Lead

Environmental estimates (circa 2011): Supplemental data

Table of Contents

1. Data for lifetime excess cancer risk estimates

Overview

The summary data used to calculate lifetime excess cancer risk and the results for lead are provided in the tables below. For more detailed information on supporting data and sources, see below for each exposure pathway.

i. Environmental Concentrations

Exposure pathway	Units	Average	Maximum	Notes
Outdoor air	µg/m³	0.0012	0.0021	
Indoor air	µg/m³	0.0019	0.0027	
Dust	µg/g	144	3916	
Drinking water	µg/L	0.36	8.4	
Foods and beverages		See detailed data	Not estimated	

ii. Calculated Lifetime Daily Intake

Exposure pathway	Average intake (mg/kg bodyweight per day)	Maximum intake (mg/kg bodyweight per day)
Outdoor air	0.000000028	0.000000049
Indoor air	0.00000062	0.00000088
Dust	0.000095	0.00257
Drinking water	0.0000093	0.00022
Foods and beverages	0.000026	Not estimated

iii. Cancer Potency Factors

Exposure route	Health Canada	US EPA	CA OEHHA
Inhalation	--	--	0.042
Ingestion	--	--	0.0085

Sources for Cancer Potency Factors:

- Health Canada, 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment. Version 2.0.
- Health Canada, 2010. Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors. Version 2.0.
- United States Environmental Protection Agency Integrated Risk Information System
- California Office of Environmental Health Hazard Assessment, 2009. Air Toxics Hot Spots Risk Assessment Guidelines Part II: Technical Support Document for Cancer Potency Factors, Appendix A. (Updated 2011)

iv. Lifetime Excess Cancer Risk (per million people)

	Average[1]			Maximum[2]
Exposure pathway	Health Canada	US EPA	CA OEHHA[3]	
Outdoor air	--	--	0.0012	0.0020
Indoor air	--	--	0.026	0.03684
Dust	--	--	0.804	21.86
Drinking water	--	--	0.079	1.85
Foods and beverages	--	--	0.224	Not estimated

[1]Lifetime excess cancer risk based on average intake x cancer potency factor from each agency
[2]Lifetime excess cancer risk based on maximum intake x highest cancer potency factor
[3]California Office of Environmental Health Hazard Assessment

Supporting data by exposure pathway

i. Outdoor air

Outdoor air concentrations are from the National Air Pollution Surveillance monitoring network operated by Environment Canada, for the year 2010.

Source	Stations (n)	Min	Max	Mean	DF
NAPS 2010 (µg/m³)	15	0.00014	0.0021	0.0012	1.0

DF = Detection frequency

We assume lead is present at these levels in all outdoor air, although concentrations may vary from one location to another.

ii. Indoor air

Indoor air concentrations are based on data published in peer-reviewed literature since 2000. A ranking system was used to select data most representative of Canadian conditions circa 2011:

1. Canadian data collected in 2000 or more recently, sample duration of 24 hours or longer;
2. US studies of similar currency and sample duration;
3. Studies from northern European countries of similar currency and sample duration;
4. Canadian, US or European studies with data collected prior to 2000 and similar sample duration; and
5. Studies with sample duration of less than 24 hours regardless of country or collection date, or studies from countries not comparable to Canada.

Rank: 1 **Author:** Rasmussen (2005) **Location:** Canada, Ottawa

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
10	1.0	0.5	2002	µg/m³	7 days	0.0004	0.0027		0.0023		
10						0.0005	0.00107		0.0015		

Notes: Values listed in the following order: Rural $PM_{2.5}$, Urban $PM_{2.5}$. Analyzed using ICP-MS (most accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 2 **Author:** Green Brody (2009) **Location:** USA, California

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
40	0.83	0.0008		µg/m3			0.0041		0.0012		
10	0.4						0.0015		< DL		

Notes: Values listed in the following order: Richmond (Industrial), Bolinas (Urban). Analytical method not reported.
*DF = Detection frequency
**DL = Detection limit

Rank: 2 **Author:** Na (2004) **Location:** USA, Riverside CA

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
20			2001-	µg/m³	6 days			0.036			
12			2002					0.038			
7								0.037			
1											

