Lung Diseases of Coal Miners

National Mine Health and Safety Academy
July 25, 2007

Edward L. Petsonk, MD, Team Leader
Workforce Screening and Surveillance Team
Senior Medical Officer
Division of Respiratory Disease Studies

The findings and conclusions in this presentation have not been formally disseminated by NIOSH and should not be construed to represent any agency policy or determination.

CDC Workplace Safety and Health

National Institute for Occupational Safety and Health NIOSH

Understanding, detecting, and preventing lung disease from coal mining

- Definitions
- Causes
- Disease course
  - Role of smoking
  - Impact on life quality
- Diagnosis
- Treatment
- Prevention
- Recent findings (from medical monitoring)

Diseases caused by: Inhalation of coal mine dust and the body's reaction to it

- The Mine Act – Title IV
  - "chronic dust disease of the lung arising out of employment in an underground coal mine"

Diseases caused by: Inhalation of coal mine dust and the body's reaction to it

- Fibrotic diseases – damage/destroy lung tissue
  - Silicosis
  - Coal workers' pneumoconiosis "CWP"
- Airflow diseases "COPD" – block movement of air in and out of lungs
  - Bronchitis
  - Emphysema
  - Mineral dust airway disease
- Infectious diseases – dust reduces immunity
  - Tuberculosis in other countries, previously in U.S.

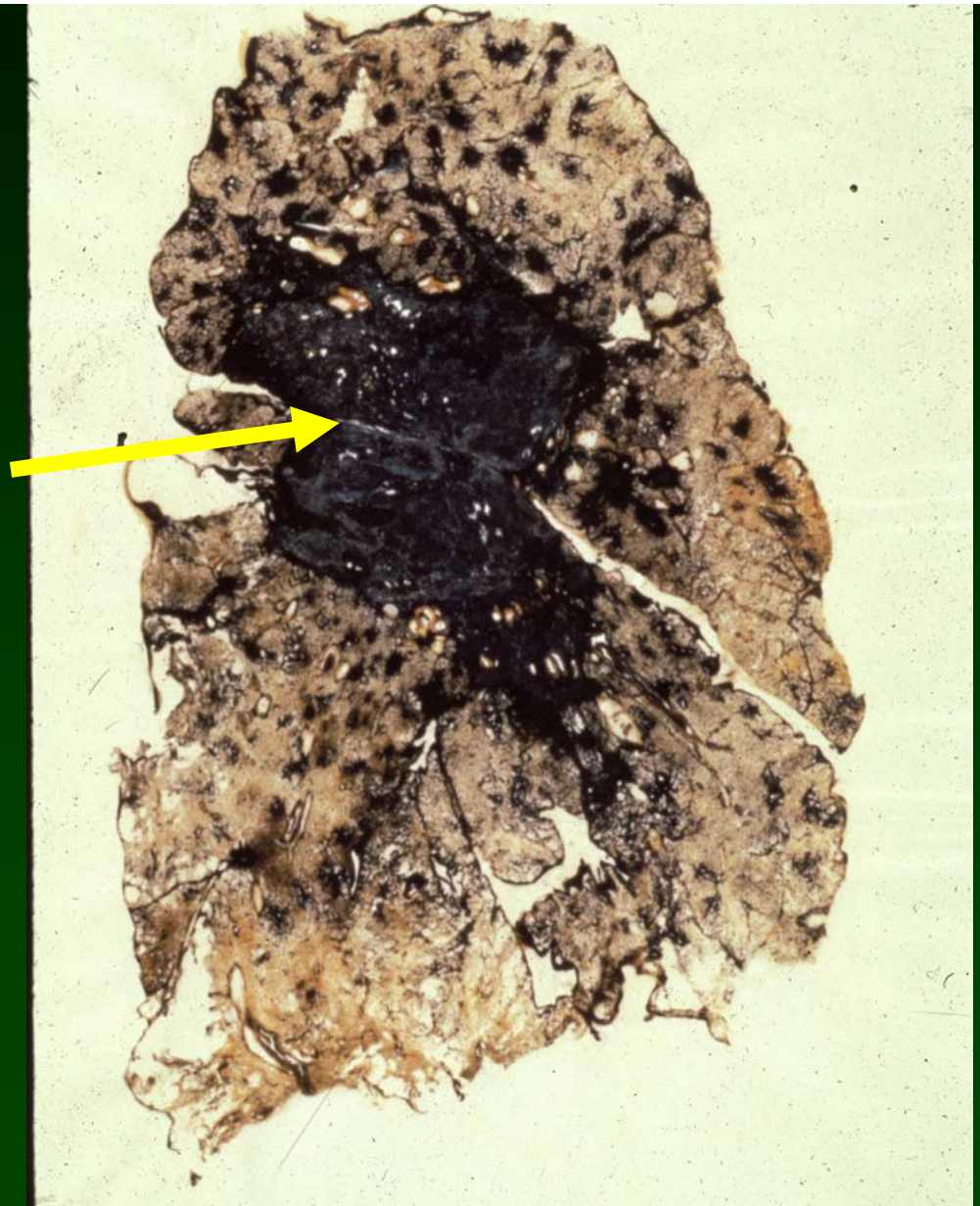
Diseases Caused by Inhalation of coal mine dust

