Public Health Assessment

Final Release

WEST TROY CONTAMINATED AQUIFER

TROY, MIAMI COUNTY, OHIO

EPA FACILITY ID: OHN000508132

Prepared by
Ohio Department of Health

OCTOBER 23, 2013

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

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 45-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

PUBLIC HEALTH ASSESSMENT

WEST TROY CONTAMINATED AQUIFER

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Prepared by:

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

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SUMMARY

Introduction

The West Troy Contaminated Aquifer is a plume of chlorinated solvents in groundwater that has migrated to parts of the west well field in Troy, Miami County, Ohio. This site was proposed for addition to the U.S. Environmental Protection Agency's (EPA) National Priorities List (NPL, or "Superfund") in March 2012 and officially added to the NPL in September 2012. The Agency for Toxic Substances and Disease Registry (ATSDR) is required by law to conduct a public health assessment at all sites proposed for or listed on EPA's NPL. This public health assessment (PHA) has been prepared by the Ohio Department of Health (ODH) Health Assessment Section (HAS) under a cooperative agreement with ATSDR. This report reviews the available environmental sampling data collected by the Ohio Environmental Protection Agency (Ohio EPA) and the U.S. Environmental Protection Agency (U.S. EPA) regarding the contamination of groundwater at the West Troy Contaminated Aquifer site.

Overview

ODH reached two conclusions about the West Troy Contaminated Aquifer site in Troy, Ohio.

Conclusion 1

Volatile organic compounds (VOCs) found in public well 12-W in Troy's west well field currently will not harm people's health, because Troy effectively keeps VOCs below detectable limits in the finished drinking water. In the future, however, the city's public wells may continue to be impacted until the source of the groundwater contamination is remediated.

Basis for Decision

Area groundwater has been contaminated by chlorinated solvents, as documented by the U.S. EPA and Ohio EPA. Tetrachloroethylene (PCE) has been detected in untreated water from Troy's west well field public drinking water production well (PW)-12W at concentrations exceeding the federal drinking water maximum contaminant level (MCL).[1] Trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) have also been detected but at concentrations below their MCLs (5 ppb and 70 ppb, respectively). Trace levels of cis-1,2-DCE were also detected in PW-3W for the first time in 2010 by Ohio EPA, indicating contaminant movement past PW-12W. Troy minimizes pumping PW-12W and blends water from both well fields to reduce concentrations of VOCs to below detectable limits, typically 0.5 ppb, in finished water going to the distribution system. Troy's finished water does not currently show any detections of PCE. However, in the future, the contamination may continue to impact the public wells until the source of the groundwater contamination is remediated.

Next Steps

The U.S. EPA will investigate and address all of the contamination sources and associated plumes at this site to protect public health and the environment. The U.S. EPA remedial

[1] Maximum Contaminant Levels (MCLs) are standards set by the U.S. EPA for the highest level of a contaminant allowed in drinking water that is delivered to the free flowing outlet of the ultimate user of a public water system. Although it does not apply to untreated water, we are using the standard here for comparison purposes.

investigation and feasibility study (RI/FS) will provide this information and develop ways to best mitigate or eliminate the source of contamination associated with the contaminated groundwater.

Conclusion 2

Currently, exposures to plume-related VOCs in indoor air are unlikely to occur due to the lack of homes and buildings in the immediate vicinity of the plume. However, in the future, if the plume migrates or if contamination exists in other areas, there may be some structures over it that could be affected by vapor intrusion.

Basis for Decision

Currently, the plume is suspected to extend from a possible source on the west side of the Great Miami River to wells PW-12W and PW-3W in Troy's west well field on the east side of the river. The area of the suspected plume (Figure 1) does not appear to have residences that may be affected by vapor intrusion. Due to the lack of residences overlying the West Troy Contaminated Aquifer, the migration of chemical vapors into peoples' homes appears to be unlikely. However, the sources(s) of contamination and the precise extent of the groundwater plume haven not been identified. If the suspected plume migrates to the west or if contamination exists in areas further west, it could underlie some properties on the west side of Elm Street and possibly affect these structures through vapor intrusion.

Next Steps

The U.S. EPA will conduct a remedial investigation and feasibility study (RI/FS) to determine the full extent of the contamination, which may include whether or not there is indeed a potential for the vapor intrusion pathway to occur at this site.

For More Information

For information about this site, including site remediation, please see the U.S. EPA Superfund Site Progress Profile at http://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0508132. For health information regarding the West Troy Contaminated Aquifer site, you can call the Health Assessment Section at the ODH at 614-466-1390.

PURPOSE AND HEALTH ISSUES

The West Troy Contaminated Aquifer site was proposed for addition to the U.S. Environmental Protection Agency's National Priorities List (NPL) in March 2012 and listed on the NPL in September 2012. Because a public health assessment (PHA) is required at all sites proposed for or listed on the U.S. EPA's NPL, this document was prepared by the Health Assessment Section (HAS) at the Ohio Department of Health (ODH) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). This PHA reviews the available environmental sampling data collected by the Ohio Environmental Protection Agency (Ohio EPA) and the U.S. EPA regarding the contamination of groundwater at the West Troy Contaminated Aquifer site and makes conclusions and recommendations for actions that may be necessary to protect the public's health.

