Letter Health Consultation

COPLEY SQUARE PLAZA SITE

COPLEY, SUMMIT COUNTY, OHIO

Prepared by
Ohio Department of Health

NOVEMBER 20, 2012

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

Health Consultation: A Note of Explanation

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

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

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LETTER HEALTH CONSULTATION

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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

DEPARTMENT OF HEALTH & HUMAN SERVICES

Agency or Toxic Substances and Disease Registry, Region 5

Public Health Service
77 W. Jackson Blvd., Room 413
Chicago, IL 60604

November 8, 2012

Margaret Gielniewski
Remedial Project Manager
United States Environmental Protection Agency
77 W. Jackson Blvd., Room 06132
Chicago, IL 60604

Dear Ms. Gielniewski:

On May 5th, 2011 you met with ATSDR Region 5 regarding the presence of chlorinated solvents in indoor air and sub-slab samples in the Copley Square Plaza site in Summit County, Ohio. You provided us with indoor air, sub-slab, and groundwater data collected by U.S. EPA contractors between February and April 2011, and asked for a health interpretation of the data. The Ohio Department of Health (ODH), ATSDR's cooperative partners, have also reviewed the datasets. This letter provides our evaluation. In summary, our assessment of these datasets is that the *existing data suggest chlorinated solvents are still present in area groundwater and present an ongoing health concern*. Clearly, there is still site-related contamination in area aquifers that is impacting drinking water wells, but determining the relationship of that contamination to indoor air contamination is not possible with the data provided. The current and future activities planned since you first requested assistance are health-protective and will eliminate exposure to contaminated drinking water and greatly reduce the potential for indoor air exposures to site-related contamination. We are happy to review any future confirmatory sampling to ensure that no health hazard is present.

Site Background

The three-acre Copley Square Plaza site is in Copley, Summit County, Ohio. The plaza was developed in the 1950s and consists of two buildings. The original tenants included a grocery store, a dental office, a salon, and a dry cleaner. Previously, the businesses drew water from two wells beneath the plaza. The site came to the attention of the Ohio Environmental Protection Agency (Ohio EPA) when tenants of two plaza businesses complained of odors emanating from the water, and Ohio EPA sampling determined that the wells were contaminated (ATSDR, 2007a).

The former dry cleaner is believed to be the source of groundwater contamination. This contamination includes various solvents that were commonly used during the time the dry cleaner operated (1962 to 1994). Investigations at the former dry cleaner revealed that dry cleaning solvents were being disposed/stored in eight wastewater tanks that were leaking through the foundation and subsurface soil into the groundwater under the building (ATSDR,

2007). Investigations by Ohio EPA and U.S. EPA, beginning in 1990 have revealed a groundwater plume that has slowly migrated from the Copley Plaza property into the shallow aquifer that serves as the source for drinking water wells of adjacent residential homes.

On August 22, 1994 Ohio EPA requested that U.S. EPA perform a time-critical removal action to remove contamination associated with the wastewater tanks and reduce residential exposure to contaminated drinking water wells. Between August 1994 and April 1995, eight of nine homes contaminated with TCE, PCE, and their breakdown products received whole-house water treatment systems. Subsequent sampling at these homes included raw well sampling (bypassing the water treatment system) and tap water sampling. While these VOCs were detected in subsequent raw well sampling events, they have not been detected in quarterly samples drawn from the tap (Gielnewski, M., personal communication, 2011).

The site was added to the National Priorities List (NPL) in April 2005, based on: 1) elevated and increasing levels of tetrachloroethylene (PCE) and trichloroethylene (TCE) in shallow groundwater under the plaza and in a shallow monitoring well near the newly constructed Meadow Run Condominium complex east of the site; and 2) the potential impact on additional nearby residential drinking water wells. In addition to the increasing levels of PCE in the shallow glacial "aquifer" near the Meadow Run condominiums, there was evidence that shallow soils become more sandy (more porous and permeable) in the subsurface towards the condominiums. Based on this evidence, Ohio EPA became concerned about a possible migration of PCE vapors from contaminated shallow groundwater into indoor air in the basements of the new condominium units. However, the methodology used by U.S. EPA in the NPL scoring process does not consider the migration of vapors from contaminated groundwater into indoor air (ATSDR, 2007a).

