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# Submission 1 - Coal Workers' Pneumoconiosis (CWP) Select Committee Inquiry

Email: **cwpsc@parliament.qld.gov.au**

Research Director
CWP select committee
Parliament House
George Street
Brisbane Qld 4000

Dear Madam

It is my intention to make a number of submissions to the above Inquiry. This submission relates to issues that were either raised or obviously omitted from the Departmental Briefing which I attended on Friday 14th October. At least one further submission will cover the NRM Health Surveillance Unit and both its previous and potential roles in the prevention and management of risk of respiratory related disorders in coal miners.

My role in the Coal Industry Employees Health Scheme was that of coordinator from the start of the 1994 electronic health data recording program until my voluntary early retirement in 2002. In my role, I liaised with the mine operators, contractors, miners, mining unions, Nominated Medical Advisers, the Workers Compensation authority, the Coal industry Superannuation fund managers, SIMTARS and the Mines Inspectorate. I was involved with arranging regular meetings of Nominated Medical Advisers, revising the Health Assessment Form, coordination of data entry and record retrieval.

I was also involved with a number of research projects that made use of the confidential medical data held in the health database. A number of these investigated health outcomes outside the normal health surveillance data collection processes. This included injury data, workers compensation data, early claims for superannuation due to death or total permanent disability and the Deaths Index held by the Australian Institute of health and welfare.

My educational background is that have bachelor degrees in mining engineering and geology and masters degrees in commerce and occupational health and safety. I also have a First Class Certificate as a Colliery Manager (NSW). This and details of my experience and publications are in my CV which is attached.

The following outlines issues arising from the Departmental Briefing:

1 Report by Rathus and Abrahams (1984)

The records referred in this report had a 'M' prefix in the numbering. Almost all of these were boxed and sent off site (NRM Office) for archiving. CWP Cases identified by Rathus were marked with a red dot.

2 Monash Report

There was some mention of regulatory capture. It is interesting to note that none of my 10 or so publications relating to the Health Surveillance Program were identified in the Monash report. The most significant publication could well have been my masters thesis on the 'Role of the Health Surveillance Program in Queensland Coal Mining Industry. This was located in the NRM Library and in the QUT Library. Within it, there is a chapter relating to respiratory assessment.

3 Observation that while 75 cases were reported in 1984, why are there no cases until 2006.

In the late 1950's and 1960's, there was a change in technology that greatly reduced the exposure of miners to coal dust. This was the introduction of mechanisation with the continuous miner (machines) and the move to large scale opencut mining. Given the long latency of CWP, the report by Rathus largely reflects pre-1960 exposures. The findings in my Master's Thesis was that the respiratory function of most miners was better than the general population. An area of considerable concern was the respiratory function of miners at the German Creek collieries where average respiratory function was worse than that of other mines. The significance of this finding was that German Creek was the oldest longwall mine as it commenced using this new technology in 1986.

4 Qualifications and Competency

Mr Albury, when asked, said that he had a First Class Mine Managers Certificate. The Inquiry might ask further into relevant qualifications, competency and maintenance of competency. The most relevant standards in relation to occupational health are provided by the Safety Institute of Australia (Ref- www.ohsbok.org.au). The peak professional body for the mining industry is the Australasian Institute of Mining and Metallurgy. While this group has a professional development certification program, its occupational health component is lacking. The Board of Professional Engineers in Queensland has a capacity to demand a level of occupation health competence but leaves recommendations to the Australasian Institute of Mining and Metallurgy.

The Australasian Institute of Mining and Metallurgy is organising a seminar on risk management in Brisbane on November 2nd. It is an interesting reflection on the mining culture, that occupational disease is not obviously included in the program.

5 Health Data recording

I was concerned to hear Ms Cronin use the word 'scan' in relation to health assessment records. When I was with the Department in the late 1990's early 2000's, there were one or two data entry officers who were unable to keep up with the data entry demand. It would be a backward step if health records were simply scanned and not entered into a data base that could be subsequently analysed.

