Select Occupational Diseases in the Mining, Forestry and Paper Environments: A Rapid Review

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Notes

• This presentation has been prepared to assist workplace parties in understanding their obligations under the Occupational Health and Safety Act (OHSA) and the regulations. This presentation does not constitute legal advice. To determine your rights and responsibilities under OHSA, please contact your legal counsel or refer to the legislation.
Objectives

- Recent history of occupational illness in Ontario mines
- Understand what occupational illness is
- Review prevention of occupational illness
- Overview of occupational lung diseases in the mining environment
- Overview of occupational diseases in Forestry, Pulp and Paper
- Resources
Royal Commission on the Health and Safety of Workers in Mines (Report submitted 1976)

• The “Ham Commission”
• Highlighted health and safety in the mining industry
• Developed the concept of the internal responsibility system
• Clear focus on occupational disease prevention (in addition to injuries)
  • Silica exposure and silicosis
  • Dust exposure and chronic obstructive lung disease
  • Ionizing radiation exposure and lung cancer and in uranium mines
  • Noise exposure and noise-induced hearing loss
  • Chemical exposures and contact dermatitis
  • Exposure to other chemicals, for example:
    • Carbon monoxide, solvents, nickel carbonyl, sulfur dioxide, diesel fumes
  • Consider both acute effects and effect of chronic exposure to toxic substances
What is an occupational disease?

Definition (Occupational Health and Safety Act)

1. “occupational illness” means a condition that results from exposure in a workplace to a physical, chemical or biological agent to the extent that the normal physiological mechanisms are affected and the health of the worker is impaired thereby and includes an occupational disease for which a worker is entitled to benefits under the Workplace Safety and Insurance Act, 1997

2. Work-related illnesses are those caused by physical, chemical, or biological hazards in the workplace. They can also include acute psychological trauma resulting from work.
Preventing Occupational Illnesses

- **Primary prevention** – preventing development of disease/illness by taking measures to avoid/control exposures

- **Secondary prevention** - early detection, intervention and treatment of an existing disease to prevent permanent impairment or reverse disease process e.g. medical surveillance

- **Tertiary prevention** – involves medical management of established disease to minimize impairment by restoring function and reducing disease-related complications
Primary Prevention of Occupational Illness

Elements include:

- Anticipation
- Hazard Recognition
- Hazard Control - Hierarchy of exposure controls
- Education
- Regulation
Hierarchy of Exposure Controls

- Engineering techniques
  - Design
  - Elimination / Substitution
  - Isolation / Confinement
  - Ventilation

- Administrative measures
  - Information / Training
  - Work procedures
  - Cleaning and equipment
  - Personal hygiene
  - Work periods

- Personal protective equipment
  - Respiratory protection
  - Skin and eye protection, etc.

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Reporting of Occupational Illnesses

- Employer’s responsibilities in Subsection 52(2) of the Occupational Health and Safety Act:
  - “If an employer is advised by or on behalf of a worker that the worker has an occupational illness or that a claim in respect of an occupational illness has been filed with the Workplace Safety and Insurance Board by or on behalf of the worker, the employer shall give notice in writing, within four days of being so advised, to a Director, to the committee or a health and safety representative and to the trade union, if any, containing such information and particulars as are prescribed.”

- 52(2) applies with all necessary modifications if an employer is advised by or on behalf of a former worker that the worker has or had an occupational illness or …claim… (OHSA subsection 52(3))

- the prescribed information to include in the report may be found in the sector regulation applying to that workplace
Health Hazards of Mining, Forestry and Paper

- **Airborne (Chemical) Hazards:**
  - Particulates, dusts, naturally occurring gases, engine exhaust, chemical vapours

- **Physical Hazards:**
  - Noise, vibration, heat and cold, humidity, air pressure changes, ionizing radiation, EMF
  - Trauma