BACKGROUND

Site Location and Description

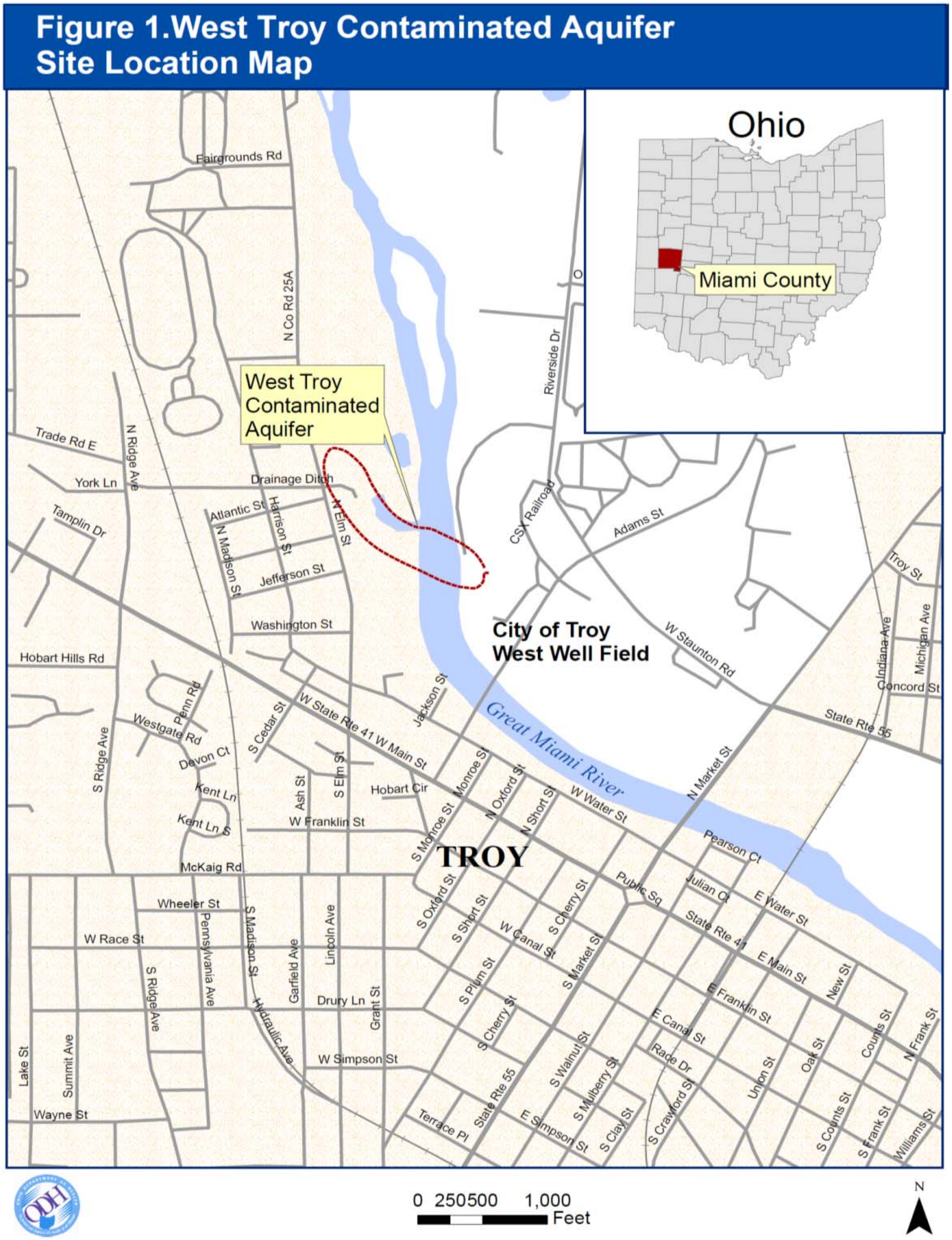
Troy is located in Miami County, Ohio, about 20 miles north of Dayton, Ohio. The municipal water supply serves about 28,000 people primarily living in the city. Troy operates 10 production wells to draw water from a sand and gravel aquifer system underlying the Great Miami River: 5 wells in the east well field and 5 wells in the west well field (Figure 1). Since 1986, volatile organic compounds (VOCs), have been detected in samples of raw water from production well (PW)-12W in the west well field. The chlorinated solvent tetrachloroethylene (PCE) has been detected as high as 7.3 micrograms per liter (µg/L) in PW-12W. The federal drinking water maximum contaminant level (MCL) for PCE is 5 µg/L. Troy minimizes pumping PW-12W and blends water from both well fields to reduce concentrations of VOCs to below detectable limits (typically 0.5 ppb) in finished water [Ohio EPA 2011].

The West Troy Contaminated Aquifer site consists of an area of groundwater contamination that extends into part of the Troy's west well field (Figure 1). The general outline of the groundwater plume has been estimated by the U.S. EPA to extend from a former automobile dealership on N. Elm Street in Troy and continue in a southeasterly direction across and under the Great Miami River to Troy's west well field on the east side of the river (Figure 1). However, the precise extent of the groundwater plume and possible source(s) of groundwater contamination have yet to be determined [U.S. EPA 2012].

Demographics and Land Use

The population of Troy is 25,058 according the 2010 census. Troy is the county seat as well as the largest city in the county. According to the 2010 census, there were 10,353 total households and 6,600 families residing in the city. The average household size was about 2.4 and the average family size was almost 3. The racial makeup of the city was approximately 90% White, 4% Black, 0.2% Native American, 2% Asian, and 2% from two or more races. People of Hispanic or Latino origin represent about 2% of the population. The median age was about 37 years, with 13% of the population age 65 and older. The per capita income for the city was about

Figure 1. Site Map for the West Troy Contaminated Aquifer Site



$23,000 and the median household income (2006-2010) was about $48,000. About 14% of the people in Troy were below the poverty level [U.S. Census 2010].

Local land use around the suspected area of contamination is mixed. Potential source areas include properties in the 500 block of N. Elm Street in Troy. To the south and west is Morgan's Ditch, a perennial stream and tributary to the Great Miami River. Troy's west well field public wells are located on the east side of the Great Miami River on park lands bordering the river [Ohio EPA 2011].

Area Geology and Hydrogeology

Generally, the geology of the area consists of near-surface, presumably river-derived silt, sand, and gravel deposits underlain by glacial deposits of sand and gravel interbedded with till [Ohio EPA 2005, 2011; U.S. EPA 2012]. Groundwater-bearing sands and gravels fill a buried bedrock valley under the river and adjacent portions of the city to depths in excess of 140 feet. Groundwater from these floodplain sand and gravel deposits serves as the primary source of drinking water for the city and its residents. City water wells draw water from underground sand and gravel at depths of between 44 and 132 feet below the ground surface (City of Troy 2012). Individual water wells can pump up to 2,100 gallons of water per minute (gpm) [ODNR well logs, 2007]. Ohio EPA approved pumping rates for these wells range from 550 gpm to 1,400 gpm [Tim Ray, personal communication, July 27, 2012]. The Troy public water system consists of ten production wells. The west well field is on the east side of the river upstream from the east well field. VOC contamination has been detected in two wells in each well field from separate sources.

