

Letter Health Consultation

Frank Wear Cleaners Site Evaluation of July 2012 – December 2013 Indoor Air Results Buckle My Shoe Early Learning Center Yakima, Yakima County, Washington

June 4, 2014

Prepared by

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



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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June 4, 2014

Jason Shira
Washington Department of Ecology
Toxics Cleanup Program
15 W Yakima Avenue, Suite 200
Yakima, Washington 98902-3452

Re: Letter Health Consultation
Frank Wear Cleaners Site
Evaluation of July 2012 – December 2013 Indoor Air Results
Buckle My Shoe Early Learning Center
Yakima, Yakima County, Washington

Dear Mr. Shira:

At the request of the Washington Department of Ecology (Ecology), the Washington Department of Health (DOH) reviewed indoor air contaminant data from the Buckle My Shoe Early Learning Center in Yakima, Yakima County, Washington. The data were collected by Ecology between July 2012 and December 2013. The childcare center is located adjacent to the former Frank Wear Cleaners property where a release of dry cleaning chemicals to soil and groundwater occurred sometime in the past. Children from 1 to 5 years old and childcare workers occupy the Buckle My Shoe Early Learning Center 5 days a week.

Indoor air contaminants were detected during the testing at the childcare center. However, DOH concludes that breathing the contaminants is not expected to cause harmful health effects. Although the contaminants found in indoor air during this time are not expected to cause harmful health effects, DOH recommends that Ecology continue monitoring indoor air at the childcare center to ensure that the contaminants associated with the Frank Wear site do not increase in the future. The occurrence and frequency of the testing and type of analysis should be based on site specific conditions.

DOH conducts health consultations in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background and Statement of Issues

The former Frank Wear Cleaners property is located at 106 South Third Avenue in a commercial area of Yakima. The property is currently vacant. Dry cleaning operations occurred on the property from the early 1940s to 2000. It is unknown how the property was used prior to 1940. Groundwater contamination at the Frank Wear Cleaners site is predominantly from tetrachloroethylene (PCE). However, other dry cleaning related chemicals may have also been released. The contaminated groundwater reportedly flows from the former dry cleaner property to the south/southeast. It travels under the adjacent building currently occupied by the Buckle My Shoe Early Learning Center, which operates as a childcare center.

The childcare center is located at 108 South Third Avenue. Currently, it is only licensed for children ages 1 to 5 years (J. Shira, Ecology, e-mail communication, March 4, 2014). Occupants of the childcare care center are typically in the building nine hours a day, five days a week.(1)

When Ecology learned in 2011 that the childcare center occupied the building, they began testing indoor air and soil gas below the building. The results suggested a small amount of soil gas contaminated with PCE could be moving into indoor air. Ecology asked DOH to assess the health risk associated with the levels found in indoor air at the childcare center in 2011 while they took steps to eliminate the exposure pathway.(2) DOH completed the assessment in January 2012 and concluded that breathing the maximum concentrations of VOCs found in indoor air for approximately one year, while Ecology took steps to eliminate the pathway, was not expected to harm the health of children or adults.(2)

Ecology installed a soil vapor extraction (SVE) system at the site in early July 2012. The SVE system captures and treats the contaminants evaporating from the soil and groundwater. It was also designed to prevent vapors associated with the contaminated soil and groundwater at the site from entering indoor air at the childcare center. This was done by creating sub-slab depressurization.(3)

After the SVE system startup, Ecology tested indoor and outdoor air at the childcare center eight times between July 2012 and December 2013. Testing was done for volatile organic compounds (VOCs) using EPA Method TO-15; some contaminants were analyzed using selective ion mode (SIM).(3-5) Soil gas below the sub-slab was also tested; however, no sub-slab testing was done in July 2012.

Twelve hour indoor and outdoor air samples were collected using 6-liter Summa canisters. Sub-slab samples were also collected with 6-liter Summa canisters; however, the sub-slab sample collection time was generally under one hour. Leak testing, using helium, was conducted prior to sub-slab testing. Windows were reportedly closed and the heating, ventilation, and air conditioning (HVAC) system was operating during each sampling event.(3;4)

One laboratory analyzed the sub-slab samples while a second laboratory analyzed indoor and outdoor air samples. The testing was limited to 13 contaminants, except in August, September,

and November 2012 when Ecology tested 49 additional contaminants.^a Attachment A, Table A1 summarizes the indoor air results and the concentration range during those eight sampling events. Some of the chemicals analyzed in indoor and outdoor air were not analyzed in the sub-slab samples (e.g., 1,3-butadiene) (Attachment 1, Table A2).

