An Evidence Based Review of the Literature

Supporting the

Mine Safety & Health Administration

Proposed

Coal Mine Dust Rule

Prepared for the National Mining Association

By

Dr. David Rosenberg

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EXECUTIVE SUMMARY

The following analysis responds to a request for medical review of the data and research relied upon by the Mine Safety and Health Administration in proposing revised regulations to reduce the permissible exposure limit ("PEL") for coal mine dust in U.S. underground and surface mines from 2 mg/m^3 to 1 mg/m^3. It is my opinion having reviewed the material and research cited in the Federal Register documents and previously in a draft analysis disseminated in 2010 titled, "A Review of Information Published Since 1995 on Coal Mine Dust Exposures and Associated Health Outcomes," that the need for a dramatic change in the PEL for coal mine dust has not been appropriately documented in a manner that comports with the best science or best epidemiological methodologies or that the proposed reduction will positively impact the health of US miners.

In particular, the following reasons cited for a regulatory change are either troublesome or not genuinely supported:

- The data supporting an increased prevalence of CWP in miners x-rayed from 1995-2005 is deeply flawed and not based upon study populations that are scientifically comparable to those in earlier studies. With so many differences among cohort groups, it is almost impossible to conduct a meaningful comparison, or draw reliable conclusions that have sufficient force to suggest a need for new regulatory limits.

- It similarly is not logical or reasonable as a matter of good science to conclude from the 1995-2005 data that the current PEL is not, or is less effective in preventing CWP today than it was in prior study years. The narrow focus of the subject selection process is so skewed in favor of miners with severe CWP or severe lung disease which may be attributable to long ago exposures that valid general conclusions for all current miners cannot be supported from this data. Nor do the data support a conclusion that the current PEL is insufficiently protective.

- There are no data showing a current increased risk of severe COPD over any prior period in miners in any grouping and no new human research data showing an increased risk of mine dust related airways disease. Cohort data suggest, in fact, that no significant loss in FEV_1 has occurred for miners having cumulative dust exposures entirely after 1969. Further, when cross-sectional data is viewed in light of the effect of aging and smoking on decrements in FEV_1 measurements, there is no science supporting the theory that by reducing the PEL, the prevalence of air flow obstruction in coal miners will diminish. Moreover, more recent studies of cigarette smokers strongly suggest that researchers assessing coal dust related airways disease greatly understate the decrement in lung function attributable to smoking and correspondingly greatly overstate the effects of dust, even among miners who worked mostly before the adoption of current standards.

- Reliance on death certificate data, particularly in coal mining communities where black lung claim filings are common, is not a scientifically valid basis for assessing mortality rates or years of potential life lost. These data do not support an assumption that reducing the PEL will have any positive effect on YPLL.

- In sum, it is my belief that the new research cited in support of a PEL reduction by 50% to eliminate coal mine dust related disease, does not employ valid science or support reasonable assumptions that this significant regulatory action will have any positive effect on the prevalence or severity of dust related disease in coal miners.

INTRODUCTION & CONCLUSIONS:

An evidence based review of the medical literature relied upon by the Department of Labor (D.O.L.) does not scientifically support the proposed rule for lowering miners' respirable dust exposures to $1mg/m^3$. In regards to this, it is not clear that the overall prevalence of CWP is increasing. This similarly applies to the reported increasing prevalence of progressive massive fibrosis (PMF). In addition, since the current permissible exposure limit (PEL) of $2mg/m^3$ is not associated with excessive decrements of airflow, consideration is not warranted for lowering miner's exposure to respirable dust in order to reduce the occurrence of airflow obstruction. Finally, even if it is accepted that over the last decade that PMF prevalence is increasing, this does not warrant reducing the current PEL to $1mg/m^3$. The reason is that any potential increase of PMF correlates with past coal dust exposures exceeding the current PEL of $2mg/m^3$. Consequently, it follows that a more prudent solution for reducing future risk for developing CWP is by directing policy at enforcing the current PEL.

PREVALENCE OF CWP

In the Draft Proposal regarding health outcomes associated with coal dust exposure pertaining to information published after 1995, it is outlined that the NIOSH 2007 Work-related Lung Disease (World) Surveillance Report indicates the presence of CWP stopped declining around 1995 to 1999, and has risen thereafter. Also, it is reported that updated data as of 2009 demonstrate an increased CWP prevalence over the last decade, as outlined in Figures 7 and 8 of the draft proposal (Attachment A). In regards to this increased CWP prevalence, further comment is in order.

First, with respect to CWP prevalence, based on NIOSH 2007 Work-related Lung Disease (World) Surveillance Report data (Figure 2-12) from 1975 to 2006, overall prevalence rates by specific time segments are as follows (Attachment B): 1975 to 1979 = 3.0%; 1980 to 1984 = 2.5%; 1985 TO 1989 = 3.5%; 1990 to 1994 = 3.0%; 1995 to 1999 = 2.0%; 2000 to 2004 = 3.6%; and 2005 to 2006 = 3.3%. It follows that the calculated mean prevalence rate ± standard deviation (SI) with corresponding 95% confidence interval (CI) for five year time periods from 1979 to 1999 is 2.86% ± 0.57 (CI 2.32 to 3.40). As such, the prevalence of 3.6% for the timeframe 2000 to 2004 is just outside the CI. Additionally, the prevalence for 2004 to 2006 of 3.3% is within the CI. Based on Figure 7 of the Draft Proposal (Attachment A) the prevalence rates for 2005 to 2006 have been extended through 2009. As depicted in this diagram this extension indicates that prevalence rates are continuing to fall, in a fashion similar to 2005-6. Thus the average prevalence rate for 2005-9 must be within the CI outlined for the five year time periods form 1979 to 1999. Consequently, statistically, there is no definite support that the overall prevalence of CWP has continued to rise since 1999 as reported in the recent Draft Proposal.