Regional groundwater flow is toward the south following the Great Miami River valley. Groundwater at Troy is part of the Great Miami River Buried Valley Aquifer System. This aquifer has been designated a sole-source aquifer by the U.S. EPA and is the principal source of drinking water for 1.6 million people. Based on two pumping tests, Ohio EPA concluded that hydraulic communication exists between the shallow sands and gravels on the west side of the Great Miami River and the deeper sands and gravels on the east side of the river where the production wells are located [Ohio EPA 2011].

Previous Site Investigations

In 2005, Ohio EPA conducted an Expanded Site Inspection (ESI) at the West Troy Contaminated Aquifer site. Ohio EPA collected groundwater samples from boreholes and newly installed monitoring wells to look for contaminant source areas and to delineate the pathways by which VOCs are entering Troy's west well field. The ESI confirmed that the aquifer is contaminated with VOCs. The pattern of detections from this and past investigations suggested to Ohio EPA that a release of PCE occurred in the vicinity of the former Wampler Buick/GMC automobile dealership at 507 and 515 N. Elm Street in Troy [Ohio EPA 2005].

In 2010, Ohio EPA conducted a Supplemental Expanded Site Inspection (SESI) under a cooperative agreement with the U.S. EPA. Sampling confirmed that the Troy west well field wells PW-12W and PW-3W are contaminated with VOCs. PCE is above its MCL in PW-12W.

Troy minimizes pumping PW-12W. Water from both wells fields is blended at the treatment plant and water is exposed to the air during the treatment process. The blending and treatment processes reduce concentrations of VOCs to below detectable limits (<0.5 ppb) in finished water. No source area was identified due to the lack of confirmatory source area soil data. A groundwater sample collected south of Morgan's Ditch in 1997 contained PCE and may indicate a potential source is located west of Wampler.

NPL Site Listing

The U.S. EPA proposed the West Troy Contaminated Aquifer site for addition to the NPL in March 2012. The site was officially added to the NPL in September 2012. Adding the site to the NPL provides the best approach to investigate and address all of the contamination sources and associated plumes at this site to protect public health and the environment. As a result of the site being officially placed on the NPL, the U.S. EPA will conduct a Remedial Investigation (RI) and Feasibility Study (FS) of the site. The purpose of the RI is to collect the data needed to determine the type and extent of contamination at a site and assess human risk from exposure to toxic chemicals. A FS is a process for developing, evaluating, and selecting a cleanup plan to deal with the contaminants identified at the site.

DISCUSSION

Exposure Pathways

In order for the public to be exposed to elevated levels of chemical contaminants in and around the Troy site, they must first come into 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.

A **completed exposure pathway** consists of five main parts:

1. **A Source of Contamination** (a chemical release, landfills, etc.).
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).
5. **A Population at Risk** (people likely to come into physical contact with site-related chemicals).

Physical contact with a chemical contaminant does not necessarily result in adverse health effects. A chemical's ability to affect a person's health is also impacted 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), and
- The toxicity of the chemical of concern (how a chemical affects the body).

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;
- Current health and nutritional status;
- Age and gender; and
- Family medical history.

Groundwater Pathway

> Groundwater is water that is located below the surface of the earth in spaces between rock and soil. Groundwater supplies water to wells and springs and is a substantial source of water used in the United States. Thirty percent of the Ohio population, or about 3½ million Ohioans, drink water from a community water system that uses groundwater [U.S. EPA 2009]. The water supply in Troy comes from a buried valley sand and gravel aquifer, where water from up to 10 wells is blended and treated prior to being pumped to community water system users.

Troy's water is supplied by two well fields, the east well field and the west well field, located on the east bank of the Great Miami River (Figure 1). Each uses five production wells to draw water from the sand and gravel aquifer, the sole source of drinking water in the area, to the water treatment plant. Low concentrations of chlorinated VOCs have been detected in samples of raw water from two production wells in each well field. These include current low level detections of cis-1,2-DCE (up to 1.38 ppb) in PW-18 and historic low level detections of cis-1,2-DCE (up to 0.6 ppb) in PW-14 in the east well field (HAS 2011). No VOC detections have been observed in the course of routine sampling of PW-14 since May 2005. The sources of contamination of each well field are currently thought to be different.

Of the wells in the west well field, PW-12W has historically shown detections of PCE, TCE, and cis-1,2-DCE (Table 1). The data indicate slowly increasing contaminant levels in PW-12W over time (Figure 2). It is suspected that contaminated groundwater on the west side of the river is migrating toward PW-12W. PCE has been detected in PW-12W above the EPA MCL of 5 ppb about 45 percent of the time from 1999 to 2009. Ohio EPA believes that the contamination plume is moving past PW-12W southeast to PW-3W, because trace levels of cis-1,2-DCE were detected in PW-3W for the first time in 2010.

Trace levels (0.5–1.1 ppb) of PCE have been detected in the finished water 28 times out of the 145 monthly VOC monitoring periods during the last 12 years (2000 to 2012). Between October 2010 and August 2011, PW-12W was placed out of service due to contamination and reduced water demand. However, PW-12W was put back in service in August 2011 because Ohio EPA was concerned that without this well running at least at a reduced flow, the contamination noted in that well might be drawn into other wells [U.S. EPA 2012]. Troy's finished tap water does not currently show any detections of PCE and has never shown any detections of TCE or cis-1,2-DCE.

