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Lung disease from open cut mining, limits of respirators and why primary prevention matters

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Brisbane, Australia

February 2020

Disclosures

Funding sources

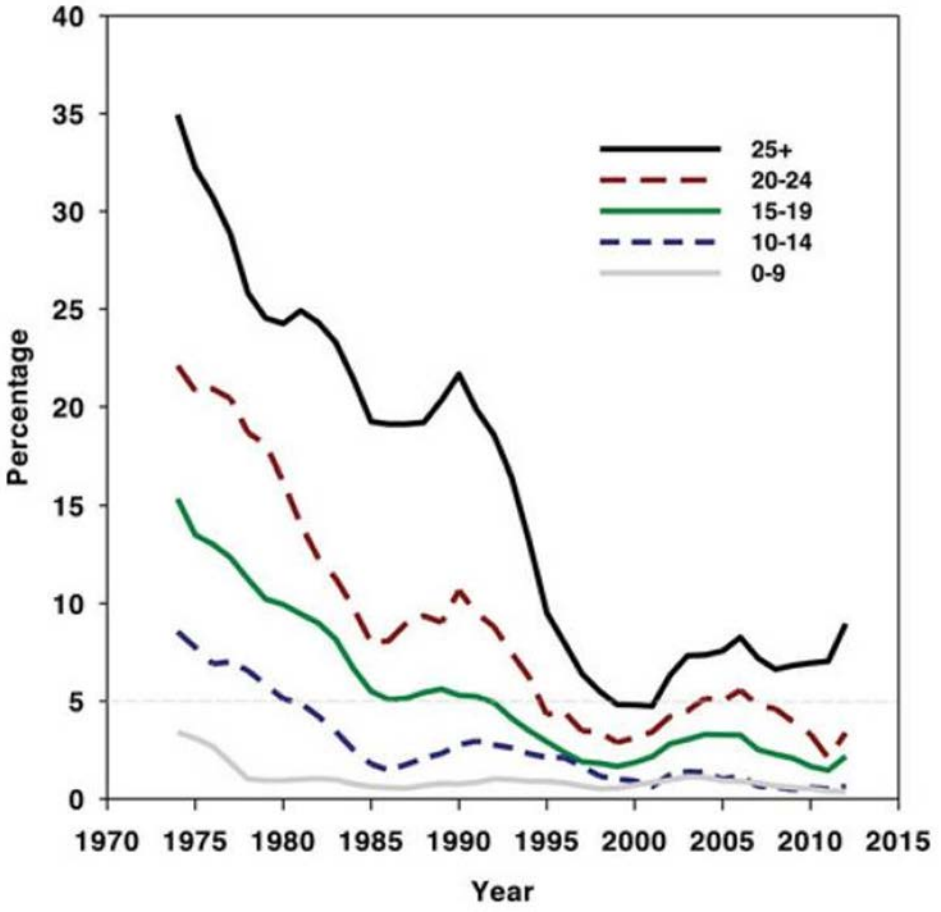
- U.S. Health Resources and Services Administration for Miners Clinic/Black Lung program
- Alpha Foundation for the Improvement of Mine Safety and Health

Overview

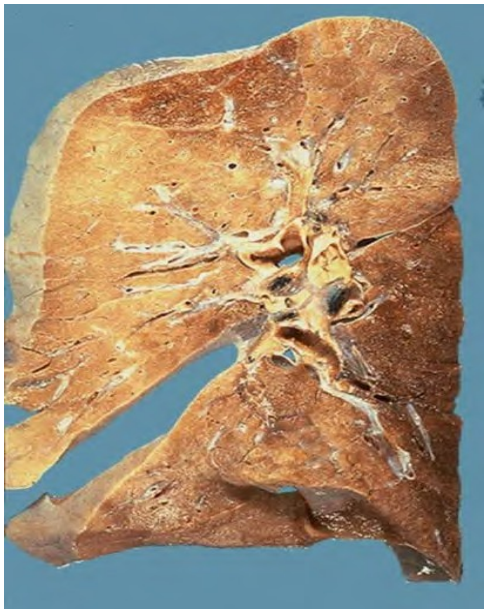
- Increasing rates of Black Lung disease
- Lung disease from open cut mining
- Primary prevention: What is it?
- Limits of respirators – the least effective primary prevention
- Importance of monitoring coal mine dust levels and particle types
- Need for international collaboration

Increasing rates of Black Lung disease

- After passage of the 1969 U.S. Federal Coal Mine Health and Safety Act, there was a decline in rates of Black Lung from 1970 to 2000.
- Since 2000, an increase in cases of severe Black Lung disease has occurred in hot-spot areas in the U.S.



