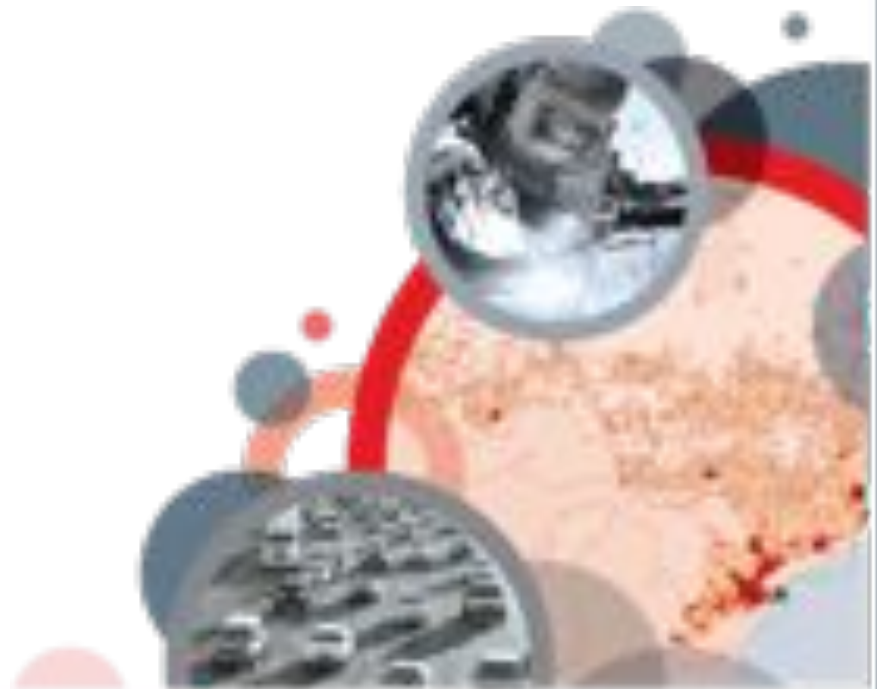

Indicators of Environmental Exposures

Eleanor Setton, PhD

Karla Poplawski, MSc

Environmental Exposures

Spatial Sciences Research Lab
University of Victoria, B.C.



CAREX Canada – Environmental Indicators

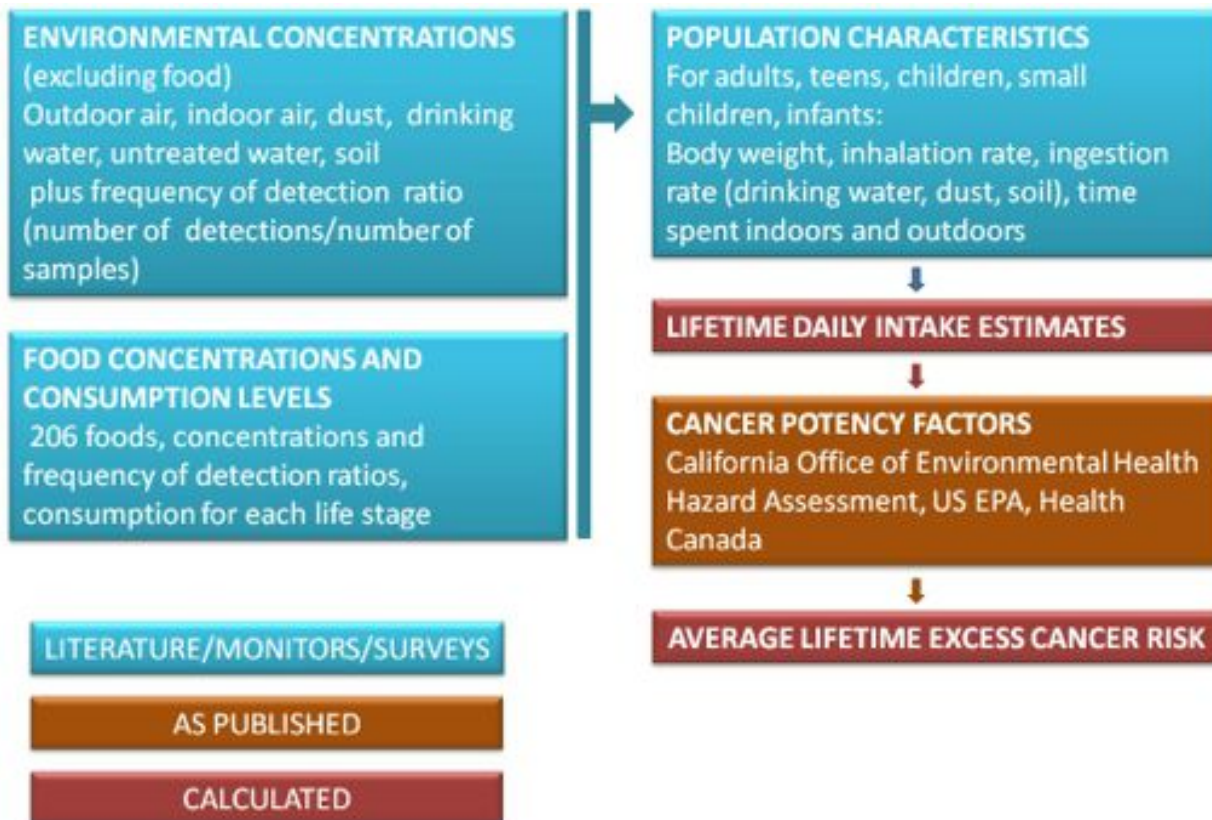
Goal for indicators:

- Enable surveillance → establish a benchmark, identify trends over time
- National in scope, while incorporating regional variation when appropriate
- Support prioritization → must be comparable across substances and pathways
- Use only existing data (no new collection)
- Applicable to 35 known/suspected carcinogens in the environment (and potentially more)

Initial Findings:

