

Health Effects of Overexposure to Respirable Silica Dust



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- Anita Wolfe, Public Health Advisor
- Edward L. Petsonk, MD, Senior Medical Officer (retired)



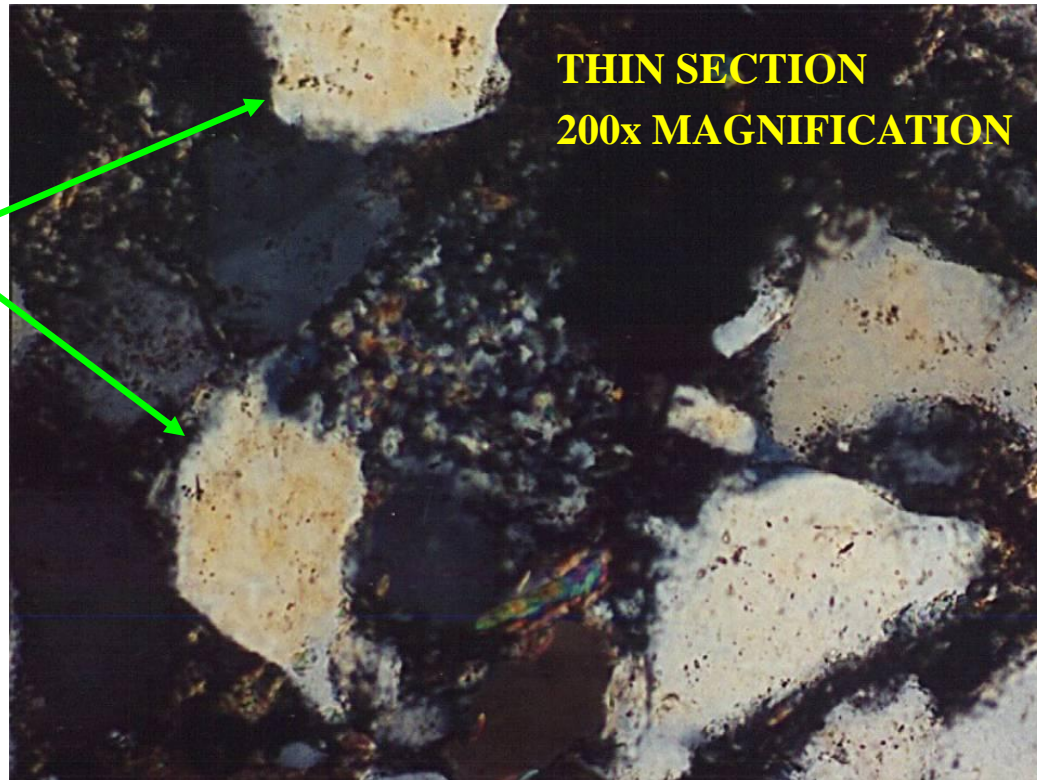
Presentation Outline

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

Silica Dust

- 2nd 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

Silica particles