Discussion

Indoor air samples collected at the childcare center were analyzed for 62 contaminants between July 2012 and December 2013. A few of the indoor air contaminants were detected in all the samples, while others were detected infrequently or not at all. Some of the contaminants were also found in sub-slab samples.

Exposure Pathway

Inhalation of VOCs is the only expected route of exposure for the children and childcare workers at the Buckle My Shoe Early Learning Center.

Results

DOH used a multi-step process to determine which of the 62 contaminants tested for in indoor air might pose a possible health threat to the children and childcare workers.

DOH first compared the highest concentrations of each contaminant found in the childcare center's indoor air to health comparison values. *Health comparison values are concentrations of contaminants that are unlikely to cause people to get sick. This is done to be protective of the most sensitive individuals (i.e., children and older adults). It is also done to account for our lack of certainty regarding the adverse health effects of low levels of contaminant exposure.* If a contaminant was noted as being less than a reporting limit^b, DOH compared the reporting limit to the health comparison values.

The primary air health comparison values used by DOH were ATSDR's cancer risk evaluation guides (CREGs) and environmental media evaluation guides (EMEGs).(6) The air CREG is the concentration of a contaminant in air that is expected to cause no more than one additional cancer in a million persons exposed over a lifetime. An EMEG is a concentration in air below which adverse non-cancer health effects are not expected to occur. If no ATSDR health comparison values were available, DOH used an Environmental Protection Agency (EPA) reference concentration (RfC) or EPA regional screening levels (RSLs) for air.(7) An EPA RfC is an estimate of a continuous human inhalation exposure (including sensitive subgroups) that is likely to be without significant risk of harmful non-cancer effects during a lifetime. The EPA RSLs are as protective as ATSDR's EMEGs.

^a The additional chemicals were tested to assess whether contaminants associated with petroleum releases in the area and historical practices at the building now occupied by the Buckle My Shoe Day Care might be present in the vadose zone. (J. Shira, Ecology, e-mail communication, April 30, 2014)

^b 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.

If a contaminant did not exceed the health comparison value, no further evaluation of that contaminant is necessary. This is because we do not expect those contaminants will pose a health threat. When a contaminant is found to be above a health comparison value, further evaluation is needed. *However, just because a contaminant was found above the comparison value does not necessarily mean it will cause people to get sick.* When a contaminant does not have a health comparison value available, a health comparison value for a contaminant similar in structure may be used as a substitute. If no substitute is available, the contaminant is further evaluated.

As shown in Table A1, a number of contaminants, including some that were not detected above the reporting limits, were above the health comparison values. These contaminants were carried forward as possible chemicals of potential concern and compared to outdoor air and sub-slab results. (Table A2). This step was particularly important for identifying whether the contaminants that were not detected in indoor air, but had a reporting limit above the health comparison value, were a site related contaminant that needed further evaluation.

Table A2 summarizes the number of indoor air, outdoor air, and sub-slab samples; shows concentration ranges and whether a contaminant might be dry cleaning related; and provides a determination regarding further assessment of a contaminant. Contaminants that were not detected in indoor air, soil gas, and outdoor air, were not carried forward for further assessment because it was assumed they were not present. This narrowed the number of contaminants down to eight, referred to as contaminants of potential health concern (COPC), that were carried forward for further health assessment (see Table A3):

- benzene;
- 1,3-butadiene;
- carbon tetrachloride;
- chloroform;
- 1,2-dichloroethane;
- ethylbenzene;
- 4-ethyltoluene; and
- trichloroethene

DOH has not evaluated the potential source of these eight COPCs; however, as noted in Table A3, some of them are considered dry cleaning related chemicals. The maximum concentration of each of the eight COPC was less than their respective non-cancer health comparison value. As a result, no further assessment of the non-cancer health effects associated with these contaminants is necessary. The eight COPC did, however, exceed their respective cancer health comparison values. Therefore, further assessment of the carcinogenic health threat posed by those contaminants is needed. *It is important to understand that exceeding the cancer comparison value does not imply that people will develop cancer when exposed to these levels.* Further discussion of the cancer risk associated with these contaminants follows.

