Letter Health Consultation

Park Laundry Site, Indoor Air Results for November 2012
Ridgefield, Clark County, Washington

March 13, 2013

Prepared by

The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

334-321 March 2013

Foreword

The Washington State Department of Health (DOH) prepared this health consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services. ATSDR is responsible for health issues related to hazardous substances

The purpose of a health consultation is to assess the health threat posed by hazardous substances in the environment. If needed, a health consultation will also recommend steps or actions to protect public health. Health consultations are initiated in response to health concerns raised by residents or agencies about exposure to hazardous substances.

This health consultation was prepared in accordance with ATSDR methodologies and guidelines. However, the report has not been reviewed and cleared by ATSDR. The findings in this report are relevant to conditions at the site during the time the report was written. It should not be relied upon if site conditions or land use changes in the future.

Use of trade names is for identification only and does not imply endorsement by state or federal health agencies.

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March 13, 2013

Guy Barrett
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Re: Letter Health Consultation
November 2012 Indoor Air Results
Park Laundry Site
Ridgefield, Clark County, Washington

Dear Mr. Barrett:

At the request of Washington Department of Ecology (Ecology), the Washington Department of Health (DOH) evaluated indoor air data collected at the Park Laundry site in November 2012. The data was collected as part of a vapor intrusion investigation. DOH's evaluation was done to determine whether the chemicals found in indoor air pose a health threat to building occupants. DOH conducts health consultations in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background and Statement of Issues

The former Park Laundry facility operated at 122 N. Main Avenue; Ridgefield, Clark County, Washington. The facility may have performed dry cleaning operations and released tetrachloroethylene (also known as perchloroethylene or PCE) to soil and groundwater. This has resulted in a plume of contaminated groundwater, which extends in a northwesterly direction away from the property. The full extent of the plume is currently unknown.

PCE and its breakdown products, such as trichloroethylene (TCE), are considered volatile organic compounds (VOCs). When found in soil or groundwater, these chemicals can evaporate and move through the soil. Vapors can enter buildings through cracks or other openings in the foundation. If this occurs, it may pose a health threat depending on concentrations measured in indoor air.

To evaluate whether PCE and its breakdown products are a possible indoor air health threat, the potentially liable party (PLP) offered to test some homes and businesses that overlie or are near the plume. Occupants at three residences and six commercial buildings, including the fire station, agreed to participate in the testing. Sampling occurred in November 2012. The PLP also tested vapor concentrations in outdoor air, soil gas, and crawlspace air. Indoor air, outdoor air, and crawlspace air were collected for about 24 hours. Soil gas was collected for about 30 minutes. All samples were collected using Summa canisters.

Discussion

The vapor intrusion pathway is complex. Because of that, it can be difficult to determine if contaminated soil or groundwater is affecting indoor air quality at nearby buildings. It is particularly challenging when the levels of chemicals found in soil gas and indoor air are very low, which is generally the case for this site. Much of what was found in indoor air at the Park Laundry site in November 2012 appears to be the result of chemicals found in ambient air and/or consumer products used or stored in the buildings. However, it is possible that a very small amount may be coming from contaminated groundwater or soil. Further work is being done to assess that.

The November 2012 indoor air sampling locations and analytical data are provided in Appendix A. Not all VOCs analyzed were detected above the reporting limits. Some chemicals, like PCE, TCE, and 1,2-Dichloroethane (1,2-DCA) were detected. Table 1 summarizes the concentration range for each chemical tested.