- Fibrotic lung diseases
  - Silicosis
  - Coal workers' pneumoconiosis
  - Both diseases:
    - Similar patterns on chest x-ray
    - Simple and Complicated forms
    - Complicated = Progressive Massive Fibrosis (PMF)

Section of Human Lung at Autopsy
78-Year Old
Basically Normal Lung

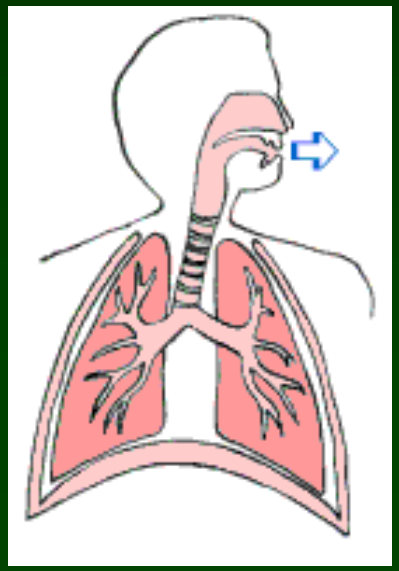
Section of Human Lung
Early simple coal workers' pneumoconiosis

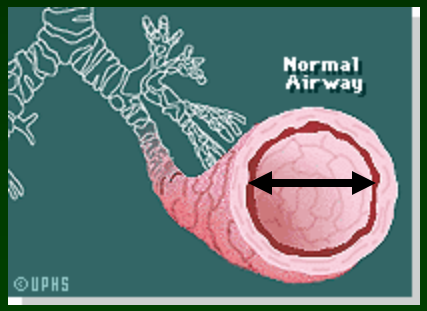
Section of Human Lung
Complicated coal workers' pneumoconiosis
(Progressive Massive Fibrosis)

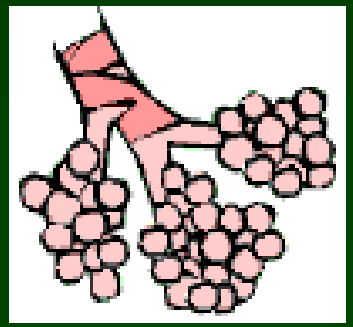


Diseases Caused by Inhalation of coal mine dust

- Airflow obstructive diseases “COPD”
  - Bronchitis
  - Mineral dust airway disease
  - Emphysema

