

Health Consultation

FORMER HIGH POINT CLEANERS

MEMPHIS, SHELBY COUNTY, TENNESSEE

DCERP FACILITY ID #D-79-158

EPA FACILITY ID: TND981027600

MAY 26, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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

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

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Introduction

In December 2005, the Tennessee Department of Environment and Conservation (TDEC), Division of Remediation (DOR), Drycleaner Environmental Response Program (DCERP), contacted the Tennessee Department of Health (TDH), Environmental Epidemiology (EEP). DCERP requested that EEP review environmental sampling data for indoor air quality within the strip mall suite that housed a former drycleaning facility. The Former High Point Cleaners facility operated at 3668 Macon Road, Memphis, Shelby County, Tennessee, 38122. Figure 1 is a map showing the location of the Former High Point Cleaners location.

The environmental impact generally associated with older drycleaner facilities is the release of drycleaning solvents into the environment. The drycleaner solvent of concern at this site is tetrachloroethylene (PCE). At sites where drycleaning was performed for many years, it is not uncommon to find that cleaning solvents, lost through routine operations, have contaminated the soil and groundwater beneath those facilities. The State of Tennessee has established the DCERP to oversee the cleanup of sites where drycleaning operations have created environmental pollution.

As part of the environmental assessment work being performed at the Former High Point Cleaners facility, the DCERP stipulated that an indoor air sample be collected and analyzed for drycleaner related solvent vapors. The analysis of the indoor air sample revealed the presence of PCE vapor in the suite. Thus, the focus of this public health consultation will be to assess any potential human health and safety concerns from the concentration of PCE vapor present in the Former High Point Cleaners facility.

Background

The Former High Point Cleaners was accepted into the DCERP program in December 1998, at which time the drycleaner business was in operation. It was registered as Facility #D-79-158. The drycleaner business was located in a central suite of a six-suite strip mall. Figure 2 shows the layout of the strip mall. The Former High Point Cleaners operated in this suite from 1950 to 2003. The strip mall is located on the northwest corner of the intersection of Dyer Street and Macon Road in a densely urbanized area (ENSAFE 2001, 2003). Figure 3 is a photograph of the strip mall storefronts. Figure 4 is a photograph of the drycleaner storefront during the time it was in operation.

The site investigation process began with a soil gas survey of the strip mall property and the Former High Point Cleaners strip mall suite. The soil gas survey is conducted by placing passive soil gas collectors in the ground at predetermined locations, inside and outside the building, at the site. The soil gas survey was used to identify areas (generally referred to as *areas of concern*) of the strip mall property that may be contaminated with drycleaner-related solvents, and to help focus investigative resources to those specific areas. The soil gas survey results showed that elevated levels of PCE were present in the soil under the floor of the strip mall suite that housed the drycleaner operation and outside, immediately north of the suite, in the soil under the pavement in the vicinity of monitoring wells 3 and 3D (ENSAFE 2001; Figure 2).

After the identification of the areas of concern, subsequent site investigation activities included the installation of thirteen groundwater monitoring wells (eleven on the strip mall property; two on adjacent properties), advancement of five Direct Push Technology (DPT) soil borings, collection of water samples from the monitoring wells and DPT borings, and the collection of one indoor air sample (ENSAFE 2001, 2003).

During the installation of the monitoring wells, a geologic profile of the site was documented, including the depth to groundwater. The site is underlain by a layer of clayey silt that ranges in thickness, from twenty-six to thirty-one feet. Monitoring well data shows that the depth to groundwater across the site ranges in depth from twenty-seven to thirty feet.

The hydrogeologic data for the site has not been consistent (ENSAFE 2004). The measured groundwater levels have varied such that investigators have been unable to obtain a clear picture as to the predominate direction of groundwater flow (DCERP 2006). Thus, the contaminated groundwater appears to be moving in an irregular, radial pattern, away from the strip mall building. It is estimated that the total area of groundwater impacted by PCE and its breakdown products is approximately one acre (ENSAFE 2003).

Chemical analysis of groundwater samples from monitoring wells at the site confirm the presence of PCE and four of its breakdown products (trichloroethylene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, vinyl chloride). However, the PCE concentrations were generally 1 to 2 orders of magnitude higher than those of its breakdown products (Appendix B). This suggests that little degradation of the PCE is occurring in the groundwater (ENSAFE 2003).

The findings from the DPT soil borings suggest that the highest PCE concentrations in the groundwater are present mainly in the area (inside the building) beneath the rear of the former drycleaner strip mall suite, and in the immediate area (outside the building) to the rear of the strip mall suite, north-northeast from the building. The site conceptual model as to the movement of the PCE, once it entered the soil, is that it essentially moved vertically downward, approximately twenty-seven to thirty feet, until it reached the groundwater. Once in the groundwater, the PCE contamination began to move laterally, in an irregular, radial pattern away from the building (DCERP 2006).

