

# Sustaining Safe Ventilation Practices in U.S. Coal Mining Operations

By:

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# Introduction

- The ventilation system is arguably the most critical of the components of an underground coal mine.
- Appropriate ventilation reduces or eliminates the risk of coal mine ignitions, fires and reduces (dilutes) airborne contaminants such as respirable dust and methane.



# Introduction

- A review of the last 9 years in regards to ignitions, fires and respirable dust was performed.
- The data was examined to ascertain if ventilation practice in U.S. coal mines has improved in this period of time.
- A description to how mine ventilation is handled in the U.S. and how other countries view coal mine ventilation engineers is presented.
- The concept of certifying ventilation engineers in the U.S. or an option for a mine ventilation certification is described.



# Background



In the United States, the Wilberg mine (fire), Jim Walter No. 5 (explosion), Willow Creek (explosion/ fire), Sago Mine (explosion), McElroy Coal Co (explosion), Aracoma Alma Mine (fire), Darby Mine (explosion), and Upper Big Branch (explosion), are examples where systems failed (1989 to 2010 – over 90 fatalities).

# Background



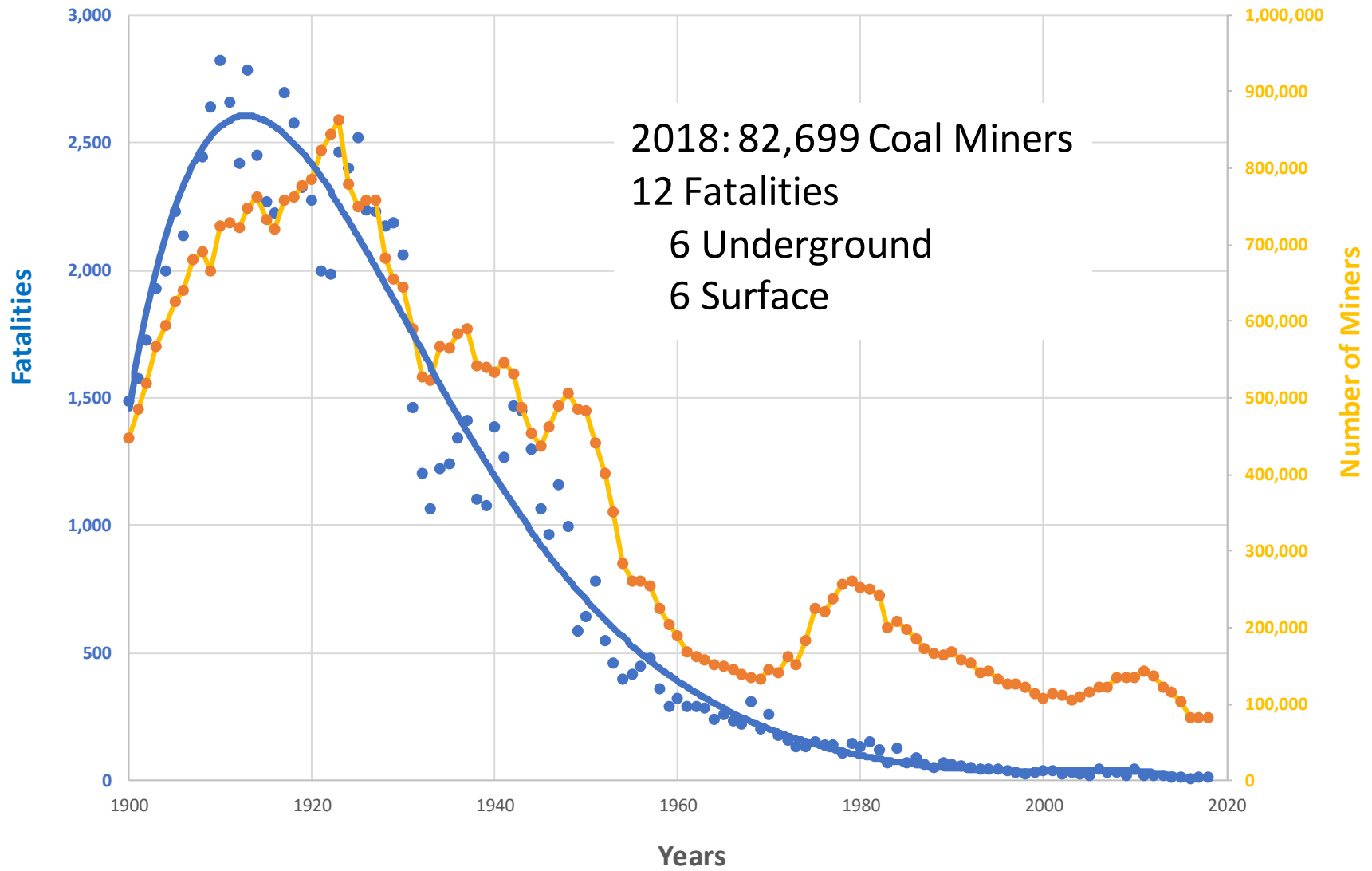
- These accidents were the driving force behind a significant push to improve coal mine ventilation.
  - Resulted in the MINER Act
  - Increased funding for mine ventilation research
  - Vigorous inspections by MSHA
- Since these accidents, the U.S. Coal industry has had two incidents caused by underground mine fires and/or explosions.
  - July 31, 2019 while installing a seal in an intake shaft, an ignition occurred and a contract employee fell 355 ft.
  - July 29, 2016 while welding a guard rail in an exhaust shaft an ignition occurred resulting in a single fatality.

