Letter Health Consultation

Vapor Intrusion Issues

HOLDEN ELEMENTARY SCHOOL

KENT, PORTAGE COUNTY, OHIO

Prepared by
Ohio Department Health

APRIL 16, 2012

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

Health Consultation: A Note of Explanation

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

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LETTER HEALTH CONSULTATION

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Prepared By:

Ohio Department of Health
Health Assessment Section
Under Cooperative Agreement with
Agency for Toxic Substances and Disease Registry (ATSDR)

OHIO DEPARTMENT OF HEALTH

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John R. Kasich / Governor

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

April 4, 2012

Lori B. Muller
On-Scene Coordinator
USEPA - Region 5
25089 Center Ridge Rd. (ME-W)
Westlake, OH 44145

Dear Ms. Muller:

On August 15, 2011, the Ohio Department of Health (ODH) received from the U.S. EPA sub-slab soil gas and indoor air sampling results for the Holden Elementary School in Kent, Ohio. The Health Assessment Section (HAS) at ODH, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), completed its review and evaluation of these data and provided an initial draft copy of our assessment to you on September 30, 2011. The intent of this assessment is to ensure the presence of a safe environment at the Holden Elementary School; to provide the school community with an understanding of the potential health concerns associated with the chemicals detected in the soil gas under the school and in the indoor air at the school; and to suggest additional actions to be taken to reduce or eliminate exposures to these chemicals. The following is our final, reviewed letter health consultation.

BACKGROUND AND STATEMENT OF ISSUES

The U.S. EPA collected samples at the school as part of a vapor intrusion investigation of the former Jerry's Professional Cleaners site located about 600 feet to the northwest of the school (at the corner of Elm and Franklin). In September 2010, the Ohio EPA requested assistance from the U.S. EPA in conducting an assessment and potential time-critical removal action involving the former Jerry's Professional Cleaners site. The U.S. EPA initial plan for a site assessment involved approaching six property owners within a 100-foot radius from the former dry cleaners property line to gain access for sub-slab soil gas and indoor air sampling. In general, vapor intrusion is likely to occur when occupied buildings are laterally or vertically within 100 feet of volatile subsurface contaminants (U.S. EPA 2002, ATSDR 2008). Due to the sensitive subpopulations present nearby, the school and the recreation center, which were close by but not within the 100 foot radius, were included for testing to determine if these building were potentially affected by the migration of tetrachloroethylene (PCE) from the former dry cleaners. Testing in June 2011 did not detect PCE from the former dry cleaners but did detect low concentrations of gasoline-related compounds and Freon 11 in the soil gas beneath the school's slab (referred to as sub-slab samples). Testing of the school's indoor air in July 2011 did not indicate a significant indoor air contamination problem at the school; however some contaminants detected in the indoor air in the school exceeded very conservative health-based screening levels.

DISCUSSION

Exposure Evaluation

At the request of the City Health Commissioner, the U.S. EPA collected sub-slab soil gas and indoor air samples at the school as part of an investigation of the Jerry's Professional Cleaners site for the potential vapor intrusion of tetrachloroethylene (PCE) into area homes and businesses. The U.S. EPA collected six sub-slab samples in June 2011 and six indoor air samples at the school in July 2011. Although sampling did not reveal the presence of PCE, other chemicals were found that indicate the presence of a gasoline plume under the school. The primary contaminants of concern at the Holden Elementary School site are components of the petroleum-based product gasoline and include benzene, hexane, and trimethylbenzenes. In addition, chlorofluorocarbon products were identified.

Sub-slab

Compounds related to gasoline, including benzene, hexane, and trimethylbenzenes, along with Freon 11 were found at low levels in the soil gas beneath the school. In some samples, benzene, hexane, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene exceeded EPA's sub-slab screening levels (Table 1). There is no direct contact with these vapors at the depths that the sub-slab samples were taken. The indoor air is a better indicator of what exposure would be due to subsurface vapor intrusion.