Furthermore, with respect to surveillance data gathered through the Enhanced Coal Workers' Health Surveillance Program (ECWHSP) after 2000, this has been analyzed by Attfield and Petsonk (2007). In regards to this, Attfield and Petsonk point out that only 20% of miners at surveillance sites were actually evaluated. Such a low participation rate does not guarantee that those investigated are representative of coal miners generally. Clearly, if the screened miners electing to undergo assessment did so either because of increased respiratory symptoms or a past history of an abnormal X-ray, this 20% surveillance pool does not represent a random sampling process. As such, resultant prevalence data can not be applied to miners generally.

In addition, the Draft Proposal includes Figure 6 (Attachment C), which is based on the data of Antao. This is a pictorial representation describing the proportion of "evaluated" miners by county developing rapidly progressive CWP. The figure infers that rapidly progressive CWP is epidemic, with 35% of "evaluated" miners developing this form of lung disease. In regards to this, the written Antao publication outlines that "evaluated" miners refers to individual miners for whom "serial" X-rays were available. This group of evaluated miners having serial X-rays (783 miners) represents only 2.6% (Attachment D) of the entire mining population evaluated between 1996 and 2002 (783 ÷ 29,521 = 2.6%). Also, outlined in Attachment D, is the fact that only 0.93% of the entire workforce (277 ÷ 29,521 = 0.93%) actually had rapidly progressive CWP as defined by Antao. Thus, rapidly progressive CWP is not rampant, as implied by figure 6 of the draft proposal. As an aside, the overall prevalence of miners with CWP in the Antao investigation was 3%. This prevalence rate is comparable to the rates outlined above for the time frame from 1975 to 1999.

In addition, with respect to the prevalence of PMF, further data recently was published by Laney (2010). It was outlined that the prevalence of PMF by decades is as follows: 1970s = 0.33%; 1980s = 0.11%; 1990s = 0.14%; 2000s = 0.31%. Clearly, the published data of PMF prevalence does not correlate with the increasing prevalence depicted in figure 8 (Attachment A) of the Draft Proposal. In the latter the prevalence was reported to be greater than 1% among miners with a coal mine tenure of over 25years. Furthermore, even if the overall prevalence of PMF is drifting upward, selection bias, as discussed above, could readily account for any perceived increase. As an aside, as illustrated in Attachment D, only 0.14% of the Antao mining population (41 ÷ 29,521 = 0.14%) had PMF, a rate inconsistent with the reported increasing prevalence of this disorder.

Further discussion at this point will focus on the prevalence of CWP among underground miners compared to surface miners. This is addressed by the work of Pon who reported on the surveillance of 31,179 miners (21,365 underground miners; 9,814 surface miners) between 1996 and 2002, through CWXSP and MCP. The data indicates that the overall prevalence of CWP in the entire mining population was 2.8% (862 ÷ 31,179 = 2.8%). The prevalence among underground miners was 3.5% (647 ÷ 18,388 = 3.5%) and among surface miners 1.9% (187 ÷ 9,814 = 1.9%). Furthermore, the overall prevalence of PMF was 0.2% (62 ÷ 31,179), 0.3 % among underground miners (47 ÷ 18,388) and 0.1% (11 ÷ 9,814) among surface miners. In addition, when miners were analyzed by employment tenure, greater tenure was associated with an overall increased general prevalence of CWP, as well as of PMF. With respect to surface miners, no cases of PMF occurred among miners having less than 20 years of coal mine employment. As applicable to underground miners, there were no cases of PMF with less than 15 years of employment in the mines. This discussion comparing CWP prevalence among surface miners to underground miners has important implications regarding the proposed reduction of respirable dust exposure to 1mg/m^3. This will be discussed within the last section of this Memorandum.

AIRFLOW OBSTRUCTION AS APPLICABLE TO THE CURRENT EXPOSURE LIMITS OF 2MG/M^3

The field of epidemiology deals with studies of diseases in populations. As such, a primary focus of epidemiology is to determine what causes the development of certain diseases or disorders. While basic sciences (for example, biochemistry, microbiology and physiology) utilize the "laboratory" for designing well controlled investigations to study hypotheses, epidemiology does not have the luxury to conduct its research in such a manner. In contrast, epidemiologic research must study populations as its "test tube" or "guinea pig". It follows because of this, many uncontrolled variables can bias results of research conducted on study populations. While this can apply to any epidemiologic research, generally cross-sectional investigations are subject to more biases than longitudinal or cohort studies.

With respect to cross-sectional studies (Attachment E), data is collected in a given group of subjects (a population) through surveys and questionnaires. Then, the prevalence (frequency) of an outcome is determined and compared to controls. This type of investigation is designed to determine what is occurring "right now". Furthermore, the significance of the findings to a major extent rests on how accurately a control group compares to the study population. If the control group is not accurately matched to the study subjects, except for the outcomes being investigated, the conclusions reached lose their credibility. Furthermore, the validity of cross-sectional studies rests on the methodology utilized for survey and information gathering. If not performed in an unbiased fashion, the validity of the conclusions reached is diminished.

