Chlorothalonil

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 chlorothalonil 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	0.001121888	0.002845	
Indoor air	µg/m³	--	0.036	
Dust	µg/g	--	3.2	
Drinking water	µg/L	Insufficient data		
Food 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	0.000000026	0.000000066
Indoor air	--	0.000012
Dust	--	0.0000021
Drinking water	Insufficient data	
Food and beverages	0.000000078	Not estimated

iii. Cancer Potency Factors

Exposure route	Health Canada	US EPA	CA OEHHA
Inhalation	--	--	0.0031
Ingestion	--	--	0.0031

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	--	--	0.00008	0.00020
Indoor air	--	--	--	0.036
Dust	--	--	--	0.0065
Drinking water		Insufficient data		
Food and beverages	--	--	0.00024	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 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:** Aulagnier (2008) **Location:** Canada, Québec

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
		$2.5x10^{-5}$	2004	µg/m³							
1	13%		May-June		Weekly	<DL	0.000015	0.000015	<DL		
1	100%		July-Sept		Monthly	0.000930	0.001724	0.001227	0.001029		

*DF = Detection frequency
**DL = Detection limit

Rank: 1 **Author:** Daly (2007) **Location:** Canada, (BC and AB)

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
			2003-2004	µg/m³	Annual						
6						0.000003	0.000032		0.000010		
5						0.000001	0.000006		0.000002		
5						0.000001	0.000012		0.000003		

Note: Values listed in the following order: Revelstoke, BC; Yoho, BC; Observation Point, Banff, AB.
*DF = Detection frequency
**DL = Detection limit

Rank: 1 **Author:** Environment Canada (2009) **Location:** Canada, Ontario

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
12	83%	$1.0x10^{-6}$	2004-2005	µg/m³	3 months	<DL	0.133		0.00377		25^{th} 0.0000896 75^{th} 0.0008410

*DF = Detection frequency
**DL = Detection limit

Rank: 1	Author:	Gouin (2008)					Location:	Canada, Ontario			
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
16		$1.0x10^{-7}$	2003-2004	µg/m³	monthly			0.0001697			

*DF = Detection frequency
**DL = Detection limit

Rank: 1	Author:	Hayward (2010)					Location:	Canada, Ontario			
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
1			March 2006 – Sept 2007	µg/m³	2 week intervals	0.0000085	0.002845	0.000918			95th 0.001345

*DF = Detection frequency
**DL = Detection limit

Rank: 1	Author:	Yao (2008)					Location:	Canada (ON, QC, PEI)			
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
		$4.0x10^{-5}$	2003	µg/m³	monthly						
1								0.005200			
1								0.003030			
1								0.001860			
1								0.011900			

Note: Values listed in the following order: Egbert, ON; St. Anicet, QC; Baie St. Francois, QC; Kensington, PEI.
*DF = Detection frequency
**DL = Detection limit

Sources for outdoor air:

- Aulagnier F, Poissant L, Brunet D, Beauvais C, Pilote M, Deblois C, Dassylva N. 2008. Pesticides measured in air and precipitation in the Yamaska Basin (Québec) : occurrence and concentrations in 2004. Sci Total Environ 294(2-3): 338-348.
- Daly GL, Lei YD, Teixeira C, Muir DCG, Wania F. 2007. Pesticides in Western Canadian mountain air and soil. Environmental Science and Technology 41: 6020-6025.
- Environment Canada. 2009. Presence and levels of priority pesticides in selected Canadian aquatic ecosystems. Prepared for Water Science and Technology Directorate, Environment Canada.
- Gouin T, Shoeib M, Harner T. 2008. Atmospheric concentrations of current-use pesticides across south-central Ontario using monthly-resolbed passive air samplers. Atmospheric Environment 42: 8096-8104.
- Hayward SJ, Gouin T, Wania F. 2010. Levels and seasonal variability of pesticides in the rural atmosphere of Southern Ontario. Journal of Agricultural Food and Chemistry 58: 1077-1084.
- Yao Y, Tuduri L, Harner T, Blanchard P, Waite D, Poissant L, Murphy C, Belzer W, Aulagnier F, Li Y, Sverko E. 2006. Spatial and temporal distribution of pesticide air concentrations in Canadian agricultural regions. Atmospheric Environment 40: 4339-435.

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: 2 Author: Rudel (2003) Location: USA, Cape Cod, MA

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
90	17	0.001	1999-2001	µg/m³	24-hr	<DL	0.036		<DL		

*DF = Detection frequency
**DL = Detection limit

Sources for indoor air data:

- Rudel RA, Camann DE, Spenger JD, Korn LR, Brody JG. 2003. Phthalates, alkyphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting compounds in indoor air and dust. Environmental Science and Technology 37(20): 4543-4553.

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: 2 Author: Rudel (2003) Location: USA, Cape Cod, MA

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
119	0.02	0.2	1999-2001	µg/g			3.20		<DL		

*DF = Detection frequency
**DL = Detection limit

Sources for dust:

- Rudel RA, Camann DE, Spenger JD, Korn LR, Brody JG. 2003. Phthalates, alkyphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting compounds in indoor air and dust. Environmental Science and Technology 37(20): 4543-4553.

iv. Drinking water

No recent data or studies were identified.

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 10% of total vegetables consumed.

