NIOSH Innovations in the Mining Health and Safety Landscape

Improving Miner Health from research to practice

Safe mines - Healthy workers

Jessica E. Kogel

Associate Director for Mining

Director Office of Mine Safety & Health Research

National Institute for Occupational Safety and Health

Joseph A. Holmes Safety Association
Holmes Mine Rescue Association
Joint Meeting
June 18-20, 2019
Virginia Beach, VA

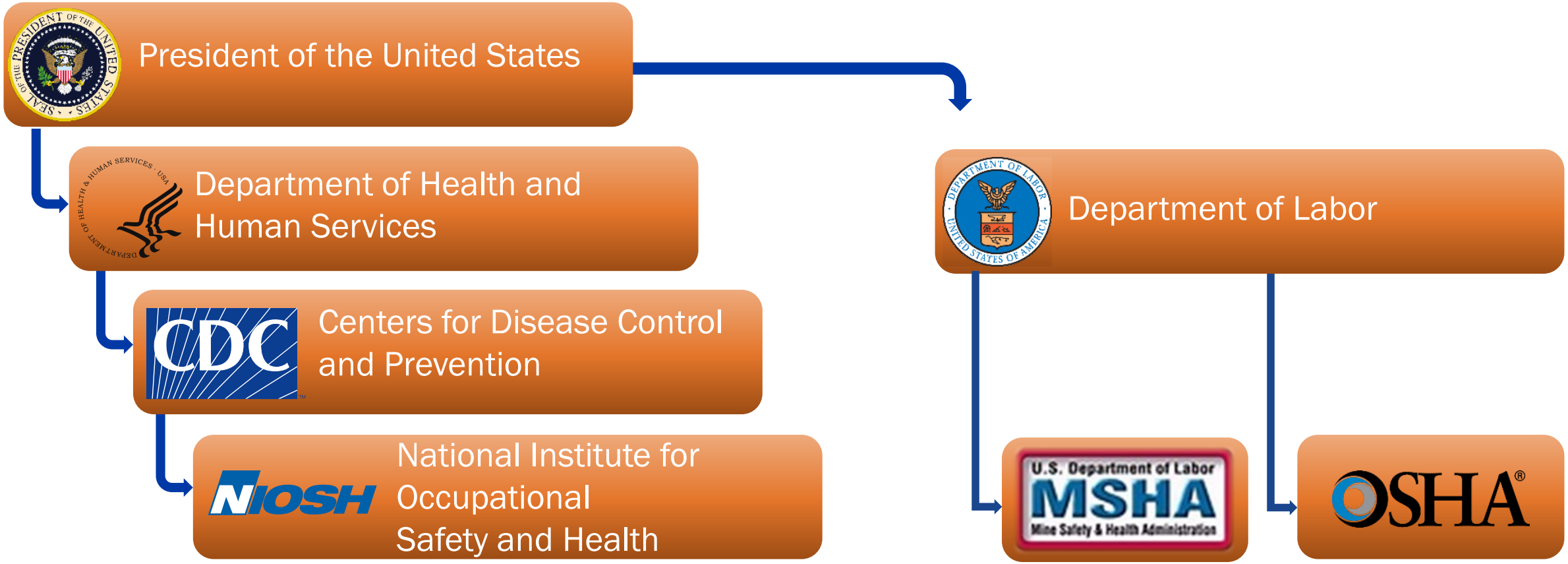
NIOSH focuses on the study of worker health and safety

- 15 Divisions, Labs, Offices & Programs in 8 locations
- 10 industry sectors
- **Create new knowledge** in the field of occupational safety and health and **transfer it into practice** through:
  - Research
  - Surveillance
  - Field investigations
  - Guidance/recommendations
  - Engineering Controls

NIOSH Mining Program

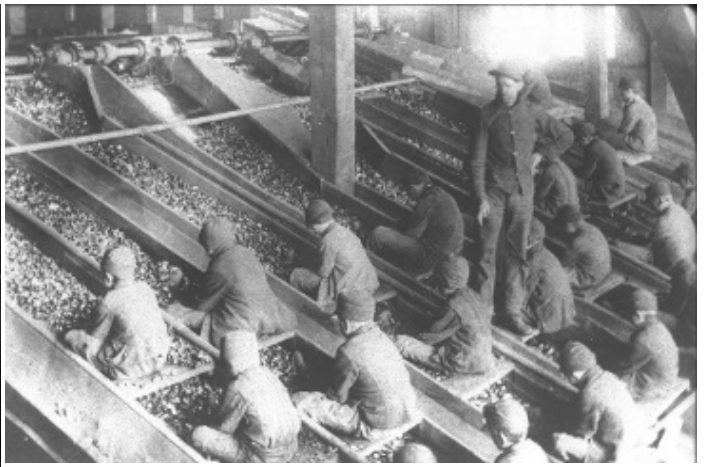
- **Office of Mine Safety & Health Research**
- **Pittsburgh Mining Research Division**
- **Spokane Mining Research Division**

NIOSH works closely with other federal agencies



The USBM was established in 1910 to address the poor safety record of coal mining

- Challenging
- High Risk
- Back-breaking
- Labor intensive
- Rudimentary safety equipment



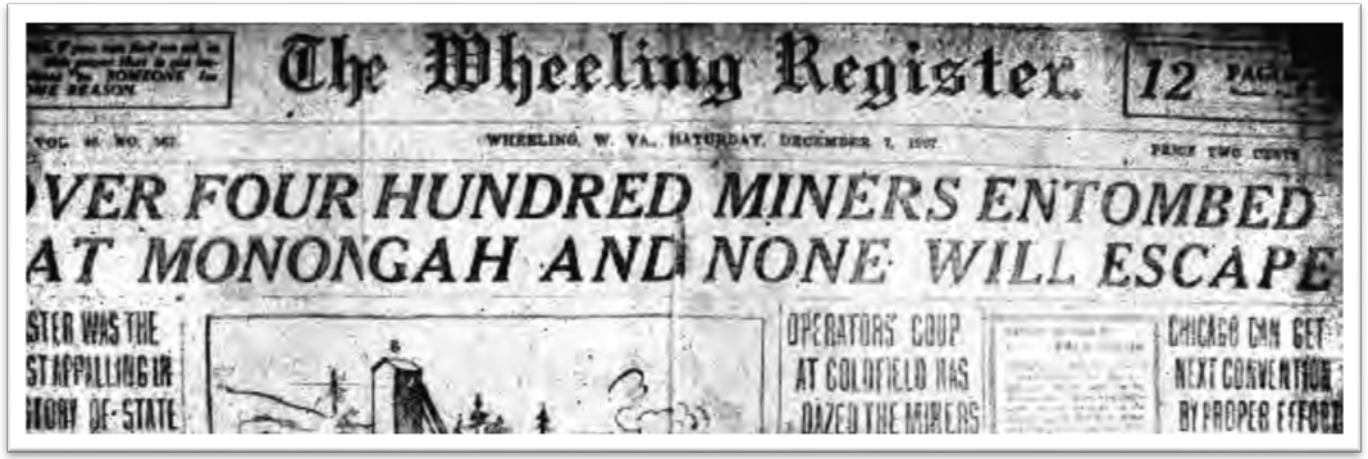
31,671 coal mining fatalities 1839-1900

1907 – The Deadliest Year in US Coal Mines

3,242 fatalities

911 from gas or dust explosions

Bloody December 692 miners died in explosions


The Wheeling Register. 12 PAGES

WHEELING, W. VA., SATURDAY, DECEMBER 7, 1907 PRICE TWO CENTS

VER FOUR HUNDRED MINERS ENTOMBED
AT MONONGAH AND NONE WILL ESCAPE

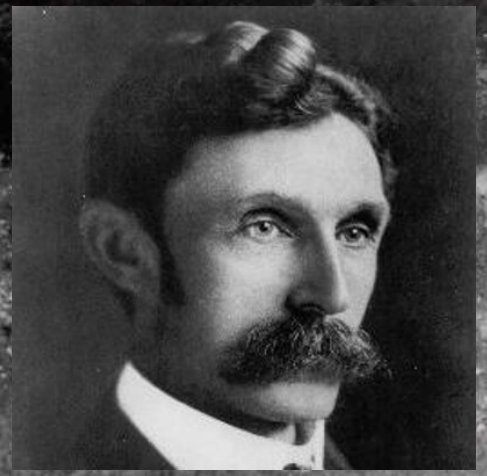
STER WAS THE
ST APPALLING IN
HORY OF STATE