- Widely varying availability of data across substances and exposure pathways
- Two groups of data:
 - measured levels in exposure pathways → risk-based approach
 - emission sources and levels in outdoor environments → relative toxicity and dynamic maps

Environmental Indicators: Risk-based approach




(assuming no change in measured levels)

Indoor Air

Data:
Published literature
and government
reports

Regional Variation:
Expect variation
among homes, but
not regionally

Average Risk:
based on average intake
x cancer potency or
unit risk factor from:

Health Canada 
CA OQ-HA 
US EPA 

Maximum Risk: 
based on maximum
intake x highest cancer-
potency factor or
unit risk factor

Insufficient Data: 

When potential lifetime
excess cancer risk is
**more than 1 per million
in any single pathway**,
a more detailed risk
assessment may be
useful for confirming
the need to reduce
individual exposures

Missing symbols indicate
no cancer potency factor
or unit risk factor, or no
data available

Data Quality:

VL = Very Low
L = Low
M = Moderate
H = High

IARC 1 - KNOWN CARCINOGENS

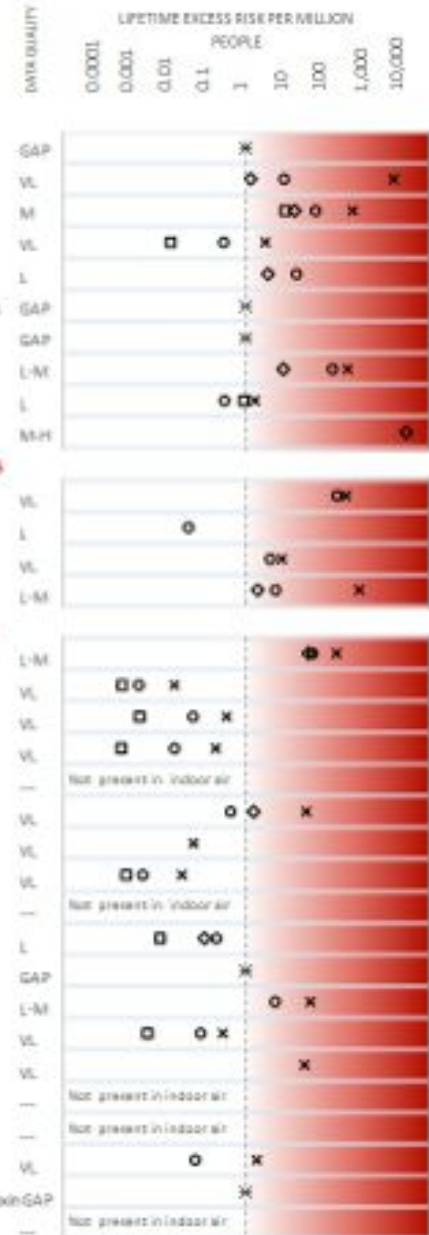
Arsenic and arsenic compounds
Asbestos
Benzene
Benzo(a)pyrene
1,3-Butadiene
Cadmium and cadmium compounds
Chromium (hexavalent)
Formaldehyde
Nickel and nickel compounds
Radon

IARC 2A - PROBABLE CARCINOGENS

Diesel engine exhaust*
Lead and lead compounds
Polychlorinated biphenyls
Tetrachloroethylene

IARC 2B - POSSIBLE CARCINOGENS

Acetaldehyde
Benzo(a)anthracene
Benzo(a)fluoranthene
Benzo(b)fluoranthene
Bromodichloromethane
Chloroform
Chlorothalipol
Chrysene
Dichloroacetic acid
Dichloromethane
Dichlorvos
Ethylbenzene
Indeno(1,2,3-cd)pyrene
Lindane
MX
N-nitrosamethylamine
Pentachlorobenzene
2,3,7,8-Tetrachlorodibenzo-p-dioxin
2,4,6-trichlorophenol





Dust

Data:
Published literature
and government
reports

Regional Variation:
Expect variation
among homes, but
not regionally

Average Risk:
Based on average intake
x cancer potency or
unit risk factor from:

Health Canada 
CA/OEHHA 
US EPA 

Maximum Risk: 
based on maximum
intake x highest cancer
potency factor or
unit risk factor

Insufficient Data: 

When potential lifetime
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IARC 1 - KNOWN CARCINOGENS

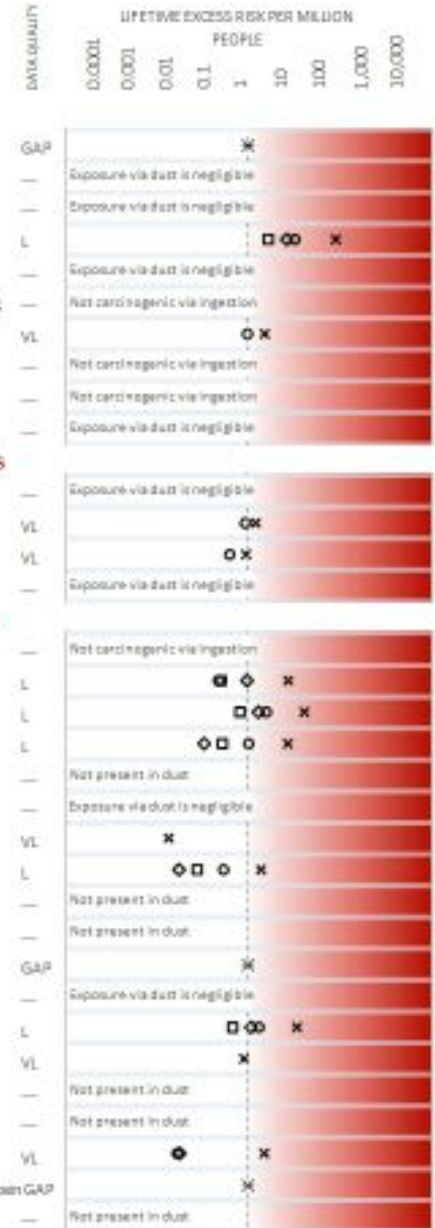
Arsenic and arsenic compounds
Asbestos
Benzene
Benzo[a]pyrene
1,3-Butadiene
Cadmium and cadmium compounds
Chromium (hexavalent)
Formaldehyde
Nickel and nickel compounds
Radon

