Letter Health Consultation

Frank Wear Cleaners Site
Evaluation of December 2023 Indoor Air Results
Terick's Early Learning Center

Yakima, Yakima County, Washington

July 15, 2024

Prepared by

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

DOH 334-555 July 2024

Foreword

Report Preparation

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July 15, 2024

Rachel Caron
Washington Department of Ecology
Toxics Cleanup Program
Central Region Office

Re: Letter Health Consultation
Frank Wear Cleaners Site (Ecology Cleanup Site ID 4194)
Evaluation of December 2023 Indoor Air Results
Terick's Early Learning Center
Yakima, Yakima County, Washington

Dear Ms. Caron:

At the request of the Washington Department of Ecology (Ecology), the Washington Department of Health (DOH) reviewed indoor air contaminant data from the Terick's Early Learning Center (the former location of Buckle my Shoe and Learning Tree Early Learning Center) in Yakima, Yakima County, Washington. The data were collected by Ecology in December 2023. Terick's Early Learning Center (TELC or childcare center) is located adjacent to the former Frank Wear Cleaners property where a known release of dry-cleaning chemicals to soil and groundwater has occurred. Children from 1 to 5 years old and childcare workers occupy TELC 5 days a week.

Previously, DOH evaluated indoor air data from TELC, and provided a Letter Health Consultation on June 15, 2023 [1]. In that document, DOH concluded that breathing the contaminants is not expected to cause harmful health effects. Although the contaminants detected in indoor air samples collected between 2015 and 2017 were not expected to cause harmful health effects, DOH recommended that Ecology continue monitoring indoor air at the childcare center to determine whether the contaminants associated with the Frank Wear site change over time.

In 2012, a soil vapor extraction (SVE) system designed to remove site contaminants was constructed at the site. The consultant has performed system operation, maintenance, and monitoring activities at the site from October 2014 to September 2015, October 2015 to May 2017 [2-4]. Ecology reports that the system has been effective at removing contaminants from the site.

In December 2023 Kennedy/Jenks Consultants, Inc. (Kennedy Jenks), on behalf of Ecology, collected indoor air and sub-slab samples to determine the levels of contaminants in the indoor air at TELC [5]. The results of this assessment are described in detail below.

Discussion

Ambient air, indoor air, and sub-slab vapor samples were collected in December 2023. Two ambient air samples were collected from TELC in the northwest corner of the outdoor play area, and within the soil vapor extraction (SVE) enclosure. According to Ecology, the SVE system has effectively removed volatile organic compounds (VOCs) including tetrachloroethylene (PCE) and trichloroethene (TCE) from soil at the site. Based on our assessment, operation of the SVE systems continues to reduce concentrations of these contaminants in the indoor air to protective levels in the childcare center.

Indoor air evaluation results are summarized in tables A1 through A3 in Appendix A.

Exposure Pathway

Inhalation of VOCs is the only identified route of exposure for the children and childcare workers at the former's childcare centers.

Skin Contact (Dermal)–The skin provides an effective barrier for most environmental contaminants, but some contaminants do cross the skin and enter the body through dermal contact. TCE can enter the body from skin contact with products that are liquid and contain TCE, or through the skin from vapors in the air or from contaminated water while bathing, showering, or swimming. Dermal contact with contaminated soil will allow only a small amount of TCE to be absorbed through the skin. The transfer of chemicals through the skin depends on the chemical and the duration of contact. Based on the low levels of Contaminants of Concern (COCs) found in the soil at the site, it is unlikely that exposure can occur through skin contact with contaminated soils. Thus, dermal contact is not considered an exposure route of concern.

Water ingestion pathway – The City of Yakima provides domestic water service to over 72,000 residents, including the childcare facility, as well as commercial, industrial, and institutional customers [6]. Its main source is the surface water supply from the Naches River through the City's Water Treatment Plant (WTP). There is a private drinking water well identified near the site, but reportedly is not in use for drinking water. Thus, ingestion of contaminated water is not considered an exposure route of concern.

Results

DOH used a multi-step process approved by ATSDR to determine which of the contaminants tested for indoor air might pose a possible health threat to the children and childcare workers that is available on the ATSDR website [7].

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 [8]. If a contaminant was noted as being less than a reporting limit[1], 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) [9]. 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 [10]. 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.