OPERATORS' COUP
AT GOLDFIELD HAS
DAZED THE MINERS

CHICAGO CAN GET
NEXT CONVENTION
BY PROPER EFFORT

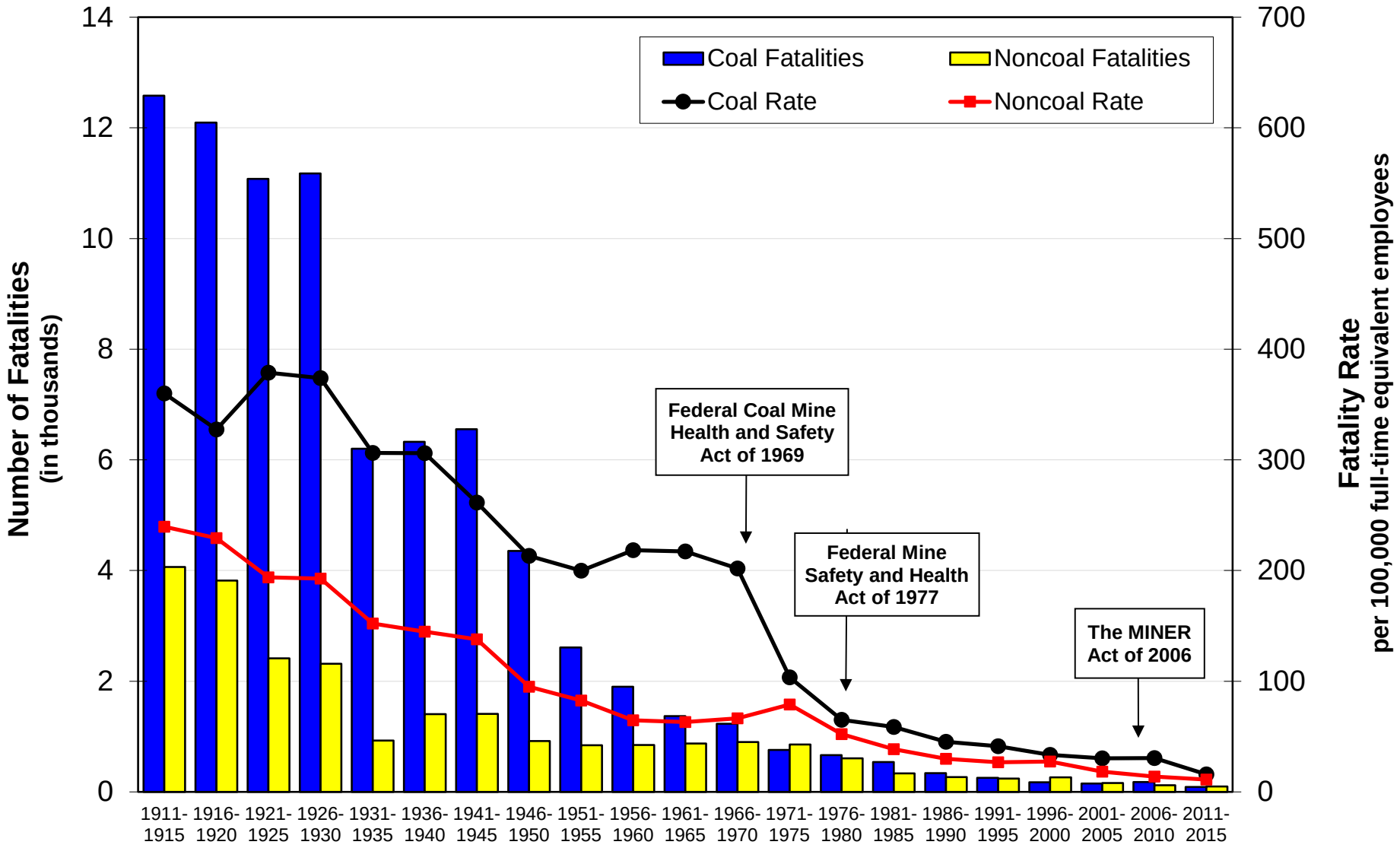
21,407 fatalities in the US coal industry between 1900 - 1909

Joseph A. Holmes appointed as the first director



Joseph A. Holmes

Number of fatalities and fatality rates (5-year aggregates) in the mining industry by sector, 1911-2015

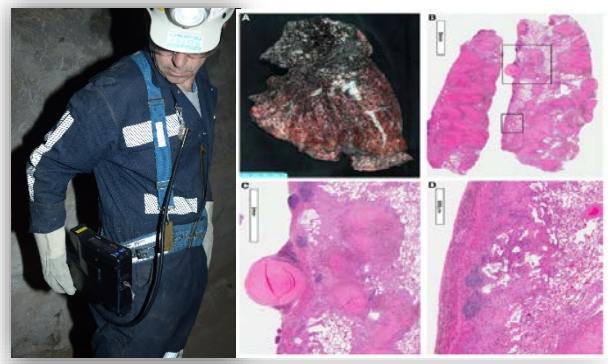


NOTE: Excludes office employees. Noncoal includes metal, nonmetal, stone, and sand & gravel operations. Sand & gravel miners included starting in 1958. Hours for 1911-1923 computed on assumption that weighted average length of workday was 9.36 hours. Full-time equivalent employees (2,000 hours = 1 FTE employee). Data source: USBM and MSHA

The NIOSH Mining Programs' mission is to eliminate mining fatalities, injuries and illnesses through relevant research and impactful solutions.

Safe mines - Healthy workers

Our research portfolio addresses 3 overarching strategic goals



Health

Reduce mine workers' risk of
occupational illness and disease

Safety

Reduce mine workers' risk of
traumatic injuries and fatalities

Disaster Prevention

Reduce the risk of **mine disasters** and
improve survivability of mine workers

Our research portfolio spans a broad range of focus areas

Reduce occupational illness and disease	Reduce injuries and fatalities	Disaster Prevention & Response
– Diesel Assessment & Control – Respirable Dust Assessment & Control – Noise and hearing loss – Thermal Stress – Chronic Disease Surveillance – Ergonomics & Musculoskeletal Disorder Prevention	– Health & Safety Management Systems – Training Research & Development – Illumination – Ground Control – Electrical, Battery & Machine Safety – Blasting Practices – Safety Culture – Cognitive Workload – Human Centered Design	– Atmospheric Monitoring & Control – Refuge Alternatives – Breathing Air Supply – Communications & Tracking – Emergency Response & Rescue – Self-escape – Explosion Prevention – Fire Prevention & Control – Ventilation

We serve all sectors of the mining industry

Coal

(surface & underground)

Employees*
55,168 (25%)

Metal

(surface & underground)

Employees
38,151 (17%)

Stone

(surface & underground)

Employees
68,606 (31%)

Construction Sand & Gravel

(surface)

Employees
36,484 (16%)

Industrial Minerals

(surface & underground)

Employees
24,971 (11%)

** # of Employees, 2017,Data Source: MSHA*

Research to practice improves mine worker health and safety by providing science-based practical solutions

Health

Respiratory Hazards

Safety

Slips, Trips & Falls

Respiratory Hazard Surveillance, Monitoring & Control

identifying, understanding, eliminating

Mining has a high prevalence of occupational respiratory disease and exposures

Coal dust

- 78,620 black lung deaths in 1968-2016
- $46 billion in black lung benefits

Respirable crystalline silica (RCS)

- Mining listed on more (28.1%) silicosis death certificates than other industries

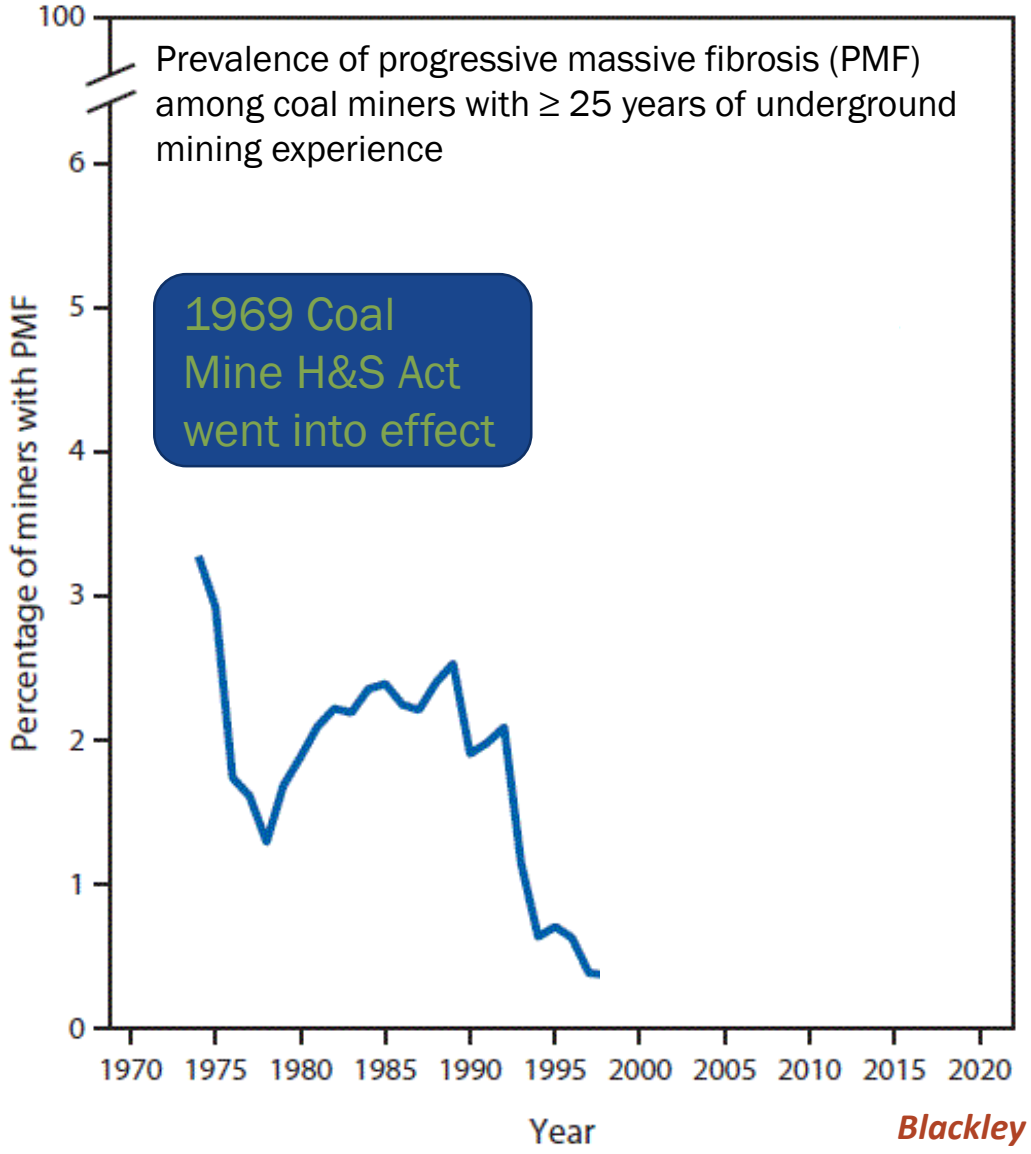
Diesel particulate matter

- Linked to lung cancer and other disorders
- 15,000 underground coal miners and 13,000 M/NM miners are exposed