Evaluating Cancer Risk

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 2 to 1 in 3 people living in the United States will develop cancer at some point in their lives.(8)

To evaluate the inhalation cancer risk associated with the eight COPC found in indoor air at the Buckle My Shoe Early Learning Center, DOH used the maximum detected concentration of each contaminant. When the maximum detected concentration was less than the laboratory reporting limits, DOH conservatively used the maximum reporting level for evaluating inhalation cancer risks. DOH also conservatively assumed that children and adult exposures would be 50 weeks out of the year (2 weeks were allowed for vacations away from the learning center), 5 days per week, and 12 hours per day.

Attachment B, Table B1 and Table B2 contain the formula and input parameters. The results of DOH’s estimated cancer risk evaluation for the eight COPCs found in indoor air are also included in Table B2. As noted in Table B2, DOH estimated the following approximate cancer risks for a child (1 to 5 years) and adult exposed to the maximum amount of the eight chemicals of concern found in indoor air at the Buckle My Shoe Early Learning Center:

- 6 additional cancer cases per 1,000,000 similarly exposed children.
- 1 additional cancer cases per 100,000 people similarly exposed adults.

When compared to the cancer risk terms provided in the adjacent box, the estimated cancer risk for a child (1 to 5 years old) is considered slight. The estimated cancer risk for a childcare worker is considered very low. These risk levels are all below a level DOH considers a health threat.^c It is important

<u>Cancer Risk</u>		
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

to note that these estimates are for excess cancers that might result, in addition to, those normally expected in an unexposed population. It is also important to note that these are estimated risk based on using the maximum indoor air concentration detected over eight indoor air sample events. The actual risk is likely lower and could be as low as zero.

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

Conclusions

DOH concludes that breathing the contaminants found in indoor air between July 2012 and December 2013 at the Buckle My Shoe Childcare Center is not expected to cause harmful health effects.

Recommendations

Although the VOCs found in indoor air between July 2012 and December 2013 are not expected to cause harmful health effects, DOH recommends that Ecology continue monitoring indoor air at the Buckle My Shoe Early Learning Center to ensure that the VOCs associated with the Frank Wear site do not increase in the future. The occurrence and frequency of the Ecology indoor air testing and type of analysis should be based on site specific conditions (e.g., changes in subsurface conditions (e.g., increases or decreases in soil gas, soil, or groundwater contaminant concentrations)).

DOH appreciates the opportunity to assist Ecology with the Frank Wear Cleaner site. Please contact me at 360-236-3373 if you have any questions.

Sincerely,

Barbara Trejo
Health Assessor
Hydrogeologist LG, LHG
Site Assessments and Toxicology Section

Attachments (2)

cc: Joanne Snarski, Department of Health
Gordon Kelly, Yakima Health District

Attachment A –Screening Level Summary Tables

Table A1: Indoor Air Contaminant Concentration Range for Buckle My Shoe Childcare Center between July 2012 and December 2013(1;5;9) and Health Comparison Values, Frank Wear Cleaners Site, Yakima, Yakima County, Washington

Chemical	Cancer Class	Indoor Air Concentration Range ($\mu\text{g}/\text{m}^3$)	Health Comparison Value (ug/m^3)	Health Comparison Value Reference (6;7)	Possible Chemical of Potential Health Concern
Acetone	DI	22 - 36	31,000	Chronic MRL	NC - No
Benzene	KL	<0.24 - 4.4	9.6 0.13	Chronic MRL CREG	NC - No C - Yes
Bromodichloromethane	B2	<1.2	0.066	EPA Cancer RSL	C - Yes
Bromoform	B2	<1.8 - <1.9	0.91	CREG	C - Yes
Bromomethane	D	<0.68 - <3.6	19	Chronic MRL	NC - No
1,3-Butadiene	CA	<0.40 - 0.58	2 0.033	EPA RfC CREG	NC - No C - Yes
2-Butanone (aka methyl ethyl ketone)	DI	<2.6 - 3.8	5,000	EPA RfC	NC - No
Carbon Tetrachloride	LC	<1.1 - <1.2	190 0.17	Chronic MRL CREG	NC - No C - Yes
Carbon Disulfide	--	<0.27 - <0.29	700	EPA RfC	NC - No
Chlorobenzene	D	<0.80 - <0.86	52	EPA Non-cancer RSL ^a	NC - No
Chloroethane	3	<0.23 - <0.25	10,000	EPA RfC	NC - No
Chloroform	LI	<0.74 - 2.9	98 0.043	Chronic MRL CREG	NC - No C - Yes
Chloromethane	CN	0.83 - 1.4	100	Chronic MRL	NC - No
Alpha-Chlorotoluene (aka benzyl chloride)	B2	<0.90 - <0.97	1.0 0.05	EPA Non-cancer RSL ^a EPA Cancer RSL	NC - No C - Yes
Cumene	CN	<0.86 - <0.92	400	EPA RfC	NC - No
3-Chloropropene (aka allyl chloride)	C	<2.7 - <2.9	1 0.41	EPA RfC EPA Cancer RSL	NC - Yes C - Yes
Cyclohexane	DI	<0.62 - 1.4	6,000	EPA RfC	NC - No
Dibromochloromethane	C	<1.5 - <1.6	0.09	EPA Cancer RSL	C - Yes
1,2-Dibromoethane (aka ethylene dibromide)	--	<1.3 - <1.4	9.4 0.0041	EPA Non-cancer RSL ^a EPA Cancer RSL	NC - No C - Yes
1,2-Dichlorobenzene	D	<1.0 - <1.1	210	EPA Non-cancer RSL ^a	NC - No
1,3-Dichlorobenzene	D	<1.0 - <1.1	210	EPA Non-cancer RSL ^{a,b}	NC - No
1,4-Dichlorobenzene	2B	<1.0 - <1.1	60	Chronic MRL	NC - No