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 in Appendix A, two indoor air contaminants, including some that were not detected above the reporting limits, were detected at concentrations above the health comparison values. Table A2 shows 2023 soil gas data for the contaminants of potential concern (COPC) detected at the TELC. These contaminants were carried forward as possible COPCs and compared to sub-slab, and outdoor air levels (Table A3). 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 A1 shows indoor air contaminant concentration range for the TELC between 2012 – 2013, 2014 – 2015, 2015 – 2017, and 2023 and Health Comparison Values. Table A3 summarizes indoor air, sub-slab soil, and outdoor air contaminant samples. Table A3 shows concentration ranges, 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 two, that were carried forward for further health assessment (see Table A1, and Table A3):

[1] 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.

- 1,2-dichloroethane
- Benzene

DOH has not evaluated the potential source of these two COPCs; however, as noted in Table A3, some of them are considered dry cleaning related chemicals. While benzene has been associated with dry cleaners, it's most used in fuels and industrial applications. The maximum concentration of all the COPC was less than their respective non-cancer health comparison value (Table A1). As a result, no further assessment of the non-cancer health effects associated with these contaminants is necessary. Benzene and 1,2-dichloroethane exceeded their respective cancer health comparison values (Table A1). 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, and 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 [10].

To evaluate the inhalation cancer risk associated with the COPCs identified in indoor air at TELC, 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 52.14 [2] weeks per year (2 weeks were allowed for vacations away from the learning center), 5 days per week, and 9.9 (1 to < 2years), 9.6 (2 to < 6 years), and 11.8 (birth to < 1 year and a full-time worker) hours per day [3] (Table B3).

Appendix B, Table B1, Table B2 and Table B3 contain the exposure assumptions and site-specific exposure parameters used to estimate non-cancer and cancer risks. The results of DOH's estimated cancer risk evaluation for the COPCs found in indoor air are included in Table B5, and Table B6. As noted in Table B2, DOH estimated the following approximate cancer risks for a child (birth to < 1 year, 1 to < 2 year, and 2 < to 6 years) and a part- and full-time worker exposed to the maximum amount of the chemicals of concern found in indoor air at TELC:

1 additional cancer case per 1,000,000 full-time workers.

[2] 52.14 weeks per year represents ATSDR reasonable maximum exposure default value (higher).
[3] These values represent ATSDR daily (hours/day) central tendency exposure default values (typical).

When compared to the cancer risk terms provided in the adjacent box, the estimated cancer risk for a childcare worker is considered slight. The risk level is below a level DOH considers a health threat.[4] It is important 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 risks based on using the maximum indoor air concentration detected over few indoor air sample events. The actual risk is likely lower and could be as low as zero.

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

Conclusions

DOH concludes that breathing the contaminants found in indoor air during the December 2023 sampling periods at TELC is not expected to cause harmful health effects.

Recommendations

Although the VOCs found in indoor air during July 2012 and December 2013, October 2014 to September 2015, October 2015 to May 2017, and December 2013 sampling periods, are not expected to cause harmful health effects. DOH recommends that:

- If funding is available, Ecology (or the consultant) continues monitoring indoor air at the TELC to determine whether the VOCs associated with the Frank Wear site increases 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)).

- If funding is available, Ecology continues monitoring the GAC filters as specified by the manufacturer.

Although there are some low levels of COPCs in the sub soil gas, DOH recommends:

- If funding is available, Ecology continues monitoring sub-slab soil vapor inside the

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

TELC.

Next steps

DOH is available to review new indoor air data and update the conclusions and recommendations of this health evaluation.

DOH is available to provide outreach and education materials to parents and community members.

DOH appreciates the opportunity to assist Ecology with the Frank Wear Cleaner site. Please contact me at 360-236-3192 if you have any questions.

Sincerely,

Elmer Diaz
Health Assessor
Toxicologist
Site Assessments and Toxicology Section

cc: Lenford O'Garro, Department of Health,
Erick Mendoza, Terick's Early Learning,
Lori Hernandez, Child Care Licensing Supervisor, Region 2, Yakima Office - Department of Children, Youth, and Families (DCYF).