Indoor Air

As expected, volatile organic compounds (VOCs) were found in the air samples collected from inside the school. Based on a review of studies conducted to evaluate background levels of volatile chemicals in indoor air, many of the compounds present in the indoor air of the school are at concentrations consistent with levels usually found in the indoor air of residences not affected by environmental contamination (U.S. EPA 2011b) and do not represent a public health concern. However, a number of these same chemicals were detected in the sub-slab soil gas under the school. Some of the compounds were detected at levels above those commonly found in indoor air. A few of the chemicals were above applicable public health comparison values (Table 2):

- 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene: These compounds are components of gasoline and vehicle exhaust.

- Freon 11: This compound is typically used as a refrigerant, solvent, and as a component in some fire extinguishers. Its presence may be related to its use at the school, its presence in the outdoor air that enters the school, or due to soil vapor intrusion.

Overall, the development of adverse health effects from exposure to these compounds at the concentrations detected is unlikely. The air sampling was conducted with the building shut down for the summer with all doors and windows closed. It is likely that the introduction of outside air –as is the case when school is in session–would reduce the levels of VOCs in the indoor air at the school to levels below their respective public health comparison values.

In this evaluation, HAS compared the sub-slab soil gas results to U.S. EPA generic screening levels established in the OSWER Subsurface Vapor Intrusion Guidance (U.S. EPA 2002). To be consistent, target indoor air concentrations were also taken from U.S. EPA 2002 OSWER guidance, because ATSDR does not have comparison values for many of the chemicals detected at the school. A sub-slab soil gas to indoor air attenuation factor of 0.1 was applied (U.S. EPA 2008).

Table 1. Chemicals Detected in the Sub-slab at Holden Elementary School

Chemical	*Range of Detections (ppb)*	*Average of Detects (ppb)*	*Frequency of Detections*	*Frequency Above Comparison Value*	*Comparison Value* (ppb*
Acetone	5.1 − 39	26	6/6	0	1,500
Benzene	ND − 26	11	5/6	**3**	9.8
2-Butanone (MEK)	ND – 4.5	4.5	2/6	0	3,400
Carbon disulfide	ND − 11	8	5/6	0	2,200
Cumene	ND − 16	9	5/6	0	810
Cyclohexane	ND − 370	194	5/6	NA	NA
1,4-Dichlorobenzene	ND – 6.7	6.7	2/6	0	1,300
Ethyl benzene	ND − 45	22	5/6	0	51
4-Ethyltoluene	ND − 54	28	5/6	NA	NA
Freon 11	35 − 72	56	6/6	0	1,200
Heptane	ND − 390	242	5/6	NA	NA
Hexane	0.86 − 570	272	6/6	**1**	570
m,p-Xylene	ND − 190	89	5/6	0	16,000
o-Xylene	ND − 74	36	5/6	0	16,000
Propylbenzene	ND − 18	10	5/6	0	280
Toluene	1.1 − 97	37	6/6	0	1,100
1,2,4-trimethylbenzene	ND − 91	49	5/6	**5**	12
1,3,5-trimethylbenzene	ND − 24	13	5/6	**1**	12

Source: U.S. EPA 2011.

Highlighted chemicals exceed U.S. EPA health-based screening levels
ND = Not detected
ppb = parts per billion
NA = Not available
*U.S. EPA OSWER 2002 Subsurface Vapor Intrusion Guidance.