Elongate Mineral Particles

- 10% of M/NM mines from 1979-2015 exceeded the NIOSH REL (0.1 f/cc) for asbestos (NY, MN, CA)

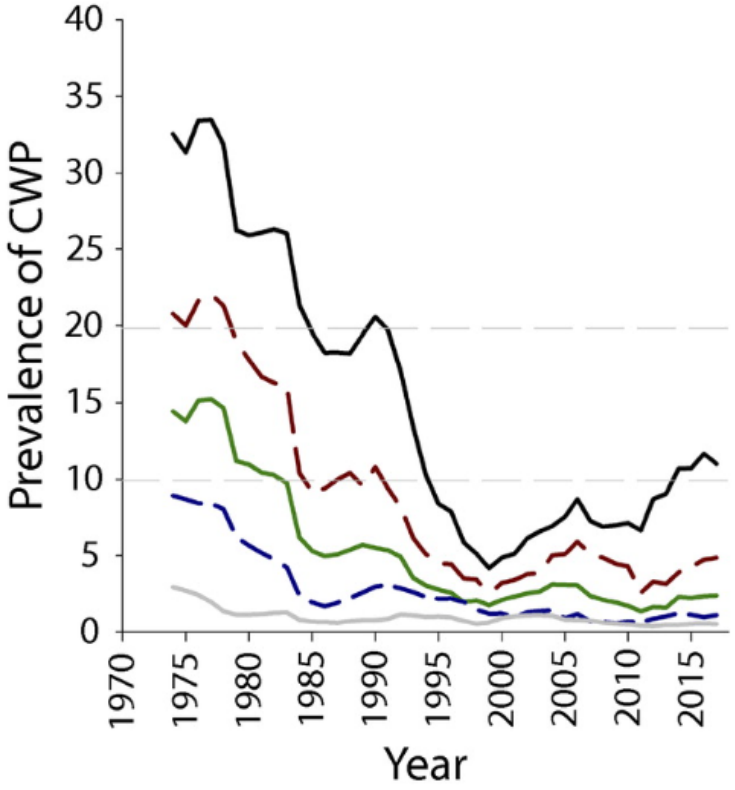
Black Lung is on the rise according to data collected through the NIOSH Coal Worker's Health Surveillance Program



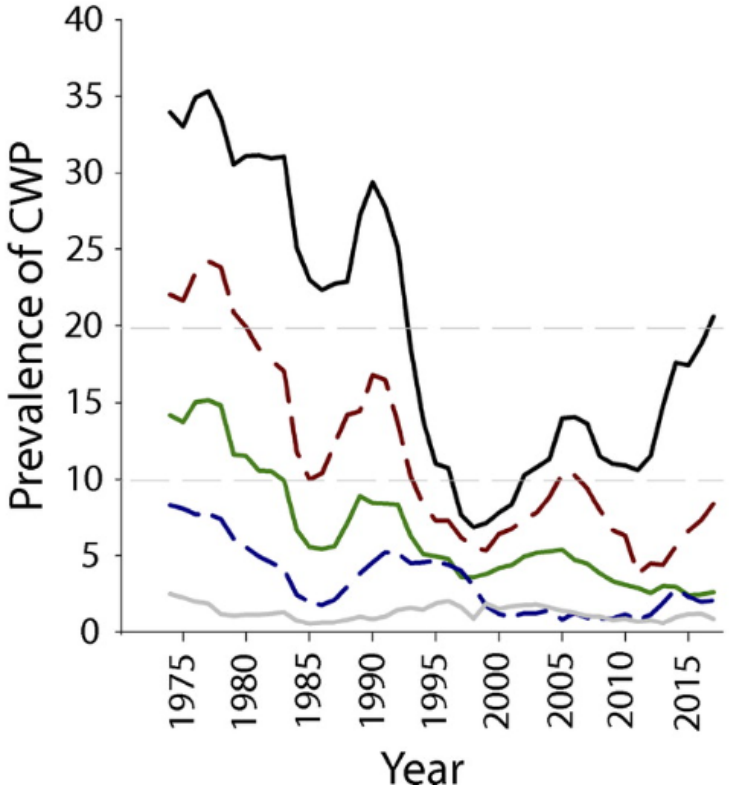
Blackley DJ, Crum JB, Halldin CN, Storey E, Laney AS. 2016. MMWR. 2018;65(49).

The highest prevalence of CWP is in central Appalachia (KT, VA, WV)

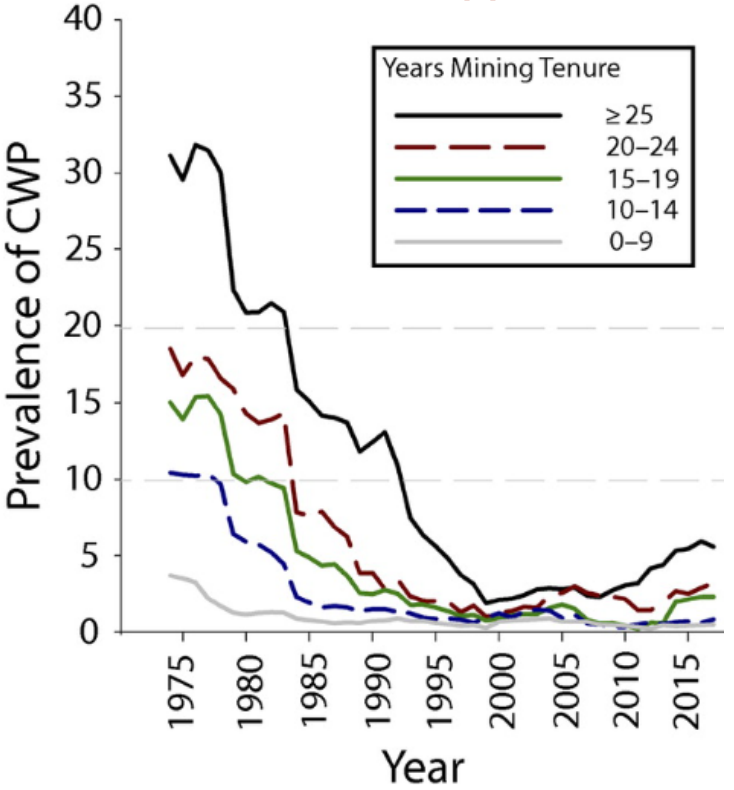
United States



Central Appalachia



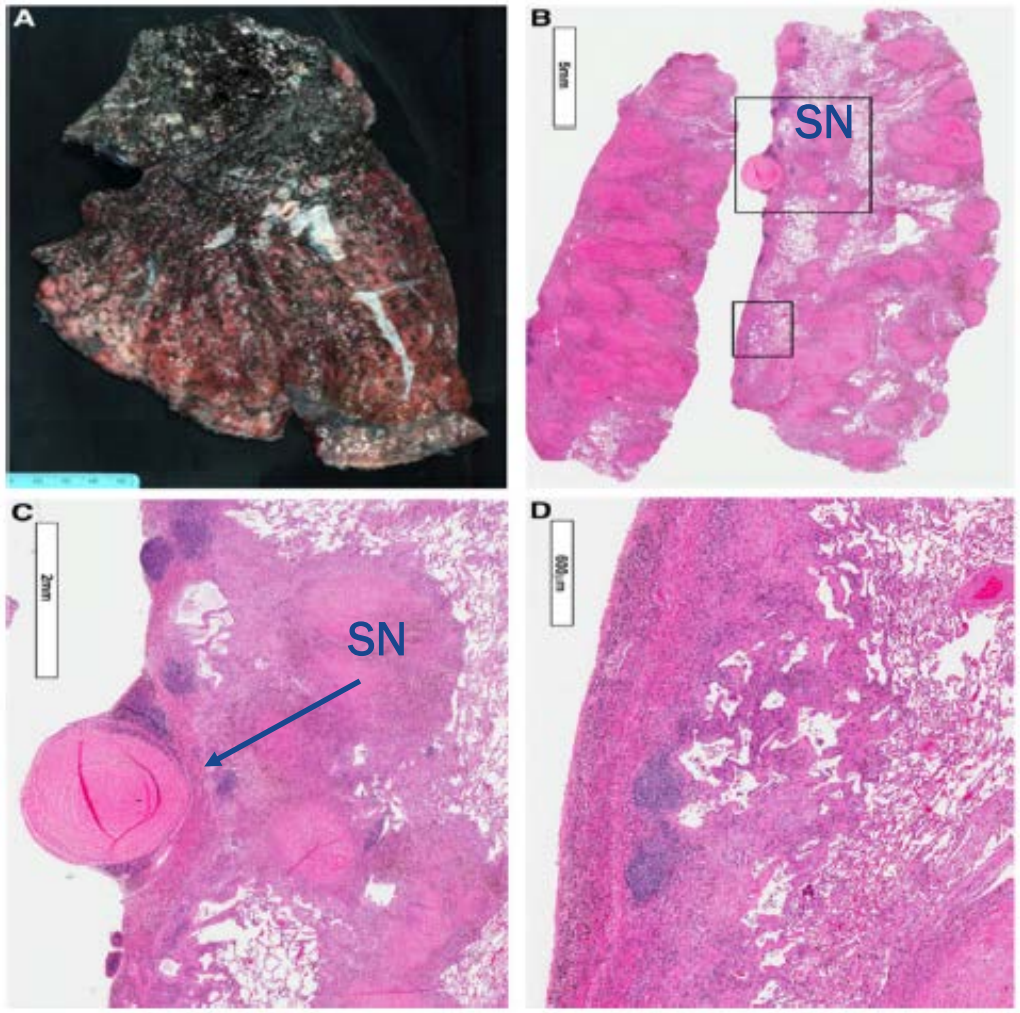
United States Excluding Central Appalachia

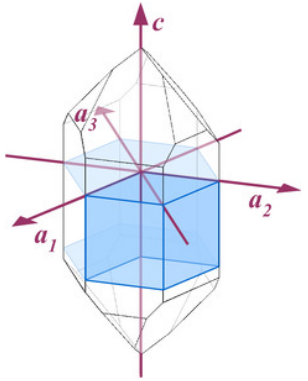


Coal Workers Health Surveillance Program 1970-2017

Note. Central Appalachia includes Kentucky, Virginia, and West Virginia. Data are the 5-year moving average. Surveillance is conducted on a 5-year national cycle.