IARC 2A - PROBABLE CARCINOGENS

Diesel engine exhaust
Lead and lead compounds
Polychlorinated biphenyls
Tetrachloroethylene

IARC 2B - POSSIBLE CARCINOGENS

Acetaldehyde
Benzo[a]anthracene
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Bromochloromethane
Chloroform
Chlorothalonil
Chrysene
Dichloroacetic acid
Dichloromethane
Dichlorvos
Ethylbenzene
Indeno(1,2,3-cd)pyrene
Undane
MX
N-nitrosomethylethylamine
Pentachlorophenol
2,3,7,8-Tetrachlorodibenzo-p-dioxin
2,4,6-trichlorophenol



Drinking water

Data:

Province of Ontario
online database and
government reports

Regional Variation:

Expect variation among
treatment plants but not
regionally.

May be regional variation
in arsenic from wells



When potential lifetime
excess cancer risk is
more than 1 per million
in any single pathway,
a more detailed risk
assessment may be
useful for confirming
the need to reduce
individual exposures

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Data Quality:
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M = Moderate
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IARC 1 - KNOWN CARCINOGENS

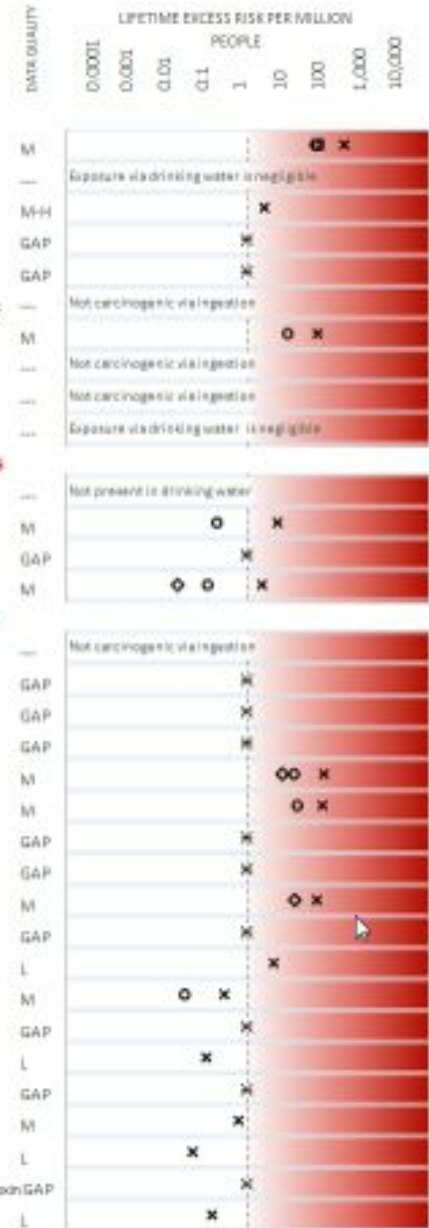
Arsenic and arsenic compounds	M
Asbestos	—
Benzene	M-H
Benzo(a)pyrene	GAP
1,3-Butadiene	GAP
Cadmium and cadmium compounds	—
Chromium (hexavalent)	M
Formaldehyde	—
Nickel and nickel compounds	—
Radon	—

IARC 2A - PROBABLE CARCINOGENS

Diesel engine exhaust	—
Lead and lead compounds	M
Polychlorinated biphenyls	GAP
Tetrachloroethylene	M

IARC 2B - POSSIBLE CARCINOGENS

Acetaldehyde	—
Benzo(a)anthracene	GAP
Benzo(b)fluoranthene	GAP
Benzo(k)fluoranthene	GAP
Bromodichloromethane	M
Chloroform	M
Chlorothalons	GAP
Chrysene	GAP
Dichloroacetic acid	M
Dichloromethane	GAP
Dichlorvos	L
Ethylbenzene	M
Indeno(1,2,3-cd)pyrene	GAP
Lindane	L
NM	GAP
N-nitrosodimethylamine	M
Pentachlorophenol	L
2,3,7,8-Tetrachlorodibenzo-p-dioxin	GAP
2,4,6-trichlorophenol	L



Food & Beverages

Data:

Variety of government reports and databases, but dated and no single comprehensive program


Relying on US data for much of the residue/contaminant data

Regional Variation:

Expect variation among individuals, but not regionally, except for those who consume locally grown foods

Average Risk:
based on average intake
± cancer potency or
unit risk factor from:

Health Canada 
CA DEHA 
US EPA 

Maximum Risk: 
based on maximum
intake x highest cancer
potency factor or
unit risk factor

Insufficient Data: 