6 Coal Mining Regulations

The post-Moura Disaster regulatory framework is based on safety management systems and risk management. Regulation 49 refers to Monitoring for Occupational exposures in terms of a risk management system. I have never seen any evidence that the Inspectorate or anyone in the

industry understands what this means. I have attached a paper from the Queensland Resources Council website documenting the 2006 Health and Safety Conference paper on Methodology in assessing long-term respiratory risk in longwall miners'.

## 7 Dust Monitoring by SIMTARS

SIMTARS is a part of the Department of Natural Resources and Mines. I was surprised that they were not included in a Departmental Briefing to the Inquiry. They are the coal industry's principal dust monitoring service provider. Recently, they provided an excellent seminar to the Southern Queensland Branch of the Australasian Institute of Mining and Metallurgy.

## 8 Workers Compensation and Health Department data

There is potential for data sharing between organisations to extract a more comprehensive data set. As long as confidentiality protocols are agreed, the register of coal mines, can be matched by name and date of birth to extract health and health outcome data on miners from databases held by other authorities.

## 9 Further Work

Neither the Senate Report nor the Monash report considered that respiratory disease in coal workers is a dose-response phenomenon. This is a key factor in developing trigger points in establishing a safety management system for occupational exposure. My view is that a priority should be to back analyse both the health and exposure data to identify whether there were trigger points that provided an early warning. I intend to expand on this in a subsequent submission.

Yours Faithfully

Bruce Ham

CURRICULUM VITAE

# BRUCE WILLIAM HAM

**Current Position**

Mining Enginee,r OHS / Environment Adviser

**Expertise**

Health and safety
Mining education and professional standards
Resource geology
Mine subsidence assessment

**Academic Record**

Bachelor of Engineering (Mining), University of Queensland, 1974
Bachelor of Science (Geology), University of Wollongong, 1977.
1st Class Colliery Managers Certificate, NSW Department of Mineral Resources, 1983.
Master of Commerce (Economics), University of Wollongong, 1985.
Master of Applied Science (Occupational Health and Safety) Queensland University of Technology, 2000.

**Professional and Community Affiliations**

Member, Australasian Institute of Mining and Metallurgy – Chartered Professional Status
Member – AusIMM Board of Chartered Professionls
AusIMM - Southern Queensland Branch committee
Registered Professional Engineer (Queensland).
Chartered Fellow, Safety Institute of Australia
President - Brisbane Organic Growers Inc.

**EMPLOYMENT HISTORY**

**2007 to Present Consulting Health and Safety Adviser / Mining Engineer**

Report on heath and safety competency standards for Mining Professionals
Risk assessment from mine subsidence in Qld Rail network Redbank to Rosewood
Review of safety procedures Curtis Island Environmental assessment
Review of university course - Socio-environmental aspects of mining - University of Queensland
Chapter Author – Health, safety and environmental management in Coal and the Commonwealth, University of Queensland

**2006 to 2007 Senior Lecturer – Mining Program, Central Queensland University, Mackay Campus**

Development of the mining program in flexible mode, project based learning.

**2002 to 2006 Consulting Health and Safety Adviser / Mining Engineer**

Health and safety systems auditing KPC Mine - Indonesia
Compilation of Trainers Guides on risk control and health and hygiene management systems for NSW TAFE
Review of mining training programs - SIMTARS
Examination of longitudinal injury, BMI, hearing and respiratory function data for coal industry health advisers.

**1991 to 2002 - Mining Engineer –Health Surveillance Adviser - Department of Mines and Energy/ Queensland Coal Board (QCB)**

Health and Safety - Management of the Coal Mine Worker's Health Scheme
Secretary of Moura Recommendations Implementation Committee and MIP 10 Committee.
Collection, analysis and reporting to Government on issues relating to health and safety and mine subsidence.