Table 2. Chemicals Detected in the Indoor Air at Holden Elementary School

Chemical	*Range of Detections (ppb)*	*Average of Detects (ppb)*	*Frequency of Detections*	*Frequency Above Comparison Value*	*Comparison Value* (ppb*
Acetone	ND − 19	16	5/6	0	150
1,4-Dichlorobenzene	ND − 16	6.3	5/6	0	130
Ethanol	ND − 57	42	5/6	NA	NA
4-Ethyltoluene	ND – 4.8	4.0	5/6	NA	NA
Freon 11	ND − 200	100	5/6	**2**	120
Heptane	ND – 1.2	1.0	4/6	NA	NA
Hexane	ND – 1.1	1.1	1/6	0	57
m,p-Xylene	ND – 0.91	0.9	1/6	0	1,600
2-Propanol	ND – 9.9	7.9	4/6	NA	NA
Propylbenzene	ND – 0.91	0.9	1/6	0	28
Toluene	ND – 3.3	2.1	5/6	0	110
1,2,4-trimethylbenzene	ND – 3.8	3.3	5/6	**5**	1.2
1,3,5-trimethylbenzene	ND – 1.7	1.3	5/6	**4**	1.2

Source: U.S. EPA 2011.

Highlighted chemicals exceed U.S. EPA screening levels
ND = Not detected
ppb = parts per billion
NA = Not available
*U.S. EPA OSWER 2002 Subsurface Vapor Intrusion Guidance.

1,2,4-Trimethylbenzene & 1,3,5-Trimethylbenzene

Discussion

The trimethylbenzene isomers 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene are clear, colorless liquids with a distinctive, aromatic odor. Trimethylbenzenes are released directly to the environment as components of gasoline and as emissions from gasoline-powered vehicles, municipal waste-treatment plants, and coal-fired power plants. Trimethylbenzenes are found in coal tar, occur in some mineral oils, and are formed during the refining of crude oil. The general population may be exposed to trimethylbenzenes by breathing ambient air, particularly in areas with heavy traffic, eating food and drinking water contaminated with trimethylbenzenes, or dermal exposure to products such as gasoline which contain trimethylbenzenes. For example, 39% of the ambient air samples collected in Washington, DC contained 1,2,4-trimethylbenzene at an average concentration of 0.27 ppb (HSDB 2010). In a New York study, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene were detected in the indoor air in 88 and 75 percent of samples collected, respectively. The 50th percentile (or median) indoor air concentration was 1.9 ppb for 1,2,4-trimethylbenzene and 0.6 ppb for 1,3,5-trimethylbenzene (U.S. EPA 2011b).

ATSDR has not established minimal risk levels (MRLs) for 1,2,4- or 1,3,5-trimethylbenzene. ODH HAS used the generic screening levels for 1,2,4- and 1,3,5-trimethylbenzene that were established by the U.S. EPA in the OSWER Subsurface Vapor Intrusion Guidance Manual (U.S.

EPA 2002). These included target indoor air concentrations of 1.2 ppb for both trimethylbenzene isomers based on non-cancer health risks. The sub-slab screening levels were set at the target shallow soil gas concentration of 12 ppb (U.S. EPA 2002). High levels of uncertainty are incorporated into the development of screening values for some chemicals such as 1,2,4-trimethylbenzene. The screening level for trimethylbenzene has a relatively high margin of safety incorporated into it. No information or studies were found on the carcinogenicity of 1,2,4- or 1,3,5-trimethylbenzene.

Public Health Implications

1,2,4- and 1,3,5-trimethylbenzene were detected in the sub-slab under the elementary school and in the indoor air. Concentrations ranged up to 91 ppb in the sub-slab and up to 3.8 ppb in the indoor air (Table 1 and 2). At most, the levels of 1,2,4- and 1,3,5-trimethylbenzene in indoor air were 3.2 and 1.4 times the screening level, respectively. The screening levels for 1,2,4- and 1,3,5-trimetylbenzene are EPA provisional reference concentrations and represent concentrations of substances to which humans can be exposed without experiencing adverse health effects during a lifetime. Reference concentrations have uncertainty factors (spanning at least an order of magnitude) and are applicable for everyone, including sensitive subgroups (children, the elderly, etc.). While these concentrations exceed the screening values used for comparison, the exposure assumptions used to develop these screening values are conservative with respect to protecting public health. Exceeding a screening value does not mean that a contaminant represents a public health threat; rather, it suggests that the contaminant warrants further consideration. Based on the limited information about these chemicals, exposure to low ppb levels of trimethylbenzenes would not be expected to result in adverse health effects. However, installing a vapor abatement system to reduce these levels is consistent with prudent public health practice.