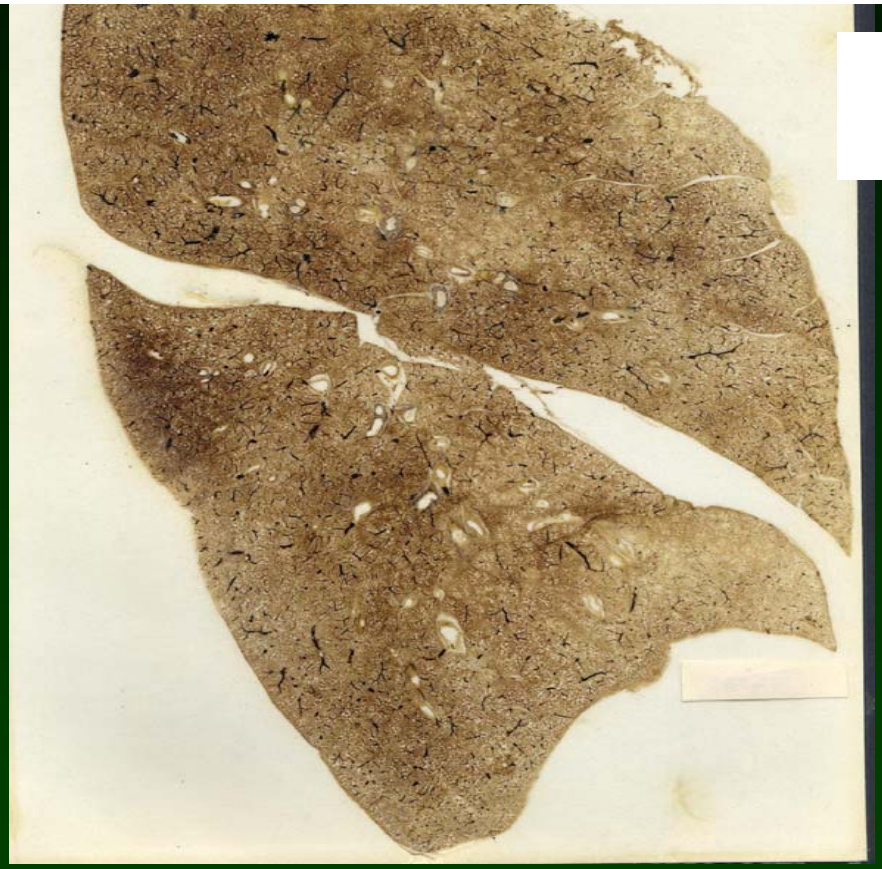




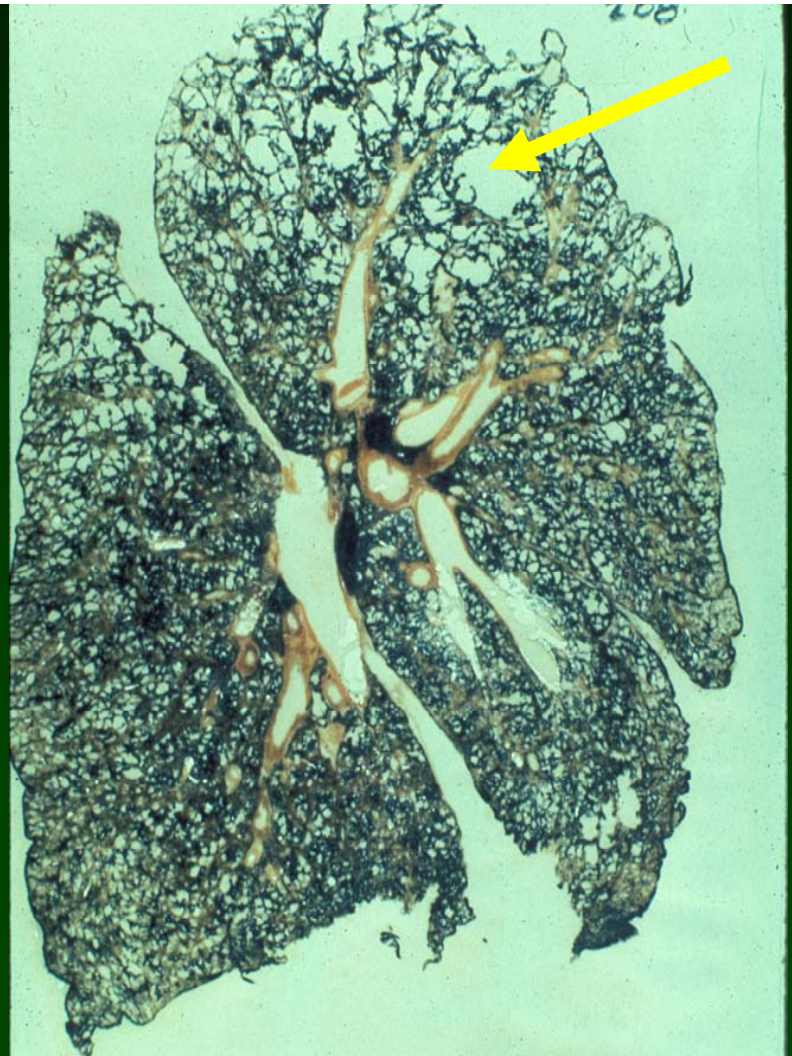


If a miner has emphysema – Air is trapped in the lung

Section of Human Lung at Autopsy
78-Year Old
Basically Normal Lung



Section of Human Lung
Coal mine dust-related emphysema



Course of Dust Disease in Miners

- Symptoms
- Physical examination
- Breathing tests
- X-rays

All findings may be NORMAL in early disease

Death from respiratory failure or heart failure

Course of Dust Disease in Miners

- Symptoms
  - Cough, phlegm, wheeze
  - Shortness of breath
  - Swelling
- Physical examination
  - Lung sounds often normal until late
  - Heart failure, fluid retention
- Breathing tests
  - Decreased breathing capacity
  - Low oxygen uptake