# Background

- This low accident rate is commendable, however, coal mining in the United States has been on the decline due to competition from natural gas and increased electrical generation from solar and wind power.
- Between 2010 and the first quarter of 2019, US power companies announced the retirement of more than 546 coal-fired power units, totaling about 102 GW of generating capacity<sup>1</sup>.
- In this period the persons working in the U.S. Coal industry has shrunk from over 135,000 to 82,700 (a 38% drop) (MSHA website).

<sup>1</sup> FROM: [MARIAN WEBB](#) CREAMER MEDIA SENIOR RESEARCHER AND DEPUTY EDITOR ONLINE

Coal Fatalities for 1900 through 2018



From: <https://arlweb.msha.gov/stats/centurystats/coalstats.asp>

# Background

- Respirable dust has long been identified as a significant health issue among coal miners.





## Coal Workers' Pneumoconiosis and the UBB miners

Coal workers' pneumoconiosis (CWP), also called black lung disease, develops when respirable coal mine dust is inhaled and deposits in the lungs. It is a chronic, fibrotic, and irreversible disease that robs miners of their breath and life. CWP is wholly preventable with diligent use of dust control measures including proper ventilation, water sprays and dust collectors.

Autopsies of the 29 men who lost their lives in the Upper Big Branch explosion were performed by the West Virginia Medical Examiner.<sup>1</sup> Lung examinations, necessary to determine the presence or absence of CWP is a specialized review, requiring physicians with expertise, additional training and practice. At our request a recognized expert in occupational diseases and with experience in lung examinations of this sort reviewed the autopsy reports and determined the presence or absence of CWP.<sup>2</sup>

Of the 29 victims, five did not have sufficient lung tissue available to make a determination relating to CWP: two due to massive injury and three due to autolysis.<sup>3</sup> The remaining 24 victims had sufficient tissue for examination.

Seventeen of the 24 victims' autopsies (or 71 percent) had CWP. This compares with the national prevalence rate for CWP among active underground miners in the U.S. is 3.2 percent, and the rate in West Virginia is 7.6 percent.<sup>4</sup> The ages of the UBB victims with CWP ranged from 25 to 61 years.

Of the seven not identified as having CWP, four had what was characterized as "anthracosis" on their autopsy report. This term is often used in lieu of the term pneumoconiosis, or may refer to a black pigment deposition without the fibrosis and other characteristics needed to make a firm diagnosis of pneumoconiosis. Consequently, it is possible that upon further expert review, these

four miners could have had pneumoconiosis. Three of the 24 victims had no pneumoconiosis or anthracosis noted.

Of the 17 UBB victims with CWP, five of them had less than 10 years of experience as coal miners, while nine had more than 30 years of mining experience. At least four of the 17 worked almost exclusively at UBB. All but one of the 17 victims with CWP began working in the mines after the 2.0 milligram coal mine dust limit was put in effect in 1973. This was an exposure limit that was believed at the time sufficient to prevent black lung disease. It has since been determined ineffective to protecting miners' health.<sup>5</sup>

The victims at UBB constitute a random sample of miners. The fact that 71 percent of them show evidence of CWP is an alarming finding given the ages and work history of these men.

1 The West Virginia Department of Health and Human Services, Medical Examiner.

2 Robert Cohen, MD, F.C.C.P., Director Pulmonary and Critical Care Medicine, Cook County Health and Hospitals System; Chairman, Division of Pulmonary Medicine/Critical Care, Stroger Hospital of Cook County, Chicago, Illinois, conducted a confidential review of the UBB victims' autopsies.