Freon 11

Discussion

Freon 11, also known as trichlorofluoromethane or CFC-11, is a colorless, nearly odorless volatile liquid or a gas above 75 degrees Fahrenheit (ºF). It is used as a refrigerant, solvent, chemical intermediate, and as a component in some fire extinguishers (NJDHSS Fact Sheet 2006). According to a New York study, Freon 11 was detected in the indoor air in 90 percent of samples of residences, where the 90th percentile concentration was 3 ppb (U.S. EPA 2011b).

ATSDR has not established minimal risk levels (MRLs) for trichlorofluoromethane. The U.S. EPA has established a target indoor air concentration of 120 ppb and a target shallow soil gas concentration (sub-slab screening level) of 1,200 ppb for trichlorofluoromethane based on non-cancer health risks (OSWER 2002 Subsurface Vapor Intrusion Guidance). The current U.S. EPA Regional Screening Level (RSL) for trichlorofluoromethane in residential air is 130 ppb (U.S. EPA 2011a).

Public Health Implications

Freon 11 is typically used as a refrigerant, in fire extinguishers, and as a solvent. Its presence in the indoor air may be related to its use at the school, its presence in the outdoor air that enters the school, or due to soil vapor intrusion. The highest level of Freon 11 detected in the indoor air of

the elementary school was 200 ppb. Indoor air levels were higher than what would be expected based on the sub-slab levels, which were found at lower concentrations. To be protective of public health, contaminant concentrations above screening levels (see Table 1 and 2) for vapor intrusion warrant the installation of a vapor mitigation system and future evaluation of indoor air.

Child Health Issues

Children can be at a greater risk of developing illness due to exposure to hazardous chemicals because of their smaller stature and developing body systems. Children are likely to breathe more air and consume more food and water per body weight than are adults. Children are also likely to have more opportunity to come into contact with environmental pollutants due to being closer to the ground surface and taking part in activities on the ground such as, crawling, sitting, and lying down on the ground.

CONCLUSIONS AND RECOMMENDATIONS

ODH HAS concludes that long-term exposure to gasoline-related compounds and Freon 11 are not expected to harm people's health at the Holden Elementary School. However, some of the school sampling results exceeded the screening levels for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and/or Freon 11 in the sub-slab soil gas under the school and in the indoor air that are based on the evaluation of non-cancer risk.

Indoor air concentrations for some chemicals were found to be above the established screening levels. An intervention strategy was suggested by EPA and supported by ODH for reducing these levels. The installation of a vapor abatement system was implemented and should reduce the potential for the migration of vapors from the subsurface into the indoor air. Future air sampling is planned to ensure that there are no future exposure concerns with regard to adults or children attending the Holden Elementary School during the 2011–2012 school year.

PUBLIC HEALTH ACTIONS

1. The U.S. EPA installed a vapor abatement system in the Holden Elementary School from September 2 through 5, 2011. Contractors installed 11 extraction ports through the concrete slab and connected PVC piping to 7 roof fans to vent vapors to the atmosphere.

2. The U.S. EPA conducted air sampling inside the school 30, 90, and 120 days after installation to evaluate the performance of the sub-slab depressurization system. Based on 30 and 90-day sampling results obtained so far, most of the chemicals detected in the sub-slab soil gas have been reduced, with some exceptions, in most sampling locations at Holden School (Personal communication, U.S. EPA, December 28, 2011).

3. The HAS will work with the U.S. EPA to review additional sampling results if requested.

ADDITIONAL INFORMATION

Please refer to the HAS fact sheet on vapor intrusion, available on the ODH web site at: http://www.odh.ohio.gov/ASSETS/E26C5AB6C94F402A896325AC3CB7B831/VapIntru.pdf

Sincerely,

John Kollman

John Kollman, Environmental Specialist
Ohio Department of Health

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