Chemical	Cancer Class	Indoor Air Concentration Range (µg/m ³)	Health Comparison Value (ug/m ³)	Health Comparison Value Reference (6;7)	Possible Chemical of Potential Health Concern
			0.2	EPA Cancer RSL	C - Yes
1,1-Dichloroethane	C	<0.14 - <0.15	1.5	EPA Cancer RSL	C - No
1,2-Dichloroethane	B2	<0.12 - 0.34	2,400 0.038	Chronic MRL CREG	NC - No C - Yes
1,1-Dichloroethene	NS	<0.069 - <0.074	79	Intermediate MRL	NC - No
cis 1,2-Dichloroethene	IN	<0.11 - <0.15	790	Intermediate MRL ^c	NC - No
trans-1,2 Dichloroethene	IN	<0.55 - <0.74	790	Intermediate MRL ^c	NC - No
1,2-Dichloropropane	3	<0.81 - <0.86	4	EPA RfC	NC - No
cis 1,3-Dichloropropene	KL	<0.79 - <0.85	20 0.25	EPA RfC ^d CREG ^d	NC - No C - Yes
trans 1,3-Dichloropropene	KL	<0.79 - <0.85	20 0.25	EPA RfC ^d CREG ^d	NC - No C - Yes
1,4-Dioxane	LC	<0.63 - <0.67	110	Chronic MRL	NC - No
Ethanol	--	160E - 1,100E	21,000	EPA Non-cancer RSL ^{a,e}	--
Ethylbenzene	2B	0.26 - 1.5	260 0.97	Chronic MRL EPA Cancer RSL	NC - No C - Yes
4-Ethyltoluene	--	<0.88 - 1.2	260 0.97	Chronic MRL ^f EPA Cancer RSL ^f	NC - No C - Yes
Freon 11(aka Trichlorofluoromethane)	--	1.1 - 1.5	730	EPA Non-cancer RSL ^a	NC - No
Freon 12 (aka Dichlorodifluoromethane)	--	2.0 - 3.3	100	EPA Non-cancer RSL ^a	NC - No
Freon 113 (aka 1,1,2-Trichlorotrifluoroethane)	--	<1.3 - <1.4	40,000	EPA RfC ^g	NC - No
Freon 114 (aka Dichlorotetrafluoroethane)	--	<1.2 - <1.3	50,000	EPA RfC ^h	NC - No
Heptane	D	0.84 - 3.4	700	EPA RfC ⁱ	NC - No
Hexachlorobutadiene	C	<9.3 - <10	0.045	CREG	C - Yes
Hexane	IN	<0.63 - 2.1	700	EPA RfC	NC - No
2-Hexanone	IN	<3.6 - <3.8	30	EPA RfC	NC - No
Methylene Chloride	LC	<1.0 - 13	1,000 100	Chronic MRL CREG	NC - No C - No
4-Methyl-2-Pentanone (aka methyl isobutyl ketone)	DI	<0.73 - 0.88	3,000	EPA RfC	NC - No
Methyl Tertbutyl Ether	3	<0.63 - <0.67	2,500	Chronic MRL	NC - No

