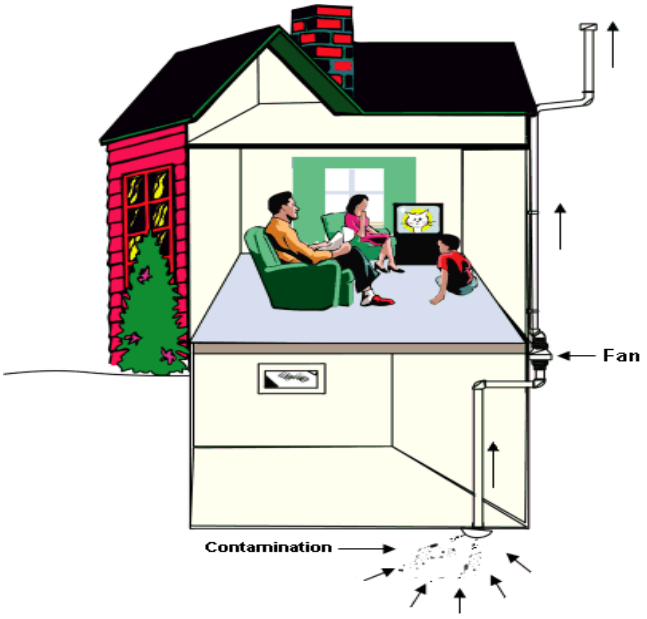
How is vapor intrusion investigated? (continued)

Because a variety of VOC sources are present in most homes, testing will not necessarily confirm VOCs in the indoor air are from VOC contamination in soils at nearby spill site. But if additional sampling is recommended, samples may be taken from beneath the home's foundation (called sub-slab samples), to see if vapors have reached the home. Sub-slab samples are more reliable than indoor air samples and are not as affected by other indoor chemical sources. If there was a need for additional sampling on a private property, homeowners would be contacted by the cleanup contractor or others working on the cleanup site and their cooperation and consent would be requested before any testing/sampling would be done.

What happens if a vapor intrusion problem is found?

If vapor intrusion is having an effect on the air in your home, the most common solution is to install a *radon mitigation system*. A radon mitigation system will prevent gases in the soil from entering the home. A low amount of suction is applied below the foundation and the vapors are vented to the outside. The system uses minimal electricity and should not noticeably affect heating and cooling efficiency. This mitigation system also prevents radon from entering the home, an added health benefit. Usually, the party responsible for cleaning up the contamination is also responsible for paying for the installation of this system. Once the contamination is cleaned up, the system should no longer be needed. In homes with on going radon problems, ODH suggests these systems remain in place permanently.

Radon Mitigation System



What can you do to improve your indoor air quality?

As stated before, the most likely source of VOCs in indoor air comes from the common items that are found in most homes. The following helpful hints will help improve air quality inside your home:

- Do not buy more chemicals than you need and know what products contain VOCs.
- If you have a garage or an out building such as a shed, place the properly stored VOC-containing chemicals outside and away from your family living areas.
- Immediately clean and ventilate any VOC spill area.
- If you smoke, go outside and/or open the windows to ventilate the second-hand, VOC-containing smoke outdoors.
- Make sure all your major appliances and fireplace(s) are in good condition and not leaking harmful VOC vapors. Fix all appliance and fireplace leaks promptly, as well as other leaks that cause moisture problems that encourage mold growth.
- Most VOCs are a fire hazard. Make sure these chemicals are stored in appropriate containers and in a well-ventilated location and away from an open pilot light (flame) of a gas water heater or furnace.
- Fresh air will help prevent both build up of chemical vapors in the air and mold growth. Occasionally open the windows and doors and ventilate.
- Test your home for radon and install a radon detector.

References:

Wisconsin Department of Health and Family Services, Environmental Health Resources, Vapor Intrusion, electronic, 2004.

New York State Department of Health, Center for Environmental Health, April 2003.

Ohio Department of Health, Bureau of Environmental Health, Indoor Environment Program, 2004.

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Bureau of Environmental Health
Health Assessment Section
"To protect and improve the health of all Ohioans"

Tetrachloroethylene (PCE)

Other names for tetrachloroethylene include PCE, perchloroethylene, PERC or tetrachloroethene.

What is PCE?

Tetrachloroethylene (also known as PCE, PERC or perchloroethylene) is a man-made liquid chemical that is widely used for dry cleaning clothes and degreasing metal. It is also used to make other chemicals and can be found in some household products such as water repellents, silicone lubricants, spot removers, adhesives and wood cleaners. It easily evaporates (turn from a liquid to a gas) into the air and has a sharp, sweet odor. PCE is a nonflammable (does not burn) liquid at room temperature.

How does PCE get into the environment?