With respect to cohort studies (Attachment F), a group of individuals having a commonality (e.g. all coal miners beginning employment after 1970) are followed over time. The basic question asked with cohort or longitudinal studies, is whether or not a given risk factor (e.g. coal dust exposure) is associated with the development of a given disease state or clinical manifestations over time. Also, the direction of inquiry is forward and not retrospective with the question being asked what will happen in the future, not what has happened in the past. Within the cohort, the risks for developing diseases or specific clinical features are compared between those with and without a given risk factor. Overall, cohort studies have distinct advantages over other epidemiologic investigations, since they are investigating temporal relationships between exposure and the eventual development of a given disease state or outcome. Also, compared to cross-sectional investigations, they allow for a greater ability to control for confounding factors, thus minimizing biases which influence the results of a given investigation.

With an understanding of the information outlined above, various cross-sectional studies have been utilized to assess the magnitude of airflow obstruction developing in relationship to coal dust exposure (Attfield and Houdos, Seixas 1992, Attfield 1995, and Love and Miller 1982).

The pertinent question to address based on the results of these studies pertains to the degree of airflow obstruction expected in relationship to coal dust exposure of 2mg/m^3. Utilizing data contained within each of these cross sectional investigations the expected loss of FEV1 (in relationship to dust exposures of 2mg/m3) varies between 2cc to 12cc/year (Attachment G).

While it is accepted that coal dust exposure causes airflow obstruction, the annual reductions demonstrated in these cross sectional studies need to be considered in relationship to how age and smoking influence predicted values of FEV_1. With this in mind FEV1 losses attributed to coal dust exposure of 2mg/m3 are likely to be less than what these studies predict. This is logically explained by the fact that cross-sectional investigations adjust for age and smoking based on assumptions regarding how these variables influence predicted airflow. As such, if these assumptions underestimate the true adverse effect that age and smoking have on FEV1, losses attributed to coal dust exposure will be magnified.

The above is put into perspective by looking at investigations designed to define the natural history of COPD. In other words, studies have been performed to determine how and age and smoking influence airflow measurement in the general population (Attachment H). This table illustrates how nonsmokers in the general population have an annual loss of FEV_1 that varies between 20 and 56cc (mean 36.8cc ± S.D. 11.8). As such, the normal aging process is associated with a wide variation in airflow reduction over time. Furthermore, these investigations indicate that the annual FEV_1 loss observed in smokers (middle column of Attachment H), varies between 38cc to 70cc (mean 52.7cc ± S.D.13.4). The column on the right within this table represents the difference between FEV1 losses observed in smokers and nonsmokers. As such, the calculated values (15.8cc ± S.D. 6.7) represent the annual losses directly attributed to smoking.

Based on what is outlined above, both age and smoking having a significant and variable adverse effect on measurements of airflow. As such, if these variables are not accurately accounted for in cross-sectional studies, FEV1 losses attributed to coal dust exposure will be greater than actually exists. In regards to this, Attfield and Hodous have stated the loss of FEV1 related to smoking is 5cc/year. This value, as outlined above, is much less than what has been determined in population studies designed to address how airflow is adversely affected by cigarette smoking.

Next, I would like to address loss of airflow caused by coal dust exposure determined by various longitudinal cohort studies. These studies include those by Love and Miller, Attfield (1995), Seixas (1993) and Henneberger (1996). As outlined above, cohort studies generally are more accurate than cross-sectional studies in assessing causation and looking at outcomes. Based on the data derived from these cohort studies, Attachment I lists the degree of FEV1 loss predicted to occur in relationship to coal mine dust exposure of 2mg/m^3. In essence, in relationship to this degree of exposure, these cohort studies predict losses of FEV_1 to be minimal in degree. In fact, the Seixas investigation performed on experienced miners actually demonstrated an increase of FEV_1 over time. Similar findings are predicted by the data of Henneberger who investigated new miners.

Thus, overall, when miners are exposed to 2mg/m^3 of coal dust, one would not expect any significant losses of FEV_1. This is based on the fact that when cross-sectional studies are viewed in relationship to how age and smoking influence FEV_1 measurements, losses attributed to coal dust exposure at an exposure level of $2mg/m^3$ are minimal in degree. Also, cohort studies in association with similar coal mine dust exposures do not demonstrate significant FEV_1 losses.

RESPIRABLE COAL MINE DUST EXPOSURE AND CWP

It should be emphasized that coal mine dust disorders occur in a dose-response relationship. As such, the greater the exposure, the greater likelihood CWP will develop in a susceptible individual. Furthermore, CWP occurs with a latency, which is defined as the timeframe from first exposure to development of the disorder. Obviously, the latency for a coal mine dust related disorder, among active miners, reflects the number of years employed in the mines (tenure). This tenure in turn correlates with the magnitude of total coal mine dust exposure that has occurred over the years.

With respect to underground coal mining and PMF, as outlined above by the work of Pon an increased prevalence did not occur in association with work tenures of less than 15 years. When surface miners were assessed, PMF did not occur before 20 years of mine employment. With this understanding, it logically follows that for individuals diagnosed as having PMF during the last 10 years (between 2000 and 2010), the development of disease reflects coal mine dust exposures having occurred 15 to 20 years before (1980-85 through 1990-95). As such, assuming the increased prevalence of PMF referred in the Draft Proposal is valid, the etiology of such reflects exposures occurring before 1995.