The problem is not limited to underground coal mining.



Open cut mining can cause severe Black Lung disease (PMF).

Debilitating Lung Disease Among Surface Coal Miners With No Underground Mining Tenure

CN Halldin et al. *J Occup Environ Med*. 2015; 57(1): 62–67.

- 8 open cut miners with PMF worked as drillers or blasters for most of their tenure (median 35.5 years).
- Chest x-rays showed progressive massive fibrosis within as few as 11 years.
- One miner's lung biopsy showed scarring and abundant silica dust.

- Some open cut miners reported poor dust control practices and working in visible dust clouds as recently as 2012.
- Miners described a tacit understanding to “get the job done” regardless of the working conditions.

Surface coal mining in the U.S. is linked to high dust levels.

Respirable coal mine dust at surface mines, United States, 1982–2017 BC Doney et al. *Am J Ind Med. 2020;63:232*

- 1.6% of 288,705 respirable coal mine dust samples exceeded the 2.0 mg/m3 PEL.
- Dust levels in active mining areas were highest among drillers.
- Highest in central Appalachia compared to the rest of the U.S.
- 15.3% of 54,040 respirable quartz samples exceeded the standard.
- Respirable quartz levels were highest among drillers.

Open cut coal mining in India generates high levels of respirable dust.

Characteristics of Hazardous Airborne Dust Around an Indian Surface Coal Mining Area Mrinal K, Ghose & Majee *Environ Monit Assess (2007) 130:17–25*

- 70% of total coal production in India comes from surface mining.
- « Requires massive overburden removal » – excavators, loaders, dumpers, belts, haulers
- Highest respirable dust levels in dragline section, haul road and loader areas.
- «No epidemiological data to correlate dust levels with health status.»

Retired Chinese opencast coal miners are at risk for Black Lung.

Time trends and future prediction of coal worker's pneumoconiosis in opencast coal mine in China based on the APC model Li et al. *BMC Public Health (2018) 18:1010*

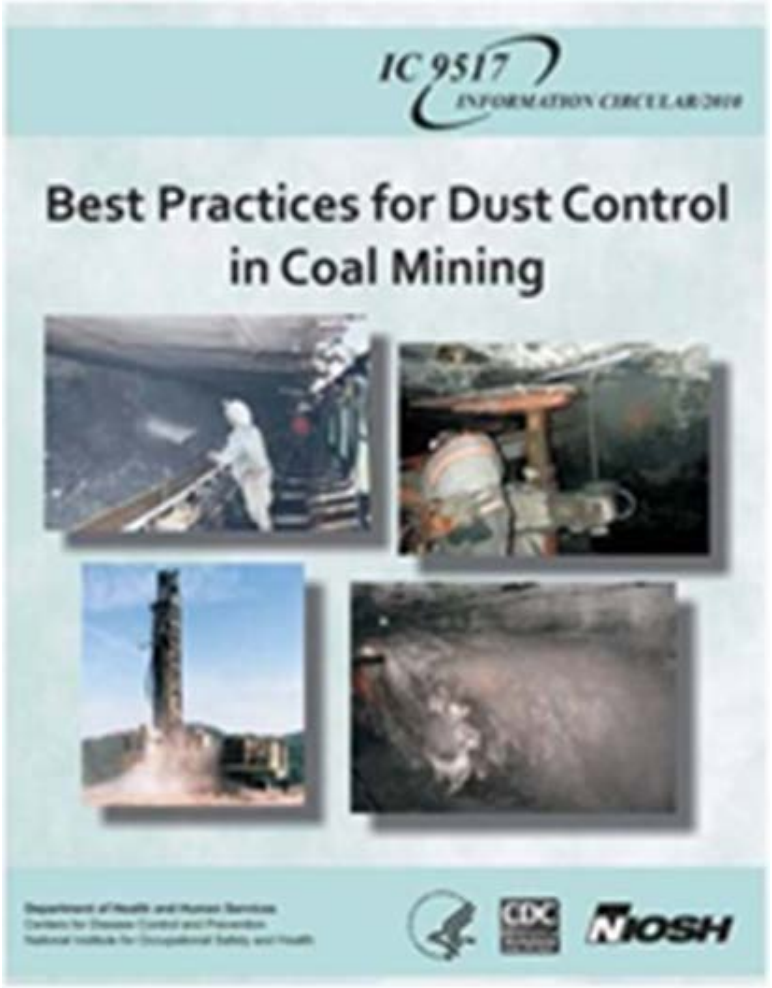
- 8191 opencast miners were enrolled in the study, including 259 miners with CWP and 7932 miners without CWP. Found that the incidence density of CWP would have an increasing trend in opencast miners from 2005 to 2024.
- The number of possible CWP cases predicted during this period was nearly 500.