Course of Dust Disease in Miners

Years of over-exposure

5 10 15 20 25 30 35

Symptoms

X-ray changes

Functional impairments

Disability/death

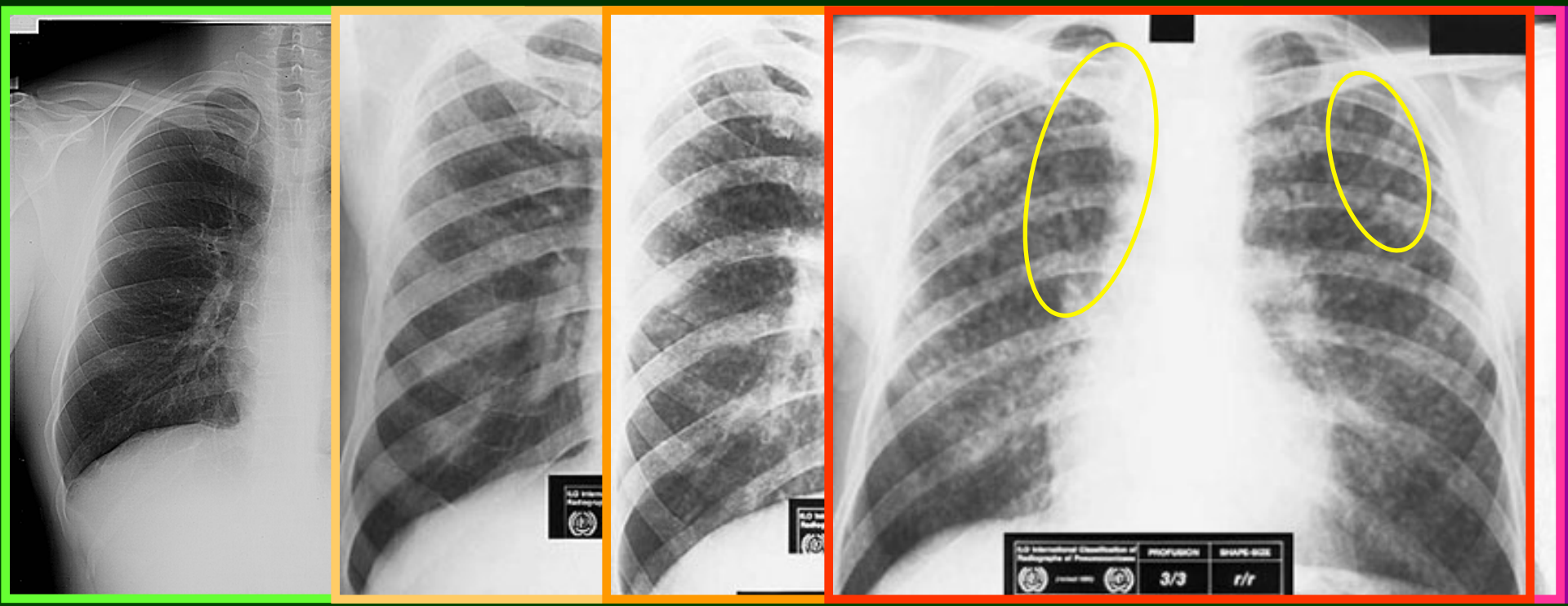
International Labour Office Classification of Radiographs

Profusion of small opacities

Large opacities

ILO classification

0/- | 0/0 | 0/1 | 1/0 | 1/1 | 1/2 | 2/1 | 2/2 | 2/3 | 3/2 | 3/3 | 3/+ | A | B | C



Course of Dust Disease in Miners

- Development and progression depend on
  - Level of respirable dust exposure
  - Toxicity of dust
  - Age of miner and years of mining
  - Clearance of dust from the lung
  - Other diseases/exposures/complications

- Miners often develop more than one disease

Among Smoking Miners: Impact of Tobacco Smoking on Dust Diseases

- Coal Workers' Pneumoconiosis and Silicosis
  - Smoking does not cause these diseases
  - Smoking does not accelerate progression
- Airway obstructive diseases
  - Both smoking and dust can cause these diseases
  - Lung damage from smoking adds to damage caused by dust

Diagnosis of Coal Workers' Pneumoconiosis

- History of inhalation of coal mine dust
- Latency period usually 10 years or more
- Radiographic pattern of abnormality
- Lung function test results
- Other medical history
- No specific findings on lung examination

Treatment of Dust Disease in Coal Miners

- No medication can reverse dust damage
- 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

Quality of Life with Dust Disease in Coal Miners

- Best described by affected miners

BlackLungClip.wmv
(7 MB)

Prevention of Dust Disease in Coal Miners

- Reduce the level of dust exposure ***
- Reduce the toxicity of the dust
- Allow time for dust to clear from lungs

Prevention of Dust Disease in Coal Miners

- Reduce the level of dust exposure ***
  - Continuous attention to effective controls
  - Accurate and extensive dust monitoring
    - Personal continuous dust monitoring
  - Respirators when dust levels exceed PELs
    - Least reliable approach to reducing exposure