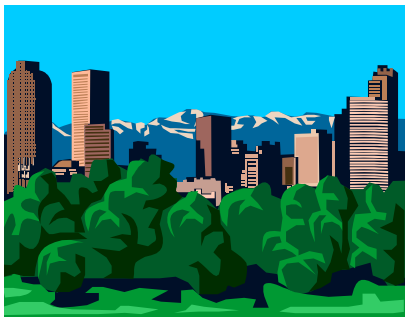
PCE can evaporate into the air during dry cleaning operations and during industrial use. It can also evaporate into the air if it is not properly stored or was spilled. If it was spilled or leaked on the ground, it may find its way into groundwater (underground drinking water).

People can be exposed to PCE from the environment from household products, from dry cleaning products and from their occupation (work). Common environmental levels of PCE (called background levels) can be found in the air we breathe, in the water we drink and in the food we eat. In general, levels in the air are higher in the cities or around industrial areas where it is used more than rural or remote areas.

The people with the greatest chance of exposure to PCE are those who work with it. According to estimates from a survey conducted by the National Institute for Occupational Safety and Health (NIOSH), more than 650,000 U.S. workers may be exposed. However, the air close to dry cleaning business and industrial sites may have levels of PCE higher than background levels. If the dry cleaning business or industry has spilled or leaked PCE on the ground, there may also be contaminated groundwater as well.

What happens to PCE in the environment?

Much of the PCE that gets into surface waters or soil evaporates into the air. However, some of the PCE may make its way to the groundwater. Microorganisms can break down some of the PCE in soil or underground water. In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain. PCE does not appear to collect in fish or other animals that live in water.



How can PCE enter and leave my body?

PCE can enter your body when you breathe contaminated air or when you drink water or eat food contaminated with the chemical. If PCE is trapped against your skin, a small amount of it can pass through into your body. Very little PCE in the air can pass through your skin into your body. Breathing contaminated air and drinking water are the two most likely ways people will be exposed to PCE. How much enters your body depends on how much of the chemical is in the air, how fast and deeply you are breathing, how long you are exposed to it or how much of the chemical you eat or drink.

Most PCE leaves your body from your lungs when you breathe out. This is true whether you take in the chemical by breathing, drinking, eating, or touching it. A small amount is changed by your body (in your liver) into other chemicals that are removed from your body in urine. Most of the changed PCE leaves your body in a few days. Some of it that you take in is found in your blood and other tissues, especially body fat. Part of the PCE that is stored in fat may stay in your body for several days or weeks before it is eliminated.

Can PCE make you sick?

Yes, you can get sick from contact with PCE. But getting sick will depend upon:

- How much you were exposed to (dose).
- How long you were exposed (duration).
- How often you were exposed (frequency).
- General Health, Age, Lifestyle Pregnant women, infants, young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

How can PCE affect my health?

Exposure to very high concentrations of PCE (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness and even death. Skin irritation may result from repeated or extended contact with the pure liquid product. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used PCE to get a "high." Normal background levels (or common environmental levels) will not cause these health effects.

Does PCE cause cancer (carcinogen)?

The US National Toxicology Program (NTP) releases the *Report on Carcinogens* (RoC) every two years. The *Report on Carcinogens* (RoC) identifies two groups of agents: "*Known to be human carcinogens*" & "*Reasonably anticipated to be human carcinogens*"

The *Twelfth Report on Carcinogens* (RoC) has determined that PCE is reasonably anticipated to be human carcinogen.

PCE has been shown to cause liver tumors in mice and kidney tumors in male rats. There is limited evidence for the carcinogenicity in humans. PCE has been studied by observing laundry and dry-cleaning workers, but they may have also been exposed to other solvents, especially trichloroethylene (TCE) and petroleum solvents.

References:

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological Profile for tetrachloroethylene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service

Report on Carcinogens, Twelfth Edition; U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, 2011. http://ntp.niehs.nih.gov/ntp/roc/twelfth/roc12.pdf

Is there a medical test to show whether you have been exposed to PCE?

One way of testing for PCE exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood. Because PCE is stored in the body's fat and slowly released into the bloodstream, it can be detected in the breath for weeks following a heavy exposure. Also, PCE and trichloroacetic acid (TCA), a breakdown product of PCE, can be detected in the blood. These tests are relatively simple to perform but are not available at most doctors' offices and must be done at special laboratories that have the right equipment. Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to PCE or the other chemicals that produce the same breakdown chemicals.

What has the federal government made recommendations to protect human health?

The EPA MCL for the amount of PCE that can be in drinking water is 5 parts per billion (ppb) or 0.005 milligrams PCE per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) have set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that PCE be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

The Ohio Department of Health is in cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health and Human Services.

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