Next, I would like to address the issue of coal dust exposure and latency utilizing quantitative exposure assessments performed in coal mines. This will specifically focus on the percentages of assessments greater than the PEL of $2mg/m^3$ and is based on data outlined in table 2-14 of the NIOSH 2007 Work-related lung disease (WORLD) surveillance system report (Attachment J). As such, for underground mining with respect to inspector samples (block a), it was determined that prior to 1995, 10.8% ± SD 2.63 had measured levels above PEL. With respect to operator samples (block b), 11.1% ± 2.48 had exposure samples greater than PEL. After 1994, in underground mines, the percentage of inspector samples (block c) above PEL was 6.02% ± SD 1.88 and for operator samples (block d) it was 8.63% ± SD 0.87. Statistical analysis of this data indicates that the percentage of samples above PEL was significantly greater ($p < 0.0001$) for the time frame before 1995 compared to the timeframe beginning thereafter. In other words, because of poor adherence to the established PEL for coal mine dust, underground coal miners through 1994 were exposed to greater amounts of coal dust, compared to after 1994. As such, this logically explains the basis for any potentially increased prevalence of PMF over the last 10 years in this mining population. Based on latency of exposure these cases of PMF reflects exposures to coal mine dust prior to 1995, when a greater percentages of mines had exposures levels exceeding the established PEL of 2mg/m3.

Probably, the best data to understand why the current PEL level of $2mg/m^3$ is acceptable in maintaining a reduced prevalence of PMF is by looking at the exposure data generated with respect to surface miners. Based on table 2-14, through 1994, the percentage of inspector samples above PEL (block e) was 4.62% ± SD 3.40 and for operator samples (block f) 5.81% ±

SD 0.83. The respective levels after 1994 are as follows: inspector samples (block g) 1.09% ± SD 0.26; operator samples (block h) 2.86% ± SD 0.54. Similarly to underground mines, statistical analysis of the surface mining data, indicates that the percentages of samples above PEL were significantly greater ($p< 0.0001$) before 1995 compared to the timeframe beginning thereafter.

Next it should emphasized, the percentages of samples above PEL have been greater in association with underground mines compared to surface mines ($p < 0.0001$), for both inspector and operator samples, during all analyzed time frames. Specifically, for inspector samples through 1994 the data are as follows: surface mines (block e) 4.62% ± SD 3.40; underground mines (block a) 10.8% ± SD 2.63. The comparable levels for operator samples are as follows: surface mines (block f) 5.81% ± SD 0.83; underground mines (block b) 11.1% ± 2.48. With respect to after 1994 the following is observed with respect to inspector levels: underground mines (block c) 6.02% ± SD 1.88; surface mines (block g) 1.09% ± SD 0.26. With respect to operator samples the values are as follows: underground mines (block d) 8.63% ± SD 0.97; surface mines (block h) 2.86% ± SD 0.54

The above information indicates over the years that underground coal miners compared to surface miners have had greater exposures to coal dust. Additionally, since CWP develops in a dose response relationship it logically follows that underground mining compared to surface mining would be associated with a greater prevalence of PMF. Also, it follows that if the frequency of exposures with underground coal mines exceeding PEL (2mg/m3) was reduced to the frequency observed in surface mines, the prevalence of PMF would be reduced to acceptable levels. This is reflected by the work of Pon, who outlined that surveillance data collected from 1996 to 2002 indicates that PMF prevalence among surface coal miners is only 0.1 %. Additionally, in view of the extremely low frequency of exposures exceeding PEL associated with surface mining since 1994 (1.09% to 2.86%), logically the occurrence of PMF into the future will be a rare clinical event.

In **CONCLUSION**, based on what has been outlined above, if the currently reported trend of increasing PMF prevalence is valid, the disease is not developing consequent to coal to coal dust exposures having occurred during the recent past. Rather, it reflects exposures occurring prior to 1995. By enforcing current the current PEL of $2mg/m^3$ within coal mines there is potential to eliminate nearly all cases of PMF.

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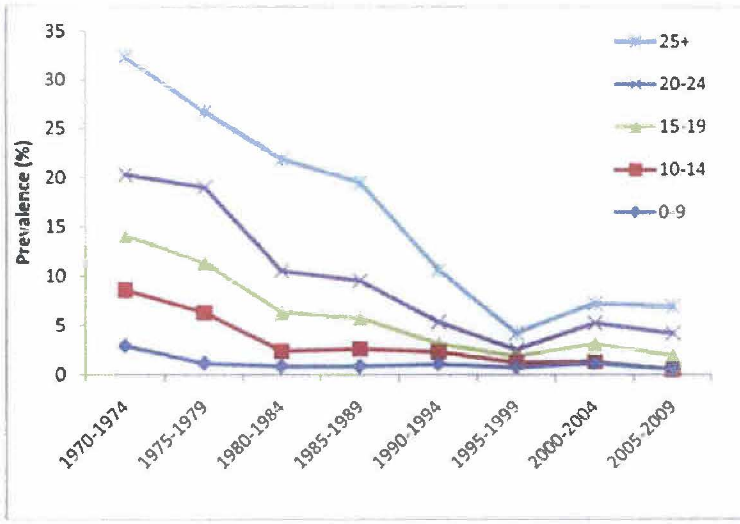


Figure 7: Percentage of miners examined in the NIOSH Coal Workers' X-ray Surveillance Program (CWXSP) with coal workers' pneumoconiosis (category 1/0+) by tenure in mining, 1970-2009. (Source: NIOSH CWXSP data).

