Health Effects of Overexposure to Respirable Silica Dust

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Presentation Outline

• Silica dust
• Lung diseases in mining
• Magnitude of impact on mining industry
• NIOSH efforts
• Black lung video
Silica Dust

- 2\textsuperscript{nd} most common element in the earth’s crust (27.7%)
- Found in many types of rock and ore
- Respirable-sized silica particles liberated during drilling, crushing, loading, and dumping
Respirable Silica Dust in Mining

• Dust less than 10 microns in size (cannot be seen with the eye)
• Overexposure can cause lung disease
• X-ray surveillance may be initial means of disease diagnosis
• Current dust exposures limits established in 1977
• Occupational sampling conducted by MSHA to monitor exposure
• Control technologies developed and used to reduce worker exposures
Diseases Caused by Inhalation of Respirable Mine Dust

• Fibrotic diseases – damage/destroy lung tissue:
  – Coal workers’ pneumoconiosis (CWP)
  – Silicosis

• Airflow diseases (COPD) – block movement of air in and out of lungs:
  – Bronchitis
  – Emphysema
  – Mineral dust airway disease
Fibrotic Lung Diseases in Miners

Silicosis and CWP:
- Similar patterns on chest x-ray
- Simple and complicated forms of disease
- Complicated is progressive massive fibrosis (PMF)
- Smoking does not cause these diseases
- International Labour Office (ILO) standards used to determine severity
- Cannot be cured, so prevention is the key
International Labour Office Classification of Radiographs

------------------ simple pneumoconiosis -----------------------

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ILO classification

I --- PMF --- I
Pneumoconiosis

• Chronic lung disease resulting from inhalation of respirable dust

• Dust deposits in the lungs, damages lung tissue, and causes scarring

• Disease development typically takes over 10 years of dust exposure

• Silicosis results from inhalation of respirable silica dust

• Coal workers’ pneumoconiosis (black lung disease) results from inhalation of respirable coal dust
Simple Pneumoconiosis

• Initially worker may not have any symptoms

• As disease progresses, symptoms appear:
  – Coughing
  – Wheezing
  – Shortness of breath (especially during exercise)

• Disease can advance to PMF
Simple Silicosis

Basically Normal Lung

Section of Freeze-Dried Human Lung Silicosis
Complicated Pneumoconiosis

- Progressive massive fibrosis (PMF)
- Fibrous tissue develops in lungs
- Lungs become stiff and cannot expand fully
- Breathing becomes difficult
- Lips and fingernails may have bluish tinge
- Fluid retention and signs of heart failure
Progressive Massive Fibrosis
Exposure to Respirable Crystalline Silica

• Silica more toxic than coal and is regulated to 1/20th the level of coal dust

• Freshly fractured silica more toxic than aged silica

• Smaller particles are more problematic

• Consequences of overexposure:
  – Silicosis
  – Airways diseases
  – Pulmonary tuberculosis
  – Chronic renal disease
  – Lung cancer (silica classified as a carcinogen)
Silicosis Classifications

• Chronic:
  – Occurs after 10 or more years of exposure
  – Swelling in lungs
  – Troubled breathing similar to COPD

• Accelerated:
  – Develops in 5 to 10 years
  – Symptoms occur faster than in chronic silicosis

• Acute:
  – Develops in less than 5 years
  – Lungs become inflamed and fill with fluid
  – Severe shortness of breath and low blood oxygen
Acute Silicosis at Gauley Bridge, WV

- Hydroelectric project in early 1930s near Gauley Bridge, WV
- Drive a 3-mile tunnel to redirect the New River through the Gauley Mountain
- Sandstone and limestone strata containing high levels of silica
- Over 450 deaths resulting from acute silicosis
Treatment of Lung Disease in Miners

• No medication can reverse damage from dust

• Treatment directed at reducing symptoms and prevention of complications:
  – Vaccines against flu and pneumonia
  – Antibiotics for infections and congestion
  – Bronchodilators for airway spasm
  – Oxygen supplementation
  – Treatment for heart failure

• Lung/heart transplant as last resort
Silicosis-related Deaths

- General consensus is that the disease is under reported
- All states do not report statistics on industry/occupations of impacted workers (information available for only 1/3 of total deaths)
- Metal/nonmetal (M/NM) mining and quarrying accounted for 15% of reported deaths from 1990s
CWP More Effectively Tracked in Underground Coal Miners

- Surveillance and benefits program mandated by the Federal Coal Mine Health and Safety Act of 1969
- Periodic x-rays available to underground coal miners (voluntary)
- NIOSH administers program
- Statistics more readily available
Need for Increased Emphasis on Dust Control

• Overexposures continue for high-risk occupations

• DRDS identified an increase in black lung disease, rapid progression of the disease, and disease in younger miners (Enhanced Coal Workers’ Health Surveillance Program)

• S-MINER Bill proposed reduced dust standards:
  – 1.0 mg/m³ coal mine dust standard
  – 50 μg/m³ silica dust standard

• MSHA has placed coal dust on regulatory agenda for 2010 and silica dust on regulatory agenda for 2011

• As mining becomes more efficient and production increases, the potential to generate more dust also increases
NIOSH Efforts:

• Initiating research to examine control technologies that can help industry comply with anticipated reductions in dust standards

• Compiled two publications that summarize dust control technologies for coal and metal/nonmetal mining (Best Practices Information Circulars 9517 & 9521)

• Conducting workshops to assist in transferring information to stakeholders and gain feedback

• DRDS produced “Faces of Black Lung” video to raise awareness of pneumoconiosis in miners
“Faces of Black Lung” DVD

- Same type of disease as silicosis
- DRDS interviewed two coal miners that have contracted CWP
- Miners discuss the importance of protecting themselves from dust exposure
- Copies available from Anita Wolfe (304) 285-6263

Important Messages……

“And always remember: What’s on your face you can wash-off, but what’s on your lungs you can’t. So be safe, and take care of yourself.”

Carl Bailey
58 years old.
Worked 28 years in WV mines, with most of his work at the face

“I was always trained to avoid injuries and I should’ve paid more attention to the dust.”

Chester Fike
55 years old.
Worked 34 years in mines in WV and MD and operated a continuous miner for 27 years.
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Thank you!

Questions??

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