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Attachment A –Screening Level Summary Tables

Table A1: Indoor Air Contaminant Concentration Range for the Childcare Center between 2012 – 2013, 2014 – 2015, 2015 – 2017, and 2023 and Health Comparison Values, Frank Wear Cleaners Site, Yakima, Yakima County, Washington.

Chemical	Indoor Air Concentration Range (µg/m^3) (2012-2013)	Indoor Air Concentration Range (µg/m^3) (2014-2015)	Indoor Air Concentration Range (µg/m^3) (2015-2017)	Indoor Air Concentration Range (µg/m^3) (2023)	Health Comparison Value (ug/m^3)	Health Comparison Value	Possible Chemical of Potential Health Concern
Benzene (KL)	**<0.24 - 4.4**	**<0.28 – 1.3**	**<0.28 – 0.82**	**1.4 – 1.5**	9.6 0.13	Chronic MRL CREG	NC - No **C - Yes**
Chloroform (LI)	**<0.74 - 2.9**	**<0.81 – 5.4**	**<0.64 – 1.6**	<0.2 U	98 0.043	Chronic MRL CREG	NC - No C - No
1,2-Dichloroethane (B2)	**<0.12 - 0.34**	**<0.13 - 0.86**	**<0.13 - 0.1**	**0.063 - 0.27**	2,400 0.038	Chronic MRL CREG	NC - No **C - Yes**
cis 1,2-Dichloroethene (IN)	<0.11 - <0.15	<0.14 – 2.3	<0.10 – 2.3	<0.12	790	Intermediate MRL[c]	NC - No
trans-1,2 Dichloroethene (IN)	<0.55 - <0.74	<0.64 - <0.81	<0.52 - <0.78	0.053 – 0.14	790	Intermediate MRL[c]	NC - No
Ethylbenzene (2B)	**0.26 - 1.5**	**<0.16 – 2.1**	0.22 – 0.31	0.53 – 0.56	260 0.97	Chronic MRL EPA Cancer RSL	NC - No C - No
Methylene Chloride (LC)	<1.0 - 13	<1.1 – 1.4	<0.92 - <1.3	<0.96	1,000 100	Chronic MRL CREG	NC - No C - No
Tetrachloroethene (PCE) (LC)	<0.19 - 2.5	<0.24 – 5.6	<0.18 - 1.5	0.1 J	270 3.8	Chronic MRL CREG	NC - No C - No
Trichloroethene (TCE) (CH)	**<0.022 - 0.52**	**<0.031 - 0.16**	**<0.05 - 0.14**	0.022 J	41 2.6E-07 (2 EPA) 0.04 (CREG)	Chronic MRL IUR (TCE action level)[k] CREG	NC - No C - No
Toluene (IN)	1.3 - 17	0.75 – 4.3	1.2 – 9.6	3.9 – 4.3	300	Chronic MRL	NC - No
m,p-Xylene (DI)	0.70 - 5.0	0.33 – 6.1	0.71 – 6.1	2.1 – 2.3	100	EPA Non-cancer RSL[a]	NC - No
o-Xylene (DI)	0.27 - 1.8	<0.16 – 1.4	0.26 – 2.7	0.76 – 0.89	100	EPA Non-cancer RSL[a]	NC - No
Vinyl Chloride (KL)	<0.035 - <0.048	<0.035 - 0.086	<0.034 - <0.052	<0.035 - <0.042	77 0.11	Intermediate MRL CREG	NC - No C - No

Orange highlighted cells - contaminants only tested in August, September, and November 2012, ug/m^3 - 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.
J – indicates an estimated concentration based on either being less than the laboratory reporting limit or data validation findings.
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 – IUR- EPA Inhalation Unit Risk - 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-Difluorethane as a surrogate, [h] - used Chlorodifluoromethane as a surrogate, [i] - used hexane as a surrogate, [j] - used 1,2,4-Trimethylbenzene as a surrogate, k – EPA TCE action level for pregnant women.

Table A2. Soil Vapor Intrusion (SVI) Soil Gas contaminants and screening values.