When potential lifetime
excess cancer risk is
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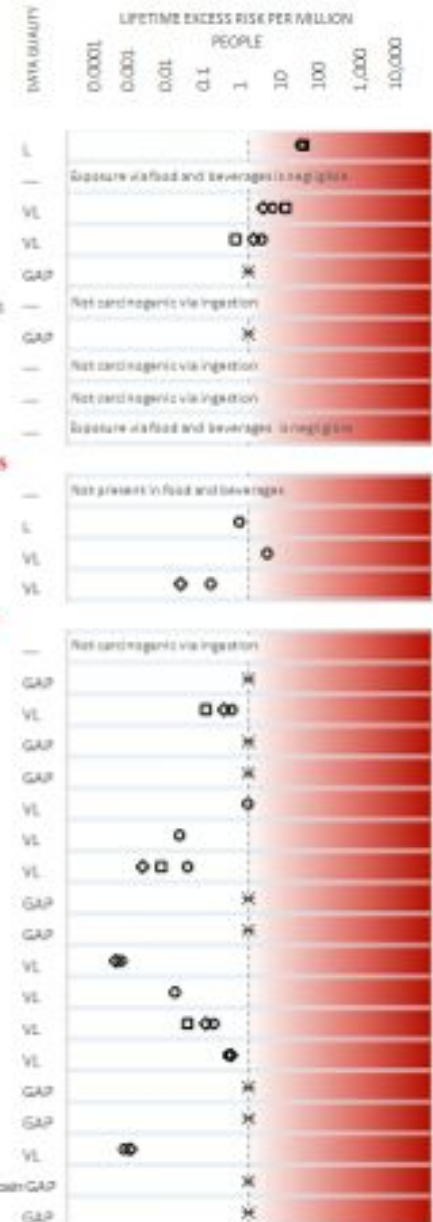
Arsenic and arsenic compounds
Asbestos
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1,3-Butadiene
Cadmium and cadmium compounds
Chromium (hexavalent)
Formaldehyde
Nickel and nickel compounds
Radon

IARC 2A - PROBABLE CARCINOGENS

Diesel engine exhaust
Lead and lead compounds
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Tetrachloroethylene

IARC 2B - POSSIBLE CARCINOGENS

Acetaldehyde
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Benzo[k]fluoranthene
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Chloroform
Chlorothalond
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Dichloromethane
Dichlorvos
Ethylbenzene
Indeno[1,2,3-cd]pyrene
Lindane
MX
N-nitrosomethylethylamine
Pentachlorophenol
2,3,7,8-Tetrachlorodibenzo-p-dioxin
2,4,6-trichlorophenol



(assuming no change in measured levels)

Outdoor Air

Data:

National Air Pollution
Surveillance (NAPS)
AQ monitors


Regional Variation:

Lots of local variation in
concentration is expected –
have modelled concentrations
for residential locations

NAPS stations sited to capture
regional trends, but many
CAREX substances are traffic
and industry related – many
people may be in higher than
average areas

Average Risk:
based on average intake
x cancer potency or
unit risk factor from:

Health Canada 
CA OEHHA 
US EPA 

Maximum Risk: 
based on maximum
intake x highest cancer
potency factor or
unit risk factor

When potential lifetime
excess cancer risk is
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Missing symbols indicate
no cancer potency factor
or unit risk factor, or no
data available

Data Quality:

VL = Very Low
L = Low
M = Moderate
H = High

IAFC 1 - KNOWN CARCINOGENS

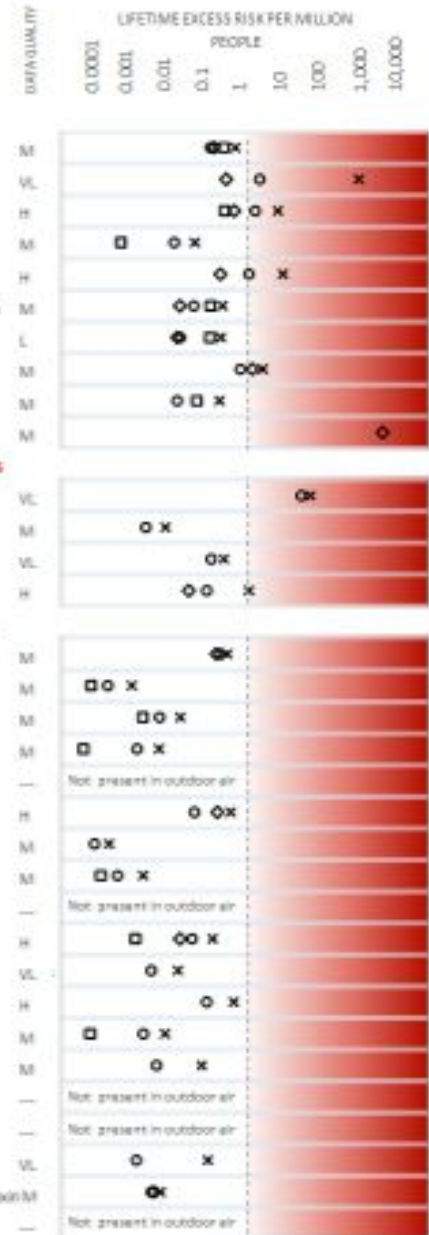
Arsenic and arsenic compounds M
Asbestos VL
Benzene H
Benzo(a)pyrene M
1,3-Butadiene H
Cadmium and cadmium compounds M
Chromium (hexavalent)* L
Formaldehyde M
Nickel and nickel compounds M
Radon M

IAFC 2A - PROBABLE CARCINOGENS

Diesel engine exhaust** VL
Lead and lead compounds M
Polychlorinated biphenyls VL
Tetrachloroethylene H

IAFC 2B - POSSIBLE CARCINOGENS

Acetaldehyde M
Benzo(a)anthracene M
Benzo(b)fluoranthene M
Benzo(k)fluoranthene M
Bromoacetic acid Not present in outdoor air
Chloroform H
Chlorothalonil M
Chrysene M
Dichloroacetic acid Not present in outdoor air
Dichloromethane H
Dichlorvos VL
Ethylbenzene H
Indeno(1,2,3-cd)pyrene M
Lindane M
MX Not present in outdoor air
N-nitrosodimethylamine Not present in outdoor air
Pentachlorophenol VL
2,3,7,8-Tetrachlorodibenzo-p-dioxin M
2,4,6-trichlorophenol Not present in outdoor air



Environmental Indicators: Risk-based approach

Environmental Estimate

Provincial Tables & Maps

Compare Substances

Trends

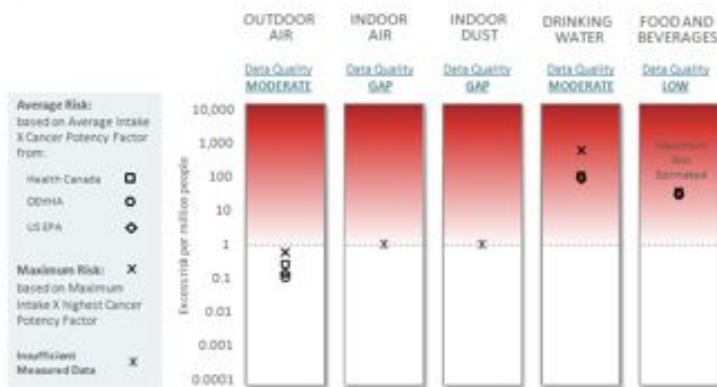
Methods

Data

Data Quality

2006 Canadian Potential Lifetime Excess Cancer Risk Estimate - ARSENIC (assuming measured levels and intake remain constant)

When potential lifetime excess risk is **greater than 1 per million people** in any single pathway, consider identifying ways to reduce the possibility of individual exposure.