The Facts:

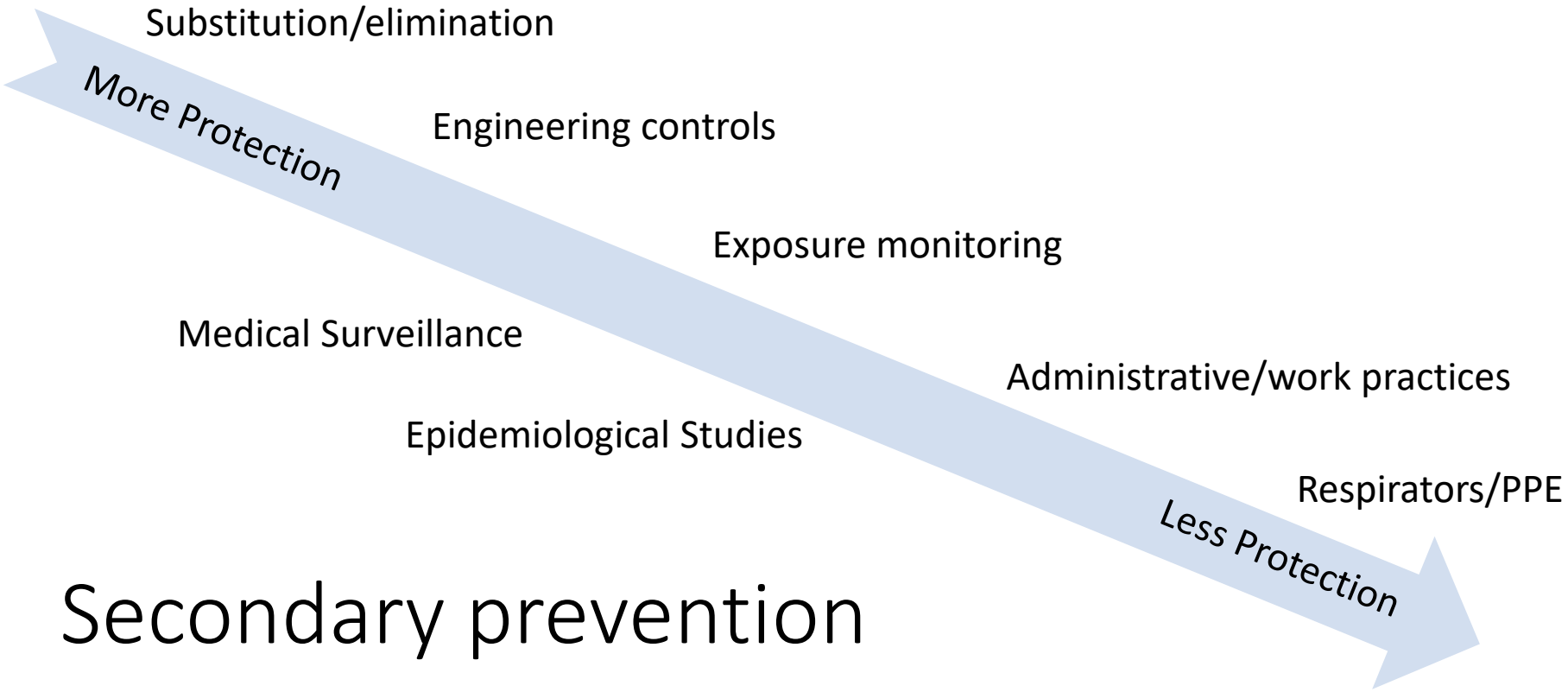
- Excessive inhalation of coal mine dust is the sole cause of Black Lung disease.
- A substantial number of coal miners continue to develop severe forms of Black Lung disease.
- Every case of Black Lung disease is a tragedy.
- Every case represents a failure to control dust exposures.
- Despite readily available dust control technology and best practice guidance, dust exposures have not been adequately controlled.