3 The destruction of cells through the action of its own enzymes.

4 National Institute for Occupational Safety and Health, US Centers for Disease Control and Prevention. Table 2-12. CWXSP: Number and percentage of examined employees at underground coal mines with CWP (ILO category 1/0+) by tenure, 1970-2006. *The Work-Related Lung Disease Surveillance Report, 2007*. Publication No. 2008-143, September 2008; *Morbidity and Mortality Weekly Report (MMWR)*. Pneumoconiosis Prevalence Among Working Coal Miners Examined in Federal Chest Radiograph Surveillance Programs: United States, 1996—2002. April 18, 2003, 52(15); 336-340.

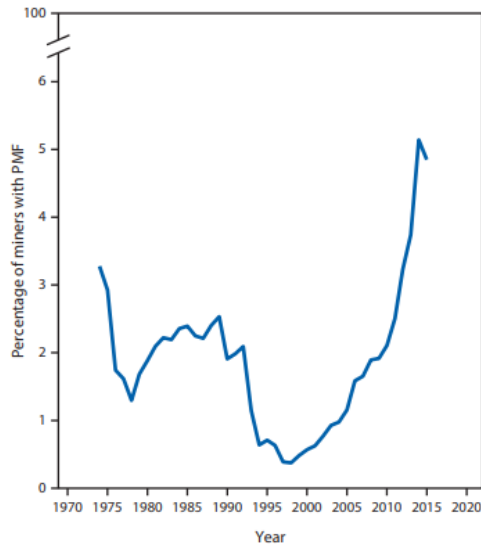
5 National Institute for Occupational Safety and Health, US Centers for Disease Control and Prevention. *Criteria for a Recommended Standard: Occupational Exposure to Respirable Coal Mine Dust*, September 1995; US Department of Labor, Mine Safety and Health Administration. Proposed rule on lowering miners' exposure to respirable coal mine dust including continuous personal dust monitors, 75 *Federal Register* 64412, October 19, 2010.

- From the Upper Big Branch Report:
- Of the 29 miners killed in this accident, 17 of 24 autopsies performed showed evidence of CWP with an additional 4 showing evidence of anthracosis.
- 5 of the 17 worked for less than 10 years in coal
- 9 had more than 30 years experience
- Only 3 showed no sign of lung disease.
- This is a finding of 71% with confirmed evidence of CWP.
- *This was one of the reasons new dust standards were implemented (all but one miner was working with the original standard of 2 mg/m<sup>3</sup>)*

# Background

- In 2016 MSHA reduced the concentration limits for respirable coal mine dust from 2.0 mg/m<sup>3</sup> to 1.0 mg/m<sup>3</sup> at underground and surface coal mines and from 1.0 mg/m<sup>3</sup> to 0.5 mg/m<sup>3</sup> for intake air at underground mine. The rule also mandates the use of continuous personal dust monitors.
- However, current studies have identified Progressive Massive Fibrosis (PMF) in coal miners as a significant issue. PMF is a result of exposure to silica dust.

# Background

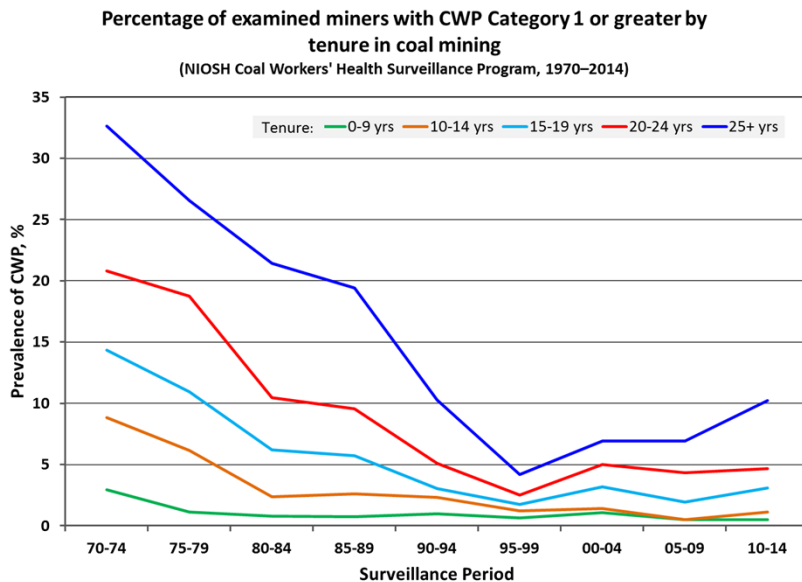


Source: Blackley DJ, Halldin CN, Laney AS. Resurgence of a debilitating and entirely preventable respiratory disease among working coal miners. *Am J Respir Crit Care Med* 2014;190:708-9. Adapted with permission.  
 \* Data are 5-year moving average (e.g., data plotted for 1974 = [PMF<sub>1970</sub> + PMF<sub>1971</sub> + PMF<sub>1972</sub> + PMF<sub>1973</sub> + PMF<sub>1974</sub>] / [Total participants<sub>1970-1974</sub>]); surveillance is conducted on a 5-year national cycle.

