



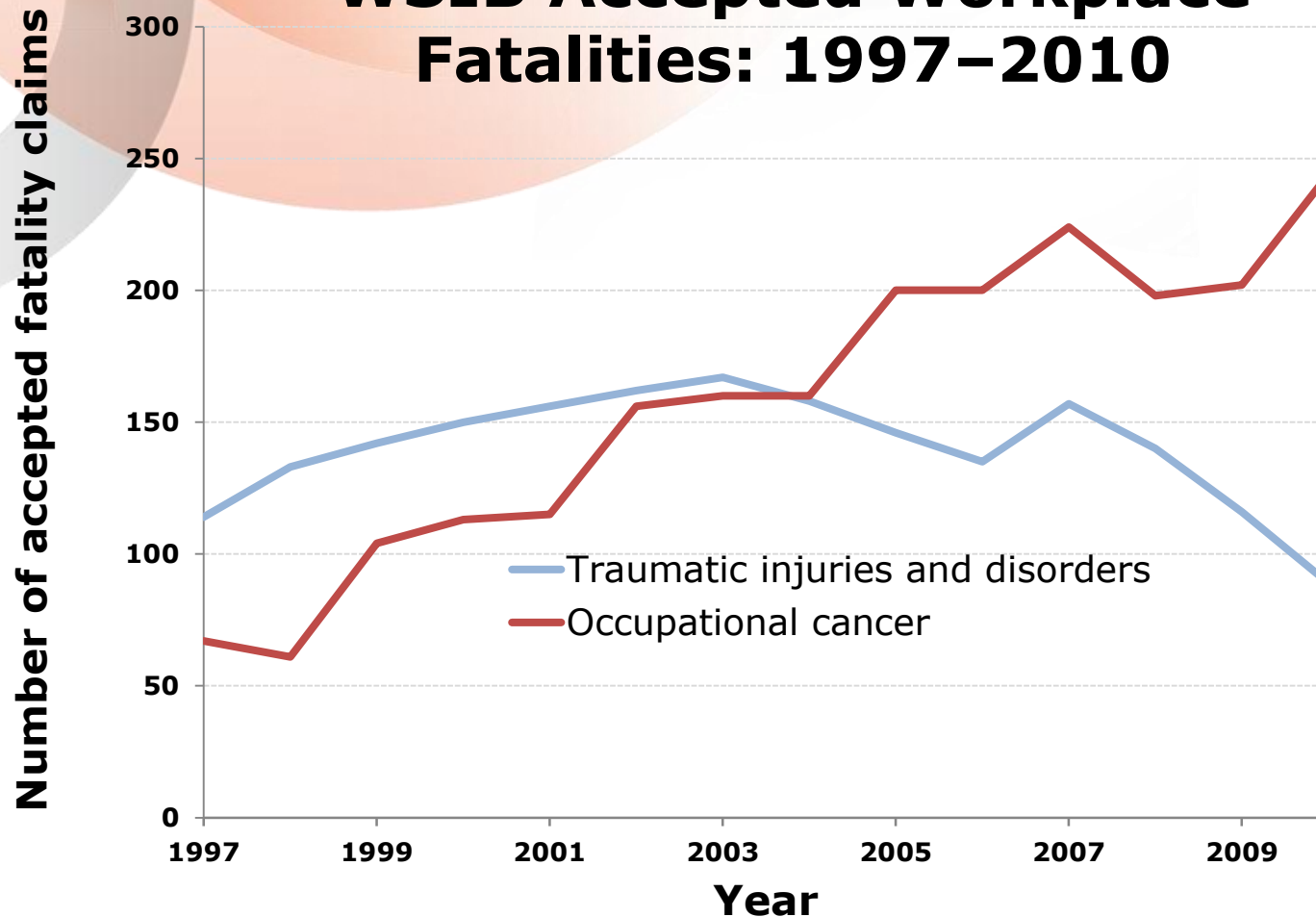
Occupational
Cancer
Research
Centre

Occupational Cancer: Current Knowledge, Gaps, and the Role of Research

Paul A. Demers, PhD

Occupational Hygiene
Association of Ontario
March 18th, 2013