Quartz may play a role in the resurgence of Black Lung



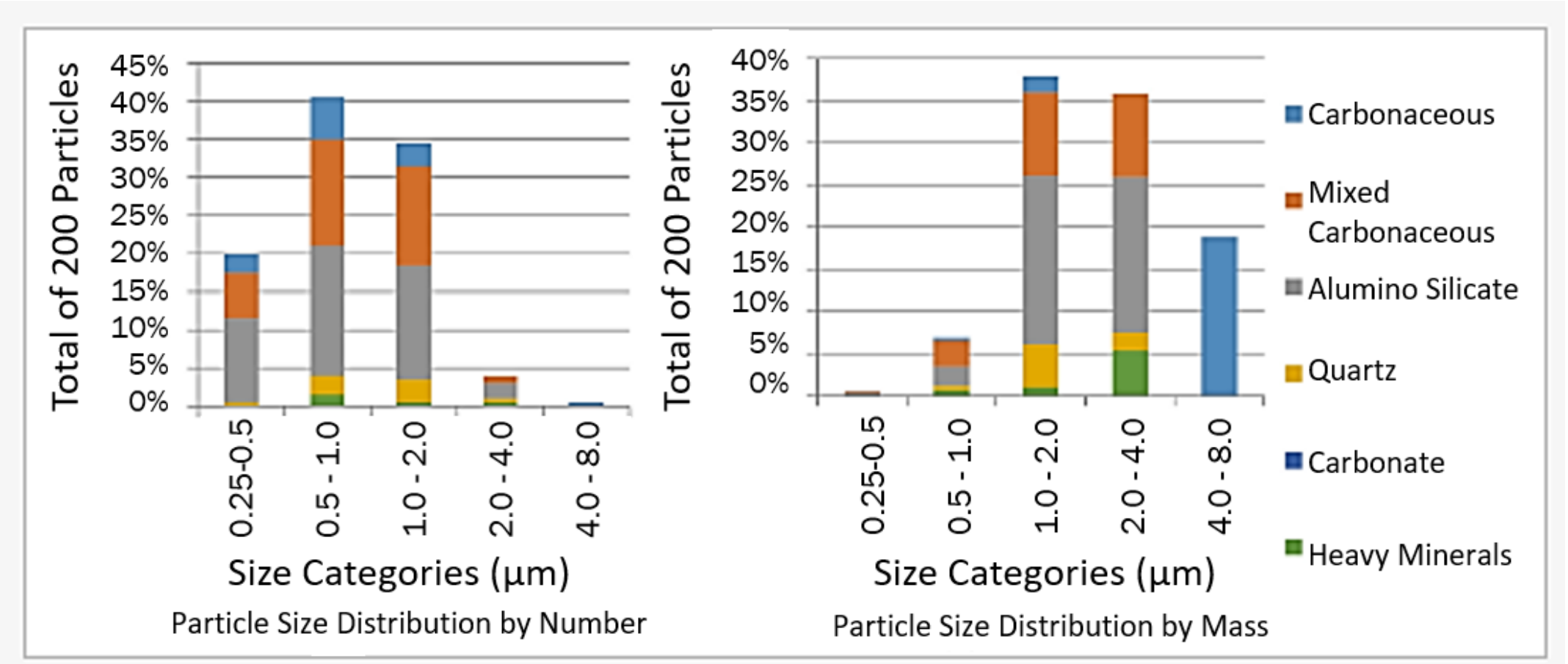


quartz

SN – Silicotic Nodule

Cohen et al., 2016. American Journal of Public Health.

Coal mine dust contains many different types of particles

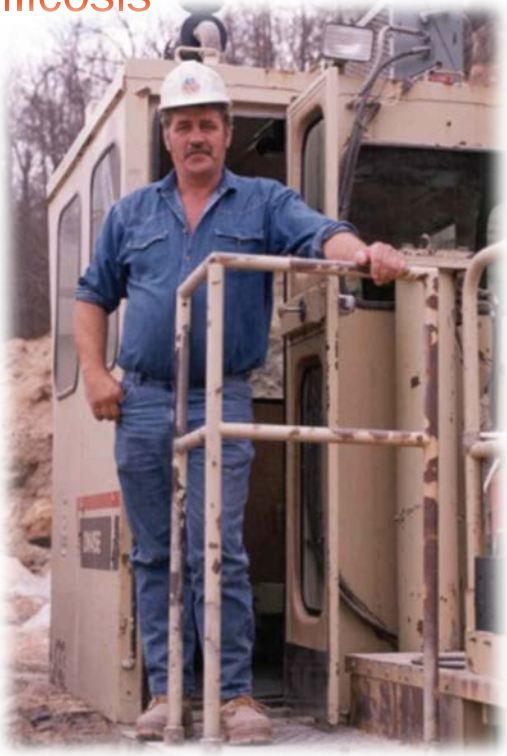


Sellaro R, Sarver E and Baxter D, 2015. Resources 2015, 4, 939-957

Health Study (1996-1997)

8 Surface Coal Mines Surveyed in Pennsylvania

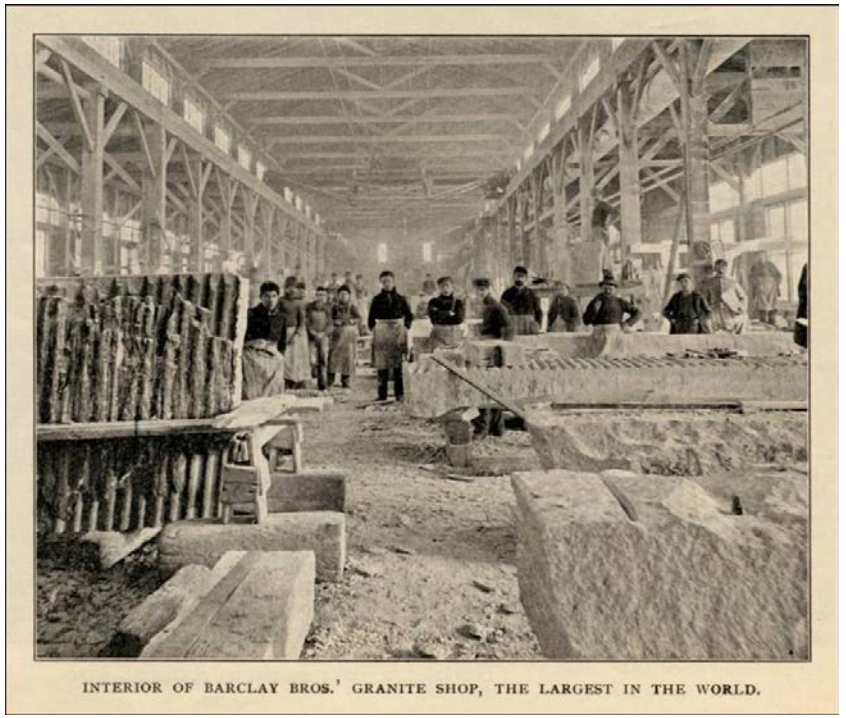
- 1,236 miners participated: **6.7%** classified with silicosis
- 213 (Clearfield County): **16%** classified with silicosis

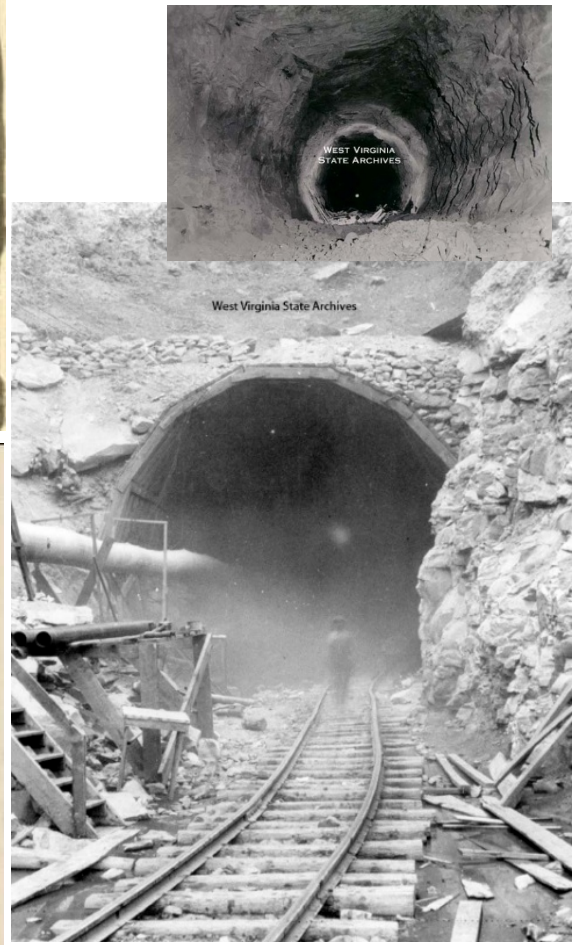


Centers for Disease Control, 2000, Silicosis screening in surface coal mines – Pennsylvania, 1996-1997. "Morbidity and Mortality Weekly Report, July 2000, Vol. 49, No. 27, pp. 612-615.