embedded in
limestone



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

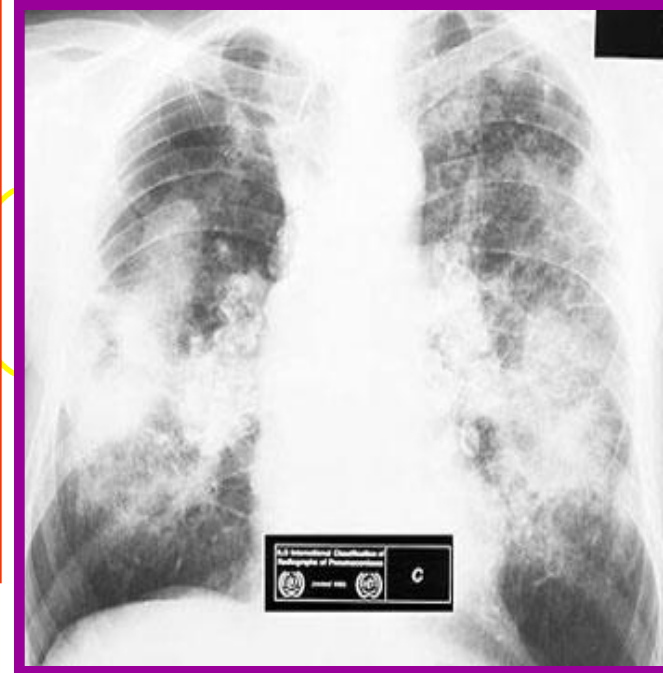
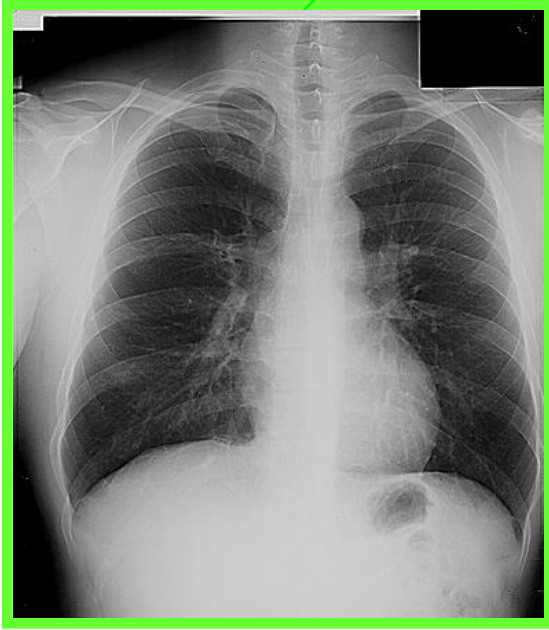
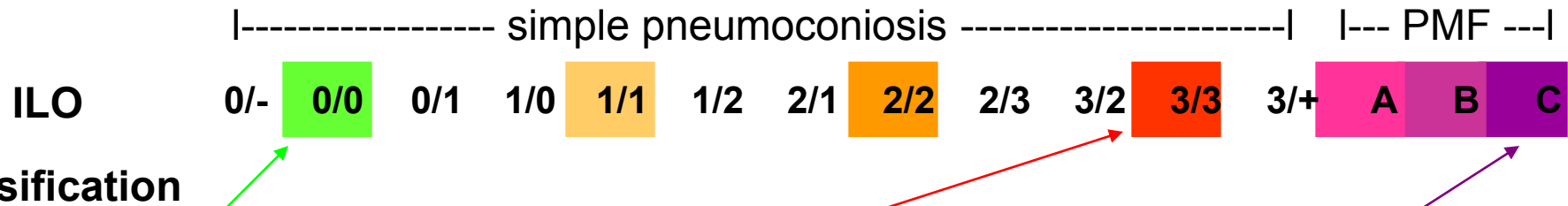
- Fibrotic diseases – damage/destroy lung tissue:
 - Coal workers' pneumoconiosis (CWP)
 - Silicosis
- Airflow diseases (COPD) – block movement of air in and out of lungs:
 - Bronchitis
 - Emphysema
 - Mineral dust airway disease