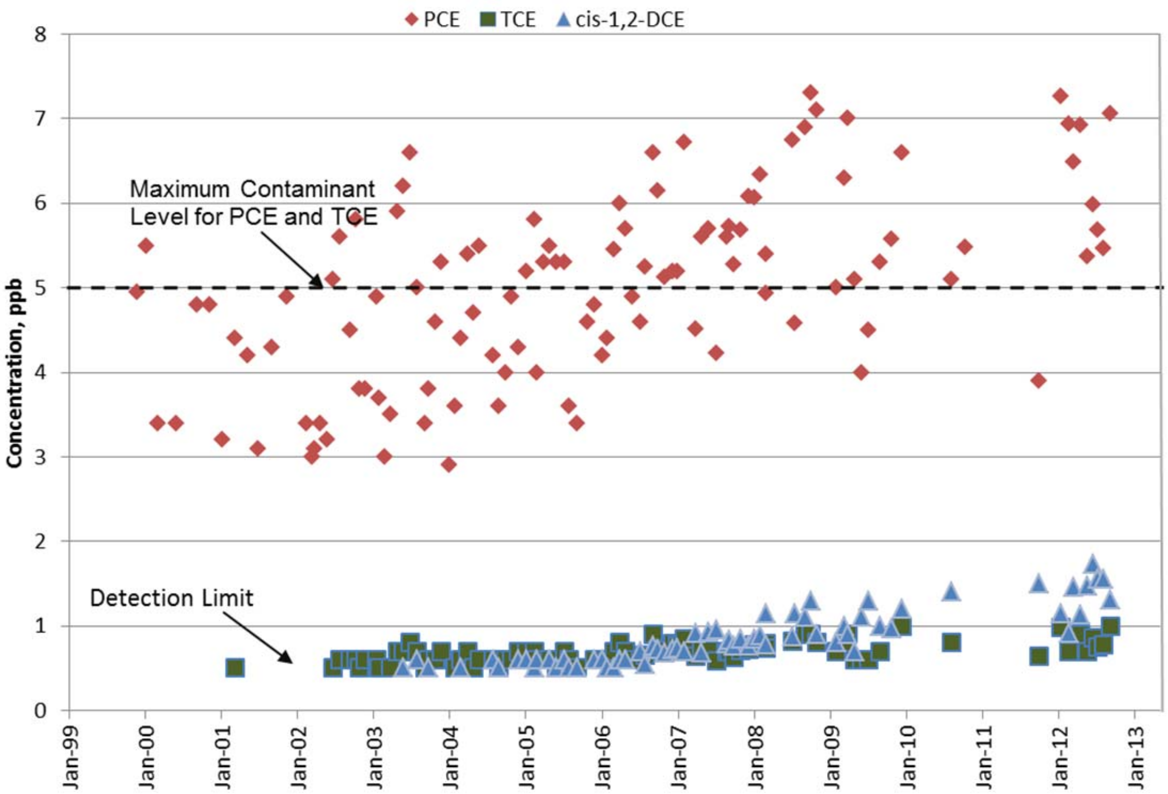
Table 1. Detections in West Well Field Production Well 12W from 1999-2012

Chemical	*Range of Detections (ppb)*	*Average (ppb)*	*Frequency of Detections*	*Frequency Above Comparison Value*	*Comparison Value (ppb) and Source*
PCE	ND – 7.3	5.0	110/112	57/112 0/112	5 – MCL 17 – CREG
TCE	ND – 1.0	0.7	87/112	0/112 21/112	5 – MCL 0.76 – CREG
Cis-1,2-DCE	ND – 1.7	0.9	67/112	0/112 0/112	70 – MCL 20 – $RMEG_{(child)}$

Source: City of Troy 2012.

ppb – parts per billion
ND – non detect (detection limit = 0.5 ppb)
MCL – maximum contaminant level for drinking water (EPA)
CREG – cancer risk evaluation guide (ATSDR)
RMEG – reference dose media evaluation guide (ATSDR)

Figure 2. Troy PW-12W Historical Monitoring Results



Source: City of Troy. Data from 12/6/1999–9/10/2012.
ppb – parts per billion

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. The area of the suspected plume (Figure 1) does not appear to underlie residences that may be affected by vapor intrusion. Due to the lack of residences overlying the projected boundaries of the West Troy Contaminated Aquifer, the migration of chemical vapors into peoples' homes appears to be unlikely. However, the populated residential area further south has been impacted by sources of contamination affecting wells in the east well field known as the East Troy Contaminated Aquifer [HAS and ATSDR 2011]. For the West Troy Contaminated Aquifer, the sources(s) of contamination and the precise extent of the groundwater plume have not been identified. Currently, the plume is suspected to extend from a possible source on the west side of the river to Troy's west well field on the east side of the river. If the suspected plume expands to the west or if contamination exists further west, it could underlie some properties on the west side of Elm Street and possibly affect these structures through vapor intrusion.

Public Health Implications

The primary contaminants of concern at the West Troy Contaminated Aquifer site include tetrachloroethylene, also known as perchloroethylene (PCE), trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE).

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].

Health studies involving the ingestion of PCE in drinking water supplies are limited. 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], 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.

Site-Specific Assessment

PCE has been detected in PW-12W above the EPA MCL of 5 ppb about 45 percent of the time from 1999 to 2009 (Table 1). Trace levels (0.5–0.8 ppb) of PCE have also been detected in the plant tap water 5 times out of the 60 monthly VOC monitoring periods from 2005 to 2009. PW-12W was shut down in 2010 but was put back in service at reduced flow in August 2011 because of concerns that the contamination might be drawn into other wells without this well running. The City of Troy minimized pumping PW-12W and blended water from both well fields to reduce VOC concentrations to below detectable limits in finished water [Ohio EPA 2011]. The detection limit concentration (typically 0.5 ppb) for PCE in drinking water is below its MCL (5 ppb) and ATSDR's cancer risk evaluation guide (CREG) for PCE in drinking water (17 ppb). Troy's finished tap water does not currently show any detections of PCE.

Trichloroethylene (TCE)

The primary use of trichloroethylene 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, such as PCE. These solvents were also added to adhesives, lubricants, paints, varnishes, paint strippers, pesticides, and cold metal cleaners. When released to surface soils, TCE will form a gas faster than many other volatile organic compounds. It has been shown that the majority of the TCE spilled on top of soils will vaporize into the air. When TCE is released into the air, it degrades rapidly when exposed to light, with about half of it breaking down to other compounds within a week [ATSDR 1997b]. TCE adsorption to soil is largely dependent on the organic carbon content of the soil, as soils with a higher organic carbon content tend to more effectively adsorb the TCE. TCE is known to be only slightly soluble in water, but there is ample evidence that 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 will rapidly vaporize into the air spaces between soil grains above the water table. Studies indicate that it will 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 will migrate to the surface and be released to the atmosphere. The primary means of degradation of trichloroethylene in groundwater is by bacteria, but the breakdown product by this means is vinyl chloride, a known human carcinogen that potentially can be more of a health concern than TCE [Vogel and McCarty 1985].