U.S. EPA initiated a Remedial Investigation and Feasibility Study (RI/FS) in 2006. The RI/FS revealed that site soil, both under and east of the former dry cleaners, remains contaminated with PCE and its breakdown compounds. Shallow groundwater is also contaminated, extending east from the former dry cleaner facility into the undeveloped area, towards the Meadow Run complex. Deep groundwater contamination extends approximately one quarter mile southeast of the former dry cleaner. In 2006, U.S. EPA conducted indoor air sampling, which revealed PCE, TCE and their breakdown compounds in a number of single family homes and townhomes located east, southeast, and south of the site. Sampling in 2011 confirmed the continued presence of these compounds in previously sampled properties (Gielnewski, M., personal communication, 2011).

Even though the time-critical removal action was performed in 1995, there are still very high levels of PCE in the groundwater monitoring wells near the site (up to 28,200 ppb in 2011), indicating that a significant source of contamination is still present.

Environmental Data

ATSDR and ODH were provided with groundwater, soil gas, and air indoor sampling data, collected in March 2011. Samples were collected at all residences within 300 feet of the delineated groundwater plume where U.S. EPA was granted access. For reference, groundwater data collected in 2006 was also provided. The samples were analyzed for volatile organic compounds (VOCs).

Groundwater sampling

In March 2011, U.S. EPA collected 26 residential and 22 monitoring well samples, and performed an analysis for organic compounds. The residential samples were collected at a point bypassing any treatment systems within the homes. Site-related compounds were detected in six of the residential and 11 of the monitoring wells. Monitoring and residential wells closest to the dry cleaner location had the highest VOC concentrations, with PCE reported at the highest concentrations. PCE concentrations ranged from non-detect further from the site to 28,200 ppb at an on-site monitoring well. In all, five compounds were frequently detected in well samples including: PCE, TCE, cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride. All homes with VOC concentrations in their untreated well samples that exceeded health based guidelines had functional full house water treatment systems. When those systems were bypassed, cis-1,2-dichloroethylene and vinyl chloride were detected at levels exceeding chronic and cancer ATSDR screening values, respectively, and their respective U.S. EPA MCL, and have been selected as groundwater contaminants of potential concern (COPCs). The same three homes had exceedences of these two compounds in groundwater, and were located adjacent or across the street from one another. When tested with the treatment system operational, none of these homes had detectable levels of VOCs. Table 1 displays compounds for which health based comparison values (CVs) were exceeded. Detection limits varied for all four compounds, but were below their respective CVs (U.S. EPA, 2011a).

Table 1. VOC Sampling Results for monitoring well (MW) and residential well sampling event near Copley Square Plaza, March 2011

Analyte	MW Range (ppb)	Residential Well Range (ppb)*-bypassing treatment system	Residential Well Range (ppb)-operational treatment system	Number of samples exceeding CVs in MWs/total sampled	Number of samples exceeding CVs in residential wells/total sampled	Most Conservative Comparison Value (ppb)
cis-1,2-Dichloroethylene	ND-**1110.0**	ND-**111.0**	ND	8/22	3/26	RMEG: 20 (Child); 70 (Adult); iEMEG: 3000 (Child); 11,000 (Adult); MCL: 70
trans-1,2-Dicholorethylene	ND-9.6	ND-2.7	ND	0/22	0/26	RMEG: 200 (Child); 700 (Adult); iEMEG: 2000 (Child); 7000 (Adult); MCL: 100
Tetrachloroethylene	ND-**28,000.0**	ND	ND	6/22	0/26	RMEG: 60 (Child); 210 (Adult); CREG: 17 MCL: 5
Trichloroethylene	ND-	ND	ND	9/22	0/26	RMEG: 5 (Child); 18 (Adult); CREG: .76 MCL: 5

	964.0					
Vinyl chloride	ND-**8.6**	ND-**10.5**	ND	6/22	3/26	RMEG: 30 (Child); 110 (Adult); cEMEG: 30 (Child); 110 (Adult); CREG: 0.025 MCL: 2