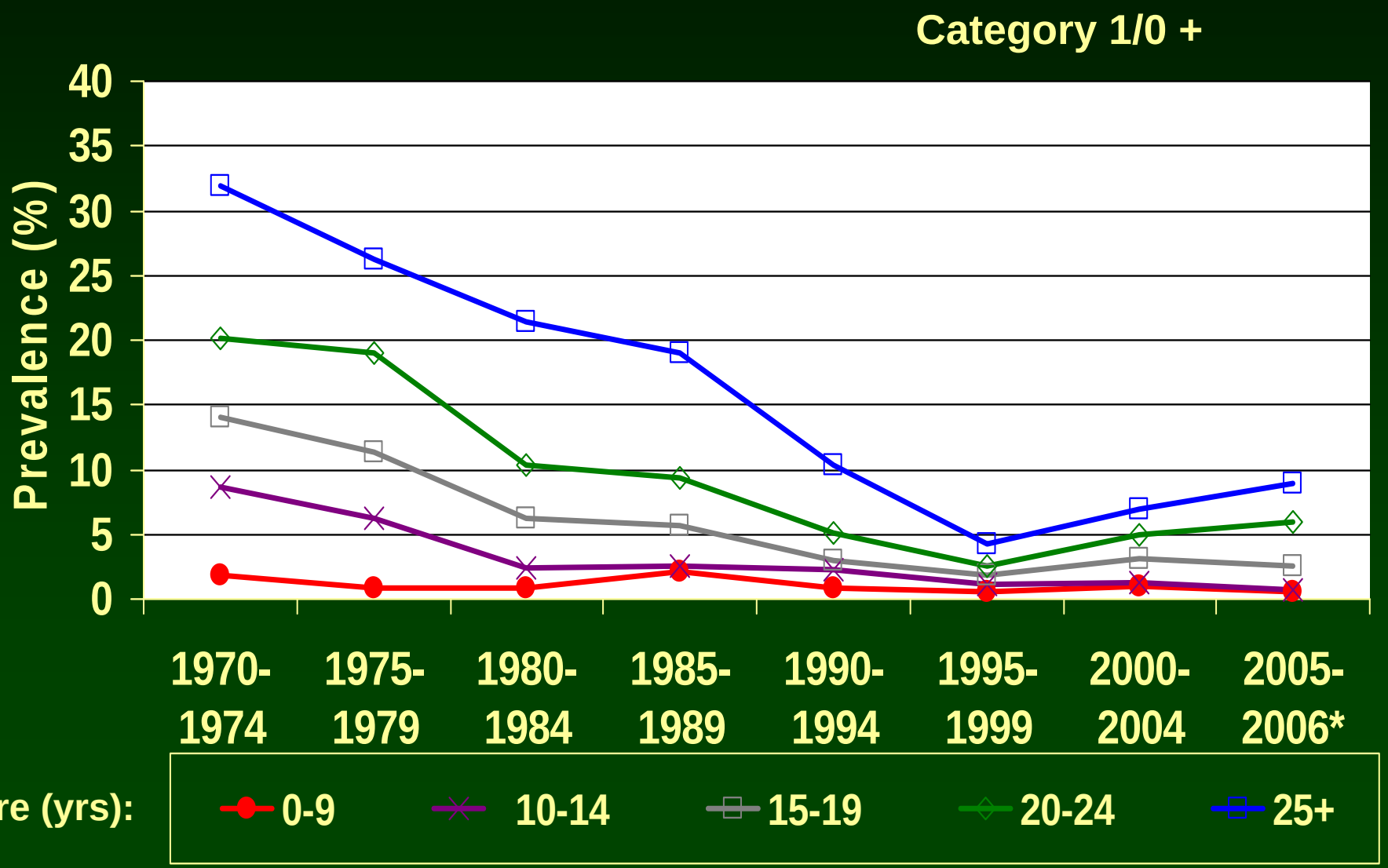
Prevention of Dust Disease in Coal Miners

- Reduce the level of dust exposure ***
- Reduce the toxicity of the dust
  - Silica is 20 times more toxic than coal
  - Reduce potential exposures to silica (drilling/cutting rock)
  - Reduce fresh fractured rock/coal exposures
  - Smaller particles are more toxic

Prevention of Dust Disease in Coal Miners

- Reduce the level of dust exposure ***
- Reduce the toxicity of the dust
- Allow time for dust to clear from lungs
  - Long shifts and extended work weeks
    - Increases dust inhaled
    - Reduces time between shifts to clear dust from lungs

Trends in coal workers' pneumoconiosis prevalence by tenure among examinees employed at underground coal mines, U.S. National Coal Workers' X-Ray Surveillance Program, 1970-2006