Notes: Values listed in following order: ALL, Non-Smoking, Occasional Smoking, Frequent Smoking. Analyzed using XRF (less accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 3 **Author:** Molnar (2007) **Location:** Sweden, Stockholm

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
28	0.96	0.43	2003-2004	µg/m³	14 days	0.00004	0.008	0.0034		0.0028	

Notes: Analyzed using XRF (less accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 4 **Author:** Adgate (2007) **Location:** USA, Minneapolis

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
235	0.98		1999	µg/m³	48 hr			0.0034	0.0024		10th 0.00066 90th 0.0068

Notes: Analyzed using ICP-MS (most accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 4 | Author: Kinney (2002) | Location: New York City, Los Angeles

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
38		0.03	1999	µg/m3	48 hrs			0.0224			
39		0.03						0.00583			

Notes: Values listed in following order: Winter, Summer. Analyzed using ICP-MS (most accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 4 | Author: Lai (2004) | Location: England, Oxford

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
50	0.17		1998-2000	µg/m3	48 hr			0.022		0.019	

Notes: Analyzed using XRF (less accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 4 | Author: Sax (2006) | Location: New York City, Los Angeles

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
79	1.0			µg/m³	48 hr		198	12.6	5.02		
75	1.0						223	14.1	6.99		

Notes: Values listed in following order: New York City, Los Angeles). Analyzed using ICP-MS (most accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 5 | Author: Dermentzoglou (2003) | Location: Greece

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
6				µg/m³	2 hrs			0.0343			
6								0.0475			
6								0.0360			
6								0.0342			

Notes: Values listed in following order: Central Heating Central, Wood Burning Central, Cigarette Central, Cooking.
*DF = Detection frequency
**DL = Detection limit

Rank: 5	Author:	Pekey (2010)						Location:	Turkey		
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
15		0.001	2006-2007	µg/m³	daily			0.034			
								0.085			
								0.057			
								0.159			
								0.0593	0.0522		
								0.0602	0.0444		
								0.092	0.068		
								0.09	0.064		

Notes: Values listed in following order: $PM_{2.5}$ Fraction S, $PM_{2.5}$ Fraction W, PM_{10} Fraction S, PM_{10} Fraction W, $PM_{2.5}$ Fraction Smoker, $PM_{2.5}$ Fraction Non-Smoker, PM_{10} Fraction Smoker, PM_{10} Fraction Non-Smoker. Analyzed using XRF (less accurate method).
*DF = Detection frequency
**DL = Detection limit

Rank: 5	Author:	Slezakova (2009)						Location:	Portugal		
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
2			2006	µg/m³	28 days 12hr/day			0.00515			
								0.00442			
								0.00695			
								0.00662			

Notes: Values listed in following order: Site 1 PM_{10}, Site 1 $PM_{2.5}$, Site 2 PM_{10}, Site 2 $PM_{2.5}$. Analyzed using XRF (less accurate method).
*DF = Detection frequency
**DL = Detection limit

Sources for indoor air data:

- Adgate JL, Mongin SJ, Pratt GC, Zhang J, Field MP, Ramachandran G, et al. 2007. Relationship between personal, indoor, and outdoor exposures to trace elements in PM2.5. Science of the Total Environment 386: 21-32.
- Dermentzoglou M, Manoli E, Samara C. 2003. Sources and patterns of polycyclic aromatic hydrocarbons and heavy metals in fine indoor particulate matter of Greek houses. Fresenius Environmental Bulletin 12: 1511-1519.
- Green Brody J, Morello-Frosch R, Zota A, Brown P, Perez C, Rudel RA. 2009. Linking exposure assessment science with policy objectives for environmental justice and breast cancer advocacy: the Northern California Household exposure study. American Journal of Public Health 99: S600-S609.
- Kinney PL, Chillrud SN, Ramstrom S, Ross J, Spengler JD. 2002. Exposures to multiple air toxics in New York City. Environmental Health Perspectives 110: 539-546.
- Lai HK, Kendall M, Ferrier H, Lindup I, Alm S, Hanninen O, et al. 2004. Personal exposures and microenvironment concentrations of PM2.5, VOC, NO2 and CO in Oxford, UK. Atmospheric Environment 38: 6399-6410.
- Molnar P, Bellander T, Sallsten G, Boman J. 2007. Indoor and outdoor concentrations of PM2.5 trace elements at homes, preschools and schools in Stockholm, Sweden. J Enivron Monit 9: 348-357.