Chemical	Cancer Class	Indoor Air Concentration Range (µg/m ³)	Health Comparison Value (ug/m ³)	Health Comparison Value Reference (6;7)	Possible Chemical of Potential Health Concern
2-Propanol	--	12 - 41	7,300	EPA Non-cancer RSL ^a	NC - No
Propylbenzene	--	<0.86 - <0.92	1,000	EPA Non-cancer RSL ^a	NC - No
Styrene	2B	<0.76 - 1.1	850	Chronic MRL	NC - No
1,1,1,2-Tetrachloroethane	C	<6.0 - <6.4	0.14	CREG	C - Yes
1,1,2,2-Tetrachloroethane	LC	<0.24 - <0.26	0.042	EPA Cancer RSL	C - Yes
Tetrachloroethene	LC	<0.19 - 2.5	270 3.8	Chronic MRL CREG	NC - No C - No
Tetrahydrofuran	SU	<2.6 - <2.8	2,000	EPA RfC	NC - No
1,2,4-Trichlorobenzene	D	<6.5 - <6.9	2.1	EPA Non-cancer RSL ^a	NC - Yes
1,1,2-Trichloroethane	C	<0.19 - <0.20	0.063	CREG	C - Yes
Trichloroethene	CH	<0.022 - 0.52	2 0.24	Chronic MRL CREG	NC - No C - Yes
1,2,4-Trimethylbenzene	--	<0.88 - 1.3	7.3	EPA Non-cancer RSL ^a	NC - No
1,3,5-Trimethylbenzene	--	<0.86 - <0.92	7.3	EPA Non-cancer RSL ^j	NC - No
2,2,4-Trimethylpentane	--	<4.1 - <4.4	700	EPA RfC ^h	NC - No
Toluene	IN	1.3 - 17	300	Chronic MRL	NC - No
m,p-Xylene	DI	0.70 - 5.0	100	EPA Non-cancer RSL ^a	NC - No
o-Xylene	DI	0.27 - 1.8	100	EPA Non-cancer RSL ^a	NC - No
Vinyl Chloride	KL	<0.035 - <0.048	77 0.11	Intermediate MRL CREG	NC - No C - No

Orange highlighted cells - contaminants only tested in August, September, and November 2012, ug/m³ - micrograms per cubic meter, < - less than the reporting limit, E - Exceeds instrument calibration range, **Bold** - One or more samples exceeded the health comparison value, NC - Non Cancer, C - Cancer, -- No cancer classification available

EPA Cancer Classes: DI - Data are inadequate for assessment of human carcinogenic potential, KL - EPA: Known/Likely human carcinogen, B2- Probable human carcinogen (inadequate human, sufficient animal studies); D - Not classified as to human carcinogenicity, CA - Carcinogenic to humans, LC - Likely to be carcinogenic to humans, LI - Likely to be carcinogenic to humans, CN - Carcinogenic potential cannot be determined, NS - Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential, IN - Likely to be carcinogenic to humans, SU - Suggestive evidence of carcinogenic potential, CH - Carcinogenic to humans

IARC Cancer Classes: 3 - not classifiable, 2B - possibly carcinogenic to humans (limited human evidence; less than sufficient evidence in animals)

Chronic MRL - ATSDR's Minimal Risk Level - Non-cancer, CREG - ATSDR's Cancer Risk Evaluation Guides, EPA - U.S. Environmental Protection Agency, EPA RfC - EPA reference concentration, EPA RSL - EPA regional screening level, ^a - target hazard index (HI) = 1.0, ^b - used 1,2-dichlorobenzene as a surrogate, ^c - used trans 1,2-dichloroethene as a surrogate, ^d - used 1,3-dichloropropene as a surrogate, ^e - used methanol as a surrogate, ^f - used ethyl benzene as a surrogate, ^g - used 1,1-Difluoroethane as a surrogate, ^h - used Chlorodifluoromethane as a surrogate, ⁱ - used hexane as a surrogate, ^j - used 1,2,4-Trimethylbenzene as a surrogate

Table A2: Comparison of Indoor Air, Sub-slab and Outdoor Contaminant Ranges and Contaminant Source Assessment for the Buckle My Shoe Childcare Center, Frank Wear Cleaners Site, Yakima, Yakima County, Washington