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



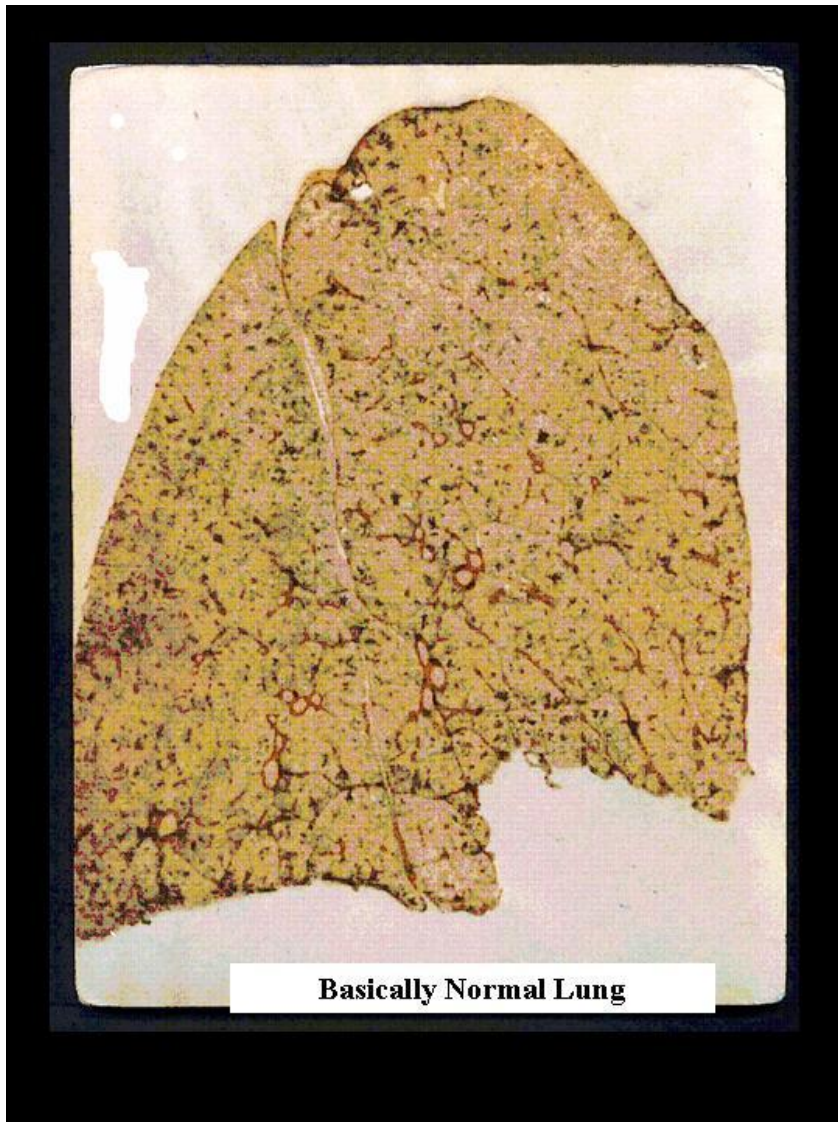
Pneumoconiosis

- 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

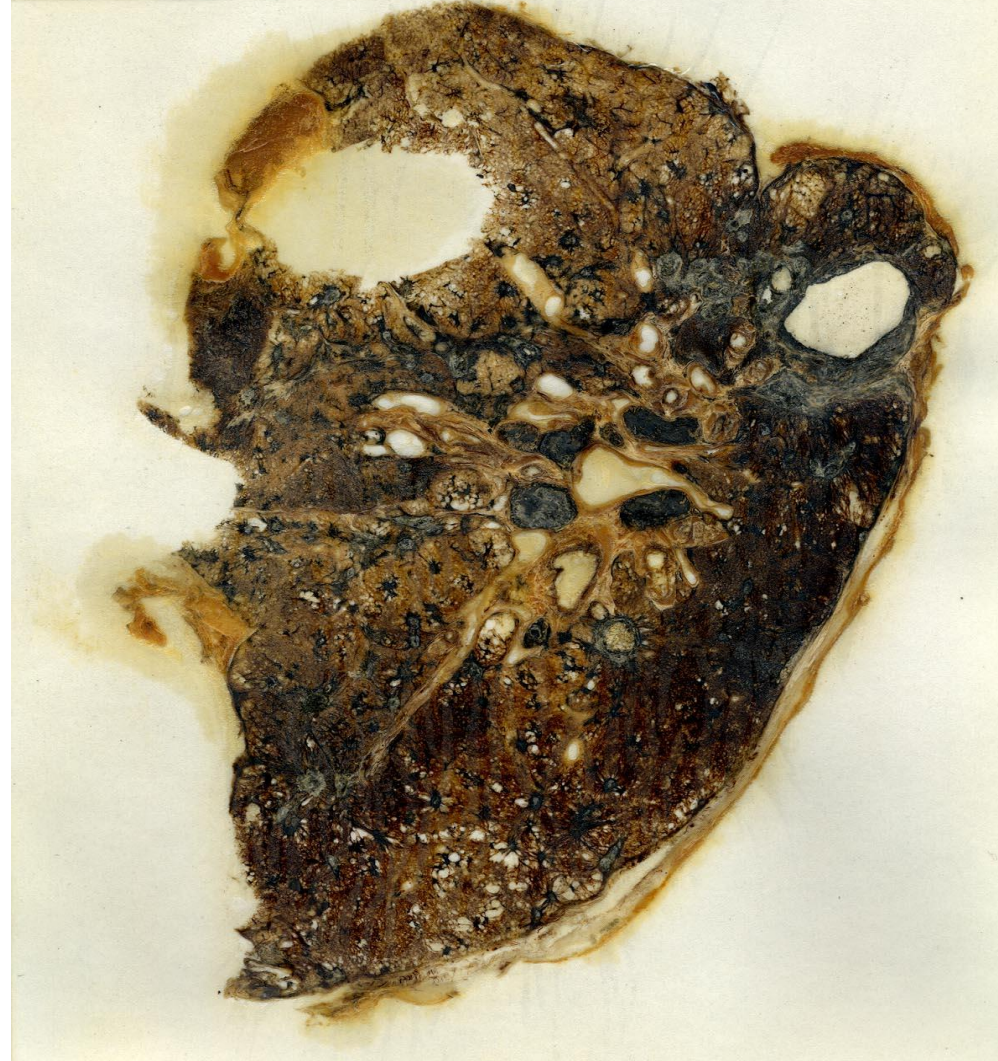


Complicated Pneumoconiosis

- 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

Section of Freeze-Dried Human Lung
Silicosis



Exposure to Respirable Crystalline Silica

