Impact of Exposure to Carcinogens in Mining

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What is the OCRC?

An applied research centre established to generate new knowledge to help prevent occupational cancer

• Created in 2009 and is currently funded by:
  • Ontario Ministry of Labour
  • Canadian Cancer Society
  • Cancer Care Ontario
What is Burden of Cancer?

“burden of cancer” is used to refer to the human impact & the economic costs associated with a specific cause of cancer.

- It can be measured in terms of:
  - Attributable fraction (the proportion of all cancer cases or deaths caused)
  - Number of cancer cases or deaths
  - Quality of life and years of life lost
  - Economic costs
Assessing the Burden of Occupational Cancer in Canada

This project is funded by Canadian Cancer Society Research Institute Multi-Sector Team Grant #701285
IARC Monograph Evaluations
CAREX Canada

Established in 2007 for surveillance of occupational and environmental carcinogens

Based at:
1. Faculty of Health Sciences, Simon Fraser University
2. School of Population and Public Health, University of British Columbia
2. Occupational Cancer Research Centre, Cancer Care Ontario

www.carexcanada.ca
Burden of Occupational Cancer

Cancers that occur now are from exposures long ago

At Risk of Cancer


Towards a cancer-free workplace
Carcinogens in Canadian Mining

- Diesel Engine Exhaust
- Crystalline Silica Dust
- Radon Gas
- Asbestos
- Nickel compounds
- Chromium (VI) compounds
- Arsenic and inorganic arsenic compounds
Diesel Engine Exhaust and Lung Cancer

• In 2012 Diesel Engine Exhaust (DEE) was upgraded to human carcinogen based on lung cancer (with limited evidence for bladder cancer)
• There are an estimated 220 new cases of lung cancer diagnosed annually in Canada (70 in Ontario) due to DEE
• DEE also irritates the eyes, throat and lungs
• CAREX estimates there are 61,000 miners exposed to DEE, 14,000 at high levels
Crystalline Silica and Lung Cancer

• There are an estimated 80 new cases of lung cancer diagnosed annually in Canada (25 in Ontario) due to crystalline silica

• Crystalline silica also causes silicosis and other lung disease, as well as rheumatoid arthritis

• CAREX estimates there are 21,000 miners exposed to crystalline silica, 2,500 at high levels
Radon and Lung Cancer

- There are an estimated 20 new cases of lung cancer diagnosed annually in Canada (5 in Ontario) due to radon
- CAREX estimates there are 11,000 miners exposed to radon in Canada
- Approximately 30,000 Ontario miners employed 1954-1996

Nickel and nickel compounds

- There are an estimated 15 new cases of lung cancer diagnosed annually in Canada (5 in Ontario) due to nickel in mining.
- CAREX Canada estimates that there are 2,700 people in the mining industry exposed to nickel in Canada.
Asbestos and Lung Cancer

- There are an estimated 55 new cases of lung cancer diagnosed annually in Canada due to asbestos in mines.
- It also causes many other cancers and asbestosis.
- There is no more mining in Canada and Ontario’s asbestos mines closed in the late 1970’s.

Northern Ontario asbestos mine 'worst yet' with workers covered in fibre, Lewis says

By JOAN HOLLOBON

Asbestos workers in a mine-mill operation at Matachewan, about 40 miles southeast of Timmins, were seen last fall with their coveralls and faces totally coated with asbestos fibre. The mine was then producing about 4,000 tons of asbestos a day.

Mr. Rajah’s report also noted that “the poor working conditions created by these spillages cannot be overemphasized by the slightest vibration created by the workers.”