**1985 to 2007 - Part-time Lecturer and Examiner**
2007 - University of Queensland - Dept of Engineering - Socio-environmental aspects of mining -
2004 – NSW TAFE – Preparation of Trainers Guides on 'Management systems for Risk Control' (level 5) and 'Health and Hygiene Management Systems' (level4)
1994 to 2003 – QUT School of Public Health – six hours lecturing per year on mining health and safety to undergraduate occupational health and safety students.
2002 - University of Queensland - Dept of Mining and Materials Engineering – Four hours of lecturing – Health Surveillance in the mining industry to third year mining engineering students.
1995 to 1998 TAFE College Southbank - Dept of Occupational Health and Safety - lecturing in Mining Health and Safety
1985 to 1991 Bundamba School of Mining -lecturing in Geomechanics and Mine Transport

**1987 to 1991 Senior Mining Engineer - Hollingsworth Dames & Moore**
Mine Planning and Geotechnical Engineering
Subsidence Assessment

**1984 - 1986 Consulting Mining Engineer**
Subsidence studies in Central Queensland.
Underground coal mine feasibility studies in New South Wales and Western Australia.
Mine planning proposed Wandoan Coal Mine.
Expert witness in several personal injury accident claims

**1980 - 1984 Planning Engineer - MIM Holdings Coal Group**
Collinsville, Denman, Newlands, and Oaky Creek.
Feasibility studies, ventilation, conveyors, rock mechanics, gas drainage, mine design studies and equipment selection.

1979 - Study Tour Examined mining practice in USA and UK.

**1975-1979 Mine Deputy - A.I.S. Collieries Group - Appin Colliery**
Comprehensive work on longwalls, including withdrawal. Other general duties of shift man were undertaken including panel development, belts, back-heading support, other timbering and some pillar extraction.

**PUBLICATIONS**
"Cutting of Coal in Longwall Mining at Appin Colliery", Rock Breaking Symposium, Aus. I.M.M. Melbourne Branch. 1978.

"Recent Developments in Longwall Mining Equipment at Appin Colliery", International Conference on Mining and Machinery, Institute of Engineers. 1979.

"Outbursts at Collinsville - A Case Study", The Occurrence, Prediction and Control of Outbursts in Coal Mines Symposium, Aus. I.M.M., Southern Queensland Branch. 1980.

"The Impact of Underground Coal Mining on Farming", Mining and the Environment Conference, Aus. I.M.M., Southern Queensland Branch, Brisbane 1987.

"Surface Impacts at Dewatering Old Colliery Workings", Third International Mine Water Congress, Melbourne, 1988.

"Field experience in the Assessment of Subsidence Related Environmental Effects Caused by Underground Mining", A.C.A. Coal Exploration Workshop, Brisbane, 1991.

"Occupational Health Monitoring in the Queensland Coal Mining Industry", Asian Pacific Conference on Occupational Health and Safety, Brisbane, 1995.

"Health and Safety Information Systems in the Queensland Mining Industry", 26th International Conference of Safety in Mines Research Institutes, Katowice Poland, 1995.

"Incidents in Open cut Coal Mines", QCO/DME Hazcoal Mine Safety Conference, Yeppoon, Queensland, 1996.

"An Analysis of the Queensland Coal Employee's Health Scheme", QCO/DME Hazcoal Mine Safety Conference, Yeppoon, Queensland 1996.

"Analysis of Lost Time Injuries in Queensland Coal Mines - 1995-96" Safety and Health Division, Department of Mines and Energy, 1997.

"Incident Reporting - local and national issues 'QCO/DME Mine Safety Conference, Yeppoon, Queensland 1997.

"A Comparison of health surveillance programs in the mining industry", Meeting of Nominated Medical Advisers, Brisbane, 1997.

"Analysis of Lost Time Injuries in the Queensland Mining Industry - 1996-97" Safety and Health Division, Department of Mines and Energy, 1998.

The Role of the Health Surveillance Program in the Queensland Coal Mining Industry, Thesis for the award of Master of Applied Science (OHS) School of Public Health, Queensland University of Technology 2000.

National Mining Heath Database – Feasibility Study – Research Report for the Joint Coal Board Health and Safety Trust, with Carmel Bofinger of SIMTARS, 2001

Heart Disease Risk Factors in Coal Miners, Research Report for the Joint Coal Board Health and Safety Trust, with Carmel Bofinger of SIMTARS, 2002

Hearts, Health and Coal Mining, Queensland Mining Industry Health and Safety Conference, 2002, with Carmel Bofinger of SIMTARS

Noise Induced Hearing Loss – What is the Coal Industry's Liability – Meeting of Nominated Medical Advisers, 2002.