- Na K, Sawant AA, Cocker III DR. 2004. Trace elements in fine particulate matter within a community in western Riverside Country, CA: focus on residential sites and a local high school. Atmospheric Environment 38: 2867-2877.
- Pekey B, Bozkurt ZB, Pekey H, Dogan G, Zararsiz A, Efe N, et al. 2010. Indoor/outdoor concentrations and elemental composition of PM10/PM2.5 in urban/industrial areas of Kocaeli City, Turkey. Indoor Air 2010 20: 112-125.
- Rasmussen PE, Dugandzic R, Hassan N, Murimboh J, Gregoire DC. 2005. Challenges in quantifying airborne metal concentrations in residential environments. Canadian Journal of Analytical Sciences and Spectroscopy 51: 1-8.
- Sax SN, Bennett DH, Chillrud SN, Ross J, Kinney PL, Spengler JD. 2006. A cancer risk assessment of inner-city teenagers living in New York City and Los Angeles. Environmental Health Perspectives 114: 1558-1566.
- Slezakova K, Pereira MC, Alvim-Ferraz MC. 2009. Influence of tobacco smoke on the elemental compositions of indoor particles of different sizes. Atmospheric Environment 43: 486-493.

iii. Dust

Indoor dust concentrations are based on data published in peer-reviewed literature since 2000. A ranking system was used to select data most representative of Canadian conditions circa 2011:

1. Canadian data collected in 2000 or more recently, sample duration of 24 hours or longer;
2. US studies of similar currency and sample duration;
3. Studies from northern European countries of similar currency and sample duration;
4. Canadian, US or European studies with data collected prior to 2000 and similar sample duration; and
5. Studies with sample duration of less than 24 hours regardless of country or collection date, or studies from countries not comparable to Canada.

Rank: 1	Author:	Rasmussen (2013)						Location:	Canada National		
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
1025		1.8	2007-2010	µg/g		7.9	3916	144	63	74	25th 39 75th 108 90th 246 95th 539

Notes: Analyzed using ICP-MS (most accurate method). Sample represents a population-based urban baseline representative for Canada, not individual cities or provinces. Reported levels are for bioaccessible lead.
*DF = Detection frequency
**DL = Detection limit

Rank: 2 Author: Johnson (2005) Location:

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
264			2003	µg/g	DUST wipe				117	13 - 1110	

*DF = Detection frequency
**DL = Detection limit

Rank: 3 Author: Turner (2006) Location: England

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
32			2005	µg/g		56.8	358	181	178	150	

Notes: Vacuum Sample
*DF = Detection frequency
**DL = Detection limit

Rank: 4 Author: Chattopadhyay (2003) Location: Australia, Sydney

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
82			1999	µg/g		18.2	16660	389	85.2	76.1	

Notes: Dust from Vacuum
*DF = Detection frequency
**DL = Detection limit

Rank: 4 Author: Davis (2005) Location: Australia, Sydney

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
38			1997 &	µg/g							
10			1999			480	2594	1830	1960	1660	
17						799	6997	1462	1514	1173	
10						105	1150	604	621	477	
1								145			

Notes: Attic dust values listed in following order: Industrial, Semi-Industrial, Non-Industrial, Rural
*DF = Detection frequency
**DL = Detection limit

Rank: 4 Author: Rasmussen (2001) Location: Canada, Ottawa

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
48	1	0.05	1993	µg/g		50.2	3225.66	405.56	222.22	232.61	90th 969.37 95th 1311.92

Notes: Dust from Vacuum
*DF = Detection frequency
**DL = Detection limit

Sources for dust:

- Chattopadhyay G, Lin KC-P, Feitz AJ. 2003. Household dust metal levels in the Sydney metropolitan area. Environmental Research 93: 301-307.
- Davis JJ, Gulson BL. 2005. Ceiling (attic) dust: A "museum" of contamination and potential hazard. Environmental Research 99: 177-194.
- Johnson DL, Hager J, Hunt A, Griffith DA, Blount S, Ellsworth S, et al. 2005. Initial results for urban metal distributions in house dusts of Syracuse, New York, USA. Science in China Ser C Life Sciences 48: 92-99.
- Rasmussen PE, Levesque C, Chénier M, Gardner HD, Jones-Otazo, H, Petrovic S. 2013. Canadian House Dust Survey: Population-based concentrations of arsenic, cadmium, chromium, copper, nickel, lead, and zinc inside urban homes. Science of the Total Environment 443: 520-529.
- Rasmussen PE, Subramanian KS, Jessiman BJ. 2001. A multi-element profile of housedust in relation to exterior dust and soils in the city of Ottawa, Canada. Sci Total Environ 267: 125-140.
- Turner A, Simmonds L. 2006. Elemental concentration and metal bioaccessibility in UK household dust. Science of the Total Environment 371: 74-81.

iv. Drinking water

Drinking water data are from the Ontario Drinking Water Surveillance Program (DWSP) for 2011. A review of published reports was also conducted in order to compare how well the Ontario data represented other regions in Canada.

Source	Units	DL							
Ontario DWSP 2011	(µg/L)	0.5							
Sample Type	Parameter	Mean	SD	Min	25th	50th	75th	Max	N
Distribution (-)	Unfiltered Total	0.22	0.60	0.0	0.0	0.04	0.14	8.24	307
Distribution (+)	Unfiltered Total	0.49	0.62	0.16	0.26	0.36	0.56	8.56	307
Calculated mean:		0.36	0.61	--	0.13	0.20	0.35	8.4	

DL = Detection limit
SD = Standard Deviation

Rank: 1	Author:	Witmans (2008)					Location:	Saskatchewan			
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
~ 205				µg/L			10.8	1.54			

Notes: Data presented in the following order: Alberta municipal treated surface water, Alberta municipal treated ground water,
*DF = Detection frequency
**DL = Detection limit

Sources for drinking water:

- Witmans MR, McDuffie HH, Karunanayake C, Kerrich R, Pahwa P. 2008. An exploratory study of chemical elements in drinking water and non-Hodgkin's lymphoma. Toxicological and Environmental Chemistry 90: 1227-1247.

v. Food and Beverages

Food consumption data are from the Statistics Canada Food Survey (2006) - Food available, adjusted for losses tables, and from the Nutrition Canada Survey (1970-1972).

Food concentration data are primarily from the US-FDA Total Diet Study (2003-2004), with additional data on metals and several PAHs from the Canadian Food Inspection Agency (CFIA) - National Chemical Residue Monitoring Program: 2009-2010 Annual Report and the US-FDA (TDS Statistics on Element Results - 2008).

In order to better represent actual intake, we incorporated data for cooked and/or processed foods, as in some cases, this can either add to or diminish the amount measured in raw food.

Concentration data were obtained for 48% of total meat consumed, 94% of total seafood consumed, 41% of total fruit consumed, 51% of total vegetables consumed, 58% of total dairy and eggs consumed, 57% of total grains consumed, and 28% of total beverages consumed.

Food or Beverage	Concentration (µg/g)	DF
Beef	0.00430	0.07600
Chicken	0.00250	0.05100
Mutton and lamb	0.00390	0.15200
Offal	0.00300	0.02000
Oils and fats	0.00000	0.01800
Pork	0.02600	0.06700
Salad oils		
Shortening and shortening oils		
Stewing hen		
Turkey	0.00300	0.02300
Veal	0.00280	0.07700
Fish fresh and frozen seafish	0.02200	0.01000
Fish freshwater		
Fish processed seafish	0.00100	0.01000
Apple pie filling		
Apple sauce	0.00100	0.00700
Apples canned		
Apples dried		
Apples fresh	0.00230	0.08300
Apples frozen		
Apricots canned		
Apricots fresh	0.00700	0.66700
Bananas fresh	0.00000	0.00700
Berries other fresh		
Blueberries canned		
Blueberries fresh	0.00350	0.75000
Blueberries frozen		
Cherries fresh	0.00320	0.44400
Cherries frozen		
Citrus other fresh		
Coconut fresh		
Cranberries fresh		
Dates fresh		
Figs fresh		
Fruit dried	0.00900	0.01000
Grapefruit fresh	0.00100	0.00500
Grapes fresh	0.00200	0.00500
Guava and mangoes fresh		
Kiwi fresh		
Lemons fresh		
Limes fresh		
Mandarins fresh		
Melons musk, cantaloupe fresh	0.00430	0.16700
Melons other fresh		
Melons watermelons fresh		
Melons, winter melons fresh		
Nectarines fresh		
Oranges fresh	0.00100	0.00700
Papayas fresh		
Peaches canned		