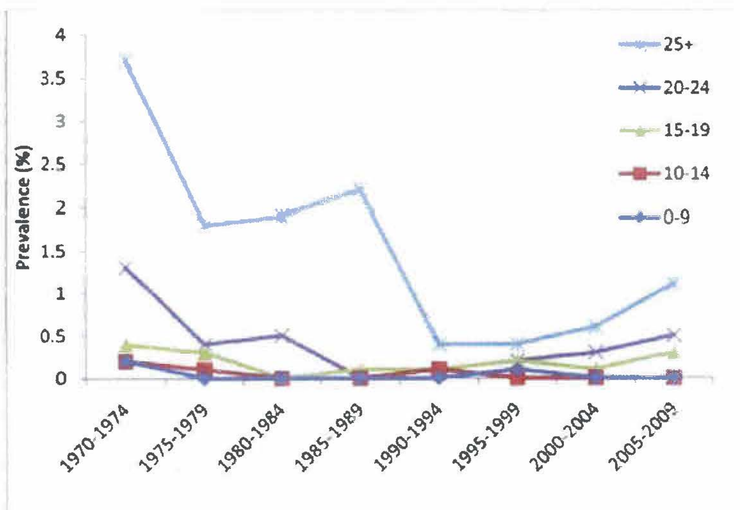


Figure 8. Percentage of miners examined in the NIOSH Coal Workers' X-ray Surveillance Program (CWXSP) with progressive massive fibrosis (PMF) by tenure in mining, 1970-2009. (Source: NIOSH CWXSP data).

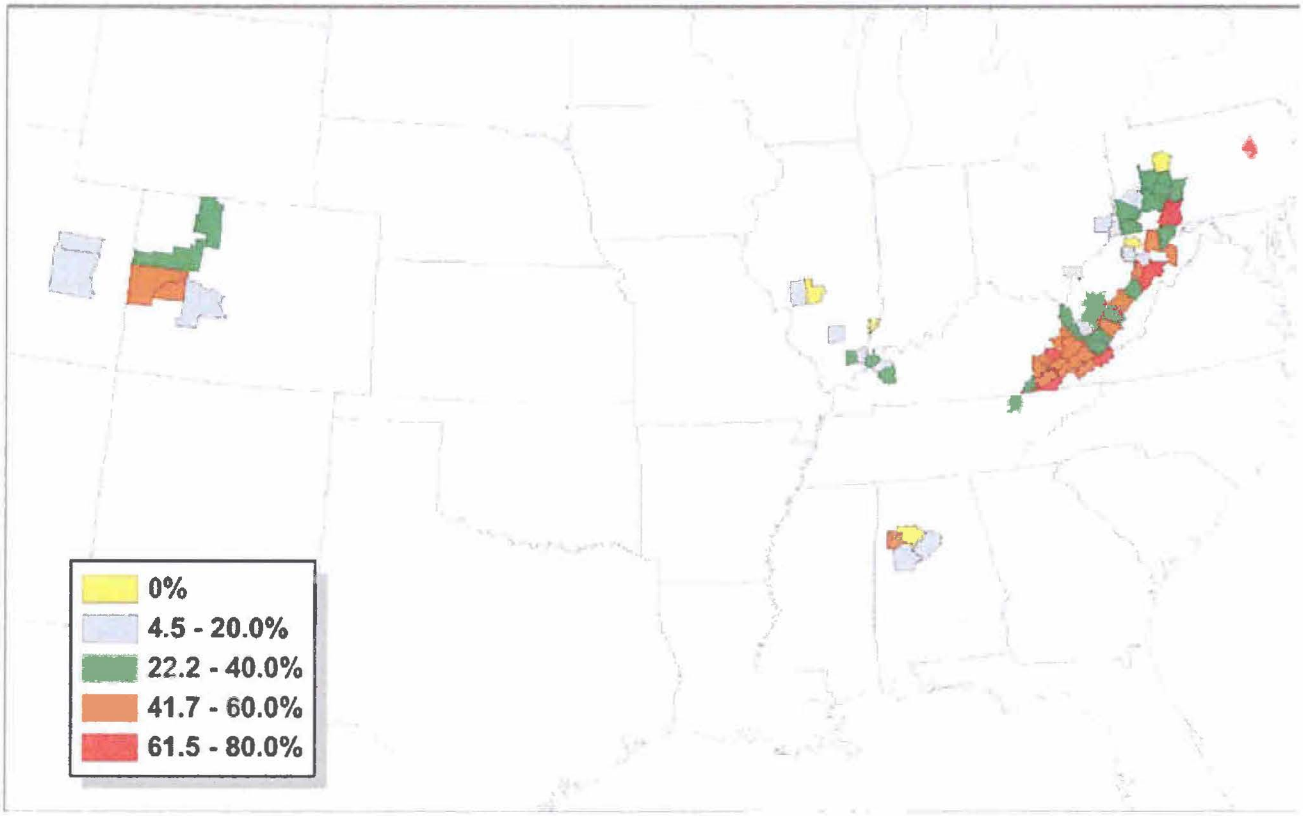
Attachment A

Table 2-12 CWXSP: Number and percentage of examined employees at underground coal mines with coal workers' pneumoconiosis (ILO category 1/0+) by tenure, 1970–2006

