Occupational Cancer Research Centre

Occupational Cancer Research: Current State of Knowledge and Data Gaps

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Scrotal Cancer among Chimney Sweeps

- Percival Pott (1775) linked scrotal cancer in chimney sweeps to the nature of their work and their exposure to cancer causing agents in soot
- He was the first to identify an occupational carcinogen
- Finally in 1840's laws were passed prohibiting young boys from performing the work

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

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

Occupational Carcinogens (Cancer Sites): Industrial Chemicals

Aromatic amines (bladder)
TCDD (dioxins)(all cancers)
Benzene (leukemia, multiple myeloma, non-Hodgkin's lymphoma)
Formaldehyde (nasopharynx, leukemia, *sinonasal?*)
Vinyl chloride monomer (liver)
1,3-Butadiene (lymphatic/hemaetopoietic)
Ethylene oxide (lymphoid?, breast?)

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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)

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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)

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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)

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

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

Mineral oils (skin)

Environmental Tobacco Smoke (lung)

Deisel Exhaust (*lung?)*

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Research Program Priority Areas from the OCRC Strategic Plan

- Surveillance of occupational cancers & workplace exposures
- Identification of causes of cancer in the workplace
- Intervention research to develop and evaluate prevention and exposure reduction strategies

Recent Reports Relevant to Setting Priorities

- Report of the Advisory Group to Recommend Priorities for *IARC Monographs* during 2010–2014. IARC, Internal Report 08/001. Lyon, France, 2008
- Ward EM, Schulte PA, Straif K, et al. Research Recommendations for Selected IARC-Classified Agents. Environmental Health Perspectives 2010:119(10):1355-62.
- Presidents Cancer Panel. Reducing environmental cancer risks. U.S. National Cancer Institute, April 2010.

All reports are available at: http://occupationalcancer.ca/topics/information-resources/reports/

IARC Evaluation Priorities 2010-2014

High Priorities (occupational)	Medium priorities (occupational)
Asphalt & bitumen*	Atrazine
Carbon-based nanoparticles	Metalworking fluids & lubricants
Crystalline fibres other than asbestos	N-Nitrosamines*
Ultrafine particles	Polybrominated biphenyls (PBB)**
Motor vehicle exhaust emissions**	Polybrominated diphenyl ethers (PBDE)**
Perfluorinated compounds (e.g. PFOA)*	Polychlorinated biphenyls (PCB)**
Radiofrequency electromagnetic fields*	DEHP and other phthalates*
Sedentary work	Styrene
Stress	Trichloroethylene & other chlorinated solvents**
Iron & iron oxides	
Welding	

* IARC already reviewed, ** IARC review scheduled

ACS/NIOSH/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)

Occupational Cancer Research Priorities: Chlorinated Solvents

Tetrachloroethylene

Trichloroethylene

Dichloromethane

Chloroform

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Occupational Cancer Research Priorities (suspected cancer sites): Metals

Lead & compounds (*stomach?*)

Cobalt & compounds(*lung?*)

Titanium dioxide (*lung?*)

Welding (*lung?*)

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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: Shiftwork, sedentary work, and stress

Libby Amphibole Composition

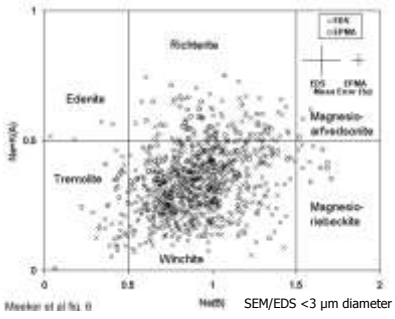
Winchite 85%

Richterite 10%

Tremolite 5%

Classification Varies Mineralogists versus Regulatory/Commercial

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



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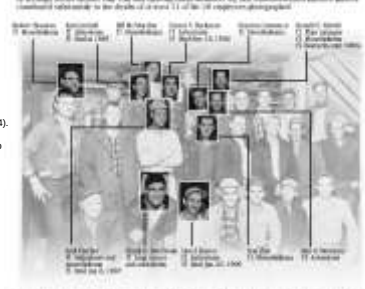
Meeker et al. (2003). The composition and morphology of amphiboles from the Rainy Creek complex, near Libby, Montana. American Mineralogist.

Libby Vermiculite Processing Sites

A hard-hit plant



Srebro SH, Roggli VL (1994). Asbestos-related disease associated with exposure to asbestiform tremolite. Am J Ind Med.

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Minneapolis Star Tribune article; Feb. 2000

Occupational Cancer Research Priorities: Pesticides

- Atrazine
- Chlorophenoxy Herbicides (2,4-D, MCPA, MCPP)
- Chlorothalonil
- Dichlorvos
- Lindane
- Polychlorinated phenols and their salts

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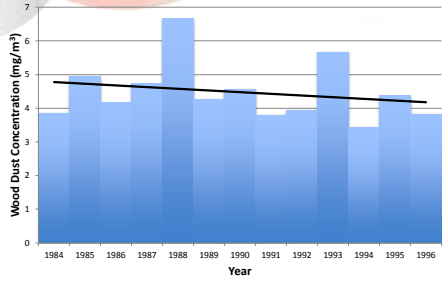
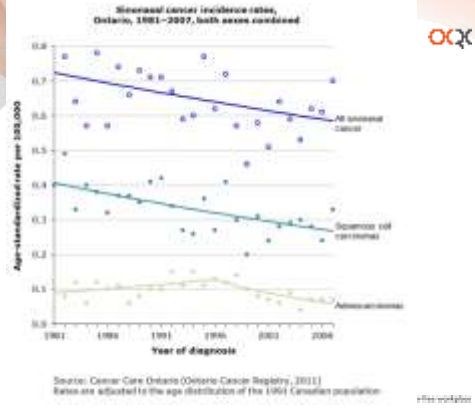
Mean Concentration by Sampling Year





Potentially Exposed Workers: Initial Estimates

Known or suspected carcinogen (IARC)	Canada
Shift work with circadian disruption (2A)	2,080,000
Solar radiation (1)	1,476,000
Diesel engine exhaust (2A)	804,000
Silica (crystalline) (1)	380,000
Other PAHs (2A/2B)	307,000
Benzene (1)	375,000
Wood dust (1)	340,000
Lead (2A)	202,000
Ionizing radiation (1)	154,000
Asbestos (1)	152,000
Formaldehyde (1)	152,000
UV radiation (artificial sources)(1)	207,000
Chromium (VI) compounds (1)	112,000
Antineoplastic Agents (1)	58,500

OCRC Cancer Research Challenges

- Access to workplaces and records
- Privacy regulations and ability to contact patients or access health records
- Lack of occupational cancer surveillance to identify new groups at increased risk and identify new potential carcinogens
- Funding

Towards a cancer free workplace

http://occupationalcancer.ca