Food or Beverage	Concentration (µg/g)	DF	Food or Beverage	Concentration (µg/g)	DF
Beef			Peaches fresh		
Chicken			Pears canned		
Mutton and lamb			Pears fresh		
Offal			Pineapples canned		
Oils and fats			Pineapples fresh		
Pork			Plums total fresh		
Salad oils			Quinces fresh		
Shortening and shortening oils			Raspberries frozen		
Stewing hen			Strawberries canned		
Turkey			Strawberries fresh		
Veal			Strawberries frozen		
Fish fresh and frozen seafish			Sugar maple		
Fish freshwater			Sugar refined		
Fish processed seafish			Honey		
Apple pie filling			Artichokes fresh		
Apple sauce			Asparagus canned		
Apples canned			Asparagus fresh		
Apples dried			Avocados fresh		
Apples fresh			Beans baked and canned		
Apples frozen			Beans dry		
Apricots canned			Beans green and wax canned		
Apricots fresh			Beans green and wax fresh		
Bananas fresh			Beans green and wax frozen		
Berries other fresh			Beets canned		
Blueberries canned			Beets fresh		
Blueberries fresh			Broccoli fresh		
Blueberries frozen			Broccoli frozen		
Cherries fresh			Brussels sprouts fresh		
Cherries frozen			Brussels sprouts frozen		
Citrus other fresh			Cabbage Chinese fresh		
Coconut fresh			Cabbage fresh		
Cranberries fresh			Carrots canned		
Dates fresh			Carrots fresh		
Figs fresh			Carrots frozen		
Fruit dried			Cauliflower fresh		
Grapefruit fresh			Cauliflower frozen		
Grapes fresh			Celery fresh	0.00111	0.18182
Guava and mangoes fresh			Corn canned		
Kiwi fresh			Corn flour and meal		
Lemons fresh			Corn fresh		
Limes fresh			Corn frozen		
Mandarins fresh			Cucumbers fresh		
Melons musk, cantaloupe fresh			Eggplant fresh		
Melons other fresh			Garlic fresh		
Melons watermelons fresh			Kohlrabi fresh		
Melons, winter melons fresh			Leeks fresh		
Nectarines fresh			Lettuce fresh		
Oranges fresh			Lima beans frozen		
Papayas fresh			Manioc fresh		
Peaches canned			Mushrooms canned		

Food or Beverage	Concentration (µg/g)	DF
Mushrooms fresh		
Okra fresh		
Olives fresh		
Onions and shallots fresh		
Parsley fresh		
Parsnips fresh		
Peas canned		
Peas dry		
Peas fresh		
Peas frozen		
Peppers fresh		
Potatoes chips		
Potatoes frozen		
Potatoes other processed		
Potatoes sweet fresh		
Potatoes white fresh		
Potatoes white fresh and processed		
Pumpkins and squash fresh		
Radishes fresh		
Rappini fresh		
Rutabagas and turnip fresh		
Spinach fresh		
Spinach frozen		
Tomatoes canned		
Tomatoes fresh	0.01000	0.02273
Tomatoes pulp, paste and puree		
Vegetables other edible root fresh		
Vegetables other leguminous fresh		
Vegetables unspecified canned		
Vegetables unspecified fresh		
Vegetables unspecified frozen		
Butter		
Cheese cheddar		
Cheese cottage		
Cheese processed		
Cheese variety		
Cream cereal 10%		
Cream sour		
Cream table 18%		
Cream whipping 32% or 35%		
Eggs		
Ice cream		
Ice milk		
Margarine		

Food or Beverage	Concentration (µg/g)	DF
Milk buttermilk		
Milk chocolate drink		
Milk concentrated skim		
Milk concentrated whole		
Milk other whole milk products		
Milk partly skimmed 2%		
Milk skim		
Milk standard		
Milk sweetened concentrated skim		
Milkshake		
Powder buttermilk		
Powder skim milk		
Powder whey		
Sherbet		
Yogurt		
Cereal products		
Oatmeal and rolled oats		
Peanuts		
Pot and pearl barley		
Pulses and nuts		
Rice		
Rye flour		
Tree nuts		
Wheat flour		
Ale, beer, stout and porter		
Beverages alcoholic		
Coffee		
Distilled spirits		
Juice apple		
Juice grape		
Juice tomato		
Juice fruit		
Juice grapefruit		
Juice lemon		
Juice orange		
Juice pineapple		
Juice vegetable		
Soft drinks		
Tea		
Water bottled		
Wines		
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	• Six Canadian studies identified reporting similar low mean and median measured values.
Indoor air	Very Low	• No Canadian studies identified. A US study (Cape Cod, MA) found infrequent detections (17% from 90 samples) of chlorothalonil at low levels and reports a maximum concentration of 0.036 µg/m³. This value is used to calculate maximum risk, but the quality of this estimate is very low.
Indoor dust	Very Low	• No recent Canadian data or studies identified using appropriately accurate analytical methods. Data from a US study (Cape Cod, MA) report Chlorothalonil detected in 2% of samples (n=119). The maximum value of 3.20 µg/g is used to calculate maximum risk, but the quality of this estimate is very low.
Drinking water	Gap	• No recent Canadian studies were identified.
Food and beverages	Very Low	• No Canadian data on concentrations of chlorothalonil in foods and beverages were identified. Data from the US-FDA (TDS-2003-2004) were used for this estimate.