Residential Locations

Arsenic Annual Average ($\mu\text{g}/\text{m}^3$)



by Estimated Concentration of Arsenic in Outdoor Air - 2006

	0.00017 to 0.00022 to 0.00022	0.00022 to 0.00029	0.00029 to 0.00043	0.00043 to 0.00065	0.00065 to 0.00086	0.00086 to 0.0011	0.0011 to 0.0013	More than 0.0013
	Below Average	Below Average	Above Average	Above Average	Above Average	Above Average	Above Average	Above Average
202	115	1,514,081	1,217,909	431,549	75,881	27,563	839,368	
(0.1%)	(0.1%)	(0.4%)	(0.4%)	(0.1%)	(0.1%)	(0.1%)	(0.4%)	
909	614,847	2,015,158	211,992	62,406	13,034	362,004		
(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	553,649	385,213	77,787	32,344	7,185	131,979		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	317,920	596,895	90,710	17,887	6,688	118,201		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	1,148,965	7,767,047	1,374,536	665,720	101,168	1,102,848		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	1,219,328	4,055,025	944,739	598,436	104,035	624,568		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
1,424	3,155	257,442	326,730	36,797	18,834	6,113	71,907	
(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	
13,648	57,813	352,617	264,148	25,153	11,824	1,907	6,132	
(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	
—	54,560	46,405	5,058	8,067	4,379	17,382		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	212,508	198,158	36,464	5,973	3,092	49,274		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	11,284	1,158	2,148	6,998	—	7,884		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)		(0.1%)		
—	16,897	1,865	636	70	10	21,986		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
—	6,843	8,405	959	761	10	13,194		
—	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)		
CANADA	5,620	28,384	215,294	61,992	6,020,951	26,894,118	5,238,528	3,509,301
% of pop.	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)	(0.1%)



Environmental Indicators: Risk-based approach

Environmental Estimate

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Trends

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Data

Data Quality

Overview

Outdoor Air

Indoor Air

Dust

Drinking Water

Food & Beverages

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

Environmental Concentrations

Calculated Lifetime Daily Intake

Cancer Potency Factors

Lifetime Excess Cancer Risk (per million people)

Exposure Pathway	Data Quality	Notes
Outdoor air	Moderate	• Arsenic is regularly measured in outdoor air at 13 monitoring stations across Canada using accepted protocols.
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	Moderate	• Arsenic was detected in at least 75 percent of samples (n = 528) from the Ontario Drinking Water Surveillance Program in 2006, and a national review of data up to the year 2002 was conducted by Health Canada.
Food and beverages	Low	• Data from the CFIA were used for some foods, with additional data from the US.

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	Author	Na (2004)	Location: USA, Riverside-CA								
Samples (N)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
12			2001-	µg/m ³	6 days			0.005			
7			2001					0.006			
1								0.006			

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

Rank:	Author:	See (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		1999-	µg/m ³	48 hr		0.00106	0.0004	0.00035		
75	1.0		2000				0.00081	0.00044	0.00042		

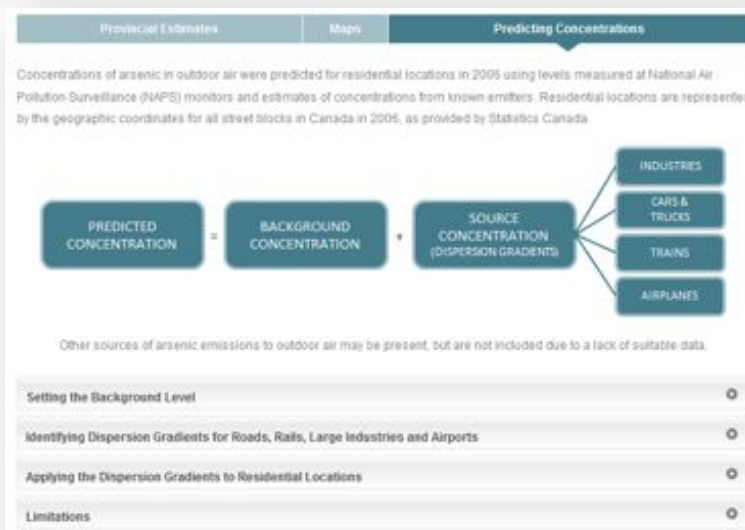
Notes: Values listed in the following order: New York City, Los Angeles. Analyzed using ICP-MS (most accurate method)
*DF = Detection frequency
**DL = Detection limit

Rank	Author	Demmentoglou (2003)					Location		Greece		
Samples (n)	DF*	DL**	Sample Date	Units	Sample Duration	Min	Max	Mean (AM)	Med	Geomean (GM)	Percentile
6				µg/m ³	2 hrs			0.00153			
6								0.00156			



Environmental Indicators: Risk-based approach

Environmental Estimate
Provincial Tables & Maps
Compare Substances
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Data Quality



Environmental Indicators: Risk-based approach

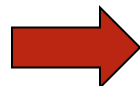
Indicator: lifetime excess cancer risk

Strengths:

- Allows comparison across exposure pathways and substances
- Will go up/down directly as measured levels change → tracking progress
- Highlights data gaps for individual substances and pathways
 - Indoor dust
 - Food and Beverages
 - Consumer products!

