



## **Diesel Engine Exhaust**

**Environmental estimates (circa 2011): Supplemental data**

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## 1. Data for lifetime excess cancer risk estimates

### Overview

The summary data used to calculate lifetime excess cancer risk and the results for diesel engine exhaust 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/m <sup>3</sup>	1.2	2.9	Not measured directly – assumes 12 percent of fine particulates are from diesel engine exhaust.
Indoor air	µg/m <sup>3</sup>	0.75	1.74	Not measured directly – assumes indoor level is 60 percent of outdoor level.

#### ii. Calculated Lifetime Daily Intake

Exposure pathway	Average intake (mg/kg bodyweight per day)	Maximum intake (mg/kg bodyweight per day)
Outdoor air	0.000029	0.000067
Indoor air	0.000162	0.00038

#### iii. Cancer Potency Factors

Exposure route	Health Canada	US EPA	CA OEHA
Inhalation	--	--	1.1
Ingestion	--	--	--

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)

Exposure pathway	Average <sup>1</sup>			Maximum <sup>2</sup>
	Health Canada	US EPA	CA OEHHA <sup>3</sup>	
Outdoor air	--	--	30.54	73.81
Indoor air	--	--	268.01	621.80

<sup>1</sup>Lifetime excess cancer risk based on average intake x cancer potency factor from each agency

<sup>2</sup>Lifetime excess cancer risk based on maximum intake x highest cancer potency factor

<sup>3</sup>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 2011.

Source	Stations (n)	Min	Max	Mean	DF
NAPS 2011 ( $\mu\text{g}/\text{m}^3$ )*	204	0.2	2.9	1.242	1.0

\* Fine particles attributable to diesel are not measured directly by NAPS. This estimate assumes that 12% of total fine particles are generated by diesel engines.

DF = Detection frequency

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

#### ii. Indoor air

Fine particles from diesel engine exhaust have not been measured in indoor air. We assume 60 percent of the estimated amount of diesel engine exhaust fine particulates in outdoor air infiltrate to indoor air via open windows, doors and air leaks.

#### iii. Dust

Fine particulates from diesel exhaust are not expected to be present in indoor dust in significant amounts.

#### iv. Drinking water

Fine particulates from diesel exhaust are not expected to be present in drinking water.

#### v. Food and Beverages

Fine particulates from diesel exhaust are not expected to be present in food and beverages.

## 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	Very Low	<ul style="list-style-type: none"> <li>Total fine particulates are regularly measured in outdoor air at 213 monitoring stations across Canada using accepted protocols. The amount of fine particulates attributable to diesel engine emissions is not measured directly. This estimate assumes that 12 percent of total fine particulates are generated by diesel engines.</li> </ul>
Indoor air	Very Low	<ul style="list-style-type: none"> <li>No studies measuring fine particulates in indoor air due to diesel engine emissions were identified. This estimate assumes that 60 percent of outdoor fine particulates attributable to diesel engine exhaust ends up indoors (via open doors, windows and infiltration through leaks in building walls).</li> </ul>
Indoor dust		<ul style="list-style-type: none"> <li>Exposure via dust is negligible</li> </ul>
Drinking water		<ul style="list-style-type: none"> <li>Not present in drinking water</li> </ul>
Food and beverages		<ul style="list-style-type: none"> <li>Not present in food and beverages</li> </ul>

### 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 diesel engine exhaust 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 diesel engine exhaust concentrations by province based on data at the health region level. The median concentration of diesel engine exhaust measured in outdoor air in 2011 at the health region level was 1.793  $\mu\text{g}/\text{m}^3$ , while the mean concentration was 1.922  $\mu\text{g}/\text{m}^3$ . Concentrations of diesel engine exhaust can be higher or lower than average in many locations.