- **Biological Hazards:**
  - Bacteria, viruses, parasites, fungi, plants
    - e.g. Tuberculosis, hepatitis, moulds, wood dust, Legionella
Airborne Particulates in the Mine Environment

- Free crystalline silica is the most abundant compound in the earth’s crust
- **Mainly Quartz**, plus tridymite, cristobalite
- Respirable particles formed when rock is drilled, blasted, crushed or pulverized
- Dispersed by wind, vehicle traffic, earth-moving machinery
- Rock may contain 30% silica or more
Silica – Where Used or Found

- Mining, quarrying, tunnelling, and in foundries
- Fabrication of stone and clay products, manufacture of glass, enamels, ceramic products and glazes
- Abrasive and grinding media (sandblasting, polishing, grinding and scouring)
- Construction materials
- Fillers and extenders in paints and coatings, plastics, and rubbers
- Found in overburden of surface mine or ceiling, floor or ore deposit of an underground mine
- Respirable silica commonly produced by drilling, blasting and cutting
- Designated Substance Regulation
Silica-related Diseases

- Silicosis
- Tuberculosis
- Lung cancer
- Connective tissue and kidney diseases
- Emphysema and chronic bronchitis
Silicosis

- Scarring disease of lung from inhalation of free crystalline silica
- Chronic silicosis may be simple or complicated
- **Chronic simple silicosis** may cause no symptoms, may slowly progress/start after exposure ends (usually after > 10 years exposure);
  - Consists of small round X-ray opacities
  - Diagnosed on screening or incidental X-ray
- **Chronic complicated silicosis**: progressively worsening symptoms and enlarging lung opacities, even after exposure ends.
  - Occurs in a minority of cases of chronic silicosis
- **Subacute silicosis** develops after 3-6 years of high exposure, and resembles chronic complicated silicosis
- **Acute silicosis** develops within a couple years of massive intense exposure to fine dust; clinically distinct from the other forms; rare
Symptoms of Silicosis

- **Chronic Simple Silicosis** (10 – 12 years exposure)
  - No symptoms; X-ray changes only

- **Chronic Complicated** (>20 yrs) and subacute (2 to 5 years heavy exposure)
  - Chest tightness, cough
  - Shortness of breath
  - Expectoration
  - Signs and symptoms of right heart failure

- **Acute silicosis** (several months intense exposure)
  - Dry cough
  - Fever
  - Severe dyspnea
  - May be fatal
Tests for Silicosis

- Pulmonary function tests (screening & diagnosis)
  - Normal in simple silicosis
- Chest X-ray (screening & diagnosis)
  - Egg shell calcification in lung lymph nodes
  - Small round opacities, initially in upper lobes
- Blood tests for oxygen capacity (diagnostic)
- TB skin test (yearly if silicosis)
- Bronchoscopy, lung biopsy (for difficult to diagnose cases)
Treatment of Silicosis

- No cure for silicosis
  - Prevention is key
- No specific treatment
- Smoking cessation
- Supplemental oxygen
- Treat infections, TB
- Breathing exercises
- May be fatal, from right heart failure
Chest X-rays

Normal

Silicosis
Silica and Lung Cancer

- Association between silicosis and lung cancer
- Risk increases with smoking and exposure to other carcinogens such as diesel emissions and radon
Silica and connective tissue and kidney diseases

- Silica exposure associated with scleroderma, rheumatoid arthritis and kidney disease
  - Prevalence of these connective tissue diseases is increased in exposed miners
Emphysema and chronic bronchitis

- Long-term silica exposure increases the risk for developing emphysema and chronic bronchitis
- Risk increases with smoking
- Work in a dusty environment can cause chronic bronchitis and chronic obstructive pulmonary disease
Asbestos – Health Effects

- Asbestos is a fibrous mineral with thermal resistance, tensile strength and acoustic insulation properties.
- Associated with cancers (lung cancer and mesothelioma) and non-cancerous disease (asbestosis, benign pleural effusions, pleural plaques).
- Occupational exposure to asbestos in Ontario occurs primarily on construction projects and in building and repair operations.
Asbestos CXR
Other particulates