Limitations:

- Assumes lifetime exposure to current measured levels – not a ‘real’ cancer risk
- Uncertainty about measured levels
- Uncertainty about cancer potency factors



eRISK tool

CAREX eRisk tool

- MS Access application available to users on request, with supporting manual
- Contains all the input data used for the indicators
- Allows users to change cancer potency factors, measured levels, add new foods etc.

The screenshot shows the CAREX eRISK web application interface. At the top left is the 'eRISK' logo in red. At the top right is the 'CAREX CANADA' logo. Below the logos, the main heading reads 'Calculate potential excess lifetime excess cancer risk using data collected by CAREX Canada or your own data and scenarios.' Below this heading, there are three lines of text: 'BETA 1.0 January 15, 2012', 'Developed by Eleanor Setton and Sean Chester', and 'CAREX Canada University of Victoria Site'. The main content area is a light blue box containing a list of steps and options, each preceded by a checkbox: 'Step 1. Open Project and Choose Carcinogen', 'Step 2. Enter Lifestyle Characteristics', 'Step 3. Enter Environmental Concentrations', 'Step 4. Enter Food Concentrations', 'REPORT: Excess Lifetime Cancer Risk', 'REPORT: Data Details', and 'Export Current Report to .XLS'. Below this list, there is a paragraph of text explaining the risk estimation process: 'Potential lifetime excess risk is estimated by multiplying intake (the amount inhaled or eaten) by a cancer potency factor. Cancer potency factors sometimes differ. Results based on cancer potency factors from Health Canada, the United States Environmental Protection Agency (US EPA), and the California Office of Environmental Health Hazard Assessment (OEHHA) are included here.' At the bottom of the light blue box, another paragraph states: 'These estimates assume exposure occurs at the same level, 24 hours per day, for 70 years. This is rarely true for any single individual, but using standard parameters allows for comparisons across exposure pathways and substances.'

For populations relying on local resources, environmental quality is critical – avoiding local foods or contaminated areas is not an acceptable exposure reduction strategy.

Developed with additional grant from CIHR:

- Synthesize existing spatial data on emissions and concentrations of known and suspected carcinogens in the outdoor environment
- Create comparable exposure ‘profiles’ for regions to support prioritization
- Increase awareness and understanding of environmental quality

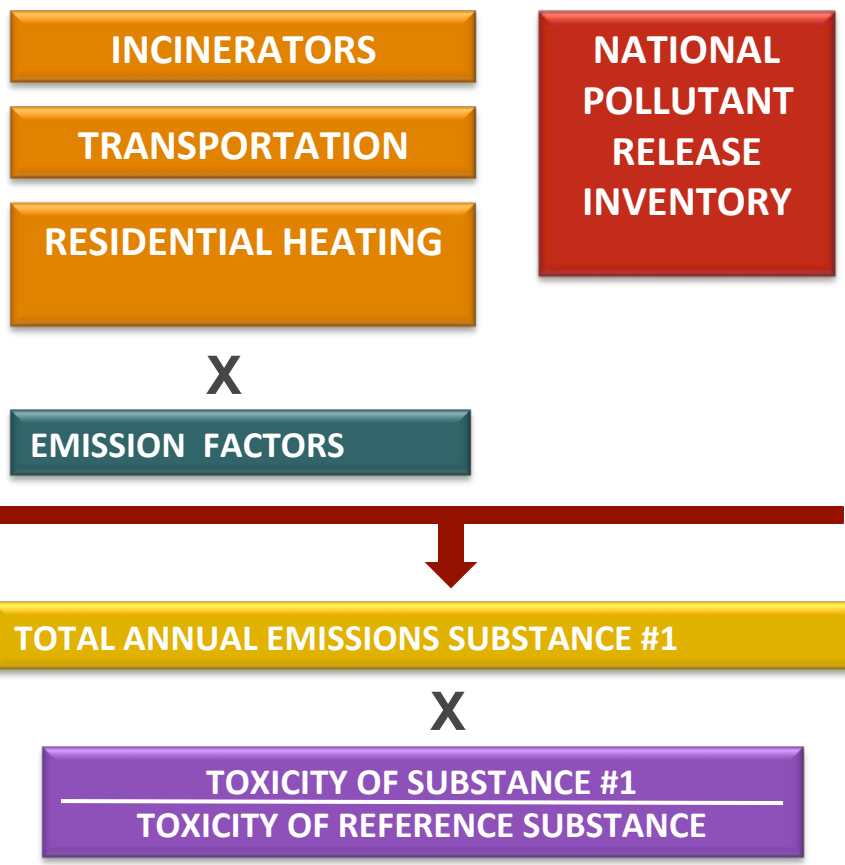
Developed for:

- Policy and decision makers working in environmental health and outdoor environmental quality:

FEDERAL, PROVINCIAL, CITY AND FIRST NATIONS

Often non-scientists

Environmental Indicators: Relative toxicity and dynamic mapping



CAN BE ADDED
ACROSS SUBSTANCES

ALLOWS FOR TOTAL RANKING
ACROSS WATERSHEDS

CAREX Emissions Mapping Project

Mapping Sources and Concentrations of Known and Suspected Carcinogens

Home

Ranks By Toxicity

Pesticides

More Google Earth Files

Resources and Tutorials

Am I Exposed?

About Us

Welcome to the CAREX Emissions Mapping Project. Our goal is to help people working in the fields of health and environmental regulation learn more about sources and concentrations of known and suspected carcinogens in the Canadian environment. By reducing or eliminating Canadians' exposure to these substances now and in the future, we hope to see fewer cancer cases over time.

View these files with Google Earth to explore differences in environmental quality across Canada; identify data gaps; and prioritize substances, sources, and geographic areas for targeted exposure reduction programs.