WSIB Accepted Workplace Fatalities: 1997–2010

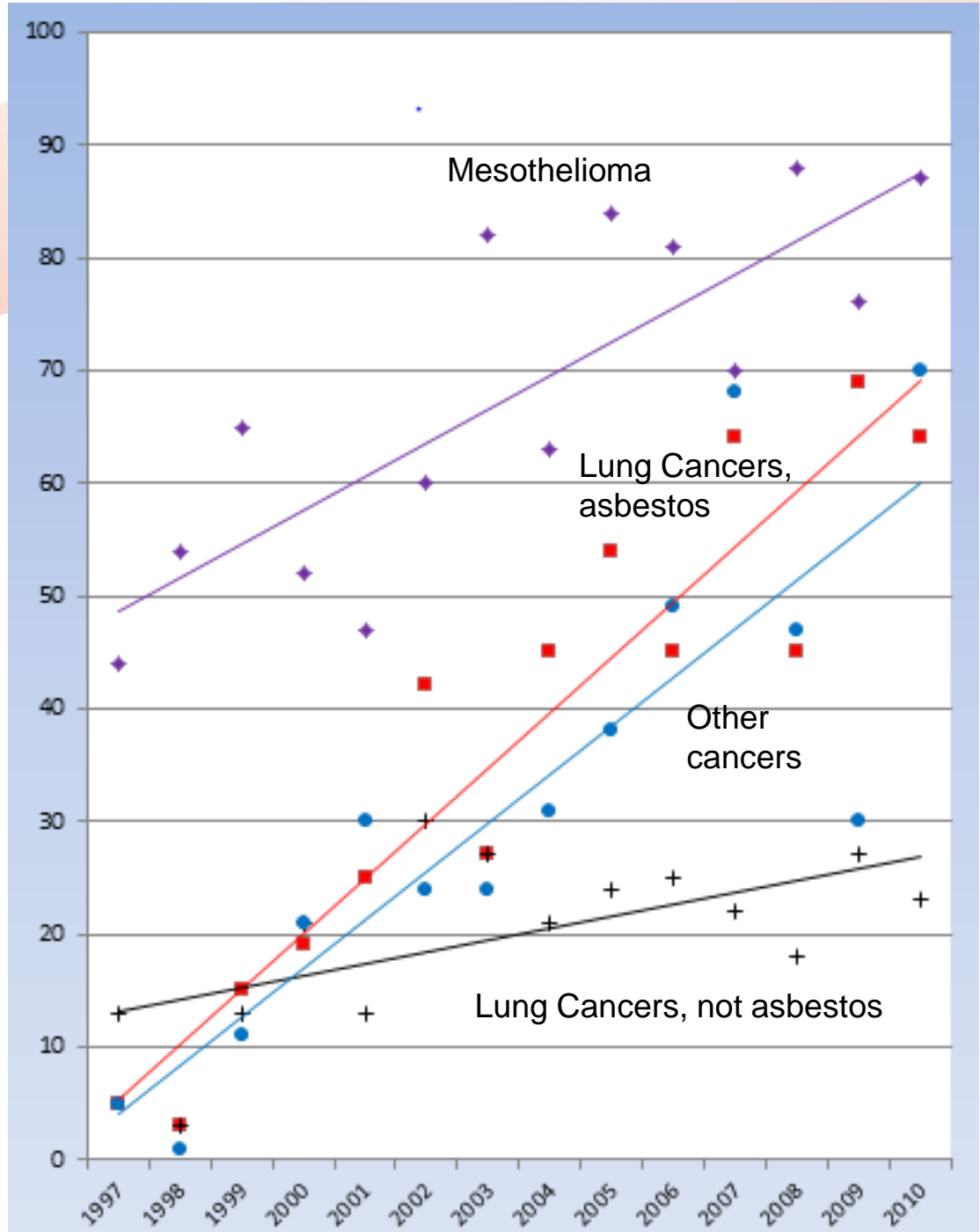


Del Bianco A, Demers PA. The Examination of Workplace Fatalities Within Ontario and Canada. Toronto: Occupational Cancer Research Centre, 2013.