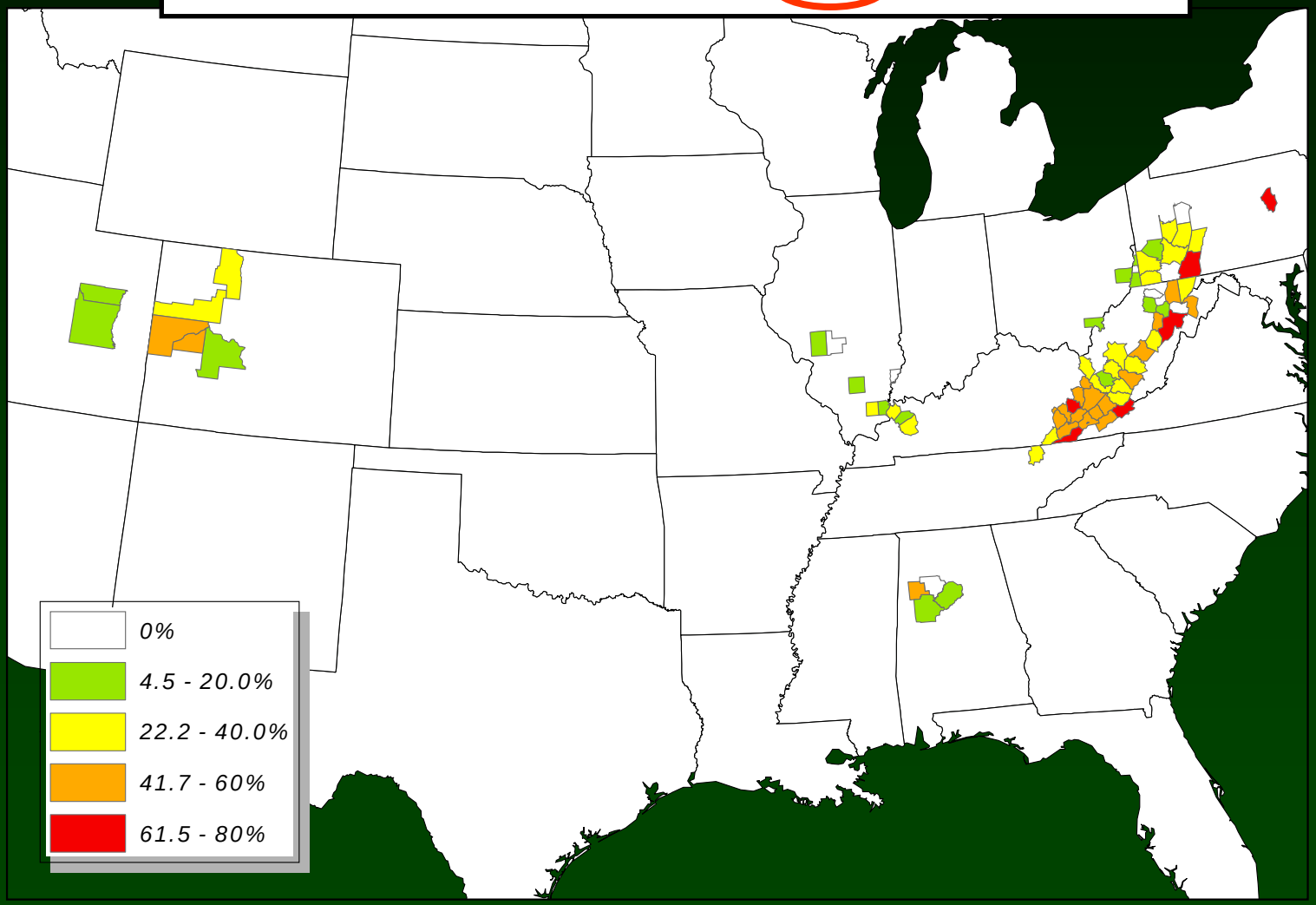
Rapidly County

ORIGINAL ARTICLE

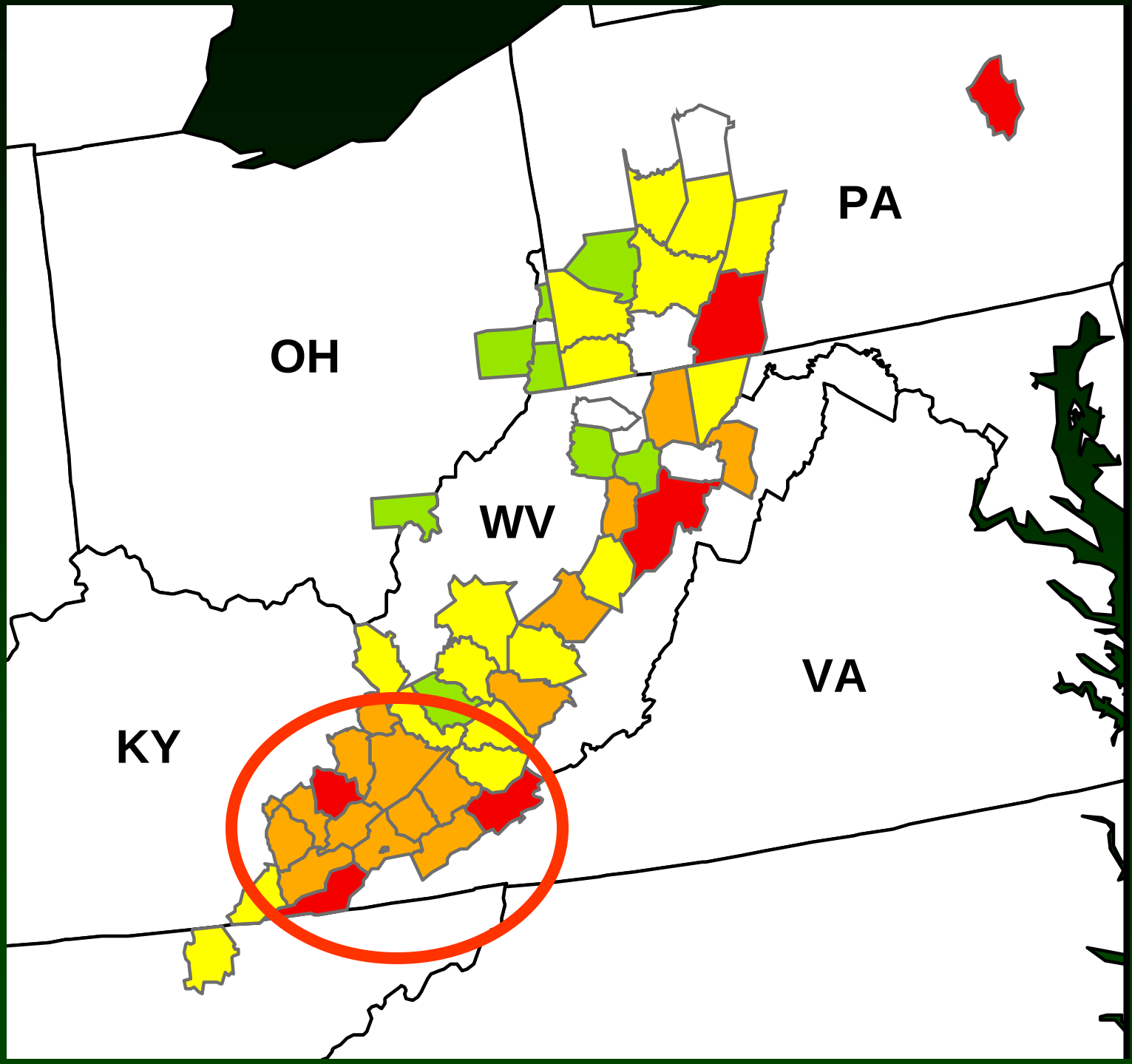
Rapidly progressive coal workers' pneumoconiosis in the United States: geographic clustering and other factors