Silicosis Outbreaks

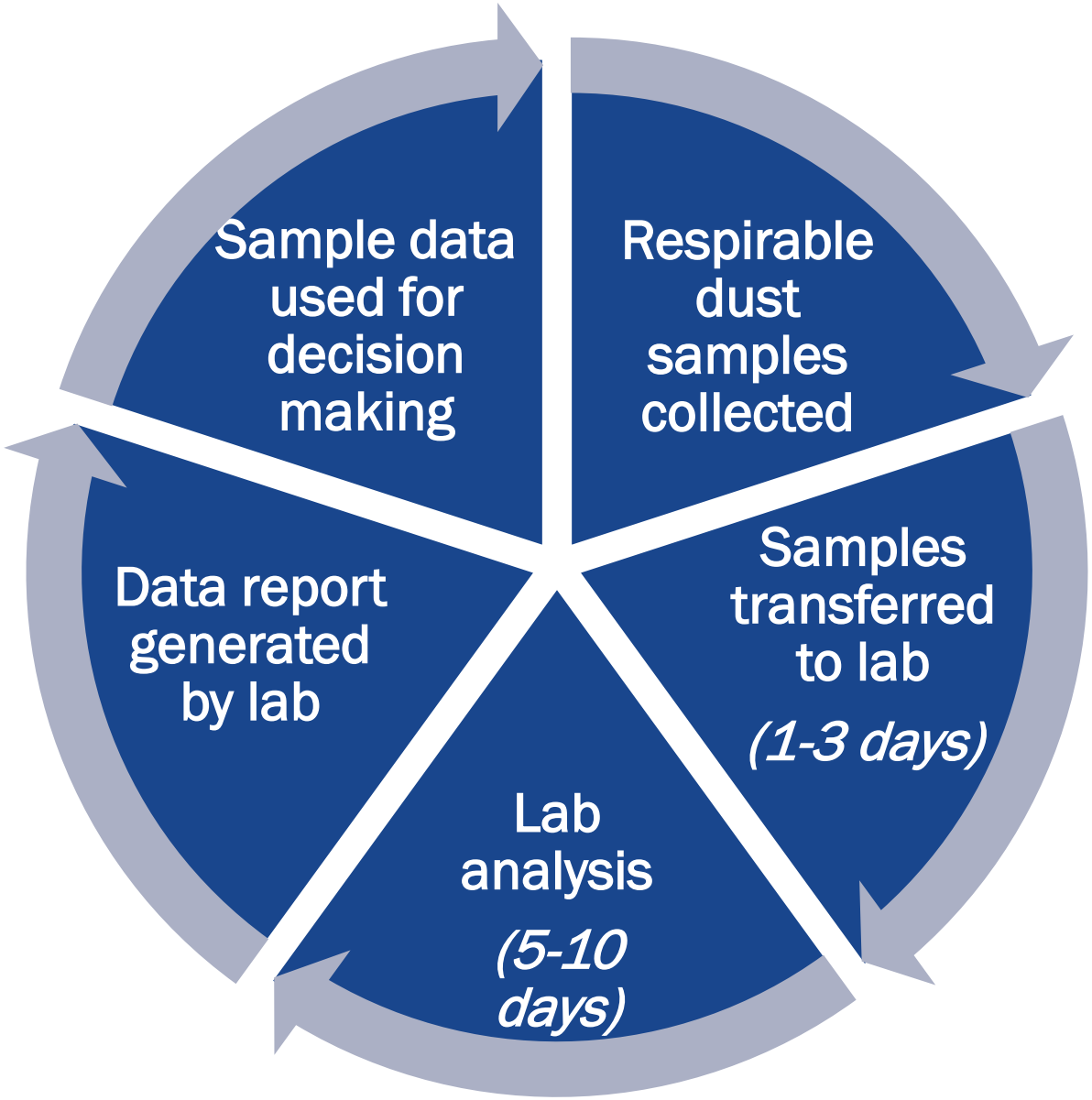
- **1910 to 1913** - 46% (3,700 miners) of Missouri lead miners found to have silicosis
- **1919** - 93% of Vermont granite workers (427 miners) found to have silicosis/1924 – 100% showed early signs silicosis within 4 years.
- **1933** - 476 deaths from Hawk's Nest Tunnel Project: workers died from silicosis drilling this tunnel in West Virginia


INTERIOR OF BARCLAY BROS.' GRANITE SHOP, THE LARGEST IN THE WORLD.



The Problem: Frequency of traditional quartz exposure monitoring in mining may not be sufficient to protect workers

- Compliance samples are collected once per quarter (coal)
- 95% of M/NM miners are not sampled in any given year.
- Results may take 1 to 2 weeks
- Mining conditions may change faster than results are available



The Solution: NIOSH has developed a rapid field-based quartz monitoring (RQM) approach using a portable FTIR analyzer

A 3 step process with optional lab verification

Collect samples using gravimetric dust samplers

Analyze samples with a portable FTIR unit

60 seconds

Process the FTIR data with NIOSH FAST software

FAST
Field Analysis of Silica Tool

150 seconds

(optional) **Verify** field analysis with laboratory tests

Field-based RQM quickly identifies quartz exposure in Coal Mines

Samples can be collected as:

- Personal or area samples
- Full shift or for a few hours
- With a variety of samplers

Allows user designed sampling campaigns

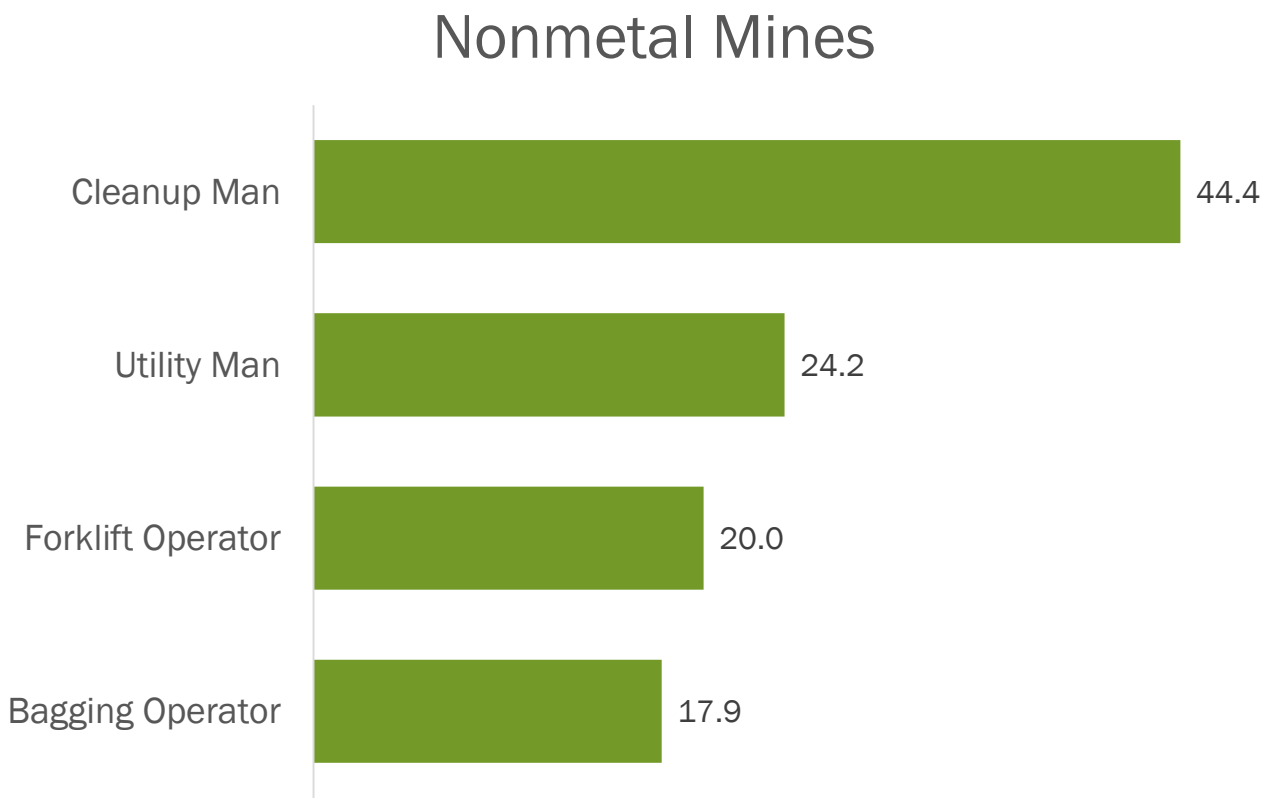
Provides immediate feedback

Available for coal mines as a self-assessment tool.

Developing for M/NM mines.