TCE is characterized as "carcinogenic in humans by all routes of exposure" by the U.S. EPA. This conclusion is based on convincing evidence of a causal association between TCE exposure in humans and kidney cancer [U.S. EPA 2011]. The IARC has classified TCE as "*probably carcinogenic to humans" (Group 2A)*. The National Toxicology Program (NTP) determined that trichloroethylene is reasonably anticipated to be a human carcinogen [NTP 2011]. The health effects from drinking and inhaling low levels of TCE (in the single or double digit ppb range) over long periods of time remain poorly-documented and controversial [ATSDR 1997b].
A study of residents in Woburn, Massachusetts associated excessive cases of acute lymphocytic leukemia in male children with their mothers' exposure to elevated levels of TCE (183 – 267 ppb) in a public drinking water well over a course of 5 to 10 years (Lagakos et al. 1986). The impacted well also contained low levels (<50 ppb) of PCE, 1,2-DCE, and chloroform. Statistically significant excess leukemia cases in females were associated with residents exposed to TCE and other chemicals in their drinking water supply in New Jersey [Fagliano et al. 1990].

Site-Specific Assessment

TCE has been detected below the MCL in PW-12W at an average concentration of 0.7 ppb from 1999-2009 (Table 1). This concentration is below its respective MCL (5 ppb) and ATSDR's cancer risk evaluation guide (CREG) for TCE in drinking water (0.76 ppb). The CREG represents an estimated risk of one excess cancer case in a population of one million (1×10^{-6}). Troy minimized pumping PW-12W and blended water from both well fields to reduce concentrations of VOCs, including TCE, to below detectable limits in finished water. Therefore, it is unlikely that TCE in drinking water would pose a cancer risk to the residents of Troy. Troy's finished tap water has never shown and does not currently show any detections of TCE above the detection limit of 0.5 ppb.

1,2-Dichloroethylene (1,2-DCE)

1,2-Dichloroethylene (1,2-DCE), also called 1,2-dichloroethene, is a highly flammable, colorless liquid with a sharp, harsh odor. There are two forms of 1,2-dichloroethylene: cis-1,2-dichloroethylene and trans-1,2-dichloroethylene. Industrial quantities of 1,2-dichloroethylene are used to produce other chlorinated solvents and compounds. The odor threshold in air is about 17,000 parts per billion. The presence of 1,2-dichloroethylene in groundwater is most likely due to the biodegradation of other more highly chlorinated compounds tetrachloroethylene and trichloroethylene present in groundwater [ATSDR 1996].

The U.S. EPA has established a maximum contaminant level (MCL) of 70 ppb for cis-1,2-DCE in drinking water. The U.S. EPA has given cis-1,2-DCE a "not classifiable" rating (D) as to its ability to cause cancer, since cancer effects have not been studied in humans or animals. Neither the NTP nor the IARC have classifications for this chemical.

Site-Specific Assessment

Production well 12W has historically shown detections of cis-1,2-DCE at levels below its respective MCL (Table 1). Troy's finished tap water has never shown and does not currently show any detections of cis-1,2-DCE above the detection limit of 0.5 ppb. Cis-1,2-DCE is not expected to harm people's health.

Mixture Assessment

Exposures to mixtures of both tetrachloroethylene and trichloroethylene are likely to be additive in nature in producing nervous system effects or noncancer and cancer kidney or liver effects [ATSDR 2004]. Troy's finished tap water does not currently show any detections of either of these compounds.

Child Health Considerations

Both the HAS and the ATSDR recognize that children are inherently at a greater risk of developing illness due to exposure to hazardous chemicals given 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.

Children's exposures and public health implications were considered in this evaluation.
As a result of special concerns with regard to children's exposures, a multi-unit vapor extraction system was installed at the St. Patrick Elementary School. The 90-day performance sampling was conducted on November 23, 2007, and none of the chemicals of concern were detected in the indoor air at the school.

HEALTH OUTCOME DATA

In addition to evaluating exposure and substance-specific toxicological information, the ODH may review available health outcome data, such as the number of reportable diseases or deaths in a community, as part of the public health assessment process.

An evaluation of health outcomes is reasonable if there is:

1) A current (or past) completed or potential exposure pathway.
2) A way to know the levels and length of exposure.
3) An identified exposed population.
4) Sufficient exposure to result in plausible health effects.
5) Information available at the geographic level necessary to compare to the exposed population.
6) A database on the health outcomes of interest likely to occur from exposure.

At this site, there is no current potential or completed exposure pathway through the drinking water route. The City of Troy minimized pumping from the contaminated well PW-12 and blended water from both well fields to reduce VOC concentrations to below detectable limits in the finished water.

COMMUNITY HEALTH CONCERNS

In June 2013, the Ohio Department of Health (ODH), in cooperation with the ATSDR, released for public comment a draft of this Public Health Assessment (PHA) for the West Troy Contaminated Aquifer. The draft PHA document was made available on the ODH and ATSDR web sites, and a printed copy was made available at the Troy-Miami Public Library in Troy, Ohio. No public health concerns or comments were received during the public comment period. Comments regarding the PHA's initial release of the PHA (September 2012) from Ohio EPA and the City of Troy were previously incorporated into the document.

This final release PHA focuses on environmental data from sampling conducted prior to the listing of this site to the National Priorities List (NPL) in March 2012. The U.S. EPA will have new information in the future as a result of the remedial investigation.