Contaminant Name	CASRN	Conc	Unit	Above or Equal to Recommended ATSDR CV?	Above or Equal to Other CV?	CREG	Chronic EMEG	Int EMEG	RMEG	Acute EMEG
1,2-dichloroethane	107-06-2	0.88	µg/m³	No	NA	0.31 [#]	NA	NA	NA	9,900
Benzene	71-43-2	17	µg/m³	Yes [1]	No	1.4 [1]	100	200	310	300
Chloroform	67-66-3	0.49	µg/m³	No	No	0.29 [#]	14	27	NA	33
Ethylbenzene	100-41-4	7.6	µg/m³	No	No	NA	2,000 [#]	67,000	7,700	170,000
Tetrachloroethylene	127-18-4	5.5	µg/m³	No	No	19 [#]	200	200	200	200
Toluene	108-88-3	15	µg/m³	No	No	NA	34,000 [#]	NA	44,000	66,000
Xylene, m-	108-38-3	31	µg/m³	No	No	NA	1,700 [#]	20,000	NA	67,000
Xylene, o-	95-47-6	16	µg/m³	No	No	NA	1,700 [#]	20,000	NA	67,000
Xylenes, total	1330-20-7	47	µg/m³	No	No	NA	1,700	20,000	770 [#]	67,000

[#] ***Recommended ATSDR Comparison Value (CV).***

[1] ***Recommended ATSDR CV met or exceeded.***

Table A3: Comparison of Indoor Air, Sub-slab and Outdoor Contaminant Ranges and Contaminant Source Assessment for the childcare center, Frank Wear Cleaners Site, Yakima, Yakima County, Washington.

Chemical	Indoor Air (IA) Concentration Range (µg/m^3) for COPC	Subslab (SS) Concentration Range (µg/m^3)	Outdoor air (AO) Range (µg/m^3)	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	**1.4 – 1.5**	1.5 – 17	1.4	IA, SS, OA	Yes	Yes - benzene is a component of some dry-cleaning chemicals [11]	**Yes**
Chloroform	<0.14 U	<0.38 J- 0.49 J	<0.14 U	SS	No	Yes - dry cleaning agent; however, it is formed when chlorine is added to water [12]	**No**
1,2-Dichloroethane	**0.063 J - 0.27**	<0.82	**0.063 J–0.066 J**	IA, OA	Yes	No - used in the production of solvents like vinyl chloride [13]	**Yes**
Ethylbenzene	**0.53 – 0.56**	**5.6 – 7.6**	**0.53 – 0.54**	IA, SS, OA	Yes	No - most used to produce styrene; found in gasoline, carpet glues, paints, inks, pesticides, tobacco products [14]	**Yes**
Trichloroethene (TCE)	**<0.15 - 0.022 J**	<1.2	<0.15 – **0.022 J**	IA, OA	Yes	Yes - breakdown product of tetrachloroethylene; solvent [15]	**Yes**
Tetrachloroethene (PCE)	**0.1 J**	**0.61 J – 5.5**	**0.1 J**	All	Yes	Yes – parent compound	**Yes**
Toluene	**3.9 – 4.3**	**9.9 - 15**	**3.9 – 4.1**	All	Yes	No, Found in gasoline	**Yes**
Cis-1,2-Dichloroethene	<0.11	<0.82	NA	No	No	Yes – break down product of TCE	No

Chemical	Indoor Air (IA) Concentration Range (µg/m^3) for COPC	Subslab (SS) Concentration Range (µg/m^3)	Outdoor air (AO) Range (µg/m^3)	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
Trans-1,2-Dichloroethene	**0.055 J – 0.14 J**	**<0.86**	**0.059 J–0.062 J**	IA, OA	Yes	Yes – break down product of TCE	**Yes**
Vinyl Chloride	<0.035	<0.52	NA	No	No	Yes – break down product of TCE	No
Xylene, m,p-	**2.1 – 2.2**	**22 – 31**	**2.1 – 2.2**	All	Yes	No, Found in gasoline	**Yes**
Xylene, o-	**0.76 – 0.89**	**12 – 16**	**0.76 – 0.81**	All	Yes	No, Found in gasoline	**Yes**
Xylene, total	**2.9 – 3.1**	**34 – 47**	**2.9 – 3.0**	All	Yes	No, Found in gasoline	**Yes**

Orange highlighted cells - contaminants only tested in August, September, and November 2012, ug/m^3 - 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.

"U" indicates that the value has been qualified as undetected (at the detected concentration if above the method reporting limit) due to blank contamination.

"J" indicates an estimated concentration based on either being less than the laboratory reporting limit or data validation findings.