Bolded *values exceed the health-based screening criteria*
MCL: *U.S. EPA Maximum Contaminant Levels (2011)**;** The threshold concentration of a contaminant above which water is not suitable for drinking.*
Cancer Risk Evaluation Guide (CREG): *A concentration of a carcinogen in a media (water, soil, or air) at which excess cancer risk is not likely to exceed one case o cancer in one million people exposed over a lifetime.*
Environmental Media Contamination Guide (EMEG): *cEMEGs represent concentrations of substances in water, soil, and air to which humans may be exposed for over a year without experiencing adverse health ef ects.*
Reference Dose Media Evaluation Guide (RMEG): *RMEGs represent concentrations of substances (in water, soil, and air) to which humans may be exposed to for a lifetime without experiencing adverse health ef ects.*
****Detects only occurred when residential water treatment systems were bypassed; no VOCs were detected when treatment systems were operational.***

U.S. EPA also provided ATSDR with the results for groundwater samples collected in 2006 for reference to those collected in 2011. While the concentrations were slightly different at the various locations, the general range of VOCs was similar between 2006 and 2011. However, of the 14 residential wells sampled both in 2006 and 2011, three had low concentrations of VOCs in 2006 and none detected in 2011. Of the monitoring wells, all concentrations were within similar range, and typically lower in 2011 than in 2006 with the exception of three wells near the dry cleaner property, which showed marked increases of VOCs in 2011 (U.S. EPA, 2011a).

Sub slab and Soil gas

Although contamination has been detected in groundwater wells as far as ¼ mile to the southeast of the plaza, the Meadow Run Condominium Complex is the closest to the dry cleaner property and has the greatest potential for vapor intrusion. The complex is approximately 200 feet to the east of Copley Square Plaza. The condos were built between 2002 and 2004, and all have finished basements. Of the 40 units sampled, 16 had detectable levels of VOCs in sub-slab soil gas samples. Levels of site-related pollutants in soil gas were screened against ATSDR health-based screening values for chronic exposure and lifetime cancer risk. In this analysis, 1,2-dichloroethane (1,2-DCA) and TCE exceeded these screening values.

Soil gas measurements were collected at 12 of the 40 single family home/townhouse residences sampled in March 2011. Two of the 12 had measureable VOC concentrations of 1,2-DCA, PCE, and TCE that exceeded ATSDR health-based screening values for chronic exposure and lifetime cancer risk and were selected as contaminants of potential concern (COPCs) in soil gas. Table 2 presents the data for compounds that exceeded health based CVs.

Table 2. Comparison Values and sampling results for volatile organic compounds in indoor air, ambient air, sub slab, and soil gas in residential homes near Copley Square Plaza; March 2011

Analyte	Media	Number of samples detected/total samples	Range of detection (ppb)	Comparison Value
1,2-Dichloroethane	Sub slab	10/40	**0.034-0.57**	CHRONIC EMEG: 600 ppb CREG: 0.01 ppb* Background in outdoor air: 0.01-5.0 ppb†
	Soil gas	1/12	**1.0**	
	Indoor air	32/48	**0.13-5.5**	
	Ambient air	10/48	**0.13-0.14**	
cis-1,2-Dichloroethene	Sub slab	6/40	1.3-32.0	No CV; Background in outdoor air: 0.01-3.0 ppb†
	Soil gas	0/12	None detected	
	Indoor air	7/48	0.15-0.32	
	Ambient air	1/48	0.24	
trans-1,2-Dichloroethene	Sub slab	1/40	1.1	INTERMEDIATE EMEG: 200 ppb ACUTE EMEG: 200 ppb Background in outdoor air: <1.0 ppb†
	Soil gas	0/12	N/A	
	Indoor air	0/48	N/A	
	Ambient air	0/48	N/A	
Tetrachloroethylene (PCE)	Sub slab	27/40	0.21-**470.0**	CHRONIC EMEG: 40 ACUTE EMEG: 200 ppb Background in outdoor air: 0.16-1.3 ppb†
	Soil gas	0/12	N/A	
	Indoor air	22/48	0.23-4.6	
	Ambient air	0/48	N/A	
Trichloroethylene (TCE)	Sub slab	15/40	**0.16-74**	CHRONIC EMEG: 0.37 ppb CREG: 0.045 Background in outdoor air: 0.03-1.2 ppb†
	Soil gas	1/12	**3.0**	
	Indoor air	13/48	**0.2-1.7**	
	Ambient air	8/48	**0.24**	