Food or Beverage	Concentration (µg/g)	DF
Peaches fresh	0.00320	0.66700
Pears canned		
Pears fresh		
Pineapples canned		
Pineapples fresh		
Plums total fresh	0.00240	0.19000
Quinces fresh		
Raspberries frozen	0.00330	0.75000
Strawberries canned		
Strawberries fresh	0.00430	0.80000
Strawberries frozen		
Sugar maple	0.10850	0.40700
Sugar refined	0.00000	0.02000
Honey	0.01560	0.16400
Artichokes fresh		
Asparagus canned		
Asparagus fresh	0.00890	0.77800
Avocados fresh		
Beans baked and canned		
Beans dry		
Beans green and wax canned		
Beans green and wax fresh	0.00560	1.00000
Beans green and wax frozen		
Beets canned		
Beets fresh	0.00470	1.00000
Broccoli fresh	0.00260	0.35300
Broccoli frozen		
Brussels sprouts fresh	0.00000	0.00700
Brussels sprouts frozen		
Cabbage Chinese fresh	0.00570	1.00000
Cabbage fresh		
Carrots canned		
Carrots fresh	0.00220	1.00000
Carrots frozen		
Cauliflower fresh		
Cauliflower frozen		
Celery fresh	0.00590	0.83300
Corn canned		
Corn flour and meal		
Corn fresh	0.08330	0.08300
Corn frozen		
Cucumbers fresh	0.00210	0.09100
Eggplant fresh	0.00380	0.12500
Garlic fresh		
Kohlrabi fresh		
Leeks fresh	0.01020	1.00000
Lettuce fresh	0.02130	0.83300
Lima beans frozen		
Manioc fresh		
Mushrooms canned		

Food or Beverage	Concentration (µg/g)	DF
Mushrooms fresh	0.00350	0.36400
Okra fresh	0.00100	0.00700
Olives fresh	0.00500	0.00700
Onions and shallots fresh	0.01220	1.00000
Parsley fresh	0.03810	1.00000
Parsnips fresh	0.00540	1.00000
Peas canned		
Peas dry		
Peas fresh	0.00330	0.50000
Peas frozen		
Peppers fresh	0.00000	0.00700
Potatoes chips	0.00000	0.02000
Potatoes frozen		
Potatoes other processed		
Potatoes sweet fresh	0.00970	1.00000
Potatoes white fresh	0.00890	0.62500
Potatoes white fresh and processed		
Pumpkins and squash fresh	0.00200	0.00700
Radishes fresh	0.03400	0.80000
Rappini fresh		
Rutabagas and turnip fresh	0.00100	0.00700
Spinach fresh	0.03500	1.00000
Spinach frozen		
Tomatoes canned		
Tomatoes fresh	0.00520	0.33300
Tomatoes pulp, paste and puree		
Vegetables other edible root fresh		
Vegetables other leguminous fresh		
Vegetables unspecified canned		
Vegetables unspecified fresh		
Vegetables unspecified frozen		
Butter	0.00200	0.02000
Cheese cheddar	0.00000	0.02000
Cheese cottage	0.00100	0.00700
Cheese processed	0.00100	0.02000
Cheese variety	0.00860	0.75000
Cream cereal 10%	0.00200	0.02000
Cream sour	0.00000	0.01000
Cream table 18%		
Cream whipping 32% or 35%		
Eggs	0.01330	0.19700
Ice cream	0.00100	0.00700
Ice milk		
Margarine	0.00300	0.02000