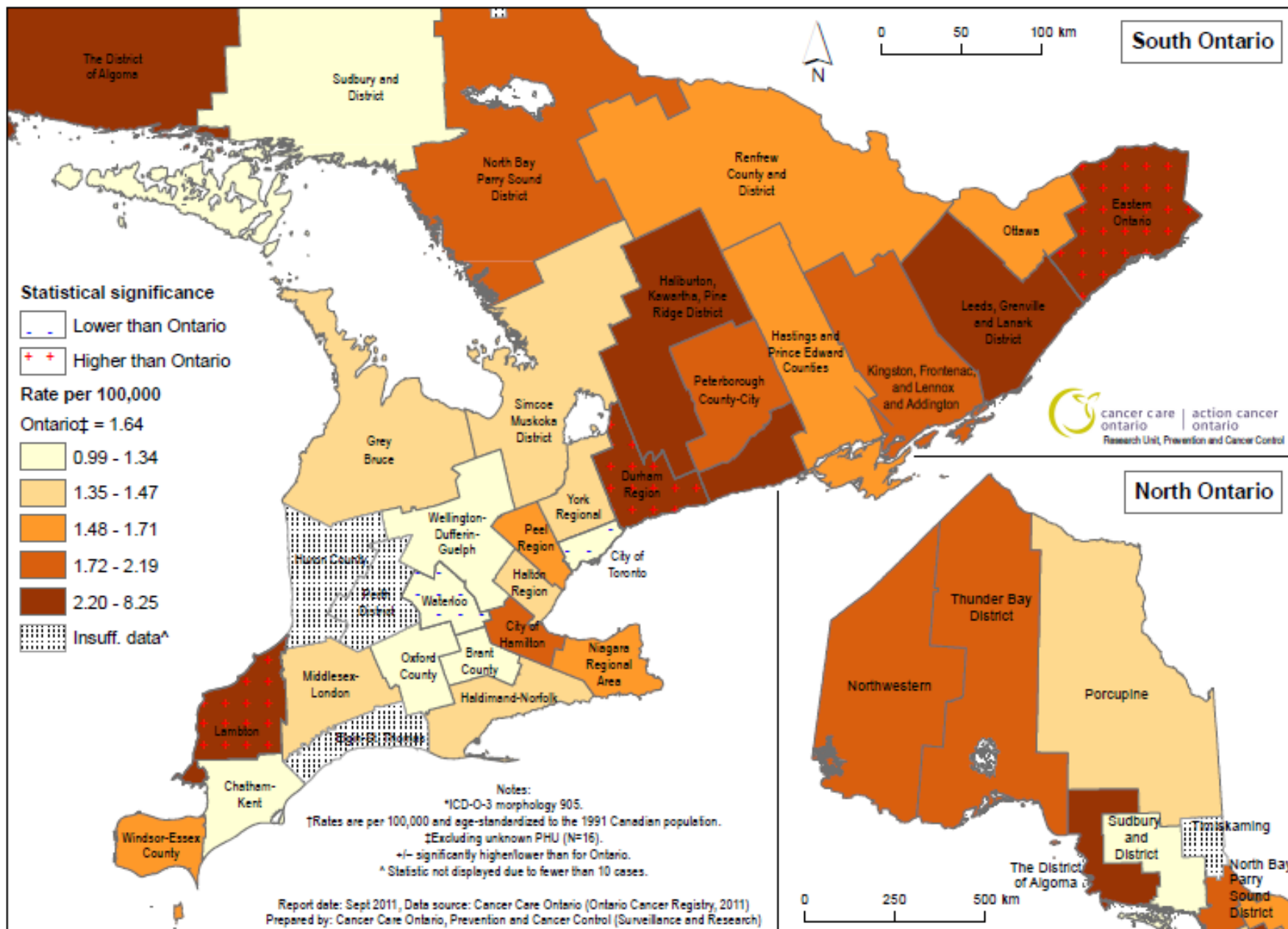
Data from Association of Workers' Compensation Boards of Canada (AWCBC) National Work Injury, Disease and Fatality Statistics 1997–2010.

Trends in Compensated Fatal Cancers in Ontario

- Del Bianco A, Demers PA. The Examination of Workplace Fatalities Within Ontario and Canada. Toronto: Occupational Cancer Research Centre, 2013.
- Data from AWCBC. National Work Injury Statistics Program, extracted March 12, 2012.



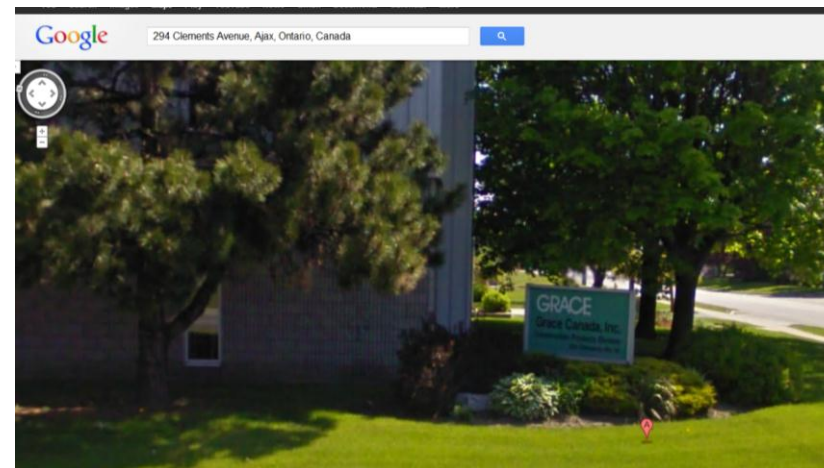
Mesothelioma* age-standardized incidence rates† by Public Health Unit, Males, 1986–2007