Attachment B –Equations and site-specific parameters Tables

Appendix B. Site-specific Parameters Table
PHAST Report, v2.4.1.0, May 2, 2024

Equations

Air Inhalation Exposure Equation

$$\textbf{Adjusted EPC} = \textbf{EPC} \times \textbf{EF}_{\textbf{noncancer}} \qquad \textbf{Equation 1}$$

EPC = exposure point concentration, $EF_{noncancer}$ = exposure factor (unitless)

Hazard Quotient

$$\textbf{HQ} = \textbf{Adjusted EPC} \div \textbf{HG} \qquad \textbf{Equation 2}$$

HQ = hazard quotient, EPC = exposure point concentration (µg/m^3 or ppb), HG = health guideline (e.g., inhalation MRL, RfC)

Cancer Risk Equations

$$\textbf{CR} = \textbf{Adjusted EPC} \times \textbf{IUR} \times (\textbf{ED} \div \textbf{LY}) \qquad \textbf{Equation 3}$$

$$\textbf{ADAF-adjusted CR} = (\textbf{Adjusted EPC} \times \textbf{IUR}) \times (\textbf{ED} \div \textbf{LY}) \times \textbf{ADAF} \qquad \textbf{Equation 4}$$

$$\textbf{Total CR} = \textbf{Sum of the CR for all exposure groups} \qquad \textbf{Equation 5}$$

CR = cancer risk (unitless), EPC = exposure point concentration (µg/m^3 or ppb), IUR = inhalation unit risk ((µg/m^3 or ppb)$^{-1}$), ED = exposure duration (years), LY = lifetime years (78 years), ADAF = age-dependent adjustment factor (unitless), EF (cancer) = exposure factor (cancer) calculated as follows: EF (noncancer; unitless) x exposure group specific exposure duration (years) ÷ lifetime of 78 years

Table B1. Site-specific Exposure Factors - Default Exposure Groups

Exposure Group	Noncancer Exposure Factor Chronic	Noncancer Exposure Factor Intermediate	Noncancer Exposure Factor Acute
2 to < 6 years	0.23	0.24	0.33
Full-time worker	0.23	0.24	0.33

Abbreviations: CTE = central tendency exposure (typical); NC = not calculated; RME = reasonable maximum exposure (higher)

Cancer EFs are not shown in the table because they are calculated using age-specific durations. The general formula is $EF_{cancer} = EF_{noncancer} \times$ Exposure Duration for $Cancer_{Exposure\ Group}$ (years) ÷ 78 years.

These exposure factors do not apply for a few special air contaminants (1,2-dichloroethene, trans-, 2-butanone, acetone, acrolein, ammonia, formaldehyde, hydrogen sulfide, sulfur dioxide, toluene, and xylenes). See the Air Inhalation Pathway - Exceptions for Exposure Factor Adjustment file on the PHAST resources page for the exposure factors for these contaminants.

Table B2. Default Exposure Groups

Exposure Group	Noncancer Exposure Factor Chronic CTE	Noncancer Exposure Factor Chronic RME	Noncancer Exposure Factor Intermediate CTE	Noncancer Exposure Factor Intermediate RME	Noncancer Exposure Factor Acute CTE	Noncancer Exposure Factor Acute RME
Birth to < 1 year	0.15	0.35	0.15	0.35	0.22	0.49
1 to < 2 years	0.14	0.29	0.14	0.29	0.2	0.41
2 to < 6 years	0.18	0.29	0.19	0.29	0.27	0.4
Full-time worker	0.24	0.35	0.25	0.35	0.35	0.49
Part-time worker	0.15	NA	0.15	NA	0.21	NA

Abbreviations: CTE = central tendency exposure (typical); NC = not calculated; RME = reasonable maximum exposure (higher)
Cancer EFs are not shown in the table because they are calculated using age-specific durations. The general formula is $EF_{cancer} = EF_{noncancer} \times$ Exposure Duration for $Cancer_{Exposure\ Group}$ (years) ÷ 78 years.
These exposure factors do not apply for a few special air contaminants (1,2-dichloroethene, trans-, 2-butanone, acetone, acrolein, ammonia, formaldehyde, hydrogen sulfide, sulfur dioxide, toluene, and xylenes). See the Air Inhalation Pathway - Exceptions for Exposure Factor Adjustment file on the PHAST resources page for the exposure factors for these contaminants.