CONCLUSIONS

1. Volatile organic compounds (VOCs) found in public well 12-W in Troy's west well field currently do not harm people's health, because the City of Troy effectively keeps VOCs below detectable limits in the finished drinking water. In the future, however, the city's public wells may continue to be impacted until the source of the groundwater contamination is remediated. The groundwater contamination may continue to impact Troy's drinking water supply wells if actions are not taken to mitigate potential exposures to chlorinated solvents. Area groundwater has been contaminated by the chlorinated solvent tetrachloroethylene (PCE), as documented by the U.S. EPA and Ohio EPA. PCE has been detected in untreated water in PW-12W from Troy's west well field at concentrations exceeding the federal drinking water maximum contaminant level (MCL). Trichloroethylene (TCE) and cis-1,2-dichloroethylene (cis-1,2-DCE) have also been detected but at concentrations below their respective MCLs (5 ppb and 70 ppb). Troy's finished tap water currently does not show any detections (<0.5 ppb) of PCE, although detections of PCE have been sporadic in the past. Neither TCE nor cis-1,2-DCE have ever been detected in the finished water.

2. Currently, exposures to plume-related VOCs in indoor air are unlikely to occur due to the lack of homes and buildings in the immediate vicinity of the plume. The area of the suspected plume (Figure 1) does not appear to underlie individual homes that may be affected by vapor intrusion. However, the sources(s) of contamination and the precise extent of the groundwater plume haven not been identified. If the suspected plume migrates to the west or if contamination exists further to the west, it could underlie some properties on the west side of Elm Street and possibly affect these structures through vapor intrusion.

RECOMMENDATIONS

1. The U.S. EPA should delineate the full extent of groundwater contamination affecting the west well field in Troy.

2. The U.S. EPA should identify the source of the contaminants currently impacting Troy's west well field and isolate and contain or remove these contaminants to prevent contamination of the well field in the future.

PUBLIC HEALTH ACTIONS

The West Troy Contaminated Aquifer site was added to the NPL in September 2012. The Ohio Department of Health, in cooperation with ATSDR, released a Public Health Assessment (PHA), dated June 14, 2013, for public comment. This PHA-Public Comment Release was made available for public comment until July 29, 2013. There were no comments from the public and no additional comments from city or state agencies. The U.S. EPA will conduct a remedial investigation to identify source(s) of groundwater contamination in the area and take steps to mitigate or eliminate this contamination.

REPORT PREPARATION

This Public Health Assessment for the West Troy Contaminated Aquifer 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.

Authors
Ohio Department of Health
Health Assessment Section
John Kollman, Environmental Specialist
Robert C. Frey, Chief

Technical Project Officer
Trent LeCoultre
Division of Community Health Investigations
Central Branch
ATSDR

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APPENDICES

Appendix A. Glossary of Terms

Acute
Occurring over a short time (compare with chronic).

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Adsorption
Adherence of the atoms or molecules of a gas or liquid to the surface of another substance, such as soil.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway (see exposure pathway).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Confounder
A factor that is associated with the exposure that may also influence the outcome of a study. This factor by itself can also cause the effect or disease under study.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

EPA
United States Environmental Protection Agency.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Finished water
Water that has been treated and is ready to be delivered to customers.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces (compare with surface water).

Hazard
A source of potential harm from past, current, or future exposures.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical (compare with public health assessment).

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way (see route of exposure).

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Maximum Contaminant Level (MCL)
The maximum permissible level of a contaminant in water that is delivered to any user of a public water system. MCLs are enforceable standards established by the U.S. Environmental Protection Agency (U.S. EPA).

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of metabolism.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

National Priorities List (NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The list is based primarily on the score a site receives from the Hazard Ranking System. The NPL is updated on a regular basis. A site must be on the NPL to receive money from the Trust Fund for remedial action.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

NPL (see National Priorities List for Uncontrolled Hazardous Waste Sites)

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment (see exposure pathway).

ppb
A unit of measurement of concentration: parts per billion.

ppm
A unit of measurement of concentration: parts per million.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community

concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health (compare with health consultation).

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future (ATSDR uses five public health hazard categories).

Public meeting
A public forum with community members for communication about a site.

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

RfD [see reference dose]

Risk
The probability that something will cause injury or harm.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. Typically set at ten, they are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use safety factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also called an uncertainty factor].

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Substance
A chemical.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Vapor intrusion
The movement of volatile chemicals and gases from soil and groundwater into the indoor air of homes and commercial buildings.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, tetrachloroethylene (PCE), and trichloroethylene (TCE).

Appendix B. Fact Sheets

Bureau of
Environmental Health
Health Assessment Section

"To protect and improve the health of all Ohioans"

1,2-Dichloroethene

(also called cis- and trans- 1,2 DCE)

Answers to Frequently Asked Health Questions

What is 1,2 DCE?

1,2-Dichloroethene (1,2 DCE) is a highly-flammable, chlorinated, colorless liquid that has a sharp, harsh odor. There are no known products you can buy that contain 1,2 DCE. 1,2 DCE is used when mixing other chlorinated chemicals and is most often used to produce chemical solvents.

How does 1,2 DCE enter the environment?

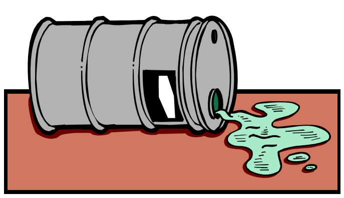
1,2 DCE is released to the environment from chemical factories that make or use this chemical, from landfills and hazardous waste sites that have a spill or leak, from chemical spills, from burning vinyl and from the chemical breakdown of other chlorinated chemicals in the underground drinking water (groundwater).

What happens to 1,2 DCE when it enters the environment?

Air: When spilled on moist soils or in rivers, lakes and other bodies of water, most of the 1,2 DCE quickly evaporates into the air. 1,2 DCE quickly breaks down by reacting with the sunlight. In the air, it usually takes about 5-12 days for half of any amount spilled to break down.

Water: The 1,2 DCE found below soil surfaces in landfills or hazardous waste sites may dissolve in water during rain events and leak deeper in the soils, possibly contaminating the groundwater. Once in groundwater, it takes about 13-48 weeks for half of any amount spilled to break down.