V C dos S Antao, E L Petsonk, L Z Sokolow, A L Wolfe, G A Pinheiro, J M Hale, M D Attfield

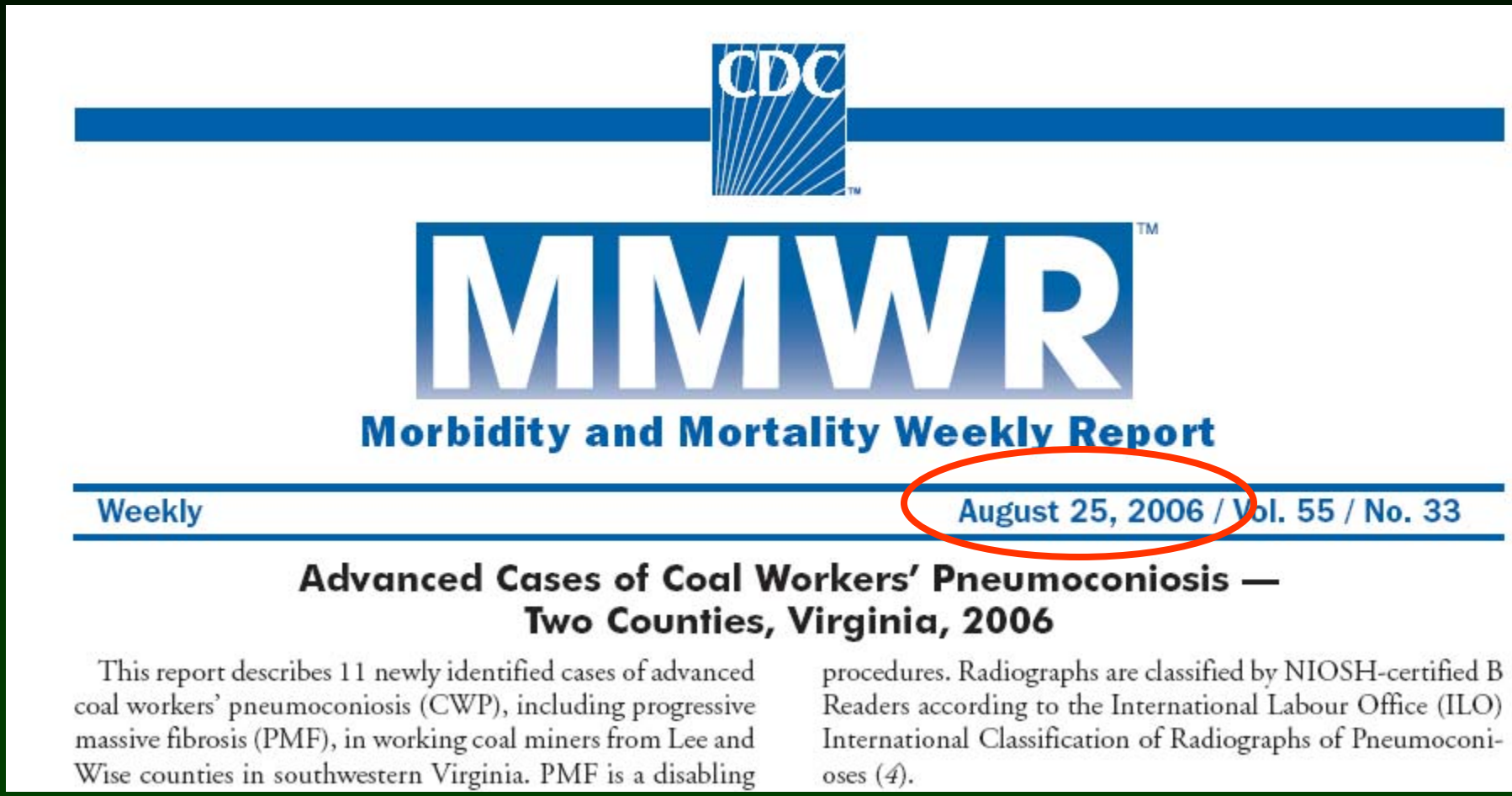
Occup Environ Med 2005;62:670–674. doi: 10.1136/oem.2004.019679



