NIOSH focuses on the study of worker health and safety

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

President of the United States

Department of Health and Human Services

Centers for Disease Control and Prevention

National Institute for Occupational Safety and Health

- 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 works closely with other federal agencies:

- President of the United States
- Department of Health and Human Services
- Centers for Disease Control and Prevention
- National Institute for Occupational Safety and Health
- Department of Labor
- Mine Safety and Health Administration
- Occupational Safety and Health Administration

Research
Innovative Solutions

Regulation
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

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

3,242 fatalities

911 from gas or dust explosions

Bloody December

692 miners died in explosions
Joseph A. Holmes appointed as the first director
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.
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

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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.
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. The graph shows the prevalence of progressive massive fibrosis (PMF) among coal miners with ≥ 25 years of underground mining experience. The 1969 Coal Mine H&S Act went into effect, and since then, the prevalence has decreased significantly. 

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).

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

SN – Silicotic Nodule

Coal mine dust contains many different types of particles

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

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 of silicosis within 4 years.

- **1933** - 476 deaths from Hawk’s Nest Tunnel Project: workers died from silicosis drilling this tunnel in West Virginia.
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

Samples transferred to lab (1-3 days)
Lab analysis (5-10 days)
Data report generated by lab
Sample data used for decision making
Respirable dust samples collected
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:

1. **Collect** samples using gravimetric dust samplers
2. **Analyze** samples with a portable FTIR unit
3. **Process** the FTIR data with NIOSH FAST software
   - **60 seconds**
4. **Verify** field analysis with laboratory tests
   - **150 seconds**
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

Nonmetal Mines

- Cleanup Man: 44.4%
- Utility Man: 24.2%
- Forklift Operator: 20.0%
- Bagging Operator: 17.9%
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

Guidelines for Performing a Helmet-CAM Respirable Dust Survey and Conducting Subsequent Analysis with the Enhanced Video Analysis of Dust Exposures (EVADE) Software

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.

- **Did you know?**
  - Using clothes cleaning technology throughout the workday can reduce your exposure to respirable dust by up to 88%.
  - Launder clothes post-shift, including sweatshirts and coats, and use leather (not cloth) gloves to avoid dust buildup.

- **Did you know?**
  - Cloth chairs in mobile equipment, break rooms, and offices can hold high levels of dust.
  - Use vinyl or leather seat covers or plastic chairs when possible.

- **Did you know?**
  - Folding bulk or mini-bag loading collars away from your breathing zone can reduce peaks in respirable dust exposure up to 92%.

- **Did you know?**
  - Starting with a forceful stream of water during housekeeping (e.g., hosing down equipment, walls, beams, and the floor) can elevate dust exposure.

Findings based on CDC field studies. To learn more, visit gcs.cdc.gov/cam.
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

Percentage of nonfatal lost-time injuries by accident class at surface mining locations, 2012-2017

- Handling materials: 35%
- Slip or fall of person: 30%
- Hand tools: 10%
- Machinery: 7%
- Powered haulage: 5%
- Unknown or NEC: 3%
- Stepping/kneeling on object: 2%
- Striking or bumping: 1%
- Electrical: 0%

and 13% percent of occupational fatalities were due to slip or fall of person, 2012 - 2017

Data Source: MSHA
Get the Ladder Safety App

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

Don’t Slip Up!
Slips can occur on inclines as little as 10°. NIOSH mining research has shown diamond weave grating to provide the best slip protection.

Friction is your friend on inclined walkways.

Wear a tool backpack to avoid carrying tools in your hands.
Always maintain three points of contact.
Choose diamond weave grating when possible.
When walking downhill, go slow.
Use extra caution when ice, grease, water, or other debris is present.

To learn more visit
www.cdc.gov/niosh/mining

To read the full research paper, please visit http://go.usa.gov/v3BAD.

Solutions
Research
Apps
Fliers
ErgoMine mobile ergonomics audit tool brings safety audits to the site
QUESTIONS?

Safe mines - Healthy workers