Chemical	Indoor Air (IA) Concentration Range (µg/m ³) for COPC	Number of Times Detected in IA Samples	Subslab (SS) Concentration Range (µg/m ³)	Number of Times Detected in SS Samples	Outdoor Air (OA) Concentration Range (µg/m ³)	Number of Times Detected in OA Samples	Detected in IA, OA, or SS	Possible Site Related IA Contaminant Requiring Further Evaluation	Source(s) of Contaminant Possibly Dry Cleaning Related	Carry Contaminant Forward for Further Evaluation
Benzene	<0.24 - 4.4	14 of 14	0.16 - 4.3	14 of 14	0.25 - 2.3	7 of 7	All	Yes	Yes - benzene is a component of some dry cleaning chemicals(10)	Yes
Bromodichloromethane	<1.2	0 of 6	<0.68 - <1.4	0 of 6	<1.2 - <1.3	0 of 3	None	No		No
Bromoform	<1.8 - <1.9	0 of 6	<1.0 - <2.1	0 of 6	<1.9 - <2.1	0 of 3	None	No		No
1,3-Butadiene	<0.40 - 0.58	2 of 6	NA	--	<0.40 - <0.44	0 of 3	IA but SS not tested	Yes	No - possible sources are motor vehicle emissions, tobacco smoke, wood burning(11)	Yes
Carbon Tetrachloride	<1.1 - <1.2	0 of 6	<0.64 - 0.95	3 of 6	<1.2 - <1.3	0 of 3	SS	Yes	Yes - in the past, widely used as a dry cleaning fluid(12)	Yes
Chloroform	<0.74 - 2.9	14 of 14	<0.25 - 5.4	10 of 12	<0.77 - <1.8	0 of 8	IA, SS	Yes	Yes - dry cleaning agent; however, it is formed when chlorine is added to water.(13)	Yes
Alpha-Chlorotoluene (aka benzyl chloride)	<0.90 - <0.97	0 of 6	NA	--	<0.95 - <1.0	0 of 3	None found in IA or OA but SS not tested	Possibly - depends on chemical use	No - used for producing flexible food packaging	No
3-Chloropropene (aka allyl chloride)	<2.7 - <2.9	0 of 6	NA	--	<2.9 - <3.1	0 of 3	None found in IA or OA but SS not tested	Possibly - depends on chemical use	No - used to produce some drugs and intermediate for producing plastics, polymers, and resins(14)	No
Dibromochloromethane	<1.5 - <1.6	0 of 6	<0.86 - <1.7	0 of 6	<0.16 - <0.17	0 of 3	None	No		No
1,2-Dibromoethane (aka ethylene dibromide)	<1.3 - <1.4	0 of 6	<0.78 - <1.6	0 of 6	<1.4 - <1.5	0 of 3	None	No		No
1,4-Dichlorobenzene	<1.0 - <1.1	0 of 6	<0.61 - <1.2	0 of 6	<1.1 - <1.2	0 of 3	None	No		No
1,2-Dichloroethane	<0.12 - 0.34	12 of 16	<0.41 - <0.82	1 of 6	<0.14 - 1.5	1 of 8	All	Yes	No - used in the production of solvents like vinyl chloride(15)	Yes
cis 1,3-Dichloropropene	<0.79 - <0.85	0 of 6	<0.46 - <0.92	0 of 6	<0.83 - <0.91	0 of 3	None	No		No
trans 1,3-Dichloropropene	<0.79 - <0.85	0 of 8	<0.46 - <0.92	0 of 6	<0.83 - <0.91	0 of 3	None	No		No
Ethylbenzene	0.26 - 1.5	14 of 14	0.70 - 6.1	12 of 14	0.19 - 1.9	7 of 7	All	Yes	No - most used to produce styrene; found in gasoline, carpet glues, paints, inks, pesticides, tobacco products(16)	Yes
4-Ethyltoluene	<0.88 - 1.2	2 of 6	0.52 - 2.3	4 of 6	<0.90 - 1.1	1 of 3	All	Yes	Unknown	Yes
Hexachlorobutadiene	<9.3 - <10	0 of 6	<2.1 - <4.3	0 of 6	<9.8 - <11	0 of 3	None	No		No
1,1,1,2-Tetrachloroethane	<6.0 - <6.4	0 of 8	<0.70 - <1.4	0 of 6	<6.3 - <6.9	0 of 4	None	No		No
1,1,2,2-Tetrachloroethane	<0.24 - <0.26	0 of 6	<0.70 - <1.4	0 of 6	<0.25 - <0.28	0 of 3	None	No		No
1,2,4-Trichlorobenzene	<6.5 - <6.9	0 of 6	<0.75 - <1.5	0 of 6	<6.8 - <7.4	0 of 3	None	No		No
1,1,2-Trichloroethane	<0.19 - <0.20	0 of 6	<0.55 - <1.1	0 of 6	<0.20 - <0.22	0 of 3	None	No		No
Trichloroethene	<0.022 - 0.52	14 of 16	<0.55 - <1.1	0 of 14	<0.025 - 0.22	2 of 8	IA, OA	Yes	Yes - breakdown product of tetrachloroethylene; solvent(17)	Yes