Food or Beverage	Concentration (µg/g)	DF
Milk buttermilk		
Milk chocolate drink	0.00000	0.00700
Milk concentrated skim		
Milk concentrated whole		
Milk other whole milk products		
Milk partly skimmed 2%	0.00000	0.00700
Milk skim	0.00000	0.00500
Milk standard	0.00100	0.00700
Milk sweetened concentrated skim		
Milkshake		
Powder buttermilk		
Powder skim milk		
Powder whey		
Sherbet		
Yogurt	0.00200	0.00700
Cereal products	0.00200	0.01000
Oatmeal and rolled oats	0.00000	0.00700
Peanuts		
Pot and pearl barley		
Pulses and nuts		
Rice	0.00000	0.00700
Rye flour		
Tree nuts		
Wheat flour		
Ale, beer, stout and porter	0.00100	0.00400
Beverages alcoholic		
Coffee	0.00000	0.00400
Distilled spirits		
Juice apple	0.00100	0.00400
Juice grape	0.00600	0.00400
Juice tomato	0.00200	0.00500
Juice fruit	0.00500	0.00400
Juice grapefruit	0.00100	0.00400
Juice lemon		
Juice orange	0.00100	0.00400
Juice pineapple	0.00000	0.00400
Juice vegetable		
Soft drinks	0.00000	0.00400
Tea	0.00000	0.00400
Water bottled	0.00000	0.00400
Wines	0.00800	0.00400
Cocoa		

2. Data quality for lifetime excess cancer risk estimates

Only publicly available data were used to calculate these indicators. Data that are not publicly available may produce different results.

No systematic method for measuring data quality was possible, so we provide the following assessments of how well the data used may represent the actual Canadian average levels. Quality is rated higher when there are data from a number of Canadian monitors, or from Canadian studies that show results similar to other comparable studies. Quality is rated lower when data from few monitors or studies were available, and lowest when estimates are based on non-Canadian data. Others may rate data quality differently.

Exposure Pathway	Data Quality	Notes
Outdoor air	Moderate	• Lead is regularly measured in outdoor air at 15 monitoring stations across Canada using accepted protocols.
Indoor air	Low	• One recent Canadian study identified (Ontario). The reported medians are similar to several older US studies using the same analytical method, although the Canadian maximum is lower than those reported in the US studies.
Indoor dust	Moderate	• One recent Canadian study was identified, representing a population-based urban baseline estimate representative for Canada, not individual cities or provinces.
Drinking water	Moderate	• Lead was detected in at least 13 percent of samples (n=307) from the Ontario Drinking Water Surveillance Program in 2006.
Foods and beverages	Low	• Data from the CFIA (National Chemical Residue Monitoring Program: 2009-2010 Annual Report) were used for some foods, with additional data from the US-FDA (TDS Statistics on Element Results - 2008).

3. Data for mapping concentrations

The maps use geographic coordinates at the census block level to represent residential locations. Concentration estimates are mapped at the health region level, which are created with aggregated census block data.

We used a model to predict annual average concentrations of lead in outdoor air at residential locations for 2011. These are predicted using levels measured from the National Air Pollution Surveillance (NAPS) monitors and estimated concentrations from known emitters. For more information on how these estimates were created, please see the Mapping Methods document on the Environmental Approach section of our website.

Estimates by health region

The table below shows predicted lead concentrations by province based on data at the health region level. The median concentration of lead measured in outdoor air in 2011 at the health region level was 0.066 µg/m^3, while the mean concentration was 0.071 µg/m^3. Concentrations of lead can be higher or lower than average in many locations.

i. Provincial averages of predicted lead concentrations (µg/m^3) in outdoor air in 2011 based on health regions

Province	Median	Mean
BC	0.0039	0.0058
AB	0.0026	0.0035
SK	0.0021	0.0023
MB	0.0031	0.0034
ON	0.0034	0.0043
QC	0.0031	0.0036
NB	0.0027	0.0029
PE	0.0026	0.0026
NS	0.0026	0.0030
NL	0.0028	0.0030
YK	0.0045	0.0045
NT	0.0039	0.0039
NU	0.0039	0.0039
Canada	**0.0030**	**0.0039**

Estimates by census block

The table below shows provincial populations by concentration levels (either annual average or number of times above/below the national average) based on the census block data and the associated potential lifetime excess risk given different cancer potency factors.

i. Provincial population distribution by estimated average concentration (μg/m³) of lead in outdoor air in 2011 based on NAPS data at the census block