The data gathered thus far suggests that the main area of contaminated soil lies beneath the floor of the rear portion of the Former High Point Cleaners strip mall suite. This contaminated soil could be a potential future source of PCE vapors inside the suite. Therefore, as a precaution, the DCERP stipulated that an indoor air sample be obtained and analyzed for drycleaner-related solvents and their breakdown products. These chemicals are also known as volatile organic compounds (VOCs). An indoor air sample was collected from the Former High Point Cleaners suite on July 19, 2005 (ENSAFE 2005). The results of that sample are the focus of this public health consultation.

Discussion

Indoor Air Sampling

The presence of drycleaner-related solvents in the environmental media (i.e., soil and/or groundwater) beneath the floor of the Former High Point Cleaners is a potential source of VOC vapors that could migrate into the former drycleaner suite. On July 19, 2005, a six-hour indoor air sample was collected from the Former High Point Cleaners suite utilizing an industry standard SUMMA canister. The former drycleaner strip mall suite was reportedly vacant and had been vacant for an extended period of time prior to the collection of the indoor air sample. Thus, the suite had been closed up with no means of exchanging indoor air with outdoor air via use of the strip mall suite doorways, or usage of the HVAC (i.e., heating, ventilation, and air conditioning) system (DCERP 2006). Table 1 (CHEMDATA 2005) shows the results of the laboratory analysis of the indoor air sample.

TABLE 1. Results of the July 19, 2005, SUMMA canister six-hour indoor air sampling for vapors from drycleaner-related solvent and its breakdown products in parts per billion (ppb).		
Chemical	Indoor Air VOC Concentration (ppb)	Analytical Detection Limits (ppb)
Tetrachloroethylene (PCE)	9.2	0.1
1,1,1-Trichloroethane	U	0.1
1,1,2-Trichloroethane	U	0.2
cis-1,2-Dichloroethene	U	0.1
Vinyl Chloride	U	0.2
U = Analyte not detected above detection limits		

Typically, for the examination of worker exposure to chemical contaminants in the air, the regulations set forth by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.1000 (i.e., the Code of Federal Regulations) are considered the standard. This legally enforceable standard is based upon an employee's average airborne exposure in any eight-hour work shift of a forty-hour work week. Thus, an air sample collected over an 8-hour period would be considered standard (OSHA 1971). In this case, because the air sample collected in the Former High Point Cleaners strip mall suite was only a 6-hour sample, it would be considered *non-standard*.

Introduction to Chemical Exposure

To determine whether persons have been, are, or are likely to be exposed to chemicals, Environmental Epidemiology of the Tennessee Department of Health evaluates mechanisms that could lead to human exposure. An exposure pathway contains five parts:

1. a source of contamination,
2. a media such as air or soil through which the contaminant is transported,
3. a point of exposure where people can contact the contaminant,
4. a route of exposure by which the contaminant enters or contacts the body, and
5. a receptor population.

A pathway is considered complete if all five elements are present and connected. If one of these elements is missing, the pathway is considered incomplete, and human exposure is not possible.

At the Former High Point Cleaners site, PCE was the only VOC detected in the July 19, 2005, indoor air sample. Therefore, in order to evaluate the potential for human exposure to PCE in air, we examined the pathway by which people could be exposed to the PCE, and compared the concentration of PCE in the air to Agency for Toxic Substances and Disease Registry's (ATSDR) Minimal Risk Level (MRL) to determine if concentrations present in the strip mall suite were sufficient to cause illness or other adverse health problems.

Potentially Exposed Populations

A completed pathway (inhalation) is assumed to have existed during the years that the Former High Point Cleaners was in operation. The fact that PCE was being utilized inside the drycleaner facility assured that employees, and patrons, would have been exposed to PCE vapor during that period of time. Additionally, persons occupying and patronizing the adjoining business suites, to either side of the drycleaner's suite, were potentially exposed to PCE vapor to some degree.

Today, the drycleaner business is gone, and active use of PCE has ceased. However, there remains a potential source of PCE vapor in the contaminated soil beneath the floor of the former drycleaner suite. The indoor air monitoring results confirms that PCE vapor is present inside the former drycleaner facility. At this time, the inhalation exposure pathway is complete for the employees and patrons of the business that now occupies the Former High Point Cleaners strip mall suite.