Orange highlighted cells - contaminants only tested in August, September, and November 2012, ug/m³ - micrograms per cubic meter, < - less than the reporting limit, E - Exceeds instrument calibration range, **Bold** - One or more samples exceeded the health comparison value, IA - indoor air, OA - outdoor air, SS - sub slab, NC - Non Cancer, C - Cancer, -- No cancer classification available

Table A3: Chemicals of Potential Concern for the Buckle My Shoe Childcare Center, Frank Wear Cleaners Site, Yakima, Yakima County, Washington

Chemical	Indoor Air (IA) Concentration Range ($\mu\text{g}/\text{m}^3$) for COPC	Source(s) of Contaminant Possibly Dry Cleaning Related	Chemical of Potential Health Concern
Benzene	<0.24 - 4.4	Yes - benzene is a component of some dry cleaning chemicals(10)	NC - No C - Yes
1,3-Butadiene	<0.40 - 0.58	No - possible sources are motor vehicle emissions, tobacco smoke, wood burning(11)	NC - No C - Yes
Carbon Tetrachloride	<1.1 - <1.2	Yes - in the past, widely used as a dry cleaning fluid(12)	NC - No C - Yes
Chloroform	<0.74 - 2.9	Yes - dry cleaning agent; however, it is formed when chlorine is added to water.	NC - No C - Yes
1,2-Dichloroethane	<0.12 - 0.34	No - used in the production of solvents like vinyl chloride(15)	NC - No C - Yes
Ethylbenzene	0.26 - 1.5	No - most used to produce styrene; found in gasoline, carpet glues, paints, inks, pesticides, tobacco products(16)	NC - No C - Yes
4-Ethyltoluene	<0.88 - 1.2	Unknown	NC - No C - Yes
Trichloroethene	<0.022 - 0.52	Yes - breakdown product of tetrachloroethylene; solvent(17)	NC - No C - Yes

Orange highlighted cells - contaminants only tested in August, September, and November 2012, $\mu\text{g}/\text{m}^3$ - micrograms per cubic meter, < - less than the reporting limit, **Bold** - One or more samples exceeded the health comparison value, NC - Non Cancer, C - Cancer

Attachment B – Cancer Risk Equations, Assumptions, and Estimated Cancer Risks

This attachment provides the equation and assumptions used for determining the estimated increased cancer risk and the results associated with a child (1-5 years), an older child, and an adult inhaling the maximum concentration of the eight COPCs found in indoor air at the Buckle My Shoe Early Learning Center in Yakima, Washington.

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

*used for all COPCs except TCE. DOH used the U.S. Environmental Protection Agency’s (EPA) spreadsheet template to estimate the lifetime TCE cancer risk.(18) The spreadsheet allows the user to apply the Age-Determinant Adjustment Factors (ADAFs) to account for kidney cancer mutagenicity and early life-stage susceptibility to TCE. See Table B2 for TCE estimated increased cancer risk.

Table B1: Exposure assumptions used to estimate the increased cancer risk associated with maximum concentration of seven of the eight COPCs at the Buckle My Shoe Early Learning Center, Yakima, Yakima County, Washington

Parameter	Value	Unit	Comments
Concentration (Ca)	Variable	mg/m ³	Concentrations in Table B2 below/1000
Inhalation Rate (IR) - child	8.3	m ³ /day	Exposure Factors Handbook(19)
Inhalation Rate (IR) - older child	14		
Inhalation Rate (IR) - adult	15		
Exposure Frequency (EF)	250	days/year	5 days a week with a 2 week vacation
Exposure Duration (ED)	2.5	years	Maximum half day exposure for 250 days per year for 5 years (child) and 25 years (adult) of exposure
	12.5		
Body Weight (BW) - child	15	kg	1-5 years old child average body weight (19)
Body Weight (BW) - older child	41		Older child mean body weight (19)
Body Weight (BW) - adult	72		Adult mean body weight (19)
Averaging Time _{cancer} (AT)	27375	days	75 years
Inhalation Cancer Slope Factor (CSF)	Variable	mg/kg-day ⁻¹	See Table B2, below