RSL: *Regional Screening Level;* ***CREG:*** *ATSDR Cancer Risk Evaluation Guide;* ***EMEG:*** *Environmental Media Evaluation Guide*
†*Background concentrations were derived rom ATSDR Toxicological Profiles for speci ic compounds: http://www.atsdr.cdc.gov*
Bolded *values exceed the health-based screening criteria*

The inconsistent concurrent collection of indoor air, sub slab, and soil gas sampling complicates the assessment of the gas migration pathway from groundwater into homes. Of the 48 homes with indoor air samples collected, 40 also had a sub slab sample collected, and 10 had soil gas samples collected. Very few Meadow Run Condominiums had soil gas samples collected, where the greatest potential risk of impact from underground gas migration exists.

Air Sampling

Indoor and outdoor air sampling occurred in 48 homes. All samples were collected over a 24 hour period (Gielnewski, M., personal communication, 2011). Some of the homes had corresponding sub slab and/or soil gas sampling. In general, indoor air levels of VOCs were low but reflected the same site-related compounds as in groundwater. Of the 48 homes tested, 40 had detects of VOCs in indoor air that included PCE, TCE, cis and trans 1,2-dichloroethylene

(1,2-DCE), 1,2-dichloroethane (1,2-DCA), and 1,1,2-trichloroethane (1,1,2-TCA). In total 118 detects of the compounds were reported, and 17 out of 118 (14.4%) had higher outdoor levels of these compounds than indoor levels, suggesting the influence of ambient sources on indoor air. Of all detects, some homes had levels of 1,1,2-trichloroethane, 1,2-dichloroethane, PCE, TCE, and vinyl chloride that exceeded chronic or cancer risk health-based comparison values and have been selected as contaminants of potential concern (COPCs) in indoor and ambient air.

Table 3. Frequency of detection of VOCs in indoor air samples

Analyte	Frequency of detection	Range of detection	CREG	# of samples exceeding CREG	EMEG	# of samples exceeding EMEG
1,1,2-Trichloroethane	**3/48**	**0.22-1.4**	**0.011**	**3/48**	**N/A**	**N/A**
1,2-Dichloroethane	**37/48**	**0.041-5.5**	**0.0095**	**37/48**	**600 (chronic)**	**0/37**
cis-1,2-Dichloroethene	12/48	0.14-0.72	N/A	N/A	N/A	N/A
Tetrachloroethene	**36/48**	**0.15-3.4**	**0.57**	**10/48**	**40 (chronic)**	**0/10**
trans-1,2-Dichloroethene	2/48	0.14-0.16	N/A	N/A	200 (intermediate)	0/48
Trichloroethene	**27/48**	**0.13-4.6**	**0.045**	**27/48**	**N/A**	**N/A**
Vinyl Chloride	**1/48**	**1.8**	**0.044**	**1/48**	**30**	**0/1**

Cancer Risk Evaluation Guide (CREG): *A concentration of a carcinogen in a media (water, soil, or air) at which excess cancer risk is not likely to exceed one case o cancer in one million people exposed over a lifetime.*
Environmental Media Contamination Guide (EMEG): *cEMEGs represent concentrations of substances in water, soil, and air to which humans may be exposed for over a year without experiencing adverse health ef ects.*

U.S. EPA (2011) reviewed 18 studies conducted between 1981 and 2005 to identify "typical" background concentrations of volatile organic compounds (VOCs) in the indoor air of residences in North America. VOCs are often emitted from paints, carpets, adhesives, appliances, cleaning or beauty products, etc., and can be present at levels higher than those measured in outdoor air. These studies are considered to provide information on typical background indoor air concentrations because they were conducted in residences that are not expected or known to be located over contaminated soil or groundwater or have effective vapor intrusion mitigation systems in place. The 18 studies collectively report statistics regarding the distribution of concentrations of more than 40 VOCs in thousands of indoor air samples (U.S. EPA, 2011b). Data from U.S. EPA and ATSDR's Toxicological Profiles can be found below.