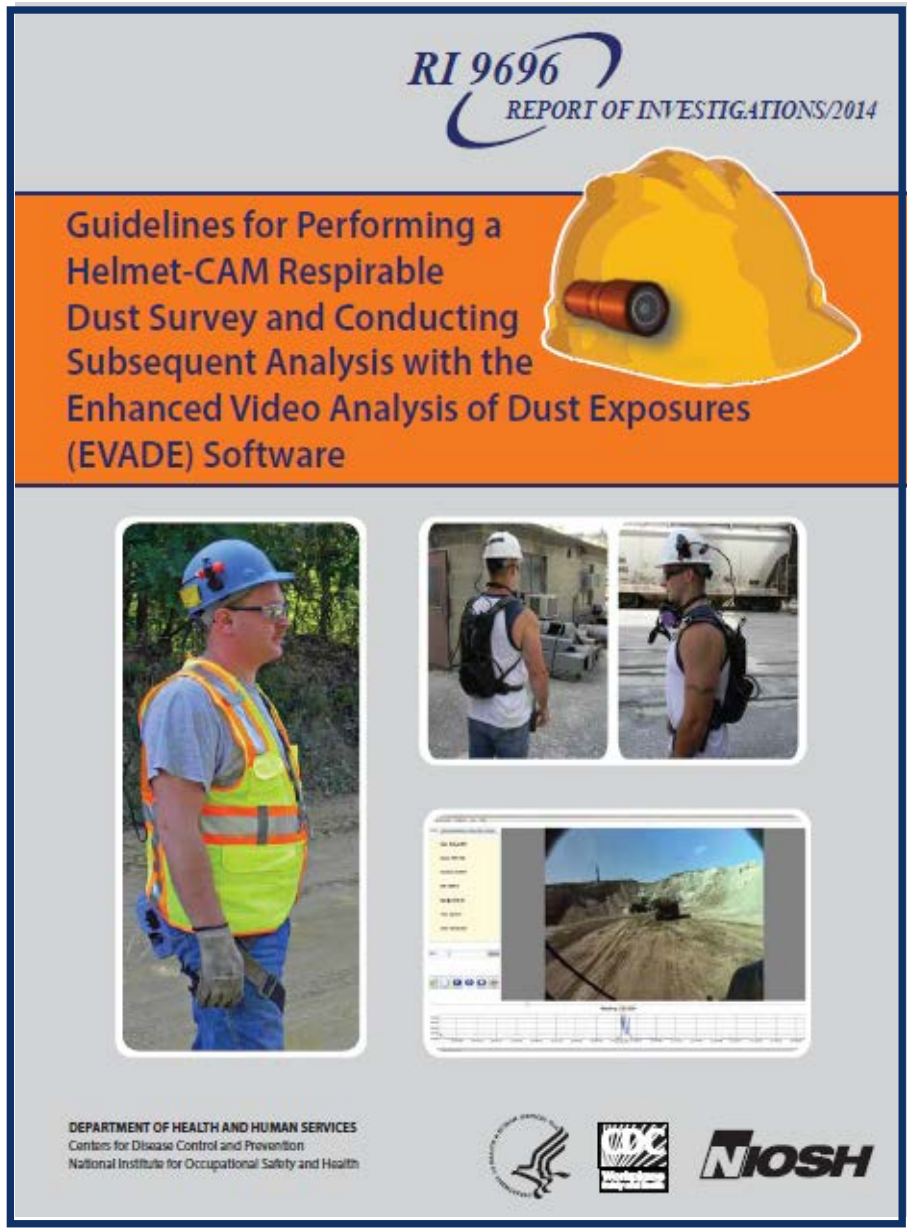
The Problem: Traditional exposure monitoring does not identify specific high exposure job tasks or worksite conditions

Percentages of respirable crystalline silica samples over the PEL



The Solution: Helmet-CAM and EVADE 2.1 identify source of noise, dust, DPM and other exposures

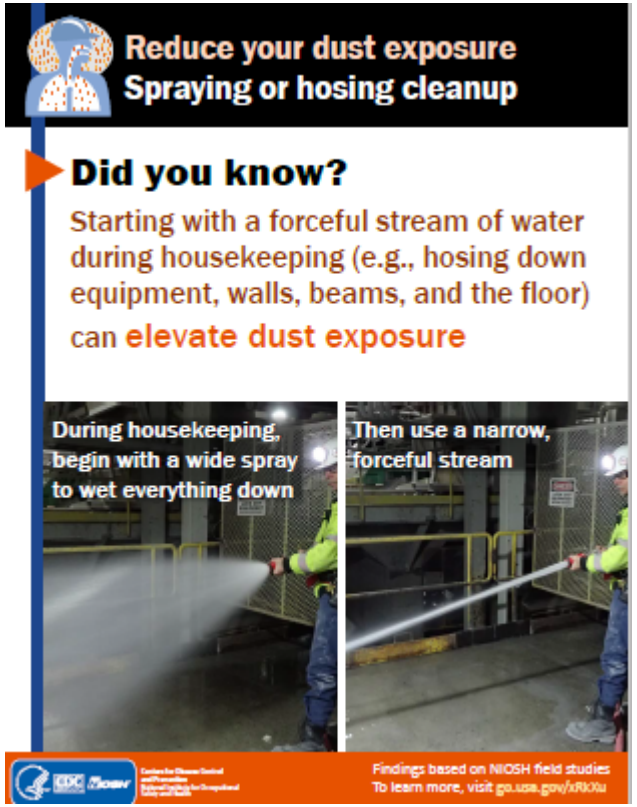
Helmet-CAM has been in the field for 5 years and has been used by 100's of M/NM miners



Notable Features

- M/NM
- Mobile Workers
- Inexpensive
- Easy to Use
- Compatible with many data-logging devices

Helmet-CAM identifies practical work practices that significantly reduce dust in the workplace.

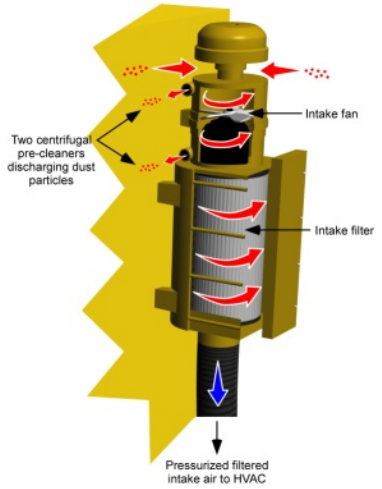


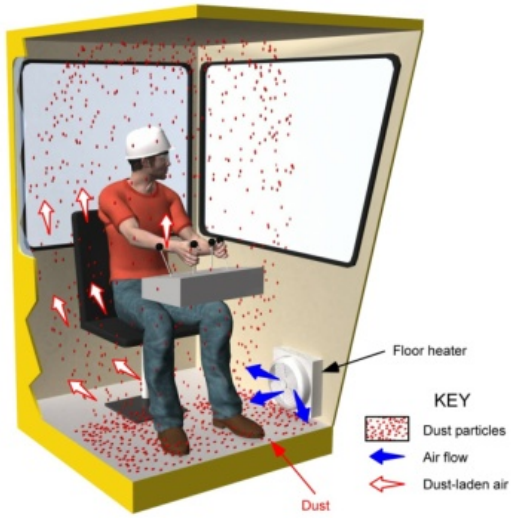
Helmet-CAM is used as a risk-management tool in M/NM mines

- raise worker awareness
- facilitate communication
- identify interventions to reduce exposure
- evaluate effectiveness of these interventions
- improve engagement