What is primary prevention?

- Controlling coal mine dust exposure to decrease lung disease
- Focuses on the WORKPLACE (not the WORKER)
- Hierarchy of prevention goes from most to least effective



Primary prevention

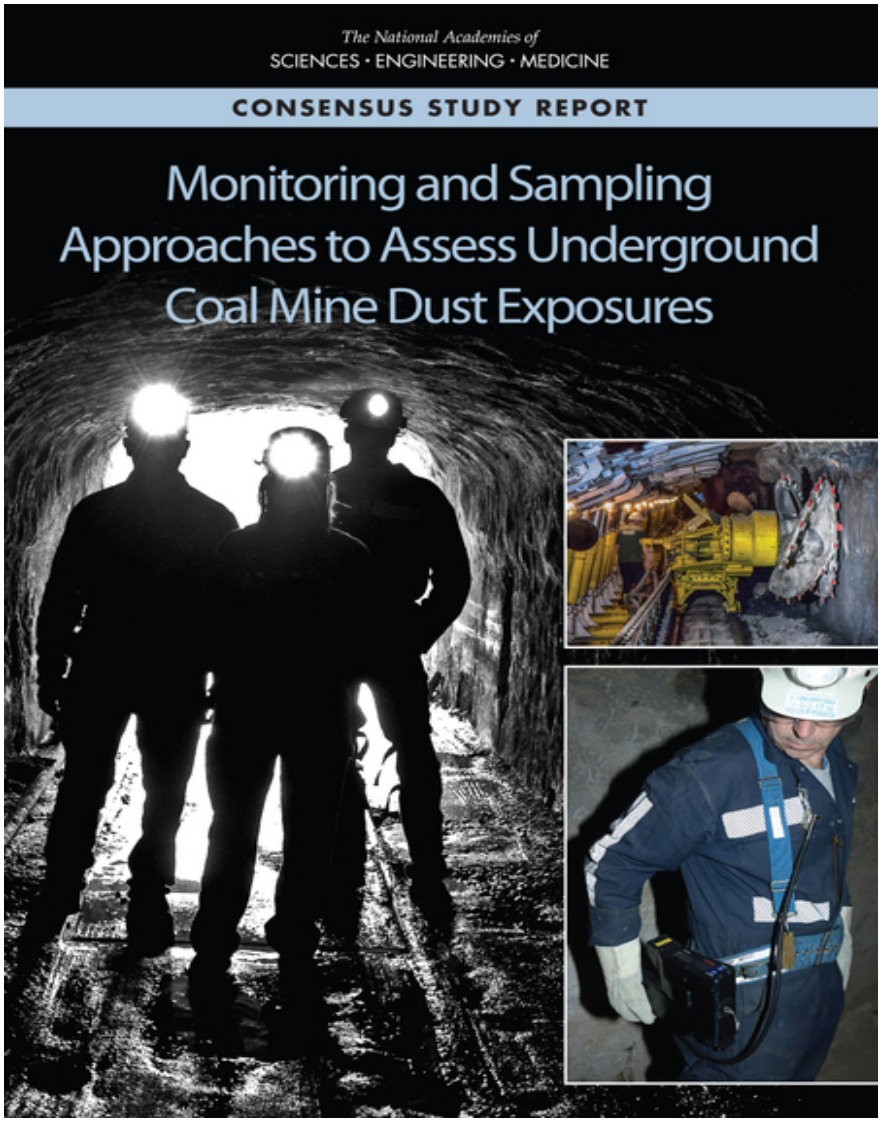


Secondary prevention

Respirators are the least effective means for controlling dust exposure.