Table 1: November 2012 Indoor Air Chemical Concentrations ($\mu g/m^3$) for Residences and Commercial Buildings, Park Laundry Site, Ridgefield, Washington

Chemical	Concentration Range ($\mu g/m^3$)			
	Minimum		Maximum	
1,1-Dichloroethane	0.11	U	0.23	U
1,1-Dichloroethene	0.053	U	0.11	U
1,2-Dichloroethane	0.074	J	1.5	
Chloroethane	0.18	U	0.38	U
Cis 1,2-Dichloroethene	0.11	U	0.23	U
Tetrachloroethylene (PCE)	0.18	U	0.27	
Trans 1,2-Dichloroethene	0.53	U	1.1	U
Trichloroethylene (TCE)	0.026	J	1.2	
Vinyl Chloride	0.034	U	0.074	U

$\mu g/m^3$ - microgram per cubic meter; U - result is non-detect at the reporting limit;
J - result is an estimated value; PCE – perchloroethylene (tetrachloroethylene)

Exposure Pathways

Exposure to VOCs in indoor air can occur when someone breathes in the chemicals. However, there are many factors that determine if the exposure will cause health effects. These factors include the dose (how much), the duration (how long), and how someone comes in contact with the chemicals (breathing in the chemical). A person's age and the number of chemicals they are exposed to are a few other factors.

Chemicals of Potential Concern

DOH compared the highest amount of each VOC measured in indoor air to cancer and non-cancer health comparison values. This comparison allows DOH to determine if any of the tested chemicals might be a health concern. The health comparison values are set at concentrations much lower than what might cause harmful effects in people. This is done to be protective of the most sensitive individuals (i.e., children and older adults). It also accounts for the general lack of certainty regarding low levels of chemical exposure. If a chemical was below a reporting limit[a], DOH used the reporting limit for that chemical to compare to the health comparison values.

The air comparison values used by DOH included chemical-specific Cancer Risk Evaluation Guide (CREG) and chronic Environmental Media Evaluation Guide (EMEG) developed by ATSDR.(1) The CREG is the concentration of a chemical in air expected to cause less than one additional cancer case in a million persons exposed over a lifetime. An EMEG is the concentration of a chemical in air below which adverse non-cancer health effects are not expected to occur.

If no ATSDR comparison values were available, DOH used inhalation reference concentrations (RfCs) or Regional Screening Levels (RSL) for residential air developed by U.S. Environmental Protection Agency (EPA).(2) An RfC is a concentration of a chemical in air below which non-cancer health effects are not expected to occur during a lifetime. The regional screening levels correspond to a cancer risk of less than one case in a million people exposed or a hazard quotient (HQ) of one for non-carcinogens.

Table 2 provides a comparison of the maximum indoor air concentration with the comparison values.

[a] Reporting limits are the lowest concentration at which a chemical can be detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision.

Table 2: Comparison of the Maximum November 2012 Indoor Air Results (µg/m^3) to Health-based Comparison Values (CV), Park Laundry Site, Ridgefield, Washington

Chemical	Cancer Class	Maximum Concentration (µg/m^3)		Non-Cancer CV	Type of CV	Cancer CV	Type of CV
1,1-Dichloroethane	C	0.23	U	2,400	Chronic EMEG for 1,2-DCA	1.5	RSL
1,1-Dichloroethene	NS	0.11	U	200	RfC	NA	--
1,2-Dichloroethane	B2	**1.5**		2,400	Chronic EMEG	0.038	CREG
Chloroethane	3	0.38	U	10,000	RfC	NA	--
cis-1,2-Dichloroethene	IN	0.23	U	63	RSL for trans-1,2-DCE	NA	--
Tetrachloroethylene (PCE)	LC	0.27		40	RfC	3.8	CREG
trans-1,2-Dichloroethene	IN	1.1	U	63	RSL	NA	--
Trichloroethylene (TCE)	CH	**1.2**		2	RfC	0.24	CREG
Vinyl Chloride	KL	0.074	U	100	RfC	0.11	CREG

Cancer Classification Key:
- CH Carcinogenic to humans based on EPA 2005 cancer guidelines
- KL Known/Likely human carcinogen based on EPA 1996 cancer guidelines
- C Possible human carcinogen (no human, limited animal studies) based on EPA 1986 cancer guidelines
- LC Likely to be carcinogenic to humans based on EPA 2005 guidelines
- B2 Probable human carcinogen (inadequate human, sufficient animal studies) based on EPA 1986 cancer guidelines
- NS Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential based on EPA 1999 cancer guidelines
- 3 Not Classifiable based on International Agency for Research on Cancer (IARC) guidelines
- IN Inadequate information to assess carcinogenic potential based on EPA 2005 cancer guidelines