Table 4. Background levels reported for indoor air studies, 1981-2005 (ppb)

Analyte	Range/(% present)	ATSDR reported background outdoors
1,1,2-Trichloroethane	Not generally detected	Not generally detected
1,2-Dichloroethane	<RL-0.2 (13.8%)	0.01-5.0
Tetrachloroethene	<RL-9.5 (62.5%)	0.16-1.3
Trichloroethene	<RL-3.3 (42.6%)	0.03-1.2
Vinyl Chloride	<RL-0.09 (9.2%)	Generally <RL; when reported <1 ppb

RL: *Reporting limit of the analytical method*

Contaminants of Potential Concern

COPCs were identified through screening the various detected pollutants against health-based comparison values (CVs). COPCs exceeding any of the CVs for the various media sampled and discussed above include:

- Ground water: cis-1,2-dichloroethylene and vinyl chloride
- Sub slab: 1,2-dichloroethane and TCE
- Soil gas: 1,2-dichloroethane, PCE, and TCE
- Indoor air: PCE, TCE, cis and trans 1,2-dichloroethylene (1,2-DCE), 1,2-dichloroethane (1,2-DCA), and 1,1,2-trichloroethane

Health implications and pathway analysis

ATSDR used health-based guidelines and a review of scientific studies to identify and evaluate compounds of concern in the Health Implications section of this document. In our evaluation, the ambient air data were compared to ATSDR chronic environmental media evaluation guides (EMEGs) and cancer risk evaluation guides (CREGs). EMEGs are calculated from ATSDR minimal risk levels (MRLs) for chronic or intermediate exposures (those occurring for 365 days or longer or from between 15-364 days, respectively), as well as acute time frames (14 days of exposure or less). RMEGs are calculated from U.S. EPA's reference doses (RfDs). Like EMEGs, RMEGs represent concentrations of substances (in water, soil, and air) to which humans may be exposed without experiencing adverse health effects. RfDs consider lifetime exposures, therefore, RMEGs apply to chronic exposures. Both MRLs and RfDs are estimates of daily human exposure to a hazardous substance that are unlikely to cause health effects over a specified duration of exposure. MRLs and RfDs are calculated using lowest observed adverse effect levels (LOAELs) and no observed adverse effect levels (NOAELs) identified in the scientific literature. The LOAEL is the lowest exposure in a study that resulted in a measurable health effect. A NOAEL is the highest exposure in a study that *did not* result in a measurable health effect. ATSDR also evaluates occupational and epidemiologic studies of human exposures, and reviews health outcomes for individual compounds. CREGs used in this analysis correspond to a concentration of a pollutant that is not likely to exceed the risk of one excess cancer in one million people exposed to the same contaminant concentration over a lifetime (10^{-6}).

Groundwater Pathway and COPCs in private well water analysis

Cis-1,2-dichloroethylene and vinyl chloride were detected in 6 of 26 and 3 of 26 homes, respectively. The same three houses had exceedences of both compounds above health based comparison values, but only when their groundwater treatment systems were bypassed. No compounds were detected when the treatment systems were operational. The range of cis-1,2-dichloroethylene in well water was below detection limits to 111 ppb. The range of vinyl chloride detection was below detection limits to 10.5 ppb. U.S. EPA eliminated this pathway by installing water treatment systems in homes with elevated VOCs in 1995 and has maintained them since that time. Furthermore, quarterly sampling has continued to demonstrate the effectiveness of the water treatment systems installed in these homes. By the end of 2012, the U.S. EPA anticipates hooking all area residences up to municipal water service, completely

eliminating this exposure pathway. Given the lack of VOCs in wells under normal conditions (operational water treatment systems) and the impending connection to city water, this is an incomplete exposure pathway.

Sub slab and Soil gas pathway and COPC analysis
Once organic compounds are introduced into the subsurface, a complex series of fate and transport mechanisms act upon them, potentially moving them away from the source area. Once volatile contaminants are present near or beneath buildings, they migrate upward as vapor through soil gas and may accumulate beneath buildings, asphalt, concrete slabs or in basements. The vapors migrate into buildings if there is a crack or opening in the wall or foundation or if there is an opening within a utility corridor that enters the building. Vapors can also migrate laterally along a preferential pathway such as a utility corridor, beneath concrete or asphalt, or within other confined passageways (U.S. EPA, 2010). A 10-fold (0.10 reduction) attenuation factor (AF) is often applied as worse-case scenario to estimate indoor air levels based on sub-slab data, and could be used to evaluate health outcomes in residential settings. However, since indoor air samples were collected in all homes where sub slab and soil gas measurements were collected, we can evaluate indoor air to determine potential health risks from exposure. Generally, levels of site-related pollutants indoor air were often at or above concentrations found in sub-slab samples or present in indoor air but not in the sub-slab, complicating this pathway analysis.