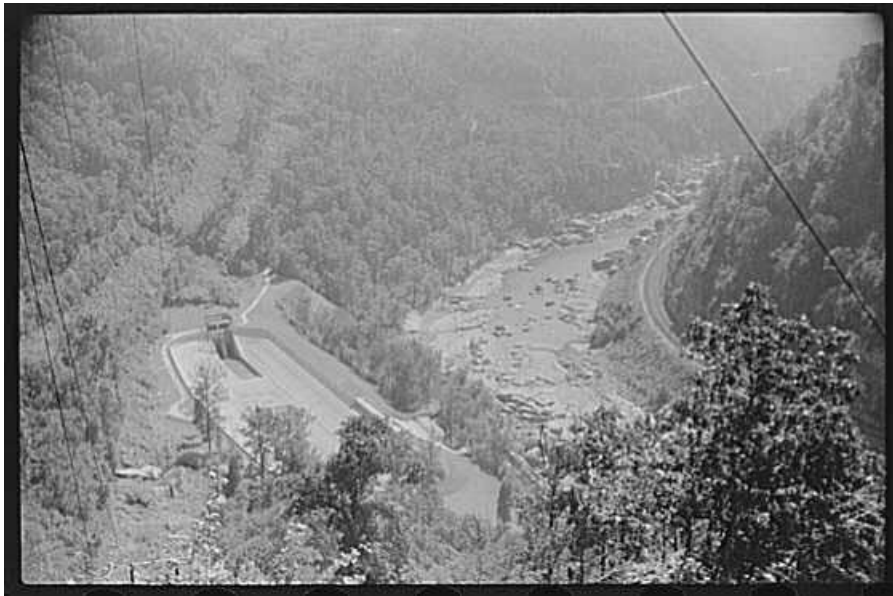
- Silica more toxic than coal and is regulated to 1/20th the level of coal dust
- Freshly fractured silica more toxic than aged silica
- Smaller particles are more problematic
- Consequences of overexposure:
 - Silicosis
 - Airways diseases
 - Pulmonary tuberculosis
 - Chronic renal disease
 - Lung cancer (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