Asbestos Exposure Continues



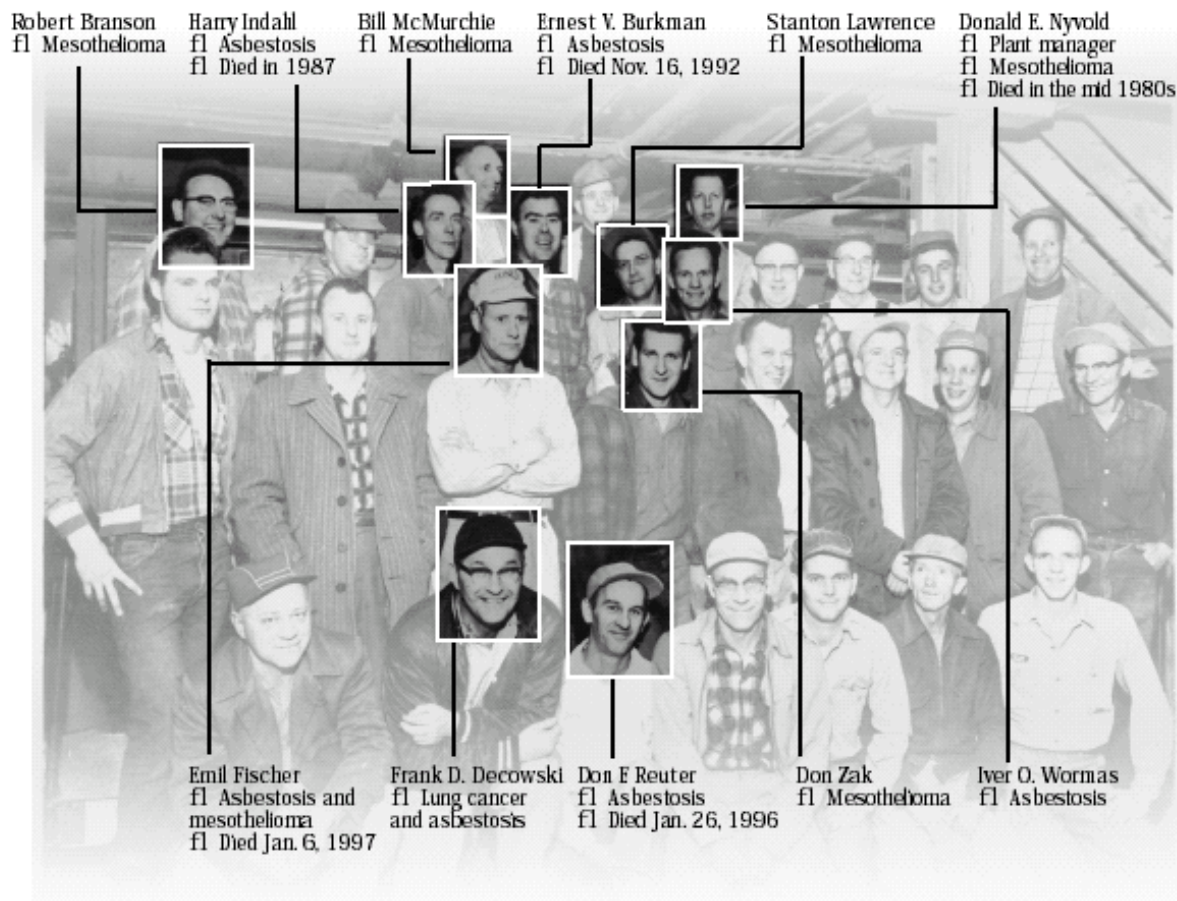
- Incidence of mesothelioma may only now be peaking in some countries
- Potential for continued exposure through contaminated buildings
- Vermiculite from Libby, Montana



Libby Vermiculite Processing Sites

A hard-hit plant

This 1964 photo of workers in W.R. Grace Co.'s former Northeast Minneapolis plant was introduced in a court case by Hastings lawyer Michael Polk. Polk and surviving family members say that asbestos-related illnesses killed or contributed substantially to the deaths of at least 11 of the 28 employees photographed.