	Tenure (years in mining)								
	0–4	5–9	10–14	15–19	20–24	25–29	30+	Unknown	Total
1970–1974									
Number of Miners Examined	26,850	11,123	6,125	5,665	7,621	8,345	16,208	23,904	105,841
Number with CWP	682	391	526	792	1,542	2,120	5,709	85	11,847
% with CWP	2.5	3.5	8.6	14.0	20.2	25.4	35.2	0.4	11.2
1975–1979									
Number of Miners Examined	28,146	15,417	5,386	2,657	2,018	1,771	3,471	40,744	99,610
Number with CWP	173	317	333	301	383	404	971	148	3,030
% with CWP	0.6	2.1	6.2	11.3	19.0	22.8	28.0	0.4	3.0
1980–1984									
Number of Miners Examined	10,638	12,591	7,009	2,215	979	724	1,555	10,086	45,797
Number with CWP	68	120	167	138	102	126	361	80	1,162
% with CWP	0.6	1.0	2.4	6.2	10.4	17.4	23.2	0.8	2.5
1985–1989									
Number of Miners Examined	2,047	3,886	4,341	2,065	680	257	390	5,383	19,049
Number with CWP	5	42	112	118	64	43	80	193	657
% with CWP	0.2	1.1	2.6	5.7	9.4	16.7	20.5	3.6	3.5
1990–1994									
Number of Miners Examined	1,693	1,288	2,937	3,992	2,305	585	307	1,176	14,283
Number with CWP	17	13	67	119	118	49	43	6	432
% with CWP	1.0	1.0	2.3	3.0	5.1	8.4	14.0	0.5	3.0
1995–1999									
Number of Miners Examined	1,444	858	1,167	2,338	3,437	1,858	515	1,057	12,674
Number with CWP	10	5	14	41	86	64	35	4	259
% with CWP	0.7	0.6	1.2	1.8	2.5	3.4	6.8	0.4	2.0
2000–2004									
Number of Miners Examined	3,134	1,124	1,205	1,408	3,084	3,219	1,475	1,995	16,644
Number with CWP	39	10	16	43	155	184	139	15	601
% with CWP	1.2	0.9	1.3	3.1	5.0	5.7	9.4	0.8	3.6
2005–2006									
Number of Miners Examined	2,151	577	442	436	603	975	1,217	1,800	8,201
Number with CWP	14	4	3	11	36	77	120	5	270
% with CWP	0.7	0.7	0.7	2.5	6.0	7.9	9.9	0.3	3.3

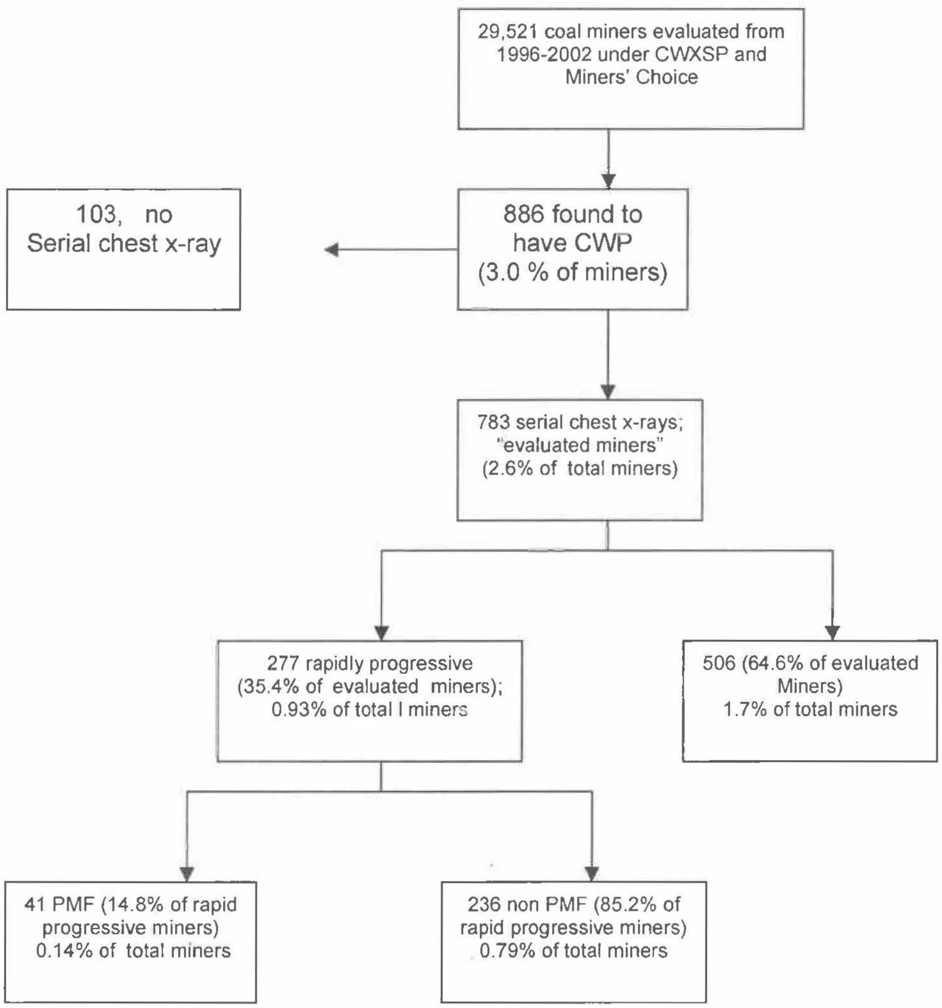
Attachment B

Figure 6: Proportion of evaluated miners with rapidly progressive coal workers' pneumoconiosis by county (not shown are counties with fewer than five miners evaluated). (Source: Antao et al. [11]).