Rate of PMF has increased significantly between 2000 and 2016.  
 Reasons for increase:

- Mining more sandstone to access coal or within coalbed.
- More reporting by miners
- Retired miner data being recorded

Currently it is a challenge to accurately measure silica exposure in coal mines.



From CDC Website: Respiratory Diseases

# Possible Factors for Trends

- Factors contributing to a low fatality rate due to ignition, fire and explosion:
  - Better ventilation/rock dusting practice
  - Increased airflow to mining areas
  - Preventing explosive gas mixtures in gob zones
  - More rigorous MSHA inspections
  - An overall reduction in coal mines resulting in statistically fewer operations, hence overall accidents.



## How Effective are MSHA Inspections/ Fines at Improved Mine Safety?

- The Office of Inspector General (OIG) for the United States Department of Health and Human Services (HHS) determined that MSHA did NOT demonstrate the Civil Monetary Penalties (CMP) program deterred unsafe operations.
- That is there was no correlation between penalties paid and safety of mine operations.
- MSHA issued more than \$1 billion in CMP violation penalties during Calendar Years (CY) 2000 – 2017.
- MSHA claims improved safety with the program.

# Possible Factors for Trends

- However, the increase in respirable dust disease indicates issues with mine ventilation.
  - Not getting air to dust generation locations
  - Ineffective dust controls



# Conclusion

- The trends are inconclusive to evaluate if ventilation in U.S. coal mines is improving.
- Therefore, is the industry doing enough to ensure each mine has the technical ability to properly design and operate a ventilation and dust control system?



# Ventilation Engineering at US Coal Mines

- In most U.S. coal mines the responsibility of the ventilation system typically lies with one of the mining engineers.
- A graduate mining engineer may only have had only one course in the subject as a student.
  - Results in requiring on the job training to be competent in engineering the mine ventilation system.
  - Is often not considered a career, rather an important component to advancement.
  - Sometimes leads to a revolving door of ventilation personnel.





# Ventilation Technical Competence at US Coal Mines



- Some companies have an experienced, competent senior ventilation engineer at the corporate level that helps oversee numerous operations and helps train on-site personnel.
  - The day to day operations are with the on-site engineer.
- For U.S. coal mines there are no legislative competency requirements for mine staff responsible for the mine ventilation system.
- As such, the technical capabilities in mine ventilation varies significantly from mine to mine and company to company.

# Global Mine Ventilation Technical Competence

- In Australia, South Africa and other countries, legislation states that a Ventilation Officer (VO) is mandatory.
- The legislation is designed to ensure a minimum knowledge requirement for coal mine ventilation and methane and dust control.
- The position is permanent and not subject to “rotating staff”.

## Ventilation Officer course - Underground coal mine

This course will help you prepare for the role of Ventilation Officer at an underground coal mine. It covers:

- managing, operating and maintaining the ventilation system
- understanding the impact of spontaneous combustion
- gas drainage and gas management
- outburst on the mine's ventilation system.

This course has been developed based on recommendations highlighted in the [ACARP Report C25001](#).

# What Other Countries Require for Mine Ventilation Engineers

- For example, in Queensland and NSW, Australia, all coal mines of a certain size must have a qualified Ventilation Officer (VO).
  - Individual holds a certification of competency by a board of examiners.
  - Responsible for implementing the mine ventilation system and establishing effective standards for the mine.
  - Appointed by the Mine Manager (and is responsible for only one mine unless authorized by the inspectorate).
  - Competent in ventilation modeling and design.



Queensland

**Coal Mining Safety and Health Act 1999**

Current as at 30 March 2017

# What Other Countries Require for Mine Ventilation Engineers (continued)

- Makes all ventilation changes in the mine.
- Coordinates ventilation needs with mine planning.
- Ensures ventilation, gas drainage and dust control functions are organized.
- Must perform continuing professional development.
- Can be held personally responsible for compliance with the inspectorate.



Queensland

**Coal Mining Safety and Health Act 1999**

Current as at 30 March 2017

# Would a Ventilation Officer Program work in the US?



- This subject has been debated for nearly two decades with the Underground Ventilation Committee of the SME.
- Such a program would no doubt enhance the technical competence of mine ventilation engineers in the industry.
- Would enhance mine safety and have a responsible, technical person for all ventilation decisions along with coordinating any degas operations and dust control.