Look in the Resources and Tutorials section to learn more about how to use Google Earth, how to understand the files, and how to create and display your own local data along with ours.

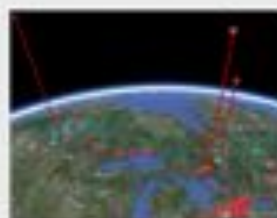
RANKING FILES



Communities and regions ranked by toxicity of emissions of known and suspected carcinogens to air in 2006.

[Major cities](#)
[Provinces](#)
[Health regions](#)
[Watersheds](#)

MORE FILES



More Google Earth files about emitters and measured levels of known and suspected carcinogens.

By Substance:
[Large emitters](#)
[Mine tailings and waste rock](#)
[Levels in air, soil, and sediment](#)

More:
[Contaminated sites](#)
[Files from other sources](#)

PESTICIDE FILES



Estimated amounts of pesticides used in agriculture and on golf courses in 2006.

[Chlorothalonil](#)
[Atrazine*](#)
[2,4-D*](#)
[MCPA*](#)
[MCP*](#)

* In Progress





Key information:

- Which substances are released to air in my watershed?
- How toxic are they?
- How does this compare to other watersheds?
- What are the main sources?
- Tell me more about this pollutant.



Google Earth

File Edit View Tools Add Help

Search

Go To: Find Businesses Directions

My Nearest: 3000 Pennsylvania Ave., 2000

Places

- Southern Arctic
- Hudson Plain
- Northern Arctic
- Tsiga Shield
- Atlantic Maritime
- Arctic Cordillera
- Mixed Wood Plain
- Temporary Places
- CAREX Watershed Rankings
 - Click on any watershed or point for more info
 - Legend
 - Watershed Layers
 - Watersheds
 - Watersheds - Med D...
 - Watersheds - Low D...

Layers

Earth Gallery

- Primary Database
- Borders and Labels
- Places
- Photos
- Roads
- 3D Buildings
- Ocean
- Weather
- Gallery
- Global Awareness
- More

Back to Google Earth

http://www.carexcanada.ca/en/index/ - CAREX Canada

Open in Firefox

CAREX CANADA

Surveillance of environmental & occupational exposures for cancer prevention

ABOUT US | PROFILES & ESTIMATES | TUTORIALS & TOOLS | PUBLICATIONS

Home / Profiles & Estimates / Arsenic / Profile


Full Profile

Quick Summary

Arsenic

METALS - Toxic (Group 1)

CAS No. 7440-38-2



General Information
Exposures and Conditions
Main Uses
Canadian Production and Trade
Occupational Exposures
Environmental Exposures
Toxicity

Photo Source: Wikimedia Commons

IARC Monograph Vol. 23, Suppl. 7, 1987 (Group 1)

IARC Monograph Vol. 84, 2004 (Arsenic in Drinking Water, Group 1)

IARC Monograph Vol 100C, 2012 (Group 1)

General Information

Arsenic is a semi-metallic element. Although it is rare to find pure arsenic in nature, inorganic arsenic compounds are found as complex minerals containing copper, lead, iron, nickel, cobalt, and other metals.^[1] Mineral arsenic compounds are white powders with no odour.^[1] Of all commercially mined arsenic compounds, arsenic trioxide is the most important.^[1] There are numerous other synonyms and product names for arsenic; see HSDB.

CAREX Emissions Mapping Project

Mapping Sources and Concentrations of Known and Suspected Carcinogens

[Home](#)

[Ranks By Toxicity](#)

[Pesticides](#)

[More Google Earth Files](#)

[Resources and Tutorials](#)

[Am I Exposed?](#)

[About Us](#)

This page contains direct links to the summary tables that are also available through our Google Earth ranking files. These tables represent emissions calculated from our models as well as those reported by industrial emitters aggregated to all of Canada, the provinces, and within 20 kilometers of major cities.

[Canada-wide Summary Table](#)

Provincial summary tables:

Alberta	British Columbia	Manitoba
New Brunswick	Newfoundland	Northwest Territories
Nova Scotia	Nunavut	Ontario
Prince Edward Island	Quebec	Saskatchewan
Yukon		

City summary tables:

Abbotsford	Airdrie	Armstrong
Barrie	Bathurst	Beauport
Belleville	Brampton	Brandon
Brant	Bramford	Brockville
Burlington	Burnaby	Calgary
Cambridge	Campbellton	Camrose



[Home](#)
[Ranks By Toxicity](#)
[Pesticides](#)
[More Google Earth Files](#)
[Resources and Tutorials](#)
[Am I Exposed?](#)
[About Us](#)
[Emissions and Measured Levels by Substance](#)
[Mines and Contaminated Sites](#)
[Other](#)

We have assembled a wide range of existing data from federal and provincial agencies or suspected carcinogens in outdoor air, soil, sediment, and surface water; reported levels of annual amounts added to or removed from mine tailings and waste rock. Emissions estimates from hazardous waste incinerators in 2006 are also available here.

Use these files to explore all the existing data for a specific substance or display them with the ranking files to help visualize where sources are located, or the range of measured levels and emissions in your region. It is important to read the information associated with the file in order to understand the data.

SELECT A SUBSTANCE TO DOWNLOAD FILES:

SELECT A SUBSTANCE TO DOWNLOAD FILES:

Arsenic

NATIONAL FILES

Measured Values

[National Air Pollution Surveillance \(NAPS\)](#)

Industrial Emissions

[To Air](#)

[To Water](#)

[To Land](#)

Other Sources

[Airports](#)

[Incinerators](#)

[Tailings](#)

[Wastewater](#)

PROVINCIAL FILES

Province

Sediment

Soil

Surface Water

BC



AB



SK



MB



ON



Additional Questions:

- Where are the emitters of a selected substance?
- Who is emitting, and how much?
- What about industrial emissions to water and land?
- What other sources might be emitters?
- What levels have been measured here?