- Diesel engine exhaust
  - Mixture of gases, vapours and particulate
  - CO, nitrogen oxide, SO2, VOCs (formaldehyde, etc.), PAHs
  - Particulate < 1 um diameter & respirable
  - Eye, nose, throat and chest irritation
  - Headache and nausea
  - Lung cancer - recently revised to IARC Group 1
  - Controls: low sulfur diesel fuel, engine maintenance, ventilation
Metals and other chemicals

- Arsenic:
  - Metal ore contaminant
  - Commercially extracted during copper smelting
  - Nerve damage in arms and legs: weakness; “pins and needles” sensation
  - Increased skin pigmentation and thickening; anemia
  - Group 1 carcinogen
  - Lung cancer
Gases and Vapours

- **Methane**: simple asphyxiant, explosive

- **Hydrogen sulfide**: eye, nose, throat irritation; acute respiratory depression, rapid loss of consciousness and death

- **Radon gas** (uranium mines)
  - Source of ionizing radiation
  - Association with lung cancer (second most common cause of lung cancer)
Malignant Disease

- Lung Cancer associated in mining with:
  - Arsenic
  - Ionizing radiation (radon gas)
  - Silica/ silicosis
  - Diesel exhaust fumes
  - Asbestos
  - Chromium
  - Nickel

- Mesothelioma

- Asbestos may be associated with other cancers
Acute Lung and Airway Inhalational Injury

- Can be due to:
  - Fires underground leading to direct thermal injury
  - CO poisoning
  - Cadmium fumes
  - Nitrous fumes (nitrogen dioxide) released after use of explosives, from welding and from diesel engines
Forestry, Pulp and Paper - Cancer Risk

- Established carcinogens – Asbestos, solar radiation/sunlight, arsenic, diesel emissions/diesel engine exhaust, formaldehyde (leukemia and nasopharyngeal cancer)
- Acid mists – larynx (sufficient evidence); lung (limited evidence)
- Wood dust – sinonasal adenocarcinoma; nasopharyngeal cancer
  - Oaks, mahogany, beech
- Volatile organochlorines - Possible carcinogens
  - Association with various cancers not well established
- Fine particulate matter less than 2.5 microns
  - Not confirmed
- Source: Cancer Care Ontario: Cancer Risk Factors in Ontario
Fine particulate matter < 2.5 microns

- Particulate matter is characterized according to size - mainly because of the different health effects associated with particles of different diameters.
- Fine particulate matter is particulate matter that is 2.5 microns in diameter and less. It is also known as PM$_{2.5}$ or respirable particles because it penetrates the respiratory system further than larger particles.
- Approximately 34 per cent and 24 per cent of PM$_{2.5}$ emitted in Ontario in 2006 came from residential and transportation sectors. Lesser sources of PM$_{2.5}$ include smelters/primary metals (12%), and pulp and paper (3%). [Source: MOE Air Quality Ontario]
Fine particulate matter < 2.5 microns (continued 2)

- The greatest effect on health is from particles 2.5 microns or less in diameter. Exposure to fine particulate matter has been associated with hospital admissions and several serious health effects, including premature death. People with asthma, cardiovascular or lung disease, are considered to be the most sensitive to the effects of fine particulate matter. Adverse health effects have been associated with exposure to PM$_{2.5}$ over both short periods (such as a day) and longer periods (a year or more).
- Possible association with lung cancer; not yet evaluated by IARC
Fine particulate matter < 2.5 microns (continued 3)

- Fine particles can be emitted directly from a variety of sources, including vehicles, smokestacks and fires. They also form when gases emitted by power plants, industrial processes, and gasoline and diesel engines react in the atmosphere.
- Sources of inhalable coarse particles, which have diameters between 2.5 and 10 micrometers, include road dust that is kicked up by traffic, some agricultural operations, construction and demolition operations, industrial processes and biomass burning.
Forestry, Pulp and Paper - Biological hazards