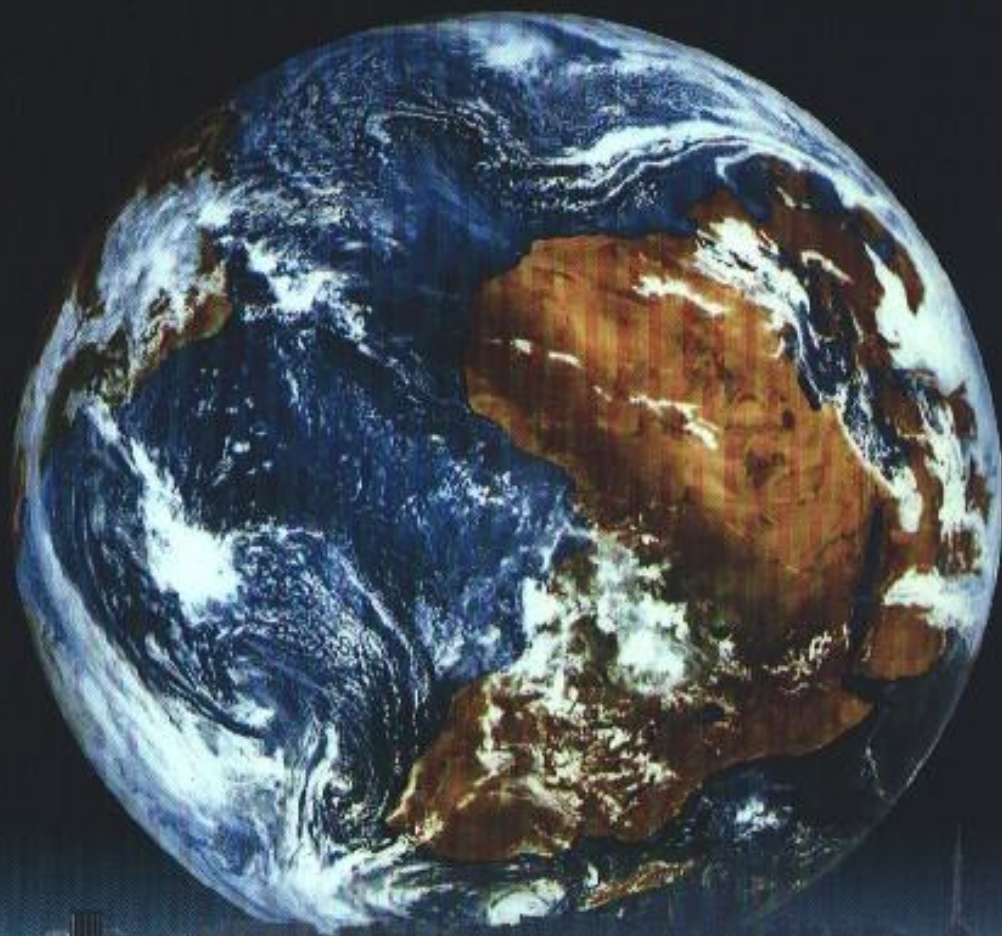
Source : Hastings law firm Sieben, Polk, LaVerdiere, Jones & Hawn; Star Tribune research Star Tribune graphic by Ray Grumney

Minneapolis Star Tribune article; Feb. 2000

**INTERNATIONAL
AGENCY FOR
RESEARCH ON
CANCER**



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IARC Monograph Evaluations

What do we Know about Occupational Carcinogens?

- ~ **60** definite or probable workplace carcinogens (IARC 1 and 2A)
- Over **100** additional workplace exposures are possible carcinogens (IARC 2B)
- Many other workplace exposures with a suspicion of human carcinogenicity
- Even greater number of workplace substances with little formal evaluation

Occupational Carcinogens (Cancer Sites):

Selected Industrial Chemicals

Benzene (leukemia, multiple myeloma, non-Hodgkin's lymphoma)

Formaldehyde (nasopharynx, leukemia, *sinonasal?*)

Trichloroethylene (kidney)

Vinyl chloride monomer (liver)

1,3-Butadiene (lympo/hemaetopoietic)

Ethylene oxide (lymphoid?, breast?)

TCDD (dioxins)(all cancers), Polychlorinated Biphenyls (PCBs)(1/2A,?), Acrylamide (2A), Epichlorohydrin (2A)



Occupational Carcinogens (Cancer Sites):

Metals and Compounds

Arsenic & compounds (lung, bladder, *kidney?*, *liver?*, *prostate?*)

Beryllium and compounds (lung)

Cadmium & compounds (lung, *prostate?*, *kidney?*)

Chromium, hexavalent (lung, *sinonasal?*)

Nickel & compounds (lung, *sinonasal*)



Occupational Carcinogens (Cancer Sites):

Dusts and Fibres

Asbestos (lung, mesothelioma, larynx, ovary, pharynx?, *colorectal?*, *stomach?*)

Erionite (mesothelioma)

Silica (lung)

Wood Dust (sinonasal, nasopharynx)

Leather Dust (sinonasal)



Occupational Carcinogens (cancer sites): Ionizing and Non-Ionizing Radiation



Radon decay products (lung)

Plutonium (lung liver, bone)

X-radiation, gamma-radiation
(lung, breast, leukemia, many
others)

Solar radiation (skin squamous
cell, basal cell, melanoma)

UV Tanning Devices (skin & eye
melanoma)

Magnetic fields (ELF)(2B)



Occupational Carcinogens (cancer sites): Combustion Products and PAH Related

Environmental Tobacco Smoke
(lung)

Polycyclic aromatic hydrocarbon
related exposures (lung, skin,
bladder)

Mineral oils (skin)

Deisel Exhaust (lung)



Estimated Burden of Occupational Cancer from Various Studies



Author and Location		Attributable Fraction (%) By Cancer Site and Gender					
		Lung	Leukemia	Bladder	Skin (NMSC)	Nasal	Total
Nurminen et al (2001) Finland	Male	29	19	14	13.1	24	14
	Female	5	2.5	0.7	3.8	6.7	2
Steenland et al (2003) United States	Male	8-19	0.8-3	6-19	1.2-6	31-43	3-7
	Female	2	0.8-3	6-19	-	-	0.8-1
Rushton et al (2010) United Kingdom	Male	21	0.9	7.1	7.1	46.0	8.2
	Female	5	0.5	1.9	1.1	20.1	2.3