Estimated annual average concentration (μg/m³)	Less than 0.0004	0.0004 to 0.00048	0.00048 to 0.0006	0.0006 to 0.0008	0.0008 to 0.0102	0.0012 to 0.0018	0.0018 to 0.0024	0.0024 to 0.003	0.003 to 0.0036	More than 0.0036
Compared to national average (0.0012μg/m³)*	> 3x lower	2.5 to 3x lower	2 to 2.5x lower	1.5 to 2x lower	1 to 1.5x lower	1 to 1.5x higher	1.5 to 2x higher	2 to 2.5x higher	2.5 to 3x higher	> 3.0x higher
	Below Average					Above Average				
BC	27,747 (0.6%)	--	314 (<0.1%)	--	1,010,907 (23.0%)	1,843,912 (41.9%)	424,243 (9.6%)	192,225 (4.4%)	103,513 (2.4%)	797,196 (18.1%)
AB	--	--	697,930 (19.1%)	81,176 (2.2%)	1,312,748 (36.0%)	988,824 (27,1%)	170,287 (4,7%)	75,606 (2.1%)	47,704 (1.3%)	270,982 (7.4%)
SK	--	--	--	--	315,596 (30.5%)	422,518 (40.9%)	73,034 (7.1%)	48,187 (4.7%)	30,069 (2.9%)	143,977 (13.9%)
MB	--	--	--	--	532,713 (44.1%)	462,252 (38.3%)	64,306 (5.3%)	19,698 (1.6%)	10,199 (0.8%)	119,100 (10.5%)
ON	--	--	--	--	2,505,916 (19.5%)	2,770,612 (21.6%)	3,966,832 (30.9%)	1,141,307 (8.8%)	773,777 (6.0%)	1,693,377 (13.2%)
QC	--	--	--	--	1,246,530 (15.8%)	1,628,998 (20.6%)	2,543,572 (32.2%)	657,328 (8.3%)	582,836 (7.4%)	1,243,737 (15.7%)
NB	62,108 (8.3%)	2,123 (0.3%)	3,446 (0.5%)	2,630 (0.4%)	232,609 (31.0%)	316,379 (42.1%)	46,096 (6.1%)	27,640 (3.7%)	15,499 (2.1%)	42,641 (5.7%)
NS	--	--	--	--	460,929 (50.0%)	346,169 (37.6%)	57,462 (6.2%)	28,780 (3.1%)	11,885 (12.9%)	16,502 (1.8%)
PE	--	--	--	--	42,419 (30.3%)	63,127 (45.0%)	11,540 (8.2%)	7,561 (5.4%)	5,277 (3.7%)	10,280 (7.3%)
NL	--	--	--	--	157,711 (30.7%)	231,506 (36.0%)	32,856 (6.4%)	27,369 (5.3%)	17,136 (3.3%)	47,958 (9.3%)
NU	--	--	--	--	--	23,292 (73.0%)	17 (<0.1%)	203 (0.6%)	1,027 (3.2%)	7,367 (23.1%)
NT	--	--	--	--	816 (2.0%)	16,730 (40.4%)	1,484 (3.6%)	2,471 (6.0%)	3,065 (7.4%)	16,896 (40.8%)
YT	--	--	--	--	8,061 (23.8%)	8,709 (25.7%)	774 (2.3%)	830 (2.4%)	772 (2.3%)	14,751 (43.5%)
CANADA	89,855	2,123	701,690	83,806	7,826,955	9,123,028	7,392,503	2,229,205	1,602,759	4,424,764
% of pop.	(0.3%)	(<0.1%)	(2.1%)	(0.3%)	(23.4%)	(27.3%)	(22.1%)	(6.7%)	(4.8%)	(13.2%)

ASSOCIATED LIFETIME EXCESS CANCER RISK (per million people):
RED = POTENTIAL LIFETIME EXCESS RISK IS GREATER THAN 1 PER MILLION PEOPLE

	< 0.0004	0.0004 to < 0.00048	0.00048 to < 0.0006	0.0006 to < 0.0008	0.0008 to < 0.0012	0.0012 to < 0.0018	0.0018 to < 0.0024	0.0024 to < 0.003	0.003 to < 0.0036	> 0.0036
Health Canada CPF: No CPF										
California OEHHA CPF: 0.042										
US EPA CPF: No CPF										

* measured at National Air Pollution Surveillance (NAPS) monitors in 2011
CPF: Cancer Potency Factor