- Molds
- Ticks and Lyme Disease
  - Lyme borreliosis
- West Nile Virus
- Tuberculosis
- Hepatitis
- Norovirus
- Hazardous plants – poison ivy, poison sumac, wild parsnip
- Wild animals
- Wasp and Bee stings
Forestry – Lung Diseases

- Lumberjacks
  - Wood dust, terpenes, exhausts – irritant symptoms, impaired lung function, asthma

- Sawmill workers
  - Wood dust, terpenes, formaldehyde, isocyanates, acrylates - impaired lung function, irritant symptoms, asthma
    - Asthma: western red cedar, eastern white cedar, ash, cedar of Lebanon, birch
  - Mold - allergic alveolitis (hypersensitivity pneumonitis)
    - Maple bark disease from moldy male bark - Cryptostroma corticale
    - Alternaria in saw mills
    - Moldy wood chips
  - Carbide, cobalt – hard metal lung disease

- Cabinet makers
  - Wood dust – sinonasal cancers

- Chronic bronchitis, COPD (chronic airways diseases)
  - Wood dust, volatile chemicals
Pulp and Paper – Lung diseases

- Process operators
  - Sulfate mills: reduced sulfur compounds – asphyxia
  - Sulfite mills: sulfur dioxide – asthma, chronic bronchitis
- Bleachery workers
  - Chlorine dioxide, ozone, peracetic acid – asthma
- Paper-machine workers
  - Paper dust, kaolin, talc – rhinitis, chronic bronchitis, lung fibrosis (pneumoconiosis)
- Maintenance workers
  - Asbestos – malignant mesothelioma, lung cancer
  - Reduced sulfur compounds, sulfur dioxide, wood dust, terpenes - ?lung cancer?
Forestry, Pulp and Paper – Other hazards

- **Noise**
  - The most common occupational illness; no treatment, preventable
  - Noise exposure levels:
    - Backtender 87 dBA
    - Bleach Plant 89 dBA
    - Utilityman 92 dBA
    - Woodyard 84-93 dBA
  - Disability starts at 25dB hearing loss
  - Signal detection and localization: signal must exceed background noise + hearing loss by 15dB
  - Impact on person-to-person speech intelligibility and safe coordination of tasks

- **Vibration**
  - Poor ergonomics and MSDs
Pulp and Paper - Dermatitis

• Paper mill workers have frequent and prolonged exposure to skin irritants and allergens and may have a higher risk of developing occupational dermatitis
• Occupational dermatitis in paper mills is primarily related to the exposure to skin irritants – contact irritant dermatitis
• High exposure to skin irritants occurs, especially when carrying out tasks that caused the hands and feet to become wet from perspiration and having contact with process water.
Resources

Ministry of Labour:
- www.Ontario.ca/SafeAtWorkOntario
- Ministry of Labour Health & Safety Contact Centre
  Tel. 1-877-202-0008
  - Report incidents, critical injuries, fatalities or work refusals
    - If this is an emergency call 911 immediately.
  - Report possible unsafe work practices
  - General occupational health and safety inquiries

Health and Safety Associations
  Workplace Safety North
  - www.labour.gov.on.ca/english/hs/websites.php
  - www.healthandsafetyontario.ca

Canadian Centre for Occupational Health and Safety
  - http://www.ccohs.ca/
Resources (cont’d)

Workers Health and Safety Centre
- [www.whsc.on.ca/contact/contact.cfm](http://www.whsc.on.ca/contact/contact.cfm)
- Tel: 416 441-1939 or toll-free: 1-888-869-7950

Occupational Health Clinics for Ontario Workers
- [www.ohcow.on.ca/contactus/contact_us.html](http://www.ohcow.on.ca/contactus/contact_us.html)
- Tel: 416 510-8713 or toll-free 1-877-817-0336
Thank you!

Questions?