Counting the cost of poor health and injury – and analysis of QCOS {Superannuation claim} data for Queensland Mining Safety and Health Conference – 2003

Extraction and analysis of death data for a heart disease risk factor project,3 Day Course in Understanding Mortality Data, QUT School of Public Health, 2003

Estimation and comparison of death rates for coal miners based on superannuation and insurance claims data, 3 Day Course in Understanding Mortality Data, QUT School of Public Health,2003

Planning for Healthy Industry, 2004. Coal 2004 5th Australasian Coal Operators Conference and Workshop– Coal Mine Planning, AusIMM, Wollongong.

Chapter Editor – Education and Training – in revision of Australasian Coal Mining Practice – in print

Trainers Guide – Implement and Maintain Management Systems to Control Risk –2004 NSW TAFE.

Trainers Guide – Implement and Monitor Health and Hygiene Management Systems 2004 NSW TAFE

Safety Management Systems for Occupational Health - the legislation, the standards and the court rulings, Queensland Mining Industry Health and Safety Conference, Townsville, 2004.

Analysis of coal miners mortality data, International Conference on Epidemiology in Occupational Health, 2004, Monash University Melbourne.

Analysis of Spontaneous Combustion Incidents, Coal 2005 Conference, AusIMM Brisbane.

Management Systems for Hazardous Exposures - Evidence of failure and opportunities for success, Coal 2005 Conference, AusIMM Brisbane.

Health and Safety – A key to tomorrow, 2005. New Leaders Conference AusIMM Brisbane.

Safety Management Systems for Occupational Exposures – acceptable risk scenarios for a sustainable future- 31st International Conference of Safety in Mines Research Institutes October 2005.

Health and Safety Management Systems in the Coal Mining Industry, Visions Conference 2005.

Private submission to the Senate Community Affairs References Committee on Workplace exposure to toxic dust – Senate Community Affairs website 2006

Methodology in assessing long-term respiratory risk in longwall miners; in progress for Qld Mining Health and Safety Conference – August 2006 Townsville

Measurement of Risk from Occupational Exposures in the Mining Industry- a Case for the Disability Adjusted Life-Year Lost Approach, 14th Annual Queensland division Safety Institute Conference, September 2006

Engineering and management for zero harm in the mining industry, Northern Engineering Conference, Engineers Australia, Mackay, November 2006.

Safe Design and Competency- Challenges for the Queensland Coal Industry- SIA Queensland Conference 2007

The legacy of underground coal mining – mine subsidence – Ipswich Coal Masures case study – Life of Mine Conference AsuIMM Brisbane 2014.

27th December 2015.

Qld Mining Health and Safety Conference – 6 to 9 August 2006 Townsville

# Methodology in assessing long-term respiratory risk in longwall miners

By Bruce Ham
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Central Queensland University.

## Abstract
A study to examine respiratory disorder risk in longwall miners is being considered. The method to be used in examining this issue is the correlation of long term cumulative exposure with changes in respiratory symptoms and functions. Measurement of respiratory dust, assessment of cumulative exposure is considered in the context of method and statistical validity. The method of estimating cumulative exposure considers structured interviews with longwall mine workers with more than ten years experience.

The process of estimating change in respiratory function involves accessing and analysing medical records obtained as part of the Coal Workers Health Scheme. Factors that may adversely distort results such tobacco smoking are identified and treated separately. The longer term objective is to establish parameters for interventions when elevated risk is identified.

## Introduction
The recent Senate Community Affairs References Committee, 'Inquiry into workplace exposure to toxic dust' (2006) has called on government and industry to re-evaluate their mechanisms for controlling adverse effects from toxic dusts in the workplace. The perception of dust related health risk in the coal mining industry has largely been dispelled by a number of Australian studies that sought to monitor dust related disease known as Coal Workers Pneumoconiosis. Since the mechanisation of coal mines in the 1960s, the levels of coal dust to which coal miners have been exposed has been relatively low until the advent of longwall mining systems in Queensland in the late 1980's. Longwall face operators are exposed to dust levels that are elevated and may exceed the statutory limits in about 15% of samples taken.