Recent IARC Evaluations (2012): Diesel Engine Exhaust



- Classified as definite human carcinogen for lung cancer, suspected for other cancers
- Increases the risk of heart disease



Recent IARC Evaluations (2012): Chlorinated Solvents



- Trichloroethylene classified by IARC as definite human carcinogen for kidney cancer
- Tetrachloroethylene classified as a probably carcinogen for bladder cancer
- 1,1,1,2 & 1,1,2,2-tetrachloroethane are possible carcinogens



NIOSH/ACS/IARC Top 20 Research Priorities



Ultrafine particles

- Titanium dioxide
- Carbon black
- Diesel Engine Exhaust
- Welding fumes

Metals

- Lead & lead compounds
- Indium phosphide
- Metallic cobalt

Pesticides

- Atrazine

Shiftwork

Chlorinated solvents

- Trichloroethylene
- Perchloroethylene
- Methylene chloride
- Chloroform

Other Chemicals

- Formaldehyde
- Styrene & Styrene-7,8-Oxide
- Acetaldehyde
- Propylene Oxide
- Polychlorinated Biphenyls (PCBs)
- Di (2-ethylhexyl) phthalate (DEHP)

Ward EM, Schulte PA, Straif K, et al. Research recommendations for selected IARC-Classified Agents. Environmental Health Perspectives 2010;119:1355-62.

IARC Evaluation Priorities 2010-2014[#]



High Priorities (occupational)

Asphalt & bitumen*
Carbon-based nanoparticles
Crystalline fibres other than asbestos
Ultrafine particles
Motor vehicle exhaust emissions*
Perfluorinated compounds (e.g. PFOA)*
Radiofrequency electromagnetic fields*
Sedentary work
Stress
Iron & iron oxides
Welding

Medium priorities (occupational)

Atrazine
Metalworking fluids & lubricants
N-Nitrosamines*
Polybrominated biphenyls (PBB)**
Polybrominated diphenyl ethers (PBDE)**
Polychlorinated biphenyls (PCB)**
DEHP and other phthalates*
Styrene
Trichloroethylene & other chlorinated solvents*

[#] Report of the Advisory Group to Recommend Priorities for *IARC Monographs* during 2010–2014. IARC, Internal Report 08/001. Lyon, France, 2008

* IARC already reviewed, ** IARC review scheduled

Libby Amphibole Composition

Based on the classification criteria of Leake et al. (1997).