Soils: Some 1,2 DCE trapped under ground may escape as soil-gas vapors. These vapors can travel through soils, especially if the soils are sandy and loose or have a lot of cracks (fissures). The vapors can then enter a home through cracks in the foundation or into a basement with a dirt floor or concrete slab. 1,2 DCE in groundwater will eventually break down into vinyl chloride and other chemicals, some of which are more hazardous to people than the 1,2 DCE.



How can I be exposed to 1,2 DCE?

People who live in cities or suburbs are more likely to be exposed to 1,2 DCE than people living in rural areas. Most people who are exposed through air or water are exposed to very low levels, in the parts per billion (ppb) range. **Notes: "ppb" is a unit of measurement. Example: 1 part per billion (1 ppb) would be equal to having one bean in a pile of one billion beans.**

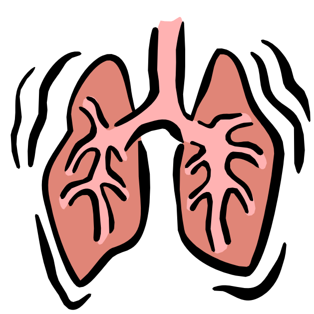
Human exposure to 1,2 DCE usually happens where the chemical has been improperly disposed of or spilled. Exposure mainly happens by breathing contaminated air or drinking contaminated water. If the water in your home is contaminated, you could also be breathing 1,2 DCE vapors while cooking, bathing or washing dishes.

The people who are most likely to be exposed to 1,2 DCE are people who work at factories where this chemical is made or used, people who work at a 1,2 DCE contaminated landfill, communities that live near contaminated landfills and hazardous waste sites.

How does 1,2 DCE enter and leave my body?

Most 1,2 DCE enters the body through your lungs when you breathe contaminated air (inhalation), through your stomach and intestines when you eat contaminated food or water (ingestion), or through your skin upon contact with the chemical (dermal).

Once breathed or swallowed, it enters your blood rapidly. Once in your blood, it travels throughout your body. When it reaches your liver it is changes into several other break-down chemicals. Some of these chemicals are more harmful than 1,2 DCE.



Can 1,2 DCE make me sick?

Yes, you can get sick from exposure to 1,2 DCE. However, getting sick will depend on many factors such as:

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

How can exposure to 1,2 DCE affect my health?

Most information about exposure to 1,2 DCE is from occupational studies where workers were exposed at very high levels. Most environmental exposures to 1,2 DCE are at much lower than those in the workplace.

The short-term occupational studies of workers exposed to breathing high levels of 1,2 DCE found workers became nauseous (upset stomach) and drowsy/tired.

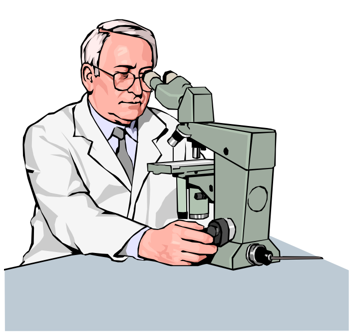
The long-term human health effects after exposure to low concentrations of 1,2 DCE are not known.

Will exposure to 1,2 DCE cause cancer?

The U.S. EPA classifies 1,2 DCE as a Class D carcinogen. The U.S. EPA Class D category is used when the chemical is not classifiable to its human carcinogenicity (ability to cause cancer). This classification is made because there is no solid data that this chemical causes cancer in humans or animals.

Is there a test to find out if I have been exposed to 1,2 DCE?

Tests are available to measure concentrations of 1,2 DCE in blood, urine and tissues. However, these tests aren't normally used to determine whether a person has been exposed to this compound. This is due to the fact that after you are exposed to 1,2 DCE, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.



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

The federal government has developed regulatory standards and guidelines to protect people from possible health effects of 1,2 DCE in water and air.

Water: The EPA has established water quality guidelines to protect both aquatic life and people who eat fish and shellfish. The EPA Office of Drinking Water has set a drinking water regulation that states that water delivered to any user of a public water system shall not exceed 70 ppb for cis-1,2 DCE and 100 ppb trans-1,2 DCE. For very short-term exposures (1 day) for children, EPA advises that concentrations in drinking water should not be more than 4 ppm for cis-1,2 DCE or 20 ppm for trans-1,2 DCE. For 10-day exposures for children, EPA advises that drinking water concentrations should not be more than 3 ppm for cis-1,2 DCE or 2 ppm for trans-1,2 DCE. For industrial or waste disposal sites, any release of 1,000 pounds or more must be reported to the EPA.

Air: The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) have established guidelines for occupational exposure to cis- or trans-1,2 DCE. Average concentrations should not exceed 200 ppm in the air.

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Where Can I Get More Information?

Ohio Department of Health
Bureau of Environmental Health
Health Assessment Section
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 466-1390

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.

This pamphlet was created by the Ohio Department of Health, Bureau of Environmental Health, Health Assessment Section and supported in whole by funds from the Cooperative Agreement Program grant from the ATSDR.

Created 08-07-09

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?

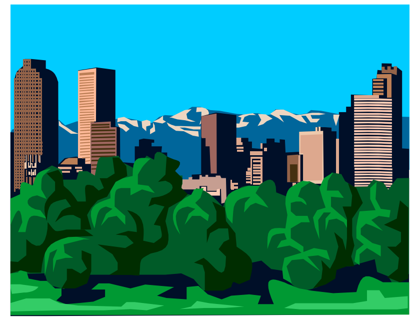
PCE can evaporate into the air during dry cleaning operations and during industrial use. It can also evaporate into the air if it is not properly stored or was spilled. If it was spilled or leaked on the ground, it may find its way into groundwater (underground drinking water).

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.

This pamphlet was created by the Ohio Department of Health, Bureau of Environmental Health, Health Assessment Section and supported in whole by funds from the Cooperative Agreement Program grant from the ATSDR.

Bureau of
Environmental Health
Health Assessment Section

"To protect and improve the health of all Ohioans

Trichloroethylene (TCE)

(try- klor'oh eth'uh- leen)

Answers to Frequently Asked Health Questions

What is TCE?