# Would a Ventilation Officer Program work in the US?

- The challenges to having a ventilation officer are:
  - The federal government would need to pass legislation mandating the program with the program enforced by MSHA
  - What organization would conduct the certification of the VO? Likely to be a new organization with a paid staff to give the exams, continuing education and other functions.
  - Funding for establishing the credential program and implementing the program would need to be from the Federal Government.

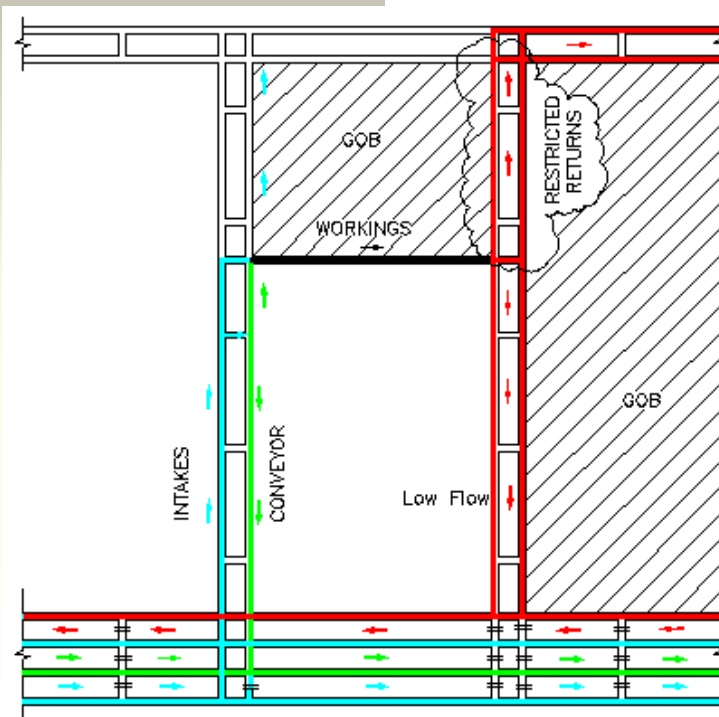


# Would a Ventilation Officer Program work in the US?

- The current climate in the coal industry is one that is not likely to be receptive to this concept.
  - Coal companies are seeking lower operating costs to maintain competitiveness.
- However, the industry needs to evaluate if the benefit of such a program in terms of improved safety outweighs the cost.

## Other Options for Determining Ventilation Engineering Competence

Another options available to determine ventilation engineering competence could be to establish a credential in Mine Ventilation similar to the Certified Mine Safety Professional (CMSP) credential.





## Other Options for Determining Ventilation Engineering Competence

- The CMSP certification was designed in 1991 to enhance safety professionals with education and a venue for innovation.
- The program is now administered by IAMSH of SME.
- One of the certification exams is offered at this conference.



## Other Options for Determining Ventilation Engineering Competence

- Would the industry be receptive to a Certified Mine Ventilation Professional credential?
- There would be numerous challenges:
  - Organizing corporate sponsorship and a management board.
  - Involving experts in the field to develop program.
  - Establish criteria for becoming a professional.
  - Ventilation is a small field (compared to safety engineers) and it may be difficult to organize a committee to run this program.

## Summary

- For nearly a decade the US coal industry has noted a low fatality rate from accidents caused by fire and explosions.
  - However, in this period a significant increase in PMF dust related lung disease has been noted.
- These trends are opposite when one considers if there has been an improvement in coal mine ventilation systems.



## Summary

- A challenge in looking at the statistics is understanding the reasons behind the low fatality rate:
  - Fewer mines and miners will statistically reduce the number of events.
  - Rigorous MSHA inspections will result in findings to be corrected to minimize certain risks. However, it is inconclusive if the civil penalties issued result in increased mine safety.
  - Improved ventilation practice in minimizing explosive gas mixtures in airways and gob areas.
  - Combination of the points above.



## Summary

- The increase in dust disease is alarming.
  - Dust disease is difficult to understand as it typically takes years to show up on medical exams.
  - The current trend may be a reflection on insufficient past dust control systems.
- The industry needs to continue to improve dust control (including ventilation) methodologies to minimize miner pneumoconiosis and PMF.



## Summary

- Ventilation Officer credentials used in other countries appears to work.
  - Such a program in the U.S. would bring consistency to the field.
  - There are significant challenges to implementing such a program.
- A ventilation certification program would benefit the industry.
  - As in the VO, there are challenges to implementing this program.



Questions?