Table B2: Exposure assumptions used to estimate the increased cancer risk associated with maximum concentration of TCE and risk estimates for Buckle My Shoe Early Learning Center, Yakima, Yakima County, Washington

Inhalation (concentration-equivalence across age groups)

Col A	Col B	Col C	Col D	Col E	Col F	Col G	Col H	Col I	Col J	Col K	Col L		
Units:	Exposure scenario parameters				Dose-response assessment calculations							-	
		($\mu\text{g}/\text{m}^3$ air)	year	-	($\mu\text{g}/\text{m}^3$ air) ⁻¹	-	-	($\mu\text{g}/\text{m}^3$ air) ⁻¹	($\mu\text{g}/\text{m}^3$ air) ⁻¹	-	-		
Age group	risk per $\mu\text{g}/\text{m}^3$ air equivalence	Exposure concentration	Age group duration*	Duration adjustment (Col D/70 yr)	Kidney unadjusted lifetime unit risk (p 5-137 [5.2.2.1.4])	Kidney cancer default ADAF	Kidney ADAF-adjusted partial risk (Col B x Col C x Col E x Col F x Col G)	Kidney+NHL+ liver unadjusted lifetime unit risk (p 5-139 [5.2.2.2])	NHL+ liver lifetime unit risk (Col I - Col F)	NHL and liver partial risk (Col B x Col C x Col E x Col J)	Total partial risk (Col H + Col K)	Child (1-5 years) and Adult Cancer Risk	
Child (1-5 years)													
1 to <2 years	1	0.52	0.500	0.0071	1.0E-06	10	3.7E-08	4.1E-06	3.1E-06	1.2E-08	4.9E-08		
2 to <3 years	1	0.52	0.500	0.0071	1.0E-06	3	1.1E-08	4.1E-06	3.1E-06	1.2E-08	2.3E-08	1.2E-07	
3 to <5 years	1	0.52	1.000	0.0143	1.0E-06	3	2.2E-08	4.1E-06	3.1E-06	2.3E-08	4.5E-08		
Childcare Worker													
18 to <21	1	0.52	1.500	0.0214	1.0E-06	1	1.1E-08	4.1E-06	3.1E-06	3.5E-08	4.6E-08		
21 to <30	1	0.52	4.500	0.0643	1.0E-06	1	3.3E-08	4.1E-06	3.1E-06	1.0E-07	1.4E-07	3.8E-07	
30 to 70	1	0.52	6.500	0.0929	1.0E-06	1	4.8E-08	4.1E-06	3.1E-06	1.5E-07	2.0E-07		

* assumed 1/2 year duration because children and childcare workers only at the facility 12 hours per day

Table B3: Estimated increased cancer risk associated with the indoor air COPC at the Buckle My Shoe Early Learning Center, Yakima, Yakima County, Washington

Chemical	Maximum Concentration (ug/m3)	Unit Risk ^a (7)	Inhalation Slope Factor (mg/kg-day) ^b	Cancer Risk	
				Child	Adult
Benzene	4.4	7.8E-06	0.0273	1.5E-06	2.9E-06
1,3 Butadiene	0.58	3.0E-05	0.105	7.7E-07	1.5E-06
Carbon Tetrachloride	1.2	6.0E-06	0.021	3.2E-07	6.1E-07
Chloroform	2.9	2.3E-05	0.0805	3.0E-06	5.6E-06
1,2-Dichloroethane	0.34	2.6E-05	0.091	3.9E-07	7.5E-07
Ethylbenzene	1.5	2.5E-06	0.00875	1.7E-07	3.2E-07
4-Ethyltoluene*	1.2	2.5E-06	0.00875	1.3E-07	2.5E-07
Trichloroethene**	0.52	See Table B-2		1.2E-07	3.8E-07
Total Cancer Risk				6.4E-06	1.2E-05

^a air unit risk = risk per $\mu\text{g}/\text{m}^3 = \text{slope factor} \times 1/70 \text{ kg} \times 20\text{m}^3/\text{day} \times 10^{-3}$

^b inhalation slope factor = unit risk $\times 70 \text{ kg} \times 1000/20\text{m}^3$ per day

* used ethylbenzene unit risk as a surrogate

** mutagenic mode of action

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