TCE is a man-made chemical that is not naturally found in the environment. TCE is a non-flammable (does not burn), colorless liquid with a somewhat sweet odor and sweet, "burning" taste. It is mainly used as a cleaner in industry to remove grease from metal parts. TCE can also be found in common household items such as glues, paint removers, typewriter correction fluids and spot removers.

The biggest source of TCE in the environment comes from evaporation (changing from a liquid into a vapor/gas) when industries use TCE to remove grease from metals or when we use common household products that contain TCE. It can also contaminate soils and groundwater (underground drinking water) as the result of spills or improper disposal.

What happens to TCE in the environment?

- Upon contact with the air, TCE quickly evaporates and breaks down in the sunlight and oxygen.
- TCE quickly evaporates from the surface waters of rivers, lakes, streams, creeks and puddles.
- If large amounts of TCE are spilled on the ground, some of it will evaporate and some of it may leak down into the soils. When it rains, TCE can be carried through the soils and into the groundwater (drinking water).
- When TCE-contaminated groundwater is in an anaerobic (without oxygen) environment and with time, it will break down into different chemicals such as 1,2 Dichloroethene (1,2 DCE) and Vinyl Chloride (VC).
- TCE does not build up in plants and animals.
- TCE found in foods is believed to come from TCE contaminated water used in food processing or from food processing equipment cleaned with TCE.

How does TCE get into your body?

- Breathing (Inhalation): TCE can get into your body by breathing air contaminated with TCE vapors. The vapors can be released from the industrial use of TCE, from using household products that contain TCE, or by TCE contaminated water evaporating in the shower.
- Drinking (Ingestion): TCE can get into your body by drinking TCE contaminated water.
- Skin (Dermal): Small amounts of TCE can get into your body through skin contact. This can take place when using TCE as a cleaner-degreaser or by contact with TCE contaminated soils.

Can TCE make you sick?

Yes, you can get sick from TCE. But getting sick will depend on the following:

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

How does TCE affect your health?

Breathing (Inhalation):

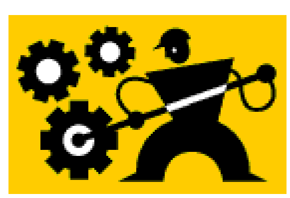
- Breathing high levels of TCE may cause headaches, lung irritation, dizziness, poor coordination (clumsy) and difficulty concentrating.
- Breathing very high levels of TCE for long periods may cause nerve, kidney and liver damage.

Drinking (Ingestion):

- Drinking high concentrations of TCE in the water for long periods may cause liver and kidney damage, harm the immune system and damage fetal heart development in pregnant women.
- It is uncertain whether drinking low levels of TCE will lead to adverse health effects.

Skin (Dermal) Contact:

- Short periods of skin contact with high levels of TCE may cause skin irritation and rash.



Does TCE cause cancer?

In September of 2011 the U.S. EPA revised their Integrated Risk Information System (IRIS) numbers for cancer and non-cancer effects for Trichloroethylene (TCE). The U.S. EPA newly revised IRIS document has classified TCE as “carcinogenic to humans.” This classification is used when there is evidence between human exposure and cancer.

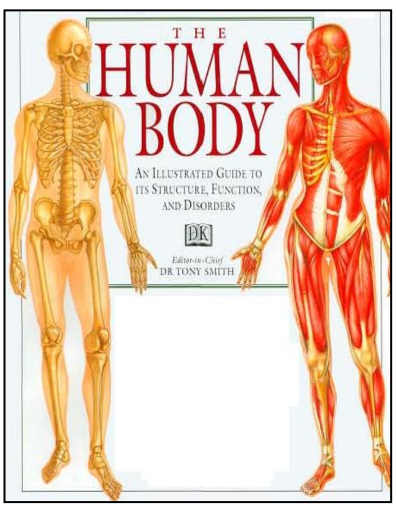
The National Toxicology Program’s 12th Report on Carcinogens list TCE as *Reasonably Anticipated to be a Human Carcinogen*. **NOTE:** The 12th Report on Carcinogens was released prior to the release of the new EPA IRIS revision. It is likely the next Report on Carcinogens will reflect the EPA IRIS number changes.

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

Yes, medical testing is available to determine recent exposure(s).

- TCE can be measured in your breath, but only if you have been exposed to ***large*** amounts (part per million -- ppm levels).
- Blood or urine samples can also be used, but only if you have been exposed to ***large*** amounts (part per million -- ppm levels).

TCE in the human body:



When chemicals enter the human body, they typically get broken down and eliminated through normal bodily functions. Some of the break down products (called metabolites) of TCE can be measured in your blood or urine. However, some of the same metabolites in your blood and urine can also be produced as a result of exposure to similar chemicals and other sources (diet, medications, environment, etc.). For this reason, blood and urine testing is not always an accurate measure of exposure to TCE.

It is important to note TCE and TCE’s metabolites usually leave the body shortly after exposure, so the testing would only be useful for recent exposures. Also, testing may not be useful or reliable in determining whether people have been exposed to low-doses of TCE or whether they will experience any harmful health effects.

Has the federal government made recommendations to protect human health?

The federal government develops regulations and recommendations to protect public health and these regulations can be enforced by law.

Recommendations and regulations are periodically updated as more information becomes available. Some regulations and recommendations for TCE follow:

- ✓ On 09/28/2011 the U.S. EPA revised their Integrated Risk Information System (IRIS) numbers for Trichloroethylene (TCE) (CASRN 79-01-6) -- see below reference section for link --
- The Environmental Protection Agency (EPA) has set a maximum contaminant level (MCL) for TCE in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5.0 parts of TCE per billion parts water (5.0 ppb).
- The Occupational Safety and Health Administration (OSHA) have set an exposure limit of 100 ppm (or 100 parts of TCE per million parts of air) for a healthy adult, 8-hour workday, 40-hour workweek.
- The EPA has developed regulations for the handling and disposal of TCE.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for TCE (electronic at) **http://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=173&tid=30**

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

U.S. EPA Integrated Risk Information System (IRIS) for Trichloroethylene (TCE) (CASRN 79-01-6) **http://www.epa.gov/iris/subst/0199.htm**

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ATSDR AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Updated 06/25/12