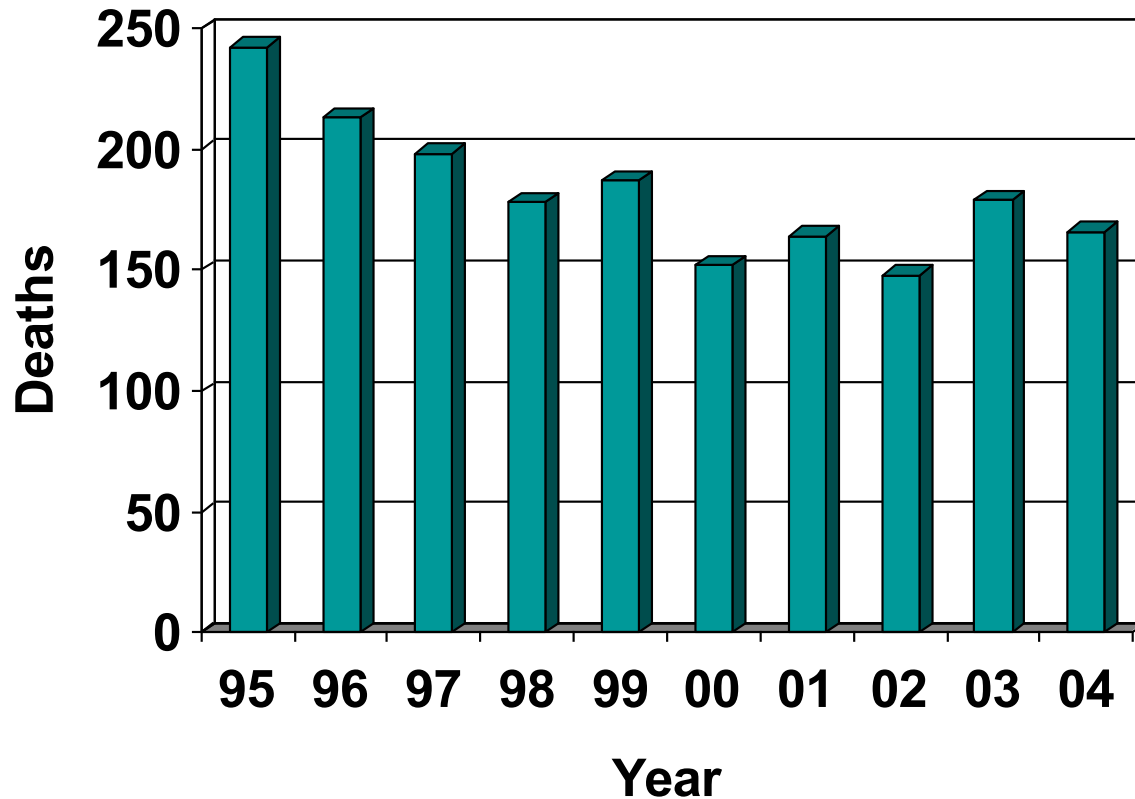


Treatment of Lung Disease in Miners

- 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



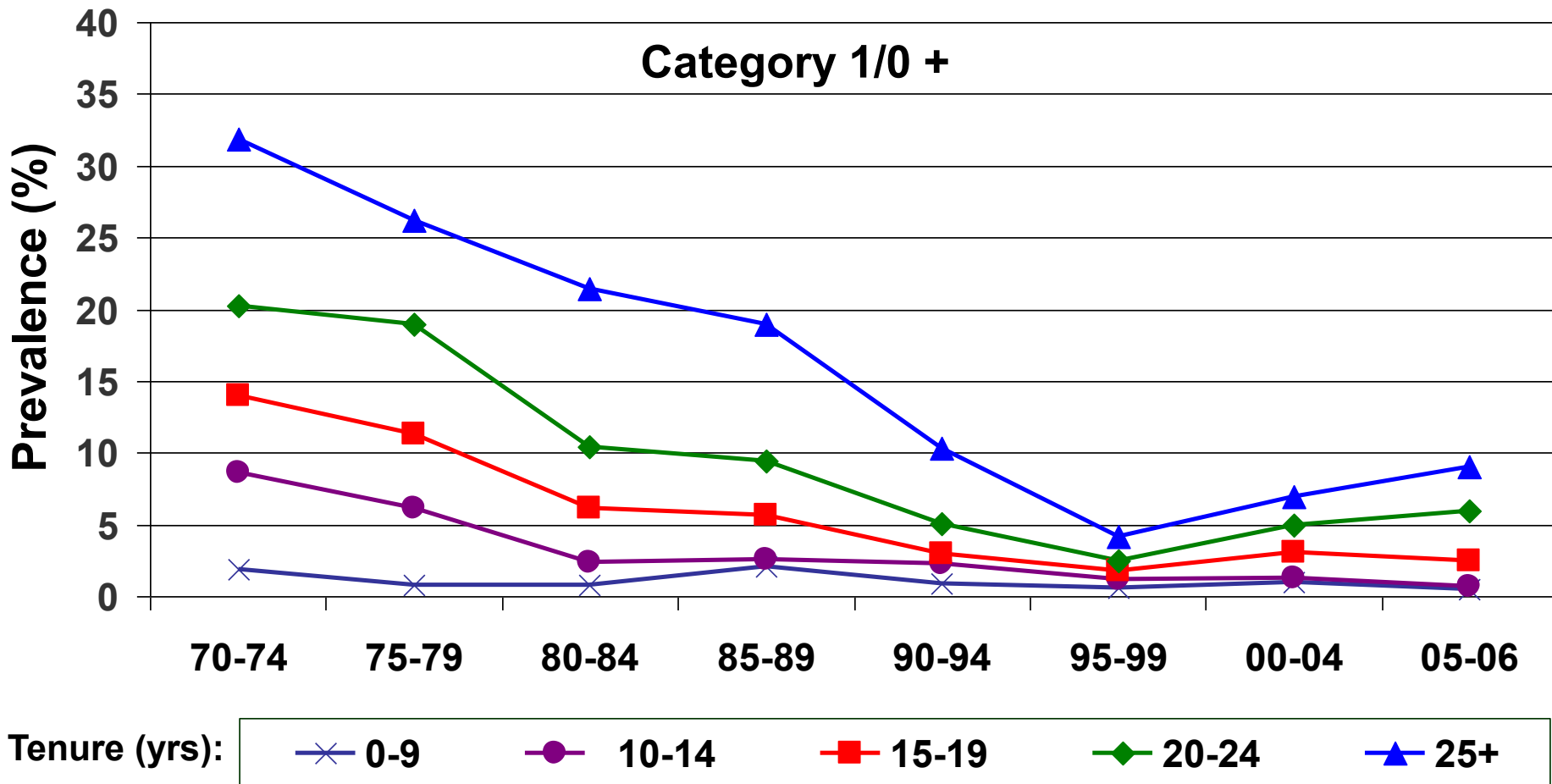
CWP More Effectively Tracked in Underground Coal Miners

