2,4-D

Environmental estimates (circa 2011): Supplemental data

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1. Data for lifetime excess cancer risk estimates

Overview

Calculating lifetime excess cancer risk requires an estimate of intake and a cancer potency factor. No published cancer potency factors for inhalation or ingestion of 2,4-D are available from Health Canada, the California Office of Environmental Health Hazard Assessment (OEHHA), or the US Environmental Protection Agency (US EPA).

Concentrations of 2,4-D have been measured in Canadian outdoor air, drinking water, and food and beverages in a limited number of studies.

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
1	38	3.0×10^{-6}	2004	µg/m³	May – June	b.d.l.	0.001306	0.00044			
1	0				July – Sept	b.d.l	b.d.l.	b.d.l.			

*DF = Detection frequency
**DL = Detection limit
b.d.l. = below detection limit

Rank: 1 Author: Yao (2006) Location: Canada, Saskatchewan

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
1			2003	µg/m³	Jul22-Aug19	0.0000286	0.000897	0.000219			
1					May12-Aug13	n.d.	0.000492	0.000117			
1					May12-Aug13	n.d.	0.000240	0.0000587			

Note: Values listed in the following order: Bratt's Lake, Hafford, and Waskesiu, SK
*DF = Detection frequency
**DL = Detection limit
n.d. = non-detect

Rank: 1	Author: Yao (2008)					Location: Canada: BC, SK, ON, QC, PEI					
Samples (n)	DF *	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
1		1.0x10⁻⁶	2004	µg/m³	Apr28 – Jun1	0.000005	0.0000162	0.00001			
1					May19 – Aug4	n.d.	0.00398	0.00073			
1					May18 – Jul13	n.d.	0.0000933	0.000024			
1					May21 – Jul23	n.d.	0.0002	0.000041			
1					May4 – Jun29	n.d.	0.0000434	0.000016			
1					May4 – Jun29	n.d.	0.00004	0.000011			
1					Jun24 – Sep28	n.d.	0.0000878	0.000011			
1			2005		May4 – May30	n.d.	0.000212	0.000094			
1					May19 – Jul7	n.d.	0.000562	0.000193			
1					Jun2 – Aug5	n.d.	0.000382	0.000079			
1					Jun16 – Aug11	n.d.	0.000516	0.000175			
1					Jun1 – Jun29	n.d.	0.000271	0.000109			
1					Jun1 – Jun29	n.d.	0.000136	0.000059			
1					Aug8 – Sep5	n.d.	n.d.	n.d.			

Note: Values listed in the following order for 2004: Abbotsford, BC; Bratt's Lake, SK; Egbert, ON; Vineland, ON; St. Anicet, QC; Baie St. Francois, QC; Kensington, PEI. Values listed in the following order for 2005: Abbotsford, BC; Egbert, ON; Vineland, ON; Downsview, ON; St. Anicet, QC; Baie St. Francois, QC; Kensington, PEI

*DF = Detection frequency

**DL = Detection limit

n.d. = non-detect

Sources for outdoor air data:

- 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.
- 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: 4339-4351.
- Yao Y, Harner T, Blanchard P, Tuduri L, Waite D, Poissant L, Murphy C, Belzer W, Aulagnier F, Sverko E. 2008. Pesticides in the atmosphere across Canadian agricultural regions. Environ. Sci. Technol. 42 : 5931-5937.

ii. Indoor air

No data.

iii. Dust

No data.

iv. Drinking water

Drinking water data are from the Ontario Drinking Water Surveillance Program (DWSP) for 2006. 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 2006	(µg/L)	0.1

Sample Type	Parameter	Mean	SD	Min	25th	50th	75th	Max	N
Treated Water		0.1	0.0	0.1	0.1	0.1	0.1	0.1	54

Rank: 1 Author: Byrtus (2004) Location: Canada, Alberta

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
238	16.4		2000	µg/L			0.649				
196	30.6		2001				0.48				
212	11.3		2002				0.031				
111	13.5		2003				0.155				

*DF = Detection frequency
**DL = Detection limit

Rank: 1 Author: Donald (2007) Location: Canada: Alberta, Saskatchewan, Manitoba

Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
28		0.0005	2004-2005	µg/L		0.0105	0.0814	0.589			

*DF = Detection frequency
**DL = Detection limit

Sources for drinking water data:

- Byrtus G, Pongar K, Browning C, Burland R, McGuinness E, Humphries D. 2004. A summary of pesticide residue data from the Alberta Treated Water Survey, 1995-2003. Alberta Environment, Environmental Assurance Service. Edmonton. 57 pp.
- Donald DB, Cessna AJ, Sverko E, Glozier N. 2007. Pesticides in surface drinking-water supplies of the Northern Great Plains. Environmental Health Perspectives 115(8): 1183-1191.

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 85% of total grains 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		
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	Food or Beverage	Concentration (µg/g)	DF
Mushrooms fresh			Milk buttermilk		
Okra fresh			Milk chocolate drink		
Olives fresh			Milk concentrated skim		
Onions and shallots fresh			Milk concentrated whole		
Parsley fresh			Milk other whole milk products		
Parsnips fresh			Milk partly skimmed 2%		
Peas canned			Milk skim		
Peas dry			Milk standard		
Peas fresh			Milk sweetened concentrated skim		
Peas frozen			Milkshake		
Peppers fresh			Powder buttermilk		
Potatoes chips			Powder skim milk		
Potatoes frozen			Powder whey		
Potatoes other processed			Sherbet		
Potatoes sweet fresh			Yogurt		
Potatoes white fresh			Cereal products	0.00023	0.09659
Potatoes white fresh and processed			Oatmeal and rolled oats		
Pumpkins and squash fresh			Peanuts		
Radishes fresh			Pot and pearl barley		
Rappini fresh			Pulses and nuts		
Rutabagas and turnip fresh			Rice		
Spinach fresh			Rye flour		
Spinach frozen			Tree nuts		
Tomatoes canned			Wheat flour	0.00104	0.32576
Tomatoes fresh			Ale, beer, stout and porter		
Tomatoes pulp, paste and puree			Beverages alcoholic		
Vegetables other edible root fresh			Coffee		
Vegetables other leguminous fresh			Distilled spirits		
Vegetables unspecified canned			Juice apple		
Vegetables unspecified fresh			Juice grape		
Vegetables unspecified frozen			Juice tomato		
Butter			Juice fruit		
Cheese cheddar			Juice grapefruit		
Cheese cottage			Juice lemon		
Cheese processed			Juice orange		
Cheese variety			Juice pineapple		
Cream cereal 10%			Juice vegetable		
Cream sour			Soft drinks		
Cream table 18%			Tea		
Cream whipping 32% or 35%			Water bottled		
Eggs			Wines		
Ice cream			Cocoa		
Ice milk					
Margarine					

2. Data quality

We searched for only publicly available data of measurements of 2,4-D in the Canadian environment. 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	• Three recent Canadian studies were identified, which measured 2,4-D in outdoor air in various provinces of Canada.
Indoor air	Gap	• No recent data or studies identified using appropriately accurate analytical methods.
Indoor dust	Gap	• No recent data or studies identified using appropriately accurate analytical methods.
Drinking water	Very Low	• Only one sample of treated drinking water was tested for 2,4-D in 2009 for the Ontario Drinking Water Surveillance Program. It was not detected in any samples of treated drinking water (n=54) in 2006. The detection limit was 0.1 µg/L. • Two recent studies in the Canadian prairies were identified that measured 2,4-D in drinking water.
Food and beverages	Gap	• No Canadian data on concentrations of 2,4-D in foods and beverages were identified.