Tetrachloroethylene Exposure Scenario

For the purposes of this public health consultation, the analytical results of the six-hour indoor air sample will be adjusted upward by twenty-five percent in order to approximate the results of an eight-hour air sample. Thus, the PCE concentration value of 9.2 ppb will be increased to an estimated, eight-hour value of 11.5 ppb.

Background concentrations of PCE in ambient air, in the United States, are typically less than 1 ppb (ATSDR 1997). The estimated eight-hour concentration of PCE vapor in the former drycleaner suite is 11.5 ppb. Thus, the estimated concentration of PCE vapor present inside the Former High Point Cleaners suite is above background level. Assuming that as long as the potential source of PCE (i.e., believed to be the contaminated soil beneath the floor of the former drycleaner suite and below the pavement outside immediately to the rear of the suite) is present, there will exist the potential for elevated concentrations of PCE in the former drycleaner suite. This will result in a completed inhalation exposure pathway for the occupants of the suite.

In order to accurately assess the exposure of persons to the PCE in the former drycleaner facility, the correct type of exposure standard must be utilized. Though this is a commercial building, a standard utilized for occupational exposures would not be appropriate for this site, as this would imply the resumed active use of PCE inside the suite. We will assume that the occupants of the suite are not engaged in drycleaning activities, and that there is no occupational use of PCE in the former drycleaner suite. Therefore, an environmental standard (i.e., the standard used for residential settings) would be applicable to this PCE vapor exposure scenario.

Two environmental/residential standards could be utilized for this site. The Environmental Media Evaluation Guides (EMEGs) and the ATSDR MRL. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-carcinogenic health effects over a specified duration of exposure. The exposure an individual is subjected to is estimated as if it is occurring continuously (i.e., 24 hours a day, 7 days a week) over a specific period of time. EMEGs, like MRLs, are also estimated contaminant concentrations that are not expected to result in adverse, non-carcinogenic health effects to persons exposed to those contaminants.

ATSDR EMEGs are based on the MRLs and are conservative assumptions about chemical exposure. EMEGs apply to acute (14 days or less), intermediate (15–365 days) and chronic (365 days or more) exposures. In the case of PCE, the ATSDR EMEG and MRL values (or concentrations) for the inhalation exposure to the PCE are the same. The ATSDR EMEG/MRL concentration for PCE is 200 ppb for acute inhalation exposure, and 40 ppb for chronic inhalation exposure (ATSDR 2005).

The chronic exposure level will be utilized for this assessment since it is the lower of the two, and would be the most conservative value to utilize in the assessment of PCE exposures to employees working within the former drycleaner suite. The use of the chronic exposure level assumes that occupants of the former drycleaner suite are exposed to 40 ppb PCE for 24 hours a day, everyday for 365 days or more. This of course is not the case. Current employees working (an average of 40 hours per week) in the Former High Point Cleaners suite, would actually be experiencing a degree of exposure over 4 times lower than the assumed 24 hour/day, 7 day/week (168 hours) exposure. This scenario adds an additional level of conservatism to the following comparison.

When the estimated indoor air concentration of 11.5 ppb PCE for the Former High Point Cleaners suite is compared to the EMEG/MRL, the concentration level is 3 times lower than the chronic inhalation exposure level of 40 ppb. Therefore, no illness or other adverse health effects would be anticipated for a 24/7 exposure scenario. Likewise, no adverse effects would be expected for any employees working in, or patrons visiting the Former High Point Cleaners strip mall suite.

We acknowledge that the conclusions of this public health consultation are based on the results of a non-standard, 6-hour indoor air sample. However, it is believed to be applicable to present exposure scenarios due to the following factors:

- 1) The drycleaner suite was vacated in 2003, and thus any on-going or active sources of PCE inside the strip mall suite have been eliminated.
- 2) The potential source of PCE vapor is the contaminated soil beneath the floor of the former drycleaner suite, and immediately to the outside rear of the building. It is anticipated that remediation activities at this site will involve the removal and/or in-situ treatment of the contaminated environmental media. The remedial activities are expected to further reduce PCE concentrations in the former drycleaner suite (DCERP 2006).
- 3) The former drycleaner suite was vacant and closed up at the time the indoor air sample was collected, having no indoor climate control and limited exchange of air with the outdoors. The suite now has a new occupant, and it is expected that the dynamics of the indoor air will now be considerably different with the activation of the HVAC (heating, ventilation, and air conditioning) system to control the indoor climate. Also, the nature of a commercial business (i.e., the entering and exiting of customers and employees) facilitates the opening and closing of the doors to the suite, thus allowing the exchange of indoor air with the outdoors.
- 4) The PCE concentrations from the indoor air sample results were adjusted upward by twenty-five percent in order to approximate the results of an eight-hour air sample. Even with this adjustment, the estimated indoor air concentration of PCE is below the EMEG/MRL for chronic inhalation exposure level for PCE.