- 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



Trends in CWP Prevalence by Tenure Among Examinees Employed at Underground Coal Mines

(U.S. National Coal Workers' X-Ray Surveillance Program, 1970–2006)



Need for Increased Emphasis on Dust Control

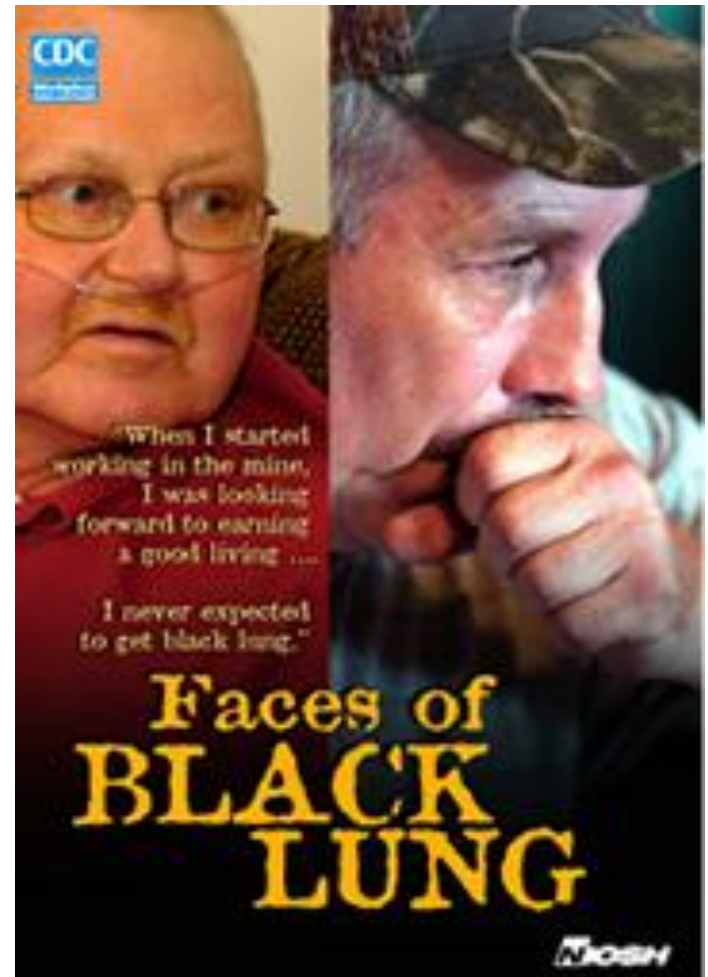
- Overexposures continue for high-risk occupations
- DRDS identified an increase in black lung disease, rapid progression of the disease, and disease in younger miners (Enhanced Coal Workers' Health Surveillance Program)
- S-MINER Bill proposed reduced dust standards:
 - 1.0 mg/m³ coal mine dust standard
 - 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



Website for video: <http://www.cdc.gov/niosh/docs/video/2008-131/default.html>

Slide with Link to “Faces of Black Lung” video
<http://www.cdc.gov/niosh/docs/video/2008-131/>

Important Messages.....

A close-up portrait of Carl Bailey, a middle-aged man with light hair and a mustache, wearing a red collared shirt and clear safety glasses. He is looking directly at the camera with a neutral expression.

Carl Bailey

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

“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”.

A close-up portrait of Chester Fike, a middle-aged man with a mustache, wearing a light-colored plaid shirt and a dark cap. He is looking slightly to the right of the camera with a serious expression.

Chester Fike

55 years old.
Worked 34 years in mines
in WV and MD and operated
a continuous miner for 27 years.

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

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Thank you!

Questions??

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