Indoor and Outdoor Air Pathway and COPC analysis
Soil gases migrating from contaminated water plumes can enter homes through crack in the home's foundation, sumps, crawlspaces, etc. Indoor air was collected in forty-eight homes. In total 118 detects of the possible site-related pollutants were reported, and 17 out of 118 (14.4%) had higher outdoor levels of these compounds than indoor levels, suggesting the influence of ambient sources on indoor air. Of all detects, some homes had levels of 1,1,2-trichloroethane, 1,2-dichloroethane, PCE, TCE, and vinyl chloride that exceeded chronic or cancer risk health-based comparison values and were selected as contaminants of potential concern (COPCs) in indoor and ambient air. Exposures to VOCs in indoor air represent a completed exposure pathway.

The COPCs identified for the air pathway are characteristic of dry cleaning waste, but some are also common in indoor air. For example, in the U.S. EPA evaluation of all indoor air studies conducted at homes with no known contamination between 1981 and 2005, PCE, TCE, and 1,2-DCA were detected in 62.5%, 42.6%, and 13.8% of all homes sampled, respectively (U.S. EPA, 2011). Vinyl chloride, only detected in one residence in this assessment, was detected less frequently at 9.2% of the residences and 1,1,2-TCA was rarely detected (<1%).

In general, these compounds are solvents typically used in the dry cleaning industry. 1,2-DCA is a chemical intermediate and breaks down into 1,1,2-TCA. 1,2-DCA is used to manufacture vinyl chloride, and when chlorinated, PCE and TCE can form. All of these pollutants can form with the partial degradation of PCE. They all have similar depressant effects on the central nervous system and can be respiratory irritants. They are all known or suspected carcinogens as well,

however health effects have not been noted in scientific studies at levels detected in Copley Square homes or in treated drinking water(ATSDR 1989; ATSDR 1997a,b; ATSDR 2001; ATSDR 2006).

Noncancer and cancer health effects were assessed through risk assessment methodology. The likelihood of non-cancer health risks can be evaluated with the calculation of hazard quotients and hazard indices. A hazard quotient is the ratio of the potential exposure to the substance and the level at which no adverse effects are expected. If the HQ is calculated to be equal to or less than 1, then no adverse health effects are expected as a result of exposure (in this instance, the U.S. EPA inhalation RfC). If the HQ is greater than 1, then further evaluation is warranted. Excess cancer risk can be calculated using measured air concentrations that represent a 10^{-6} cancer risk (the risk of 1 excess cancer per one million people exposed to the same contaminant concentration over a lifetime). U.S. EPA's inhalation unit risks (IURs) for cancer and contaminant concentrations were used to calculate cancer risk for each COPC in this investigation. IURs are the upper-bound excess lifetime cancer risks estimated to result from continuous exposure to an agent at concentrations of 1 $\mu g/m^3$ in air. In non-cancer and cancer risk calculations, a reasonable estimate of exposure is important. U.S. EPA Risk Assessment Guidance suggests that an exposure point concentration (EPC) be used that is believed to be representative of typical site concentrations to evaluate risk. The most commonly used EPC is the 95% upper confidence limit (UCL95) of the mean, which is the 95th percent confidence limit of the average concentration calculated for each pollutant at the site (U.S. EPA, 2007b).

U.S. EPA developed a software package to calculate the UCL95 called ProUCL®. In this assessment, ProUCL® version 4.0 was used to identify the UCL95 for the various COPCs, from which a total estimated cancer risk can be calculated. The UCL95 as estimated by ProUCL® for the various detected COPCs are listed in Table 5 (U.S. EPA, 2007b). Also included in the table are cancer and non-cancer risk values for maximum detections of COPCs in indoor air.