COMMON EXPOSURE PATHWAYS:



Exposure occurs only when a substance is present in the air you breathe, the food, dust, and soil you eat, and the water and beverages you drink.

Pollutants released to air, land, and water may travel through different pathways before coming into contact with a person.

The physical characteristics of a substance affect how long it stays in the environment, how far it travels, and whether or not it can transfer between air, water, and soil, or be taken up by plants.

Find out which known or suspected carcinogens on the CAREX priority list are present in which exposure pathways:

Substances by exposure pathway

Find out more about some of the factors that affect exposure levels via:

Outdoor air
Indoor air
Indoor dust
Soil
(Drinking)
Foods
Absorption

TUTORIAL VIDEOS:

- ▶ [How To Read the Ranking Files](#)
- ▶ [How to Read the Pesticides Files * In Progress](#)
- ▶ [How to Add More Google Earth Files](#)
- ▶ [Google Earth Basics: Navigating](#)
- ▶ [Google Earth Basics: Searching](#)

* Exposure can occur through the skin but this pathway is rarely important in our context.

Emissions and Measured Levels by Substance Mines and Contaminated Sites Other Links

Other useful and interesting maps and Google Earth files are available from other websites. Check back regularly as we add to the list.

Canada Lands

The [Canada Lands in Google Earth](#) site is maintained by Natural Resources Canada and contains the location, administrative boundaries, and parcel data of the geopolitical Aboriginal Reserve Lands.

Commission for Environmental Cooperation

The CEC's [Taking Stock Online](#) tools allow you to explore information on pollution America. Create customized queries and download your results in a variety of form Google Earth and Google Maps.

National Pollutant Release Inventory

The [NPRI](#) is Canada's legislated and publicly accessible inventory of pollutant releases (to air, water, and land), disposals, and transfers for recycling. The website provides resources for accessing, analyzing, and interpreting information on pollutant releases and transfers in Canada.

Canadian Wind Energy Atlas

The [Atlas](#) provides wind direction information for any latitude/longitude in Canada.

MANUAL 5:



CAREX Manual of Google Earth Basics

- [System Requirements](#)
- [Navigating in Google Earth](#)
- [Searching in Google Earth](#)
- [Adding and Saving files in Google Earth](#)
- [Adding placemarks, polygons, and paths](#)



CAREX Manual of Geocoding and Creating Google Earth files [for Excel 2007] OR [for Excel 2003]

- [An Overview of Excel Basics](#)
- [Adding your own data directly to Google Earth](#)
- [Converting data in a spreadsheet to a Google Earth file](#)



Download [tools, data, and exercises](#)* to work through Geocoding Manual

* Updated Nov 202011 - Download new version now

CAREX EMISSIONS MAPPING PROJECT

ESTIMATING EMISSIONS OF KNOWN AND SUSPECTED CARCINOGENS TO OUTDOOR AIR

METHODS FOR:



Contact us to organize a training session:
info@carexcanada.ca

Prepared by:
Eleanor Jensen, PhD
Anders Erickson, PhD candidate
CAREX Canada - UNIVERSITY OF VICTORIA SITE

November 2011



Environmental Indicators: Relative toxicity and dynamic mapping

Indicator: Total toxic equivalent emissions and mapping

Strengths:

- Allows comparisons across substances
- Highlights data gaps
- Easy to visualize available data
- Users can display their own local data at the same time
- Supports hypothesis generation for environmental health studies
- Important ecosystem viewpoint – for some groups, avoidance of foods or areas is not a viable exposure reduction option

Limitations:

- Cannot make direct connection to ambient concentration and potential intake
- Counts emissions within a region, but emissions will travel across boundaries

CAREX – Environmental Exposures

Similar in Concept to:

Scorecard - the pollution information site <http://scorecard.goodguide.com/>

Developed by NGO Environmental Defense in 1998, now hosted by GoodGuide

Provides two kinds of rankings:

- Ranks based on emissions reported to the US Toxic Release Inventory (air and water)
- Risk ranks based on modeled concentrations in outdoor air (NATA)

CAREX Environmental Indicators & EMP

Provides two kinds of rankings:

- Ranks based on emissions reported to the NPRI + our own estimates of emissions from transportation, residential heating and non-reporting hazardous waste incinerators – air only
- Risk ranks based on national average levels reported for outdoor air, indoor air, dust, drinking water, food and beverages

Environmental substances: Group A

INDUSTRIAL	IARC
1,3-Butadiene	1
Acetaldehyde	2B
Benzene	1
Chloroform	2B
Dichloromethane	2B
Ethylbenzene	2B
Formaldehyde	1
Polychlorinated biphenyls (PCBs)	2A
Tetrachloroethylene (PERC)	2A

CHLORINATION BYPRODUCTS	IARC
2,4,6-Trichlorophenol	2B
Bromodichloromethane	2B
Chloroform	2B
Dichloroacetic acid	2B
MX	2B
N-nitrosoethylmethylamine	2B

POLYCYCLIC AROMATIC HYDROCARBONS	IARC
Benz[a]anthracene	2B
Benzo[a]pyrene	1
Benzo[b]fluoranthene	2B
Benzo[k]fluoranthene	2B
Chrysene	2B
Indeno[1,2,3-cd]pyrene	2B

METALS	IARC
Arsenic and arsenic compounds	1
Cadmium and cadmium compounds	1
Hexavalent chromium	1
Lead and inorganic lead compounds	2B, 2A
Nickel and nickel compounds	2B, 1

OTHER	IARC
Particulate air pollution	--
Diesel engine exhaust	2A

FIBRES and DUSTS	IARC
Asbestos	1

PESTICIDES	IARC
2,4-D	2B
Chlorothalonil	2B
Dichlorvos	2B
Lindane	2B
MCPA	2B
MCPP	2B
Pentachlorophenol	2B

RADIATION	IARC
Extremely low frequency magnetic fields	2B
Radon	1