µg/m^3 – microgram per cubic meter; U - result is non-detect at the method reporting limit; NA – not applicable ATSDR – Agency for Toxic Substances and Disease Registry; EPA – Environmental Protection Agency; CREG - Cancer Risk Evaluation Guide (ATSDR); EMEG - Environmental Media Evaluation Guide (ATSDR); RfC – inhalation reference concentration (EPA); RSL – regional screening level (EPA); Shaded boxes indicate that a comparison value has been exceeded and will be further evaluated; PCE – perchloroethylene (tetrachloroethylene); 1,2-DCA – 1,2-Dichloroethane; trans 1,2-DCE – trans 1,2-Dichloroethene; CREG - Cancer Risk Evaluation Guides

As shown in Table 2, all chemicals detected and non-detected are below the non-cancer comparison values. As a result, no further assessment of the non-cancer health effects is necessary. Two of the nine tested chemicals were above the cancer comparison values: 1,2-DCA and TCE. These two chemicals were evaluated further to assess the carcinogenic health threat.

TCE was only found above the cancer comparison value at the fire station building. Therefore, the carcinogenic health threat associated with TCE was only evaluated for a fire station worker. 1,2-DCA was found in all the residential and commercial buildings. It is important to understand that exceeding the cancer comparison value does not mean people will develop cancer when exposed to these levels. A more complete discussion of cancer risk is provided below.

TCE and 1,2-DCA Use and Carcinogenic Health Effects

TCE is a breakdown product of PCE but is also used in industry. Mainly, TCE is used as a solvent to remove grease from metal parts. It is also used to make other chemicals. TCE can be found in household products including typewriter correction fluid, paint removers, adhesives, and spot removers.(3) EPA classifies TCE as carcinogenic to humans by all routes of exposure. This is based on convincing evidence of a causal association between people exposed to TCE and kidney cancer. There is also some evidence suggesting an association between TCE exposure and non-Hodgkin's lymphoma and liver cancer.(4)

1,2-DCA is a breakdown product of PCE but it is also used in industrial processes. 1,2-DCA is used to make vinyl chloride. Vinyl chloride is used to make various plastic and vinyl products including polyvinyl chloride (PVC) pipes, packaging materials, furniture and automobile upholstery, wall coverings, house wares, and automobile parts. In the past, 1,2-DCA was used as a solvent for degreasing and was also found in cleaning products. EPA classifies 1,2-DCA as a probable human carcinogen based on animal studies although it was unclear whether breathing 1,2-DCA causes cancer in animals. Some studies of cancers in people exposed to 1,2-DCA have been inconclusive. Because of the cancer findings in animals, the possibility of cancer in humans cannot be ruled out.(5)

Evaluating Cancer Risk

Some VOCs, like 1,2-DCA and TCE, have the ability to increase people's risk of developing cancer. Because current risk assessment practice assumes there is no "safe dose" of a carcinogen, any dose of a carcinogen will result in some additional increased cancer risk. Cancer risk estimates are not yes/no answers but measures of chance (probability). Such measures, however uncertain, are useful in determining the magnitude of a cancer threat.

Cancer Risk

Cancer risk estimates do not reach zero no matter how low the level of exposure to a carcinogen. Terms used to describe this risk are defined below as the number of cancer cases for the number of persons similarly exposed over a lifetime:

Term		# of Excess Cancers
moderate	is approximately equal to	1 in 1,000
low	is approximately equal to	1 in 10,000
very low	is approximately equal to	1 in 100,000
slight	is approximately equal to	1 in 1,000,000
insignificant	is less than	1 in 1,000,000