Winchite 85%

Richterite 10%

Tremolite 5%

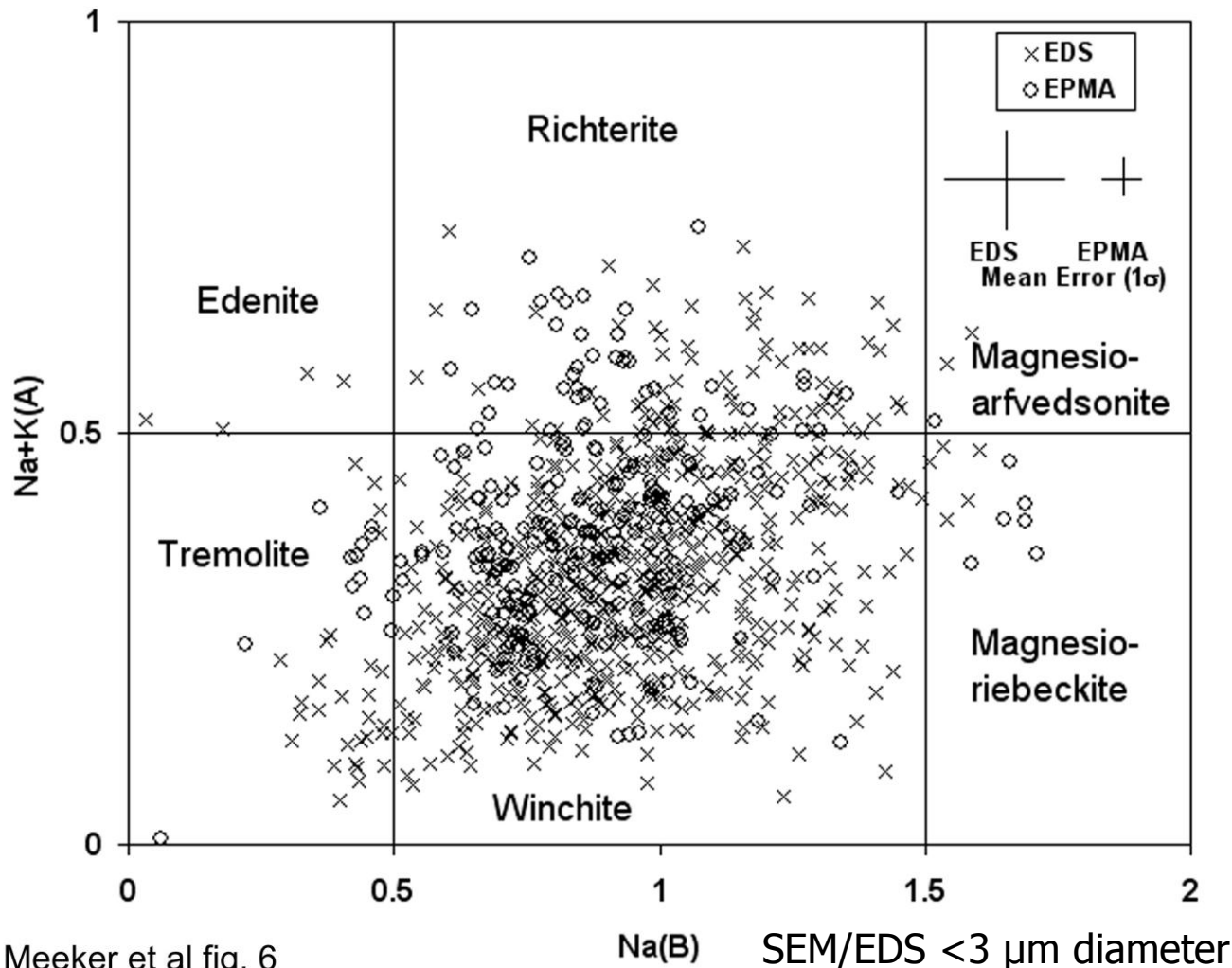


Classification Varies

Mineralogists

versus

Regulatory/Commercial



Meeker et al. (2003). The composition and morphology of amphiboles from the Rainy Creek complex, near Libby, Montana. American Mineralogist.

Carbon Nanotubes



This image of a mass of carbon nanotubes was taken using a scanning electron microscope. The bar in the bottom right corner is 1 micrometre (1,000 nanometres).

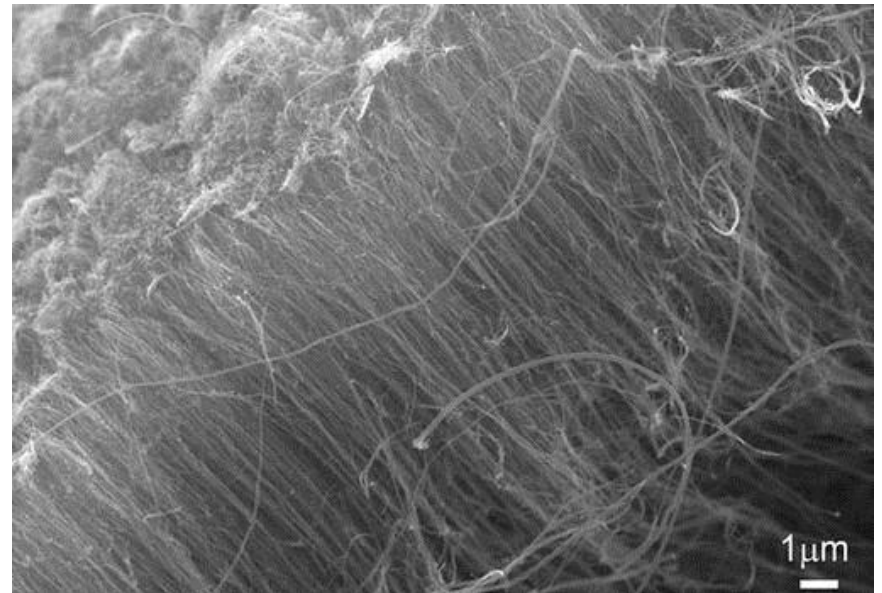


Image credit: John Spencer, 2008

Occupational Cancer Research Priorities: Sedentary work and stress



Occupational Cancer Research Priorities (suspected cancer sites): Metals

- Lead & compounds
(*stomach?*)
- Cobalt &
compounds(*lung?*)
- Titanium dioxide
(*lung?*)



Occupational Cancer Research Priorities:

Pesticides (IARC classification)

Atrazine (3)

Chlorophenoxy Herbicides
(2,4-D, MCPA, MCPP)(2B)

Chlorothalonil (2B)

Dichlorvos (2B)

Lindane (2B)

Polychlorinated phenols and
their salts (such as
pentachlorophenol)(2B)



Shift Work at Night



- Classified as probable human carcinogen in 2007
- Potentially increases the risk of breast cancer, suspected for other cancers
- Increased risk of injury, potential risk heart disease, reproductive problems, other problems



Potential shiftwork interventions

- Schedule changes (direction, length, control)
- Controlled exposure to light and dark (lighting, goggles, timing)
- Exogenous melatonin
- Stimulating, varied environment/work tasks, social interaction, and physical activity
- Sleep hygiene advice, family counseling, ...
- Naps

Workers Potentially Exposure to Antineoplastic Agents in Canada

Job Category	Exposed
Hospital Nurses	15,800
Hospital LPNs	3,300
Hospital Physicians	480
Hospital pharmacists	2,000
Other hospital pharmacy staff	2,300
Community pharmacists	14,000
Other community pharmacy staff	17,000
Veterinarians	2,200
Veterinary Technicians	1,400
Total potentially exposed	58,480



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CAREX Canada is a national surveillance project that estimates the number of Canadians exposed to substances associated with cancer in workplace and community environments. These estimates provide significant support for targeting exposure reduction strategies and cancer prevention programs.