Children's Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances (ATSDR 1997, 1998). Children have lower body weights than adults. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health. In the preparation of this health document, the health of children was thoughtfully considered. No health threats unique to children that require special attention were observed during this drycleaner solvent investigation of the Former High Point Cleaners.

Conclusions

1. No apparent health hazard exists from drycleaner-related solvent vapors in the Former High Point Cleaners (DCERP Abandoned Facility #D-79-158) strip mall suite based on the July 19, 2005, indoor air sample analytical results.
2. An indeterminate health hazard exists from drycleaner-related solvent vapors in the adjacent strip mall suites to either side of the Former High Point Cleaners (DCERP Abandoned Facility #D-79-158) suite, since no indoor air samples were taken in these suites.

Recommendations

1. As a matter of prudent public health practice, methods approved by TDEC-DOR DCERP should be utilized to eliminate or reduce the source of drycleaner-related solvent vapors entering the Former High Point Cleaners strip mall suite.

Public Health Action Plan

1. TDH EEP will provide copies of this health consultation to TDEC-DOR DCERP and the management and occupants of the Former High Point Cleaners suite.
2. TDH EEP will continue to work with DCERP as needed as this site goes through DCERP regulatory process.
3. DCERP will continue oversight and guidance of the investigation and remedial activities at the Former High Point Cleaners site.
4. TDH EEP is available to review additional data.

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FIGURE 1 - Map of the location of the Former High Point Cleaners site, 3668 Macon Road, Memphis, Shelby County, Tennessee, 38122. (Map credit: MapQuest.com)



FIGURE 2 - Schematic Layout of the strip mall location of the Former High Point Cleaners site. Also shown are the groundwater monitoring well (MW) and DPT sampling locations (DP) at this site. The denotation of the strip mall suite occupants may no longer be accurate. The number values shown at each MW/DP location denote the PCE concentrations in parts per billion (ppb), as of August 2005. (Drawing credit: ENSAFE Inc., 2005)

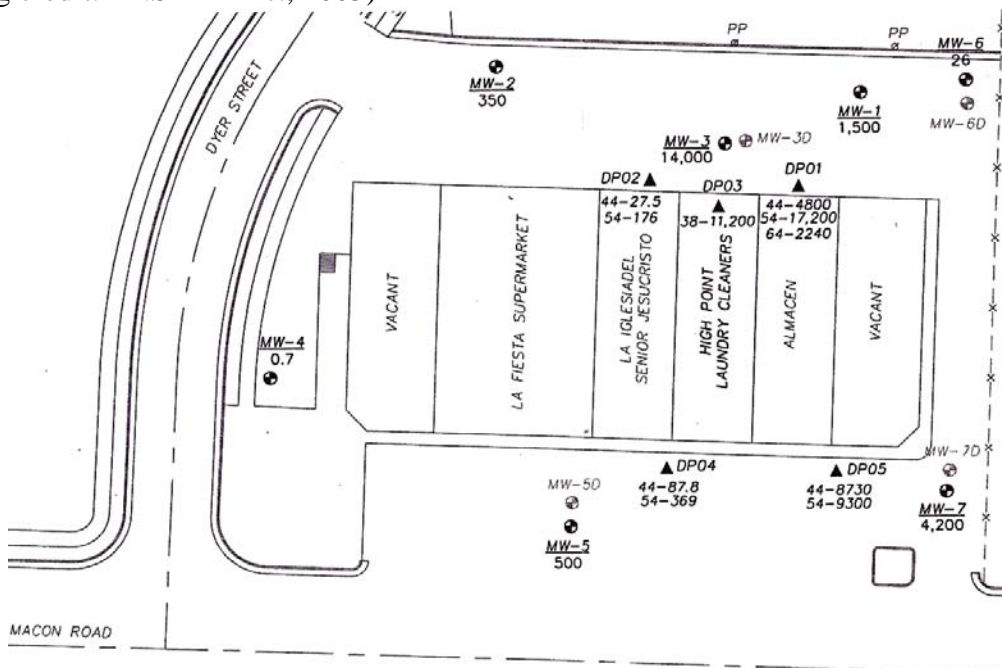


FIGURE 3 - Photograph of the strip mall storefronts in 2001; Former High Point Cleaners, 3668 Macon Road, Memphis, Shelby County, Tennessee, 38122. (Photo credit: Jim Gilbert, DCERP, 10/31/01)



FIGURE 4 - Close up photograph of the drycleaner storefront in 2001; Former High Point Cleaners, 3668 Macon Road, Memphis, Shelby County, Tennessee, 38122. (Photo credit: Jim Gilbert, DCERP, 10/31/01)



APPENDIX A

Tetrachloroethylene (PCE) $\text{Cl}_2\text{C}=\text{CCl}_2$

PCE is a commonly used drycleaner solvent/fluid and metal degreaser (also known as perchloroethylene; also referred to as “perc”). Introduced in the 1930s, PCE is the solvent or cleaning agent, most often used by professional drycleaners. It can remove stains and dirt from all common types of fabric, and does not usually cause clothes to shrink or dyes to bleed.