Cancer is a common illness and its occurrence in a population increases with the age of the population. There are many different forms of cancer resulting from a variety of causes; not all are fatal. Approximately 1 in 3 to 1 in 2 people living in the United States will develop cancer at some point in their lives.(6)

To evaluate the inhalation cancer risk, DOH used the maximum chemical concentration detected for each building type (residence and commercial). This was done for 1,2-DCA at the residences and 1,2-DCA and TCE at the commercial buildings.[b] For residences, DOH conservatively assumed that

[b] TCE was only detected above the comparison value at the fire station.

exposures would be 24 hours per day, 7 days per week, for 50 weeks out of the year (2 weeks were allowed for vacations away from home). For workers at commercial buildings, including the fire station, DOH conservatively assumed exposures would be 24 hours per day, 5 days per week, for 50 weeks out of the year (2 weeks were allowed for vacations away from the building). Appendix B contains the equation, assumptions (Tables B1 and B2), and results of DOH's estimated cancer risk evaluation (Table B3).

As noted in Appendix B, Table B3, DOH estimated the following cancer risks for children, older children, and adults exposed to the maximum amount 1,2-DCA in a residential setting for a lifetime:

- 5 additional cancer cases per 1,000,000 similarly exposed children.
- 6 additional cancer cases per 1,000,000 similarly exposed older children.
- 6 additional cancer cases per 1,000,000 similarly exposed adults.
- This is a lifetime cancer risk of 2 additional cases for every 100,000 similarly exposed people.

DOH estimated the following cancer risk for workers exposed to the maximum amount 1,2-DCA and TCE at the commercial buildings:

- 1 additional cancer cases per 1,000,000 workers similarly exposed to 1,2-DCA.
- 6 additional cancer cases per 10,000,000 workers similarly exposed to TCE.
- For workers similarly exposed to both chemicals, this would be about 2 additional cancers in 1,000,000.

When compared to the cancer risk terms provided on page 6, the estimated cancer risks for 1,2-DCA detected in the homes is considered slight to very low. Cancer risk for workers exposed to 1,2-DCA in commercial buildings or 1,2-DCA and TCE at the fire station are considered insignificant. These risk levels are all below a level DOH considers a health threat.[c] It is important to note that these estimates are for excess cancers that might occur in addition to those normally expected in an unexposed population. It is also important to note that these are estimated risk estimates and the actual risk could be as low as zero.

Conclusions

DOH concludes that breathing the maximum concentrations of VOCs found in indoor air at the residential and commercial buildings during November 2012 are not expected to cause harmful health effects.

[c] DOH generally considers there to be an increased health threat when an assessment shows 1 additional cancer in a population of 10,000.

Recommendations

DOH recommends the vapor intrusion investigation work scheduled for late spring 2013 continue as planned. This testing will allow further assessment of the vapor intrusion pathway at the site.

DOH appreciates this opportunity to assist Ecology with this project. Please contact me at 360-236-3373 if you have any questions.

Sincerely,

Barbara Trejo
Health Assessor, Hydrogeologist
Site Assessments and Toxicology Section

cc: Joanne Snarski, Department of Health

Appendix A

Figure A1
Indoor Air Sampling Locations
Park Laundry Site
Ridgefield, Washington

Legend

Indoor Air Sampling Locations

Former Park Laundry Property

2/8/2013 Background Imagery: ESRI, Bing Maps
Map Disclosure Statement:The Washington State Department of Health does not warrant the accuracy, reliability or timeliness of any information published in this map and assumes no responsibility for errors in the content of the information provided. Persons or entities that rely on any information obtained from this map do so at their own risk.