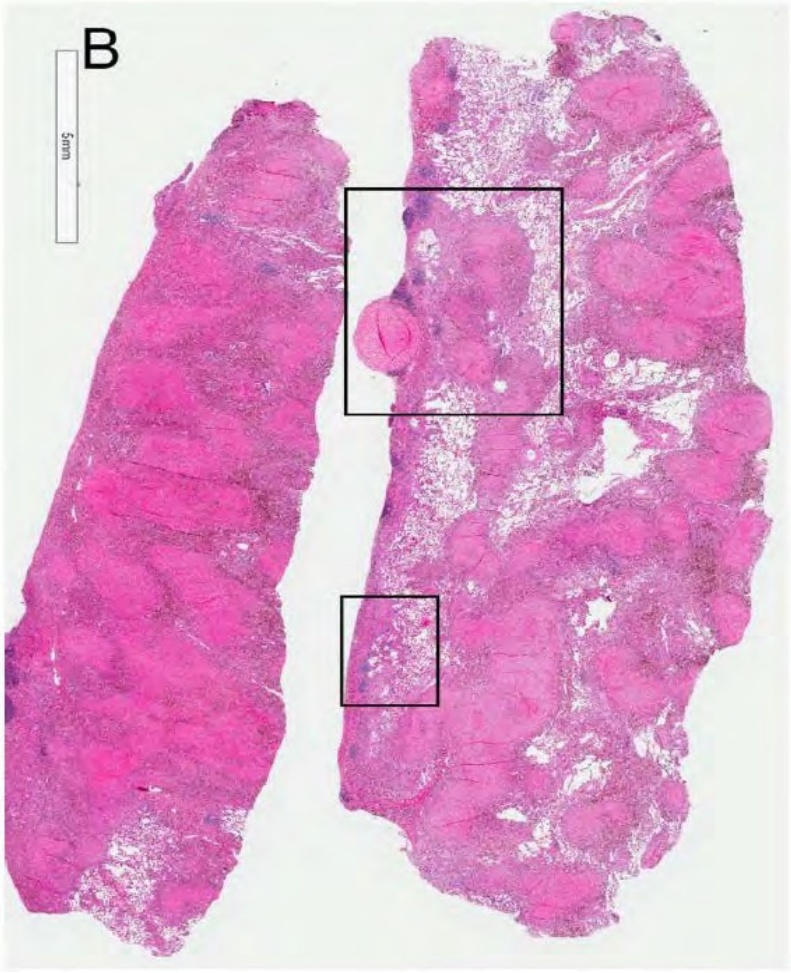
- Uncomfortable
- Interfere with communication
- Require fit testing and compliance with regulations
- Work in low coal and strenuous tasks like shoveling compromise face seals for filtering respirators.
- This may increase exposure by giving a false sense of protection or effective prevention.

Dust control in U.S. coal mines: The 2018 National Academies report



Changes in mining methods have likely increased exposures to silica dust.

Changes in mining practices and conditions (for example, increases in equipment size and horsepower and mining thinner coal seams) have likely resulted in an increased extraction of overburden rock.



Particle size distributions and types may have changed.

- Changes in mining technologies during the past several decades might have led to changes in coal mine dust particle size distributions.

- This may have changed the health risks associated with particle type, size, concentration, deposition and lung inflammation.

Are we measuring the right things?

Optimal monitoring and sampling is needed to assure dust exposures are controlled.