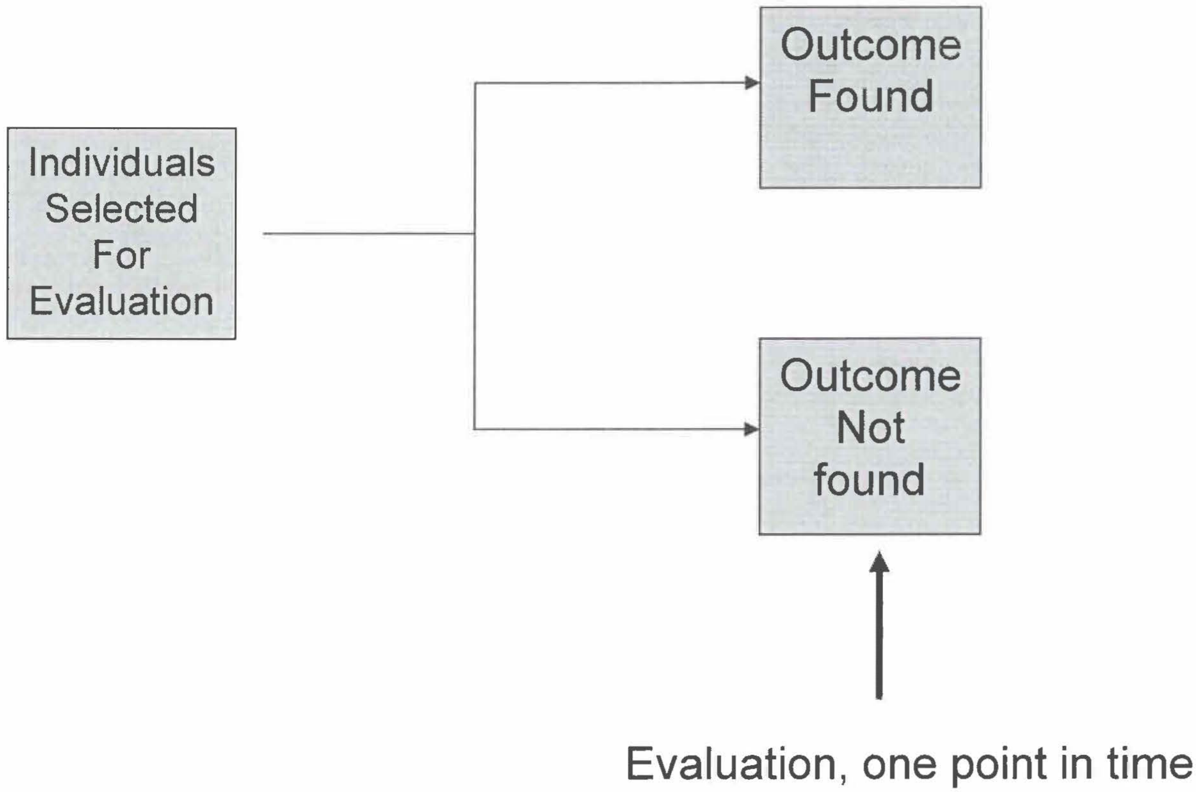
Attachment C

Antao 2005



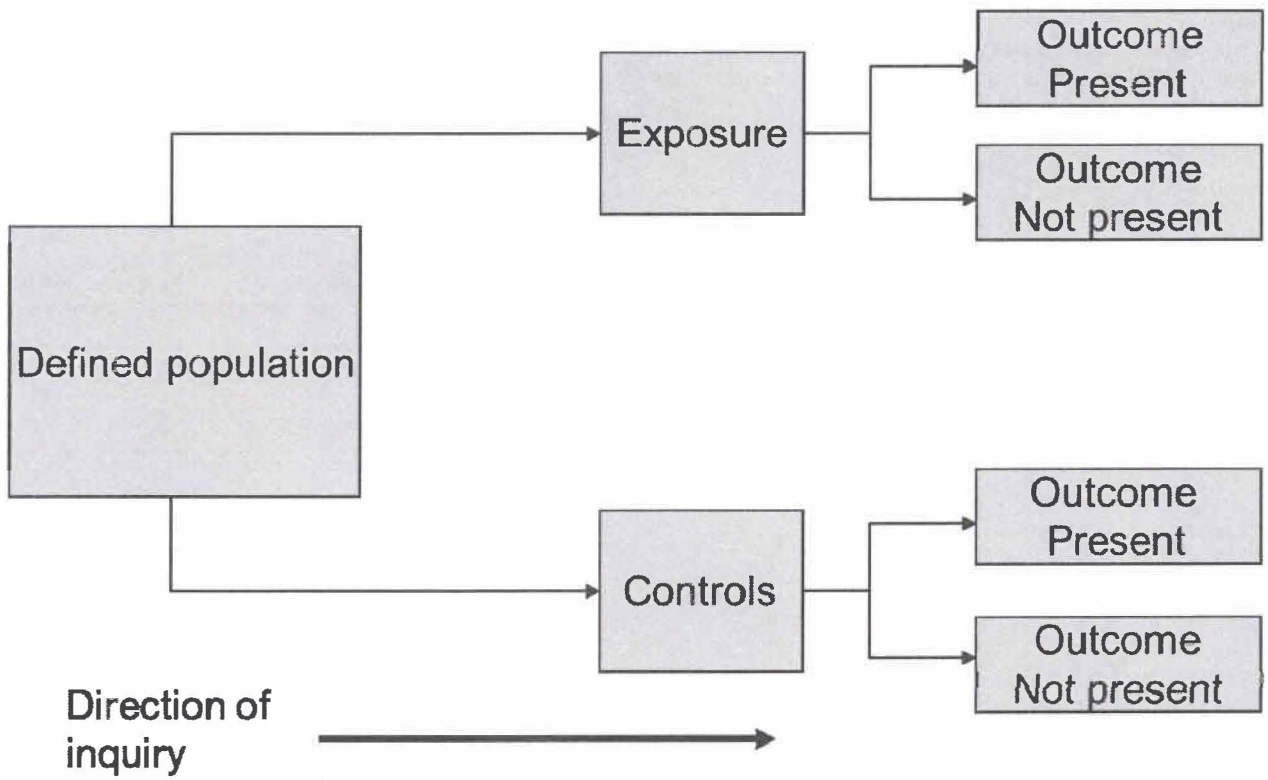
Attachment D

Cross sectional studies



Attachment E

Cohort or Longitudinal Studies



Attachment F

Annual FEV1 loss in relationship to coal dust exposure (2mg/m3).....cross sectional