Table A1: November 2012 Indoor Air Results (µg/m^3) for Residential and Commercial Buildings, Park Laundry Site, Ridgefield, Washington

Building Location	1,1-Dichloro-ethane	1,1-Dichloro-ethene	1,2-Dichloro-ethane	Chloro-ethane	cis-1,2-Dichloro-ethene	Tetrachloro-ethene (PCE)	trans-1,2-dichloro-ethene	Trichloro-ethene (TCE)	Vinyl chloride
1-IA1	0.12 U	0.059 U	**0.31**	0.2 U	0.12 U	0.2 U	0.59 U	**1.2**	0.038 U
1-IA2	0.11 U	0.053 U	**0.2**	0.18 U	0.11 U	0.18 U	0.53 U	**1**	0.034 U
1-IA3	0.13 U	0.063 U	**0.086 J**	0.21 U	0.12 U	0.21 U	0.63 U	**1**	0.04 U
5-IA1	0.12 U	0.061 U	**0.093 J**	0.2 U	0.12 U	**0.23**	0.61 U	**0.063 J**	0.04 U
5-IA2	0.12 U	0.06 U	**0.11 J**	0.2 U	0.12 U	**0.22**	0.6 U	**0.17**	0.039 U
5-IA3	0.13 U	0.065 U	**0.074 J**	0.22 U	0.13 U	0.22 U	0.65 U	**0.058 J**	0.042 U
7-IA1	0.12 U	0.06 U	**0.12**	0.2 U	0.12 U	0.2 U	0.6 U	**0.12 J**	0.039 U
7-IA2	0.12 U	0.059 U	**0.08 J**	0.2 U	0.12 U	**0.2 J**	0.59 U	**0.074 J**	0.038 U
9-IA1	0.23 U	0.11 U	**0.16 J**	0.38 U	0.23 U	0.39 U	1.1 U	**0.12 J**	0.074 U
9-IA2	0.14 U	0.069 U	**0.12 J**	0.23 U	0.14 U	0.24 U	0.69 U	**0.056 J**	0.044 U
10-IA1	0.14 U	0.069 U	**0.33**	0.23 U	0.14 U	0.24 U	0.69 U	**0.03 J**	0.045 U
10-IA2	0.13 U	0.064 U	**0.44**	0.21 U	0.13 U	0.22 U	0.64 U	**0.026 J**	0.041 U
11-IA1	0.13 U	0.063 U	**0.22**	0.21 U	0.13 U	**0.23**	0.63 U	**0.043 J**	0.041 U
11-IA2	0.12 U	0.06 U	**0.2**	0.2 U	0.12 U	0.21 U	0.6 U	**0.051 J**	0.039 U
11-IA3	0.12 U	0.06 U	**0.19**	0.2 U	0.12 U	**0.27**	0.6 U	**0.035 J**	0.039 U
13-IA1	0.13 U	0.062 U	**0.48**	0.2 U	0.12 U	0.21 U	0.62 U	**0.03 J**	0.04 U
13-IA2	0.13 U	0.063 U	**0.67**	0.21 U	0.13 U	0.22 U	0.63 U	**0.095 J**	0.041 U
24-IA1	0.12 U	0.061 U	**0.08 J**	0.2 U	0.12 U	0.21 U	0.61 U	**0.068 J**	0.039 U
24-IA2	0.12 U	0.061 U	**0.08 J**	0.2 U	0.12 U	0.21 U	0.61 U	**0.029 J**	0.04 U
27-IA1	0.12 U	0.061 U	**1.5**	0.2 U	0.12 U	0.21 U	0.61 U	**0.083 J**	0.04 U
27-IA2	0.14 U	0.067 U	**1.5**	0.22 U	0.13 U	0.23 U	0.67 U	0.052 UJ	0.043 U

µg/m^3 – micrograms per cubic meter; U- result not detected at the reporting limit; J – estimated value; **Bold** – detected results

Commercial Building Residence

Appendix B

This section provides the equation and assumptions used for determining the estimated increased cancer risk. We considered a child (0-5 years), an older child, and an adult inhaling the maximum concentration of 1,2-Dichloroethane (1,2-DCA) at a residence and commercial building located at the Park Laundry site in Ridgefield, Washington. It also provides the assumptions and estimated increased cancer risk for a worker inhaling the maximum amount of trichloroethylene (TCE) and 1,2-DCA at the fire station.

$$\text{Estimated increased cancer risk} = \frac{Ca \times IR \times EF \times ED \times CSF}{BW \times AT}$$

Table B1: Exposure assumptions used to estimate the increased cancer risk associated with maximum concentration of 1,2-DCA found in indoor air at residences, Park Laundry Site, Ridgefield, Washington.