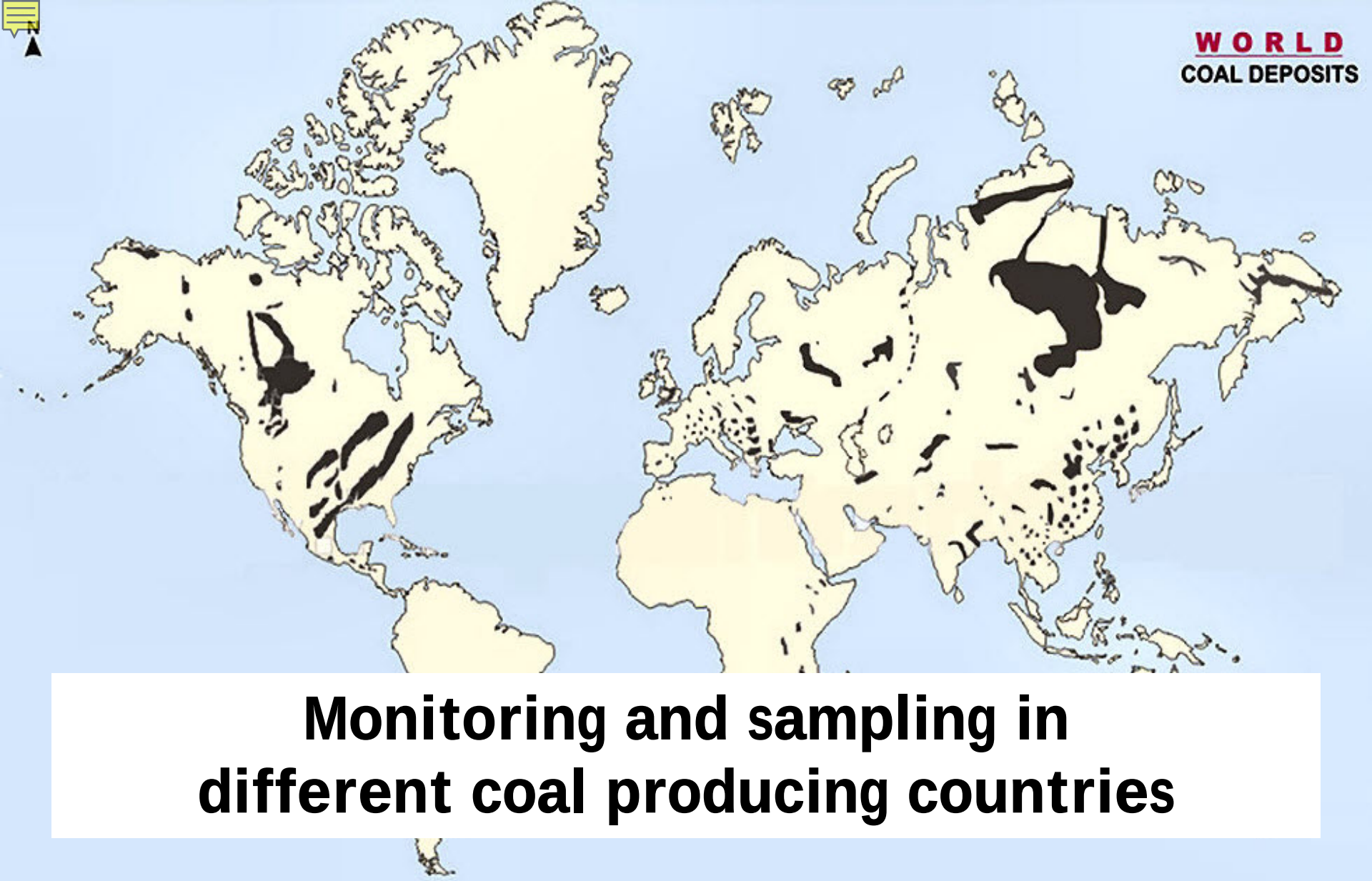
https://www.thermofisher.com/blog/mining/how-underground-mining-is-made-possible/

The real-time continuous personal dust monitor (CPDM) is an important advance.

- If a CPDM measurement collected over a full shift exceeds allowable limits, mine operators must take corrective actions immediately.
- Miners wearing CPDMs are able to use readouts to make immediate adjustments to reduce exposure.

Limitations of the CPDM

- Bulky and heavy
- Unclear if exposure reduction benefits are maintained on days when miners don't wear them so can't see the continuous exposure readouts.
- Don't measure crystalline silica dust levels.



Monitoring and sampling in different coal producing countries

There are opportunities to harmonize monitoring data to learn from other countries.

Differences in monitoring and sampling among major coal-producing countries make it difficult to compare exposures.

https://www.ausimmbulletin.com/opinion/kiwi-mining-conundrum/

More work is needed to compare international approaches to exposure monitoring and medical surveillance.

- Need analysis of country-specific rates of Black Lung diseases over time to understand the success of various strategies for monitoring and controlling exposures.
- Need real-time monitoring of crystalline silica.
- Need to assess how dust characteristics have changed over time and track future trends.

Summary

- Black lung disease continues to afflict coal miners worldwide.
- Reliable data on dust exposures in both open cut and underground coal mines is crucial for predicting, reducing and preventing miners' disease risks.
- Exposure monitoring combined with medical surveillance is needed to understand disease trends and risk factors and to know whether exposure controls are working.

An injury to one is an injury to all.

Thank you for your attention.