PCE is a clear, colorless liquid said to produce a sharp, sweet smell. People can detect the smell of PCE in the air at 1 part per million (ppm) or more. It evaporates readily at room temperature, and unlike many other common solvents, it is not flammable. PCE is a synthetic chemical and is often used as a starting point for the manufacture of other chemicals (ATSDR 1997). It is used in certain consumer products including water repellents, silicone lubricants, fabric finishers, spot removers, adhesives, and wood cleaners.

In general, PCE concentrations in air are higher in cities or industrial areas where it is used more than in more rural or remote areas. Background concentration of PCE in the environment is usually less than 1 ppb. It can exceed 1 ppb in air near manufacturing facilities and hazardous waste sites containing PCE (ATSDR 1997). If it is released to the environment, most of it will evaporate into the air and disperse. PCE is in a class of chemicals called Dense Non-Aqueous Phase Liquids (DNAPLs). DNAPLs will readily travel through soil and enter into groundwater. Once in the groundwater, DNAPLs do not easily dissolve, and can remain there for many months or years with very little chemical breakdown or change.

People are most likely to be exposed to PCE by inhalation of the compound in ambient air and ingestion of contaminated drinking water. People can also be exposed to PCE by using certain consumer products containing the chemical. The full significance to human health of these exposures to small amounts of tetrachloroethylene is unknown, but to date, they appear to be relatively harmless (ATSDR 1997).

Most PCE leaves the body through the lungs while breathing. A small amount is changed by the liver into other chemicals and is removed from the body in urine. Most of the altered chemical leaves the body in a few days. However, PCE can be found in blood and other tissues, especially body fat, and may remain stored in the body for several days to weeks (ATSDR 1997).

PCE has been used safely as a general anesthetic. At high concentrations it is known to produce loss of consciousness. When air concentrations are high, particularly in closed, poorly ventilated areas, single exposures can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended dermal (skin) contact. Results in animal studies, conducted with amounts of PCE much higher than most people are normally exposed to, show that it can cause liver and kidney damage and also liver and kidney cancers. Although studies have not shown PCE to cause cancer in humans, the International Agency for Research on Cancer (IARC) has determined that it is probably carcinogenic to humans. Exposure to very high levels of PCE in animals has shown to produce neurological deficits and developmental problems (ATSDR 1997).

APPENDIX B

Former High Point Cleaners Groundwater Analytical Results

Previous monitoring well sampling data of the Former High Point Cleaners site has shown that the PCE concentrations in the groundwater below the site are higher than the concentrations of its breakdown products. The analytical results from the May 2005 Direct Push Technology (DPT) borings provide the most recent set of groundwater data for the Former High Point Cleaners site. The laboratory results from the DPT groundwater samples confirm the previous findings and show that the PCE concentrations continue to be much higher than that of the breakdown products. The breakdown products of PCE are: Trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and Vinyl chloride (VC).

Groundwater Analytical Results DPT Borings at the Former High Point Cleaners Site, May 2005 Results are provided in parts per billion (ppb)						
Sample Location	Sample Depth (Feet - BGS)	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	VC
DP01	44	4800	239	288	7	5
	54	17200	700	486	13	30
	64	2240	250	115	2	ND
DP02	44	28	3	1	ND	ND
	54	176	10	2	ND	ND
DP03	38	11200	196	335	4	NA
DP04	44	88	6	3	ND	ND
	54	369	14	6	ND	ND
DP05	44	8730	136	89	3	4
	54	9300	143	71	2	ND
NA = Not analyzed ND = Not detected above laboratory detection limits BGS = Below ground surface						

Certification

This Public Health Consultation (*Former High Point Cleaners, Shelby County, Tennessee*) was prepared by the Tennessee Department of Health Environmental Epidemiology under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with the approved methodology and procedures that existed at the time the health consultation was begun. The editorial review was completed by the cooperative agreement partner.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with the findings.

Team Leader, CAT, SPAB, DHAC, ATSDR