Parameter	Value	Unit	Comments
Concentration (Ca)	Variable	mg/m^3	Maximum detected value 1,2-Dichloroethane = 0.0015
Inhalation Rate (IR) - child	8.3	m^3/day	Exposure Factors Handbook (7)
Inhalation Rate (IR) - older child	14		
Inhalation Rate (IR) - adult	15		
Exposure Frequency (EF)	350	days/year	7 days a week with a 2 week vacation
Exposure Duration (ED) - child	5	years	Exposure Factors Handbook (7)
Exposure Duration (ED) - older child	10		
Exposure Duration (ED) - adult	15		
Body Weight (BW) - child	15	kg	0-5 year-old child average body weight (7)
Body Weight (BW) - older child	41		Older child mean body weight (7)
Body Weight (BW) - adult	72		Adult mean body weight (7)
Averaging $Time_{cancer}$ (AT)	27375	days	75 years (7)
Inhalation Cancer Slope Factor (CSF)	Variable	$mg/kg\text{-}day^{-1}$	1,2-Dichloroethane = 0.091 (8)

Table B2: Exposure assumptions used to estimate the increased cancer risk associated with maximum concentration of 1,2-DCA and TCE found in indoor air at commercial buildings and fire department at the Park Laundry Site, Ridgefield, Washington.

Parameter	Value	Unit	Comments
Concentration (Ca)	Variable	mg/m^3	Maximum detected value 1,2-Dichloroethane = 0.00044 TCE = 0.0012
Inhalation Rate (IR) - adult	10.4		Mean inhalation rate for outdoor workers (1.3 m3/hr).(7)
Exposure Frequency (EF)	250	days/year	5 days a week with a 2 week vacation
Exposure Duration (ED) - adult	25	years	Exposure Factors Handbook (7)
Body Weight (BW) - adult	72	kg	Adult mean body weight (7)
Averaging $Time_{cancer}$ (AT)	27375	days	75 years (7)
Inhalation Cancer Slope Factor (CSF)	Variable	$mg/kg\text{-}day^{-1}$	1,2-Dichloroethane = 0.091 (8) TCE = 0.014 (9)

Table B3: Estimated increased cancer risk associated with 1,2-DCA and TCE found in indoor air at the Park Laundry Site, Ridgefield, Washington.

Chemical	Cancer Risk - Residence			Cancer Risk Worker
	Child	Older Child	Adult	
1,2-DCA	4.83E-06	5.96E-06	5.53E-06	1.32E-06
TCE	NA	NA	NA	5.54E-07
Total Cancer Risk	1.63E-05			1.87E-06

NA – not applicable – indoor air concentrations below the cancer comparison value

Reference List

1. Air Comparison Values from ATSDR's Sequoia Database [Data File]. Agency for Toxic Substances and Disease Registry. 2012 Aug.

2. U.S. Environmental Protection Agency. Residential Air Screening Levels 2012 Nov [cited 2013 Jan 24] Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

3. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Trichloroethylene. 1997 Sep.

4. Agency for Toxic Substances and Disease Registry. Addendum the Toxicological Profile for Trichloroethylene. 2013 Jan.

5. Agency for Toxic Substances and Disease Registry. Toxicological Profile for 1,2-Dichloroethane. 2001 Sep.

6. American Cancer Society. Cancer Facts & Figures 2012 2012 [cited 2013 Feb 4] Available from http://www.cancer.org/acs/groups/content/@epidemiologysurveilance/documents/document/acspc-031941.pdf.

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9. U.S. Environmental Protection Agency. Trichloroethylene - Integrated Risk Information System 2012 Aug 9 [cited 2013 Jan 30] Available from http://www.epa.gov/iris/subst/0199.htm.