Attfield & Hodous (1992)	2-3cc
Seixas (1992)	11cc
Soutar & Hurley (1986)	current miners 3.0cc ex-miners 12.5cc
Marine (1988)	nonsmokers 4.1cc

Attachment G

Annual loss of FEV1

	Non-smoker	smoker	difference
Fletcher (smokers = or > 15 cig/day)	42	66	24
Tashkin	56	70	14
Tager (age 40-45)	35	40	5
Lange (age>55)	34	55	21
Sherman (with symptoms)	34	47	13
Kohansal	20	38	18

Average 16cc/year

Attachment H

Annual FEV1 loss in relationship to coal dust exposure (2mg/m3)….cohort

Love & Miller	1.3cc
Attfield (1987)	3 models: NS change 1 model: 1.2cc
Seixas (1993)	increase
Henneberger (1996)	increase

Attachment I

Table 2-14 Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by type of mine, MSHA inspector and mine operator samples, 1979–2003

NIOSH REL mg/m³ MRE	Year	Underground Coal Mine Inspector Samples				Underground Coal Mine Operator Samples				Surface Coal Mine Inspector Samples				Surface Coal Mine Operator Samples			
		GM (mg/m³)	No. of Samples	% > PEL	% > REL	GM (mg/m³)	No. of Samples	% > PEL	% > REL	GM (mg/m³)	No. of Samples	% > PEL	% > REL	GM (mg/m³)	No. of Samples	% > PEL	% > REL
	1979	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	-	0.424	429	7.9	-
	1980	0.728	16,591	14.6	-	0.554	237,484	15.5	-	0.551	112	17.0	-	0.299	394	5.3	-
	1981	0.635	17,450	11.3	-	0.599	39,767	14.3	-	0.292	12,238	3.5	-	0.381	8,300	5.2	-
	1982	0.657	17,905	10.4	-	0.554	88,599	12.4	-	0.304	9,075	3.7	-	0.351	18,071	4.9	-
	1983	0.575	17,973	9.5	-	0.496	91,520	10.2	-	0.300	8,299	4.5	-	0.363	13,619	5.8	-
	1984	0.625	17,873	11.4	-	0.499	95,560	10.1	-	0.302	8,344	5.2	-	0.376	12,660	5.6	-
	1985	0.588	17,95[illegible]	[illegible]	-	0.486	89,[illegible]	9.5	-	0.292	8,16[illegible]	3.6	-	0.371	9,63[illegible]	5.2	-
No	1986	0.625	16,65[illegible]	[illegible]	-	0.510	84,[illegible]	[illegible]	-	0.317	7,3[illegible]	[illegible]	-	0.422	7,51[illegible]	6.3	-
REL	1987	0.673	16,0[illegible]	[illegible]	-	0.519	78,[illegible]	[illegible]	-	0.322	6,868	[illegible]	-	0.423	6,39[illegible]	6.5	-
	1988	0.637	16,548	10.3	-	0.514	74,204	9.1	-	0.353	7,000	4.9	-	0.425	6,036	5.6	-
	1989	0.603	15,041	9.7	-	0.497	71,797	8.7	-	0.299	6,656	3.7	-	0.398	5,482	5.5	-
	1990	0.563	13,922	8.6	-	0.491	71,243	8.1	-	0.299	6,663	3.4	-	0.367	5,141	4.5	-
	1991	0.685	12,170	10.8	-	0.607	67,682	11.4	-	0.311	3,907	3.1	-	0.416	4,539	6.4	-
	1992	0.682	11,248	9.9	-	0.608	62,405	10.6	-	0.308	4,223	3.5	-	0.446	3,714	6.1	-
	1993	0.600	9,825	7.5	-	0.605	55,970	10.5	-	0.262	5,740	2.5	-	0.457	4,370	6.8	-
	1994	0.624	10,457	8.3	-	0.548	52,634	10.2	-	0.258	6,335	2.2	-	0.386	4,266	5.4	-
	1995	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	1996	0.664	11,939	8.3	33.3	0.525	42,850	9.1	29.9	0.238	6,600	1.2	6.6	0.307	4,445	2.8	14.4
	1997	0.666	[illegible]	7.8	32.5	0.500	41,9[illegible]	[illegible]	28.5	0.247	7,5[illegible]	1.1	6.6	0.294	4,39[illegible]	[illegible]	12.8
	1998	0.565	23,7[illegible]	6.5	26.4	0.515	40,[illegible]	[illegible]	29.7	0.194	9,3[illegible]	1.0	5.4	0.274	4,17[illegible]	[illegible]	12.4
1.0	1999	0.572	33,5[illegible]	5.3	26.7	0.590	36,55[illegible]	[illegible]	32.2	0.187	10,3[illegible]	1.0	6.0	0.325	4,20[illegible]	[illegible]	15.5
	2000	0.555	30,747	5.1	25.2	0.582	32,727	8.5	31.7	0.189	9,815	1.1	5.6	0.360	4,032	2.9	16.3
	2001	0.534	31,557	4.9	24.1	0.475	33,748	8.8	29.7	0.191	10,091	1.0	5.6	0.291	3,842	2.7	14.7
	2002	0.507	25,59[illegible]	4.5	23.0	0.473	30,994	7.7	27.7	0.153	9,621	0.9	4.5	0.258	3,155	2.3	12.7
	2003	0.468	23,906	3.2	20.2	0.458	28,414	6.6	25.6	0.148	8,350	0.8	4.3	0.285	2,220	3.1	14.9

a b c d e f g h

Attachment J