The engineer said that workers in the areas showing high asbestos fibre counts were not wearing respirators. “According to Mr. (D. C.) Lewis said a check this week shows conditions have not changed since the findings made last September, five months ago. He said that statistics developed by Dr. Irving Selikoff of New York, an

Towards a cancer-free workplace
Occupational Disease Surveillance System (ODSS)

**Objective:** To detect and monitor trends in work-related diseases

- **Physician Billing Date 1991-**
- **Ontario Cancer Registry 1964-**
- **Hospital Discharge Data 2006-**
- **WSIB Claims Data 1986-2.2 M people**
- **Ambulatory Care 2006-**

This project Funded by:
- Public Health Agency of Canada
- Ontario Ministry of Labour
Risk of Lung Cancer in Ontario Mines (ODSS initial results)

Statistical significance: * P<0.05, ** p<0.01, *** p<0.001
Risk of Lung Cancer among Men in Ontario Mines (ODSS results)

Statistical significance: * P<0.05, ** p<0.01, *** p<0.001
CONTROLLING DIESEL PARTICULATE MATTER IN UNDERGROUND MINES

**Hierarch of Controls**

- **Elimination**: Physically remove the hazard
- **Substitution**: Replace the hazard
- **Engineering Controls**: Isolate people from the hazard
- **Administrative Controls**: Change the way people work
- **PPE**: Protect the worker with Personal Protective Equipment

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**Preventive Maintenance**

- **Maintenance**: Keeps all parts of the engine, as well as any emissions control systems, functioning optimally. Poorly maintained engines can produce significantly more emissions than an engine in good condition.
- **Idling Policies**: Idling increases both emissions and engine wear. Idling policies limit the amount of time an engine can be idled.

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**Idling Technology**

- **Idling Technology Works by Automatically Turning Off the Engine When the Vehicle Idles**: The emissions reductions will be greater for equipment that spends a high proportion of time idling.

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**Hierarchical Categories**

- **More Effective**
  - Elimination
  - Substitution
  - Engineering Controls
  - Administrative Controls
  - PPE

- **Less Effective**
  - Respirators
  - Scheduling and site planning
  - Monitoring emissions

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**Proactive Controls**

- **Reduce or Eliminate Diesel Particulate Emissions Before They Enter the Workplace Air**
- **Replacing or Repowering Old Equipment**
- **Aftertreatment Systems**: A variety of different aftertreatment systems are available. Emissions reductions depend on the type of filter chosen, as well as the engine and load. Particulate reductions can range from 20-95%.
- **Idling Technology**: Idling technology works by automatically turning off the engine when the vehicle idles. The emissions reductions will be greater for equipment that spends a high proportion of time idling.
- **Idling Policies**: Idling increases both emissions and engine wear. Idling policies limit the amount of time an engine can be idled.

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**Reactive Controls**

- **REACTIVE CONTROLS**: Remove diesel particulate emissions from the workplace air or reduce the likelihood that workers will inhale particulate emissions.
- **General Ventilation**: General ventilation dilutes emissions by bringing clean air into the area. The reductions vary depending on the volume of air provided. It also helps reduce ambient air concentration of non-diesel hazards, as well as helping with temperature control.
- **Enclosed Cabs**: When properly functioning, enclosed cabs protect the operator, but do not protect the surrounding workers.
- **Tele-operating**: Tele-operation allows the operator to be in a safe location, such as a filtered control room on the surface. Reductions in exposure can be up to 100% if the operator is completely removed from the site. Other workers may still be exposed if they enter the work area, or if emissions circulate to other areas of the mine.
- **Monitoring Emissions**: An emissions monitoring program is critical for ensuring that diesel controls are functioning properly.

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**Average Reductions**

- **Average particulate matter exposure reductions based on published data**
  - Less than 50%
  - 50.85%
  - 85.99%
  - 100%
  - Varied/Unknown: ?

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**Towards a Cancer-Free Workplace**

Occupational Cancer Research Centres
Lung Cancer in Mining: Conclusions

• The human and economic costs due to past exposure to carcinogens in mining are enormous
  – Approximately 400 new cases of lung cancers are diagnosed each year from past exposure
  – The economic costs are approximately $790,000 per case (approximately 20% direct health care or indirect productivity or related costs, and 80% health-related quality of life lost)

• These cancers are preventable
  – Exposure to carcinogens is lower now than in the past, but can be lowered much more
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Towards a cancer free workplace

http://occupationalcancer.ca