Table 5. Cancer and non-Cancer risks from exposures to Site-related contaminants in indoor air near Copley Square

	N=	Highest Exposure Hazard Index (nCa)	95% UCL Hazard Index (nCa)		Cancer risk Max conc	Cancer risk 95% UCL conc
1,1,2-trichloroethane	3	35	35		1.22E-04	1.22E-04
1,2-dichloroethane	37	3.18	0.72		5.79E-04	1.31E-04
TCE	27	12.438	4.06		1.01E-04	3.31E-05
PCE	36	0.58	0.18		5.99E-06	1.86E-06
Vinyl Chloride	1	0.05	0.05		2.03E-05	2.03E-05
Hazard Quotient		**51.23**	**40**	**Cumulative Cancer Risk**	**8.29E-04**	**3.09E-04**

Excess cancer and non-cancer risks are present for residents exposed to site-related contaminants in indoor air. The Hazard Quotient for these compounds exceeds 1 (HQ=51 and 40 for highest and UCL95 exposure concentrations) and the lifetime cancer risk slightly exceeds the U.S. EPA target risk range of 10^{-4} to 10^{-6} (the risk of 1 person in 10,000 to 1 person in

1,000,000 to develop excess cancer in their lifetime). The estimated cancer risk for residents for maximum exposures was approximately 8 people per 10,000 people or 3 people per 10,000 for the UCL95 concentration. These risks represent worst case exposure conditions of constant exposure over a lifetime. Because people may go to work and school outside the affected area and move in and out of the community, actual risks are likely to be lower.

Summary of Pathway Evaluation

It is not clear whether or not indoor air levels of VOCs were a result of underground gas migration for the following reasons:

- There is little consistency with the media sampled; for example, sub slab/soil gas, and groundwater were not collected at all residences;
- In many instances, compounds were detected in indoor and outdoor air at a given residence, making it unclear whether the subsurface contamination or the ambient air was impacting indoor air;
- VOCs were detected indoors that were not present in sub slab or soil gas data;
- VOCs were detected at higher concentrations in ambient air than in indoor air or in sub slab/soil gas samples;
- VOCs were present in the sub slab or in soil gas that were not detected in indoor air.

To address these issues, ATSDR and ODH made a recommendation for U.S.EPA to conduct a hydrogeological survey and conduct additional sampling to better understand the vapor intrusion pathway. This was completed in March 2012. U.S. EPA is conducting a second remedial investigation in intermediate and deep aquifers. Beginning in 2012, five quarters of sampling are being conducted to determine the extent of verticle contaminant migration. In addition, public water lines are being extended into the affected community to eliminate exposure to contaminated drinking water.

Conclusions

Historical and recent environmental data indicate the presence of harmful levels of PCE, TCE and their breakdown products in onsite and residential wells, and that vapors from contaminated groundwater may be making their way into homes in the area.

ATSDR and ODH conclude that the presence of dry cleaning solvents migrating through groundwater and into residences of the community living near the Copley Square Plaza continue to pose a public health hazard. Planned U.S. EPA remedial activities will significantly eliminate the potential for exposure to contaminated groundwater, but to eliminate vapor intrusion risks, the contamination source must be identified and treated.

The relatively newly constructed Meadow Run condominium complex due east of the Copley Square Plaza has the potential for future impacts. As the structures age, it is possible that

foundational settling could result in the migration of these VOCs into indoor air posing a future public health threat.

Recommendations

Prior to the finalization of this letter, ATSDR and ODH made a number of recommendations to U.S. EPA. Each recommendation and its status follow:

1) An attempt to identify and remediate any possible remaining source(s) of site-related contamination. **Status: In progress**
2) A focused gas migration study which would include research into the stratigraphy of the glacial soils under the condo development and how they connect hydrogeologically with the soils under the dry cleaner. **Status: Completed in March 2012**
3) Consideration of installing sub slab depressurization systems in condominiums with site related VOC concentrations exceeding health based comparison values, or those believed to be at risk of future contamination as identified by the hydrogeologic investigation. **Status: In Progress**
4) Since groundwater contamination has persisted beyond previous remediation efforts, U.S. EPA should tie homes with site-related VOC contamination into a municipal water system. **Status: In progress**
5) The foundation floor and walls of the residential basements should be appropriately maintained and reinforced to keep gases migrating from groundwater from entering homes. **Status: This information has been relayed to property owners**
6) Continued quarterly sampling of residential and monitoring wells in the neighborhood. **Status: Ongoing.**

Please do not hesitate to contact me at 312-886-1462 and regarding this letter. Bob Frey (ODH) can also be reached at 614-466-1069 if you have any additional questions.

Sincerely,

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