The Problem: Miners are exposed to elevated dust levels in enclosed cabs

The Solution: Cab Filtration and Pressurization Systems

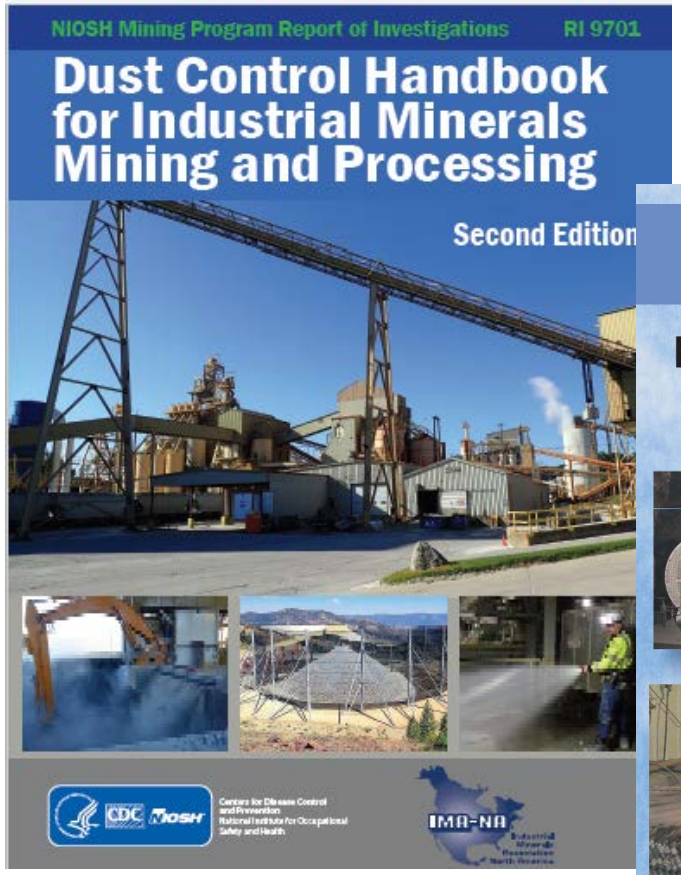


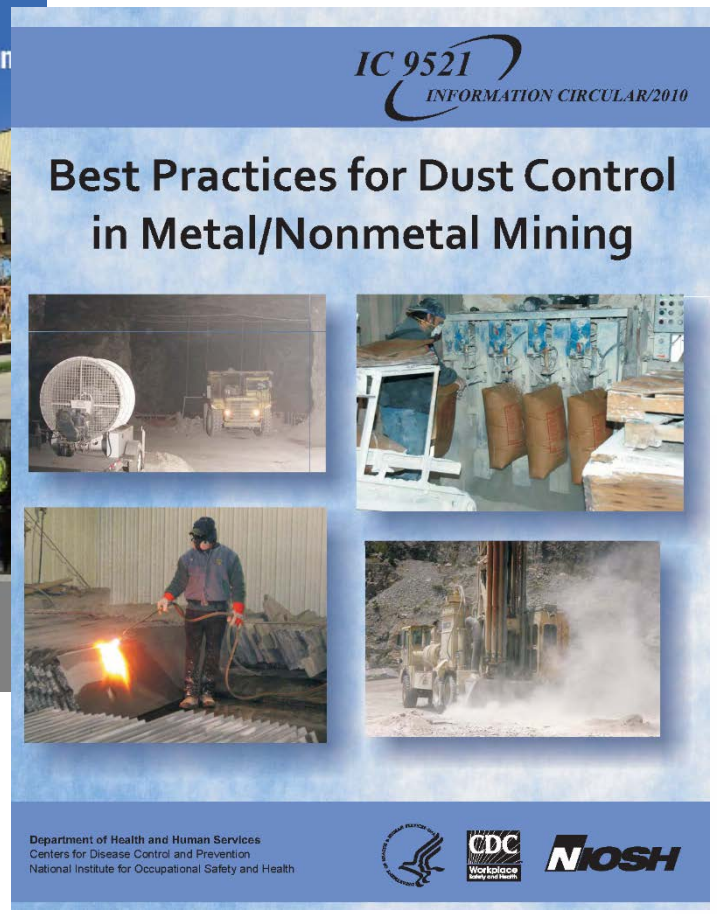


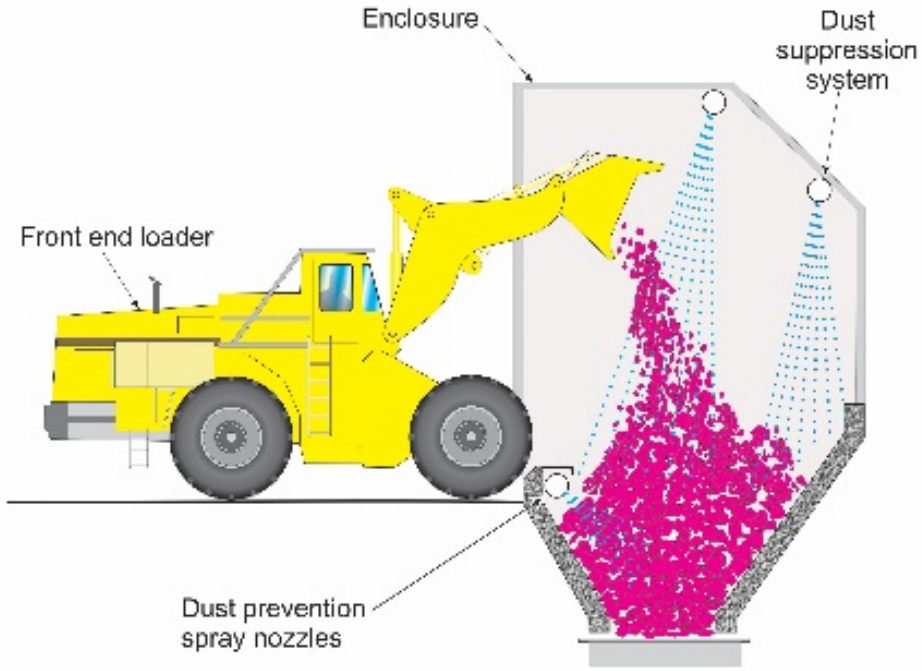
Cooperative Efforts with Cab Filtration Manufacturers, OEMs, Mining Companies, & Government Agencies

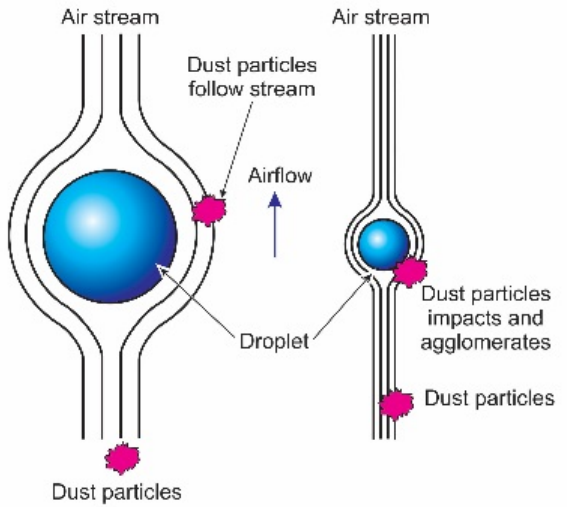
Dust suppression hopper technology reduces respirable dust by 88 %

The NIOSH Dust Control Handbooks are the primary reference for effective dust reduction strategies