*Not shown are counties with fewer than 5 miners evaluated


PA
OH
WV
VA
KY

New effort:
NIOSH Miner Health Surveys to assess Black Lung “Hot Spots”



CDC

MMWR

Morbidity and Mortality Weekly Report

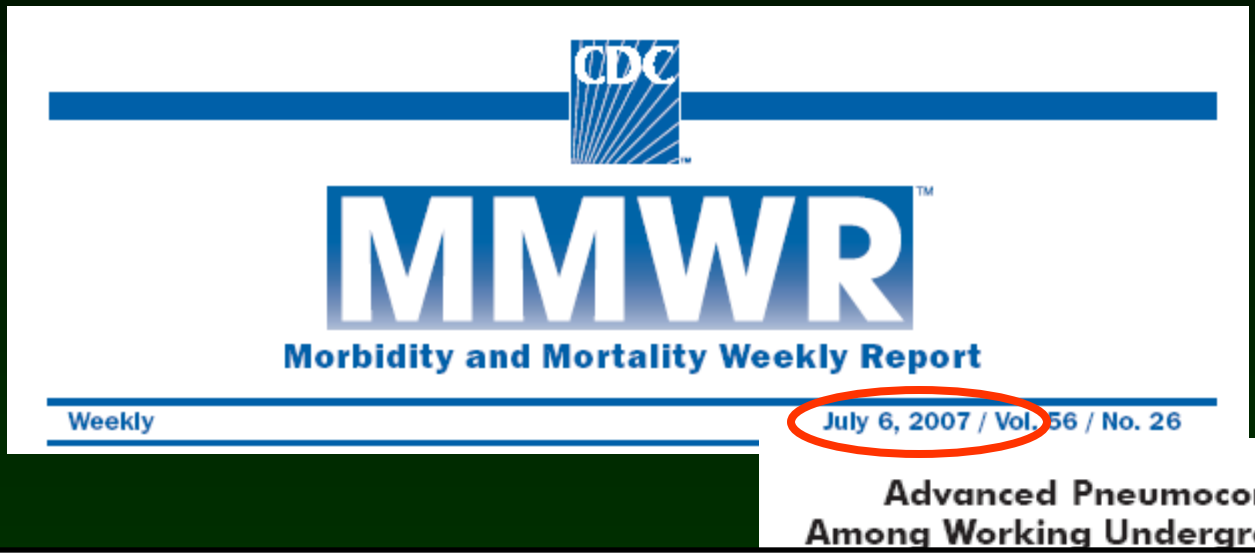
Weekly August 25, 2006 / Vol. 55 / No. 33

Advanced Cases of Coal Workers' Pneumoconiosis — Two Counties, Virginia, 2006

This report describes 11 newly identified cases of advanced coal workers' pneumoconiosis (CWP), including progressive massive fibrosis (PMF), in working coal miners from Lee and Wise counties in southwestern Virginia. PMF is a disabling

procedures. Radiographs are classified by NIOSH-certified B Readers according to the International Labour Office (ILO) International Classification of Radiographs of Pneumoconioses (*4*).

NIOSH teams are traveling through southern Appalachia – and have found more miners with advanced and rapidly progressive black lung disease



- 37 newly reported cases of advanced lung disease from dust in underground coal miners
- Silicosis versus CWP ?
- Advanced pneumoconiosis is developing under the enforcement regime of the 1969 Act
- Findings indicates gaps in regulations or procedures used to control dust

Thanks to the Staff - who do the work of NIOSH!

“The first priority and concern of all in the coal or other mining industry must be the health and safety of its most precious resource – the miner.”
Federal Coal Mine Health and Safety Act of 1969 – amended in 1977

In 2002, 27 deaths from coal mining accidents – and 854 deaths from black lung.

We can't eliminate dust in coal mining.
But by controlling dust
we can eliminate cases of advanced black lung!