#### i. Provincial averages of predicted diesel engine exhaust concentrations ( $\mu\text{g}/\text{m}^3$ ) in outdoor air in 2011 based on health regions

Province	Median	Mean
BC	1.714	1.806
AB	1.497	1.602
SK	1.504	1.512
MB	1.568	1.613
ON	2.224	2.252
QC	1.917	2.031
NB	1.626	1.678
PE	1.820	1.820
NS	2.016	2.029
NL	1.515	1.504
YK	1.705	1.705
NT	1.062	1.062
NU	3.071	3.071
<b>Canada</b>	<b>1.793</b>	<b>1.922</b>

#### 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 ( $\mu\text{g}/\text{m}^3$ ) of diesel engine exhaust in outdoor air in 2011 based on NAPS data at the census block**

Estimated annual average concentration ( $\mu\text{g}/\text{m}^3$ )	Less than 0.27	0.27 to 0.32	0.32 to 0.40	0.40 to 0.53	0.53 to 0.80	0.80 to 1.20	1.20 to 1.60	1.60 to 2.00	2.00 to 2.40	More than 2.40
	Compared to national average ( $0.80/\text{m}^3$ )*	> 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
	Below Average					Above Average				
BC	--	--	8,997 (0.2%)	967,797 (22.0%)	883,326 (20.1%)	870,153 (19.8%)	542,114 (12.3%)	525,393 (11.9%)	235,341 (5.3%)	366,936 (8.3%)
AB	5 (<0.1%)	--	6,000 (0.2%)	106,906 (2.9%)	783,671 (21.5%)	1,356,013 (37.2%)	219,815 (6.0%)	212,308 (5.8%)	158,026 (4.3%)	802,477 (22.0%)
SK	--	--	--	--	502,718 (48.6%)	181,722 (17.6%)	61,455 (5.9%)	62,105 (6.0%)	79,942 (7.7%)	145,439 (14.1%)
MB	--	--	--	--	552,543 (45.7%)	234,992 (19.4%)	76,188 (6.3%)	122,286 (10.1%)	86,955 (7.2%)	135,304 (11.2%)
ON	--	--	--	325,587 (2.5%)	5,601,704 (43.6%)	1,760,961 (13.7%)	822,032 (6.4%)	1,265,115 (9.8%)	1,262,156 (9.8%)	1,814,266 (14.1%)
QC	--	9,748 (0.1%)	--	117,058 (0.7%)	1,047,370 (15.6%)	2,238,725 (28.3%)	1,146,793 (14.5%)	271,674 (3.4%)	420,605 (5.3%)	2,651,028 (33.5%)
NB	--	--	--	31,874 (4.2%)	447,341 (59.6%)	81,247 (10.8%)	46,507 (6.2%)	44,793 (2.8%)	39,563 (5.3%)	59,846 (8.0%)
NS	--	--	--	134,887 (14.6%)	431,971 (46.9%)	112,415 (12.2%)	44,153 (4.8%)	63,095 (6.0%)	52,038 (5.6%)	83,178 (9.0%)
PE	--	--	--	--	44,785 (31.9%)	64,552 (46.0%)	1,520 (1.1%)	5,540 (4.0%)	6,795 (4.8%)	17,012 (12.1%)
NL	--	--	--	20,767 (4.0%)	351,809 (68.4%)	537 (0.1%)	18,545 (3.6%)	39,889 (7.8%)	33,835 (6.6%)	49,154 (9.6%)
NU	--	--	--	--	25,207 (79.0%)	--	6,699 (21.0%)	--	--	--
NT	--	--	--	3,463 (8.3 %)	31,637 (76.3%)	0 (<0.1%)	402 (1.0%)	2,089 (5.0%)	2,144 (5.2%)	1,727 (4.2%)
YT	--	--	--	--	6,852 (20.2%)	16,617 (49.0%)	236 (0.7%)	1,797 (5.3%)	2,464 (7.3%)	5,931 (17.5%)
<b>CANADA</b>	5 (<0.1%)	9,748 (<0.1%)	14,997 (<0.1%)	1,708,329 (5.1%)	10,710,934 (32.0%)	6,917,934 (20.7%)	2,986,459 (8.9%)	2,616,084 (7.8%)	2,379,900 (7.1%)	6,132,298 (18.3%)

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

Health Canada CPF: No CPF	California OEHHA CPF: 1.1	US EPA CPF: No CPF
< 10.5	10.5 to < 12.6	12.6 to < 15.8
15.8 to < 21.1	21.1 to < 31.6	31.6 to < 47.4
47.4 to < 63.2	63.2 to < 79.0	79.0 to < 94.8
> 94.8		

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