Table B3. Default Exposure Parameters

Exposure Group	Daily (hours/day) CTE	Daily (hours/day) RME	Weekly (days/week) CTE	Weekly (days/week) RME	Annually (weeks/year) CTE	Annually (weeks/year) RME	Age-Specific Exposure Duration (years) CTE	Age-Specific Exposure Duration (years) RME
Birth to < 1 year	5.2	11.8	5	5	50	52.14	1	1
1 to < 2 years	4.8	9.9	5	5	50	52.14	1	1
2 to < 6 years	6.4	9.6	5	5	50	52.14	4	4
Full-time worker	8.5	11.8	5	5	50	52.14	5	20

Exposure Group	Daily (hours/day) CTE	Daily (hours/day) RME	Weekly (days/week) CTE	Weekly (days/week) RME	Annually (weeks/year) CTE	Annually (weeks/year) RME	Age-Specific Exposure Duration (years) CTE	Age-Specific Exposure Duration (years) RME
Part-time worker	5.1	NA	5	NA	50	NA	3.1	NA

Abbreviations: CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher)

Table B4. Contaminant Information

Contaminant Name	Entered Concentration	EPC Type	Converted Concentration (µg/m^3)	Converted Concentration (ppb)
1,2-dichloroethane	0.27 µg/m³	Maximum	0.27	0.067
Benzene	1.5 µg/m³	Maximum	1.5	0.47

Abbreviations: µg/m^3 = micrograms per meter cubed; EPC = exposure point concentration

Table B5. Air Inhalation Chronic (Default). Exposure point concentrations for chronic exposure to 1,2-dichloroethane in air at 0.27 µg/m³ (0.067 ppb) along with cancer risk estimates*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	CTE Exposure Duration (yrs)	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient	RME Cancer Risk	RME Exposure Duration (yrs)
Birth to < 1 year	0.040	0.0099	-	-	1	0.095	0.023	-	-	1
1 to < 2 years	0.037	0.0091	-	-	1	0.080	0.020	-	-	1
2 to < 6 years	0.049	0.012	-	-	4	0.077	0.019	-	-	4
Total Child	-	-	-	-	6	-	-	-	-	6
Full-time worker	0.066	0.016	-	1.1E-7	5	0.095	0.023	-	6.3E-7	20
Part-time worker	0.039	0.0097	-	4.1E-8	3.1	-	-	-	-	-

Source: [list reference of environmental data]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); yrs = years

* The calculations in this table were generated using ATSDR's PHAST v2.4.1.0. The cancer risks were calculated using the inhalation unit risk of 2.6E-05 $(\mu g/m^3)^{-1}$.

Table B6. Default exposure point concentrations for chronic exposure to benzene in air at 1.5 µg/m³ (0.47 ppb) along with noncancer hazard quotients and cancer risk estimates*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Adjusted EPC (ppb)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	CTE Exposure Duration (yrs)	RME Adjusted EPC (µg/m³)	RME Adjusted EPC (ppb)	RME Noncancer Hazard Quotient	RME Cancer Risk	RME Exposure Duration (yrs)
Birth to < 1 year	0.22	0.070	0.023	-	1	0.53	0.16	0.055	-	1
1 to < 2 years	0.21	0.064	0.021	-	1	0.44	0.14	0.046	-	1
2 to < 6 years	0.27	0.086	0.029	-	4	0.43	0.13	0.045	-	4
Total Child	-	-	-	-	6	-	-	-	-	6
Full-time worker	0.36	0.11	0.038	1.8E-7	5	0.53	0.16	0.055	1.1E-6 ‡	20
Part-time worker	0.22	0.068	0.023	6.8E-8	3.1	-	-	-	-	-

Source: [list reference of environmental data]

Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m³ = micrograms per meter cubed; ppb = parts per billion; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher); yrs = years

* The calculations in this table were generated using ATSDR's PHAST v2.4.1.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 9.6 µg/m³ and the cancer risks were calculated using the inhalation unit risk of 7.8E-06 $(\mu g/m^3)^{-1}$.

‡ Indicates that the cancer risk exceeds one extra case in a million people similarly exposed, which ATSDR evaluates further.