Asbestos

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 asbestos 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	Fibres/millilitre (f/ml)	0.00002	0.01	
Indoor air	f/ml	0.000085	0.006	

ii. Calculated Lifetime Daily Intake

Exposure pathway	Lifetime average hourly concentration (f/ml)	Lifetime maximum hourly concentration (f/ml)
Outdoor air	0.0000013	0.00067
Indoor air	0.0000057	0.0056

iii. Unit Risk Factors

Exposure route	Health Canada	US EPA	CA OEHHA
Inhalation		0.23	1.9

Sources for Unit Risk Factors:

- 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	--	0.31	2.53	1,266.7
Indoor air	--	1.30	10.77	10,640.0

[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 based on data published in peer-reviewed literature and government reports. 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: 4	Author:	Lee RJ et al (2008)					Location:	United States			
Samples (n)	Site	Analysis Method	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
1,678	Various	TEM	1990s	f/ml optical equiv.	48 hours			0.00002			

Rank: 4	Author:	LaJoie et al (2003)					Location:	Quebec asbestos mining towns			
Samples (n)	Site	Analysis Method	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
24	Black Lake	TEM	1984	f/ml optical equiv.	12 continuous 4 week periods			0.026			
35	Thetford Mines							0.010			
22	Asbestos							0.007			

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

Sources for outdoor air data:

- LaJoie P, Dion C, Drouin L, Dufresne A, Levesque B, et al. 2003. Asbestos Fibres in Indoor and Outdoor Air The Situation in Quebec. Sub-Committee on Exposure Measurement. Institut national de sante publique du Quebec.
- Lee RJ, Van Orden DR. 2008. Airborne asbestos in buildings. Regulatory Toxicology and Pharmacology 50: 218-225.

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:	Marier et al (2007)					Location:	Thetford, Quebec			
Samples (n)	Site	Analysis Method	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
28	26 homes	TEM	2003-2004	f/ml optical equiv.	Unknown	0.0	0.006	0.0007			

Rank: 4	Author:	Lee RJ et al (2008)					Location:	United States			
Samples (n)	Site	Analysis Method	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
39	5 homes	TEM	1990s	f/ml optical equiv.	48 hours			0.00005			
3,979	752 buildings							0.00012			

Sources for indoor air data:

- Lee RJ, Van Orden DR. 2008. Airborne asbestos in buildings. Regulatory Toxicology and Pharmacology 50: 218-225.
- Marier M, Charney W, Rousseau R, Lanthier R and Van Raalte J. 2007. Exploratory Sampling of Asbestos in Residences Near Thetford Mines. International Journal of Occupational and Environmental Health 13: 386-397.

iii. Dust

Asbestos may be present in dust, but is not expected to be carcinogenic via ingestion.

iv. Drinking water

Asbestos may be present in drinking water, but is not expected to be carcinogenic via ingestion

v. Food and Beverages

Asbestos may be present in food and beverages, but is not expected to be carcinogenic via ingestion

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	• Asbestos in outdoor air is not regularly measured in Canada or the US. • Only one Canadian study was identified (conducted in 1984) that used the recommended method of measuring asbestos in non-occupational settings (transmission electron microscopy) and reported results in phase contrast optical microscopy equivalent which is required for calculation of lifetime excess cancer risk. • The outdoor air average concentration used here is based on one comprehensive study from the US, conducted in the 1990s.
Indoor air	Very Low	• Asbestos in residential indoor air is not regularly measured in Canada or the US. • Only one Canadian study was identified (conducted in 2003-2004, in Thetford PQ, where an active asbestos mine is located) that used the recommended method of measuring asbestos in non-occupational settings (transmission electron microscopy) and reported results in phase contrast optical microscopy equivalent which is required for calculation of lifetime excess cancer risk. • A number of studies measuring indoor air levels before and after asbestos remediation in workplaces were not included in our estimate. • The indoor air average concentration used here is based on one comprehensive study from the US, conducted in the 1990s.