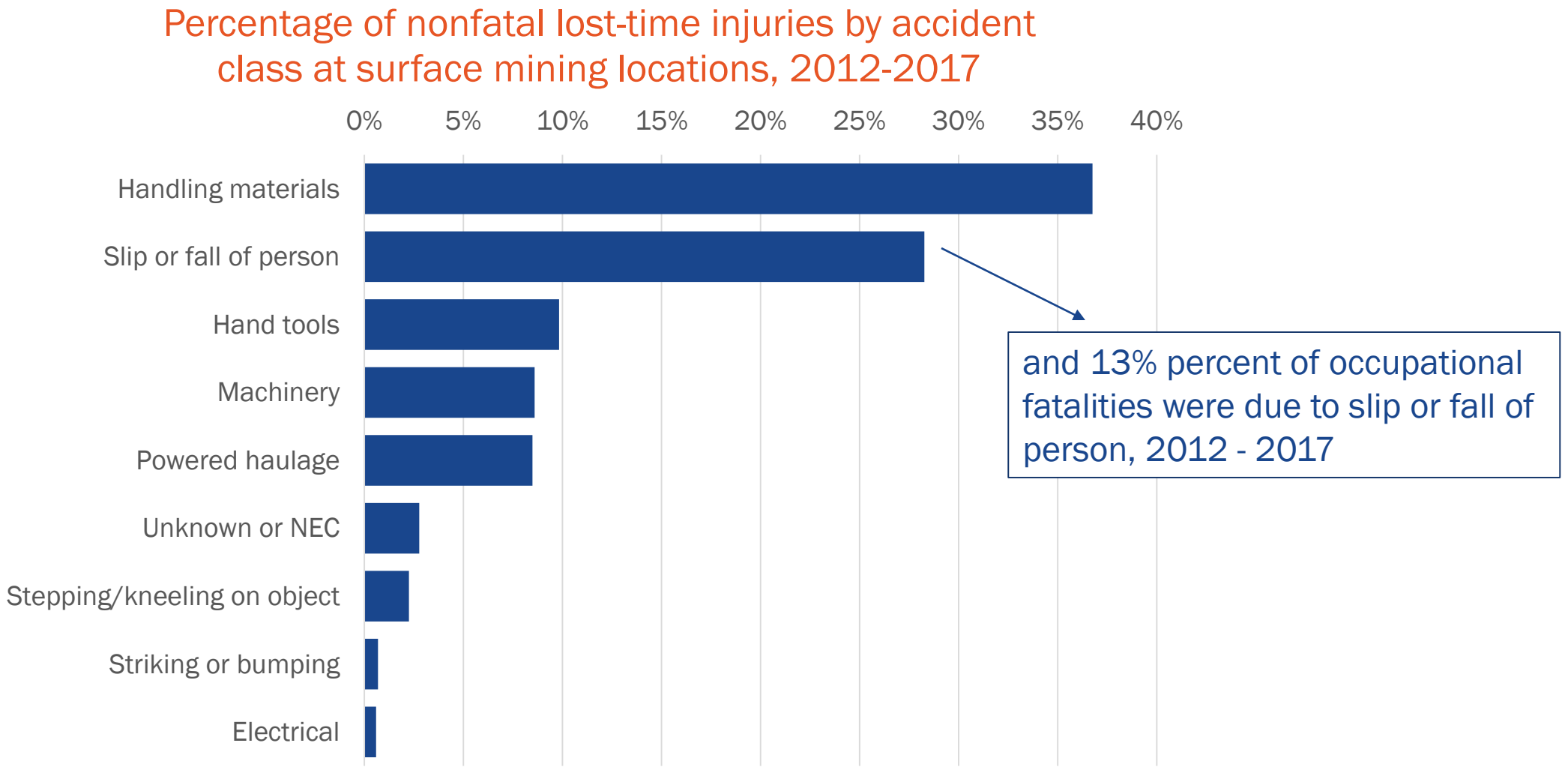






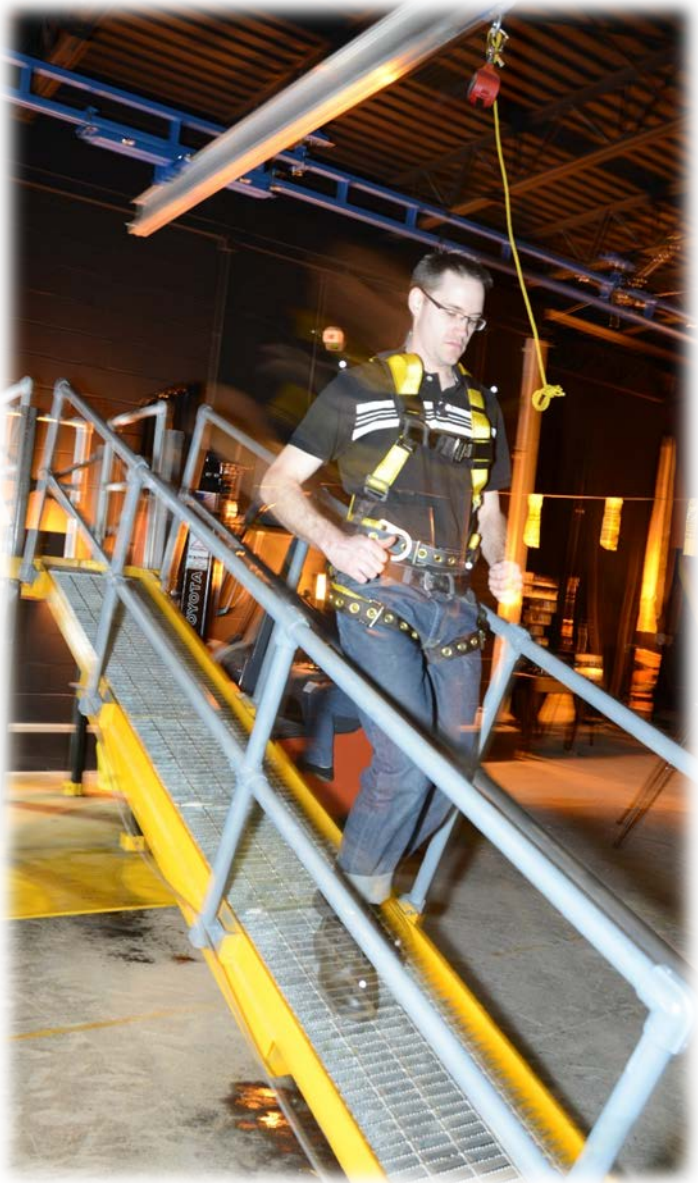

Slips, Trips and Falls

The Problem: Slips, trips & falls are a major contributor to miner injuries and fatalities



Data Source: MSHA

Solutions

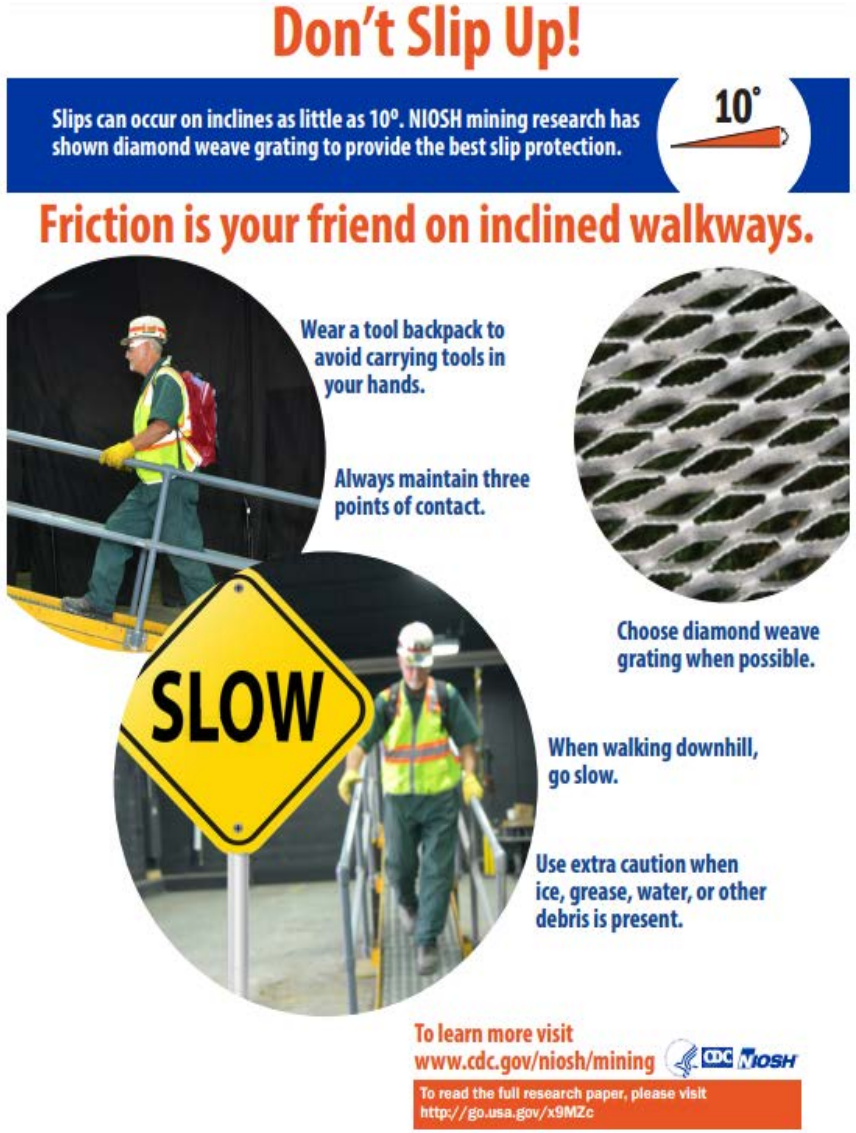


Research

Get the Ladder Safety App

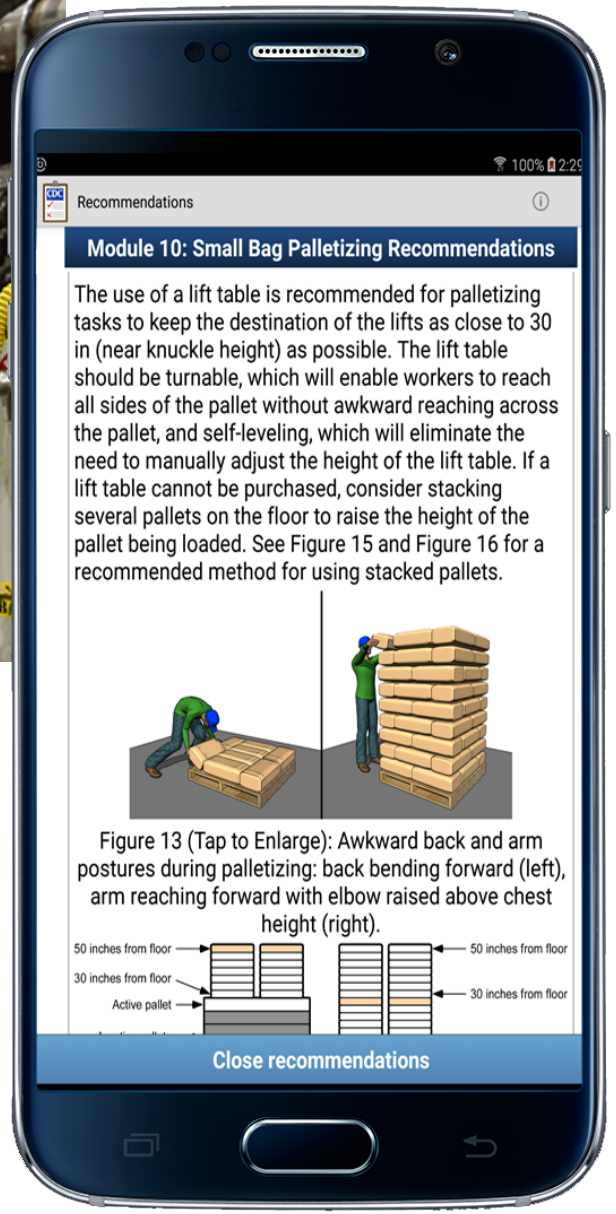
Learn more:
www.cdc.gov/niosh/topics/falls

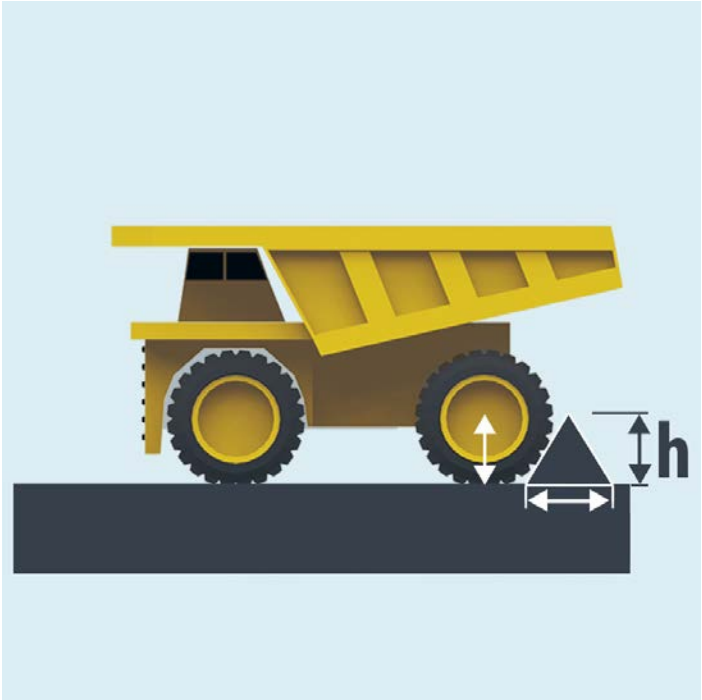
Apps



Fliers

ErgoMine mobile ergonomics audit tool brings safety audits to the site





Thank You!

Safe mines - Healthy workers

QUESTIONS?