Here are some of the latest updates on CAREX Canada:

- Recordings from a series of [CAREX presentations](#) are now available on our training page
- Announcing our new [Knowledge Translation Advisory Committee](#)
- Read the winter issue of our [e-Bulletin newsletter](#), featuring updates to our the exposure levels estimates on our website, an announcement about the upcoming eWORK tool, and more
- OCRC launches [new occupational burden of disease study](#), applies CAREX data

[View Profiles & Estimates](#) ▶



Potentially Exposed Workers in Ontario

Common Workplace Carcinogen	Exposed
Solar radiation	449,000
Diesel engine exhaust	275,000
Benzene	147,000
Silica (crystalline)	143,000
Other combustion products (PAHs)	103,000
Wood dust	93,000
UV radiation (artificial sources)	73,000
Ionizing radiation	69,000
Formaldehyde	64,000
Asbestos	52,000
Chromium (VI) compounds	42,000
Antineoplastic Drugs	21,000
Nickel compounds	18,000

Industry sectors with potential over-exposure to carcinogens in Quebec: 2001-2005



<u>Substance (IARC Category)</u>	<u>Industries</u>
PAHs (2A/2B)	70
Crystalline silica (1)	27
Wood Dust (1)	25
Beryllium (1)	12
Styrene (2B)	11
Methylene chloride (2B)	11
Lead (2B)	9
Nickel (1)	7
Cobalt (2B)	4
Asbestos (1)	4

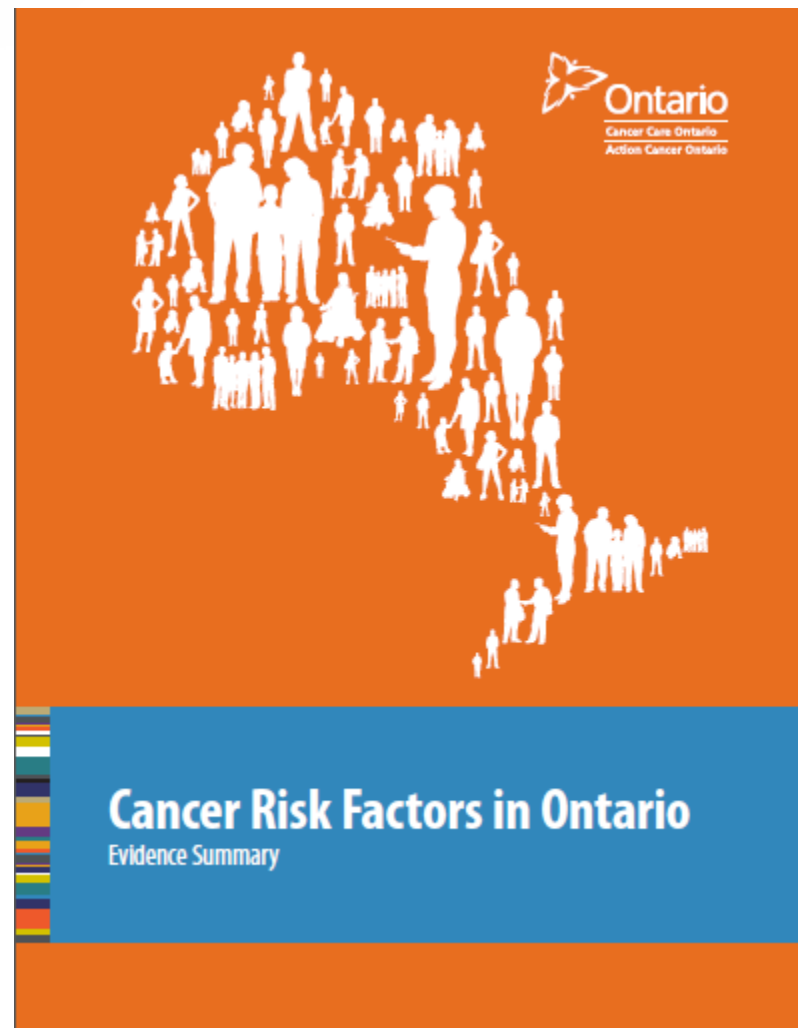
* Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) Rapport R-485, 2007

**For additional information
please visit:**

<http://occupationalcancer.ca>

<http://www.carexcanada.ca>

<http://monographs.iarc.fr/>



Towards a cancer free workplace

<http://occupationalcancer.ca>