Given that these longwall operations have been operating in Queensland for 20 years, some re-assessment of dust disease risk is warranted. Studies in the United Kingdom (Rudd, 1998), have established that coal mining dust related disease extends beyond Coal Workers Pneumoconiosis to include silicosis, chronic bronchitis, congestive obstructive airways disease (COAD) and emphysema. The latter three disorders occur in small numbers in the general population, but as indicated in the UK coal industry studies, they are more prevalent in coal mine workers.

## Aim and Objectives
A research project is being developed to examine whether there is any evidence that the respiratory health of longwall miners is being adversely affected by exposure to dust in longwall operations.

In order to achieve the study aim, it is necessary to:

a) Review previous studies in terms of method and findings;
b) Estimate the exposure of workers at various face positions at each Queensland longwall mine;
c) Identify the cumulative dust exposure of a sample of longwall miners,

d) Correlate the exposure against miner's change in respiratory function and respiratory symptoms,
e) Determine the nature of the dose-response characteristics of dust related reduction in respiratory function and
f) Assess trigger levels of cumulative exposure that might be associated with unacceptable health outcomes.

**Review of Previous Studies**

Rathus and Abrahams (1984) identified coal miner's pneumoconiosis as a serious occupational health issue faced by coal miners who had been in the Queensland coal mining industry through the 40's, 50's and 60's by identifying 75 cases of dust related respiratory disorders showing on a chest x-ray study. Ham (2000) reported no new cases of coal mining related respiratory disorders requiring an ILO pneumoconiosis classification from x-ray screening from 1993 to 1998. This study identified between 20 and 30 cases of congestive obstructive airways disease that may have been caused or exacerbated by dust exposure. The study also showed that the respiratory function of underground coal miners was generally better than would be expected in the general population (shown as predicted values). There was however one exception which was one of the older longwall mines (Mine E) where reduced respiratory function was demonstrated as shown in table 1.

**Table 1 Spirometry of Non-Symptomatic Non-Smokers - Underground Mines (FEV1/FVC%) (after Ham, 2000)**

| Mine | | E | B | C | F | E | A | U/G | AllMines |
|---|---|---|---|---|---|---|---|---|---|
| Workers | | 157 | 218 | 112 | 62 | 150 | 157 | 836 | 2953 |
| Observed Values | Av. | 81.10 | 83.42 | 85.53 | 85.97 | 84.90 | 84.07 | 83.88 | 83.34 |
| | Std Dev | 5.33 | 6.52 | 6.80 | 5.78 | 6.49 | 8.19 | 6.84 | 6.59 |
| Predicted Values | Av. | 82.62 | 82.56 | 82.82 | 82.78 | 82.69 | 82.19 | 82.58 | 82.02 |
| | Std Dev. | 2.33 | 2.15 | 1.88 | 1.79 | 2.21 | 2.00 | 2.08 | 2.28 |

In relation to environmental monitoring, Bofinger, Cliff and Tiernan (1995) identified that underground operations had respirable dust levels that exceed the exposure standards in about 15% of the samples for some work groups.

Analysis of mortality data by Bofinger and Ham (2002) identified that 232 coal miners (and ex miners) from New South Wales had been reported as dying from respiratory disease from 1980 to 2000. Further analysis showed that this represented 10% of deaths where, in the general population, only 6.4% of died from this disorder. Analysis by Ham (2004) showed that the average at death from respiratory disease in coal miners was 73, compared with the expected average age of 77 for respiratory disease in the general population. Further work by Ham (2006) expressed these results in terms of burden of disease – life years lost. The result was that the 232 respiratory related deaths represented a loss of 820 life years. This can also be expressed as a risk of 0.3 life years lost across the whole mining industry (1980 to 2000 data set).

Kizil and Donoghue (2001) examined the New South Wales respiratory dust exposure data. Their analysis considered the respiratory health risk based on and average exposure of 1.5 mg/m$^3$. Using this value, they considered dose-response studies from the United Kingdom and the United States to predict New South Wales health outcomes for pneumoconiosis and massive progressive fibrosis. They also estimated the average loss of forced expiry volume for 1 second (FEV1) to be 73.7 ml over 40 years. At an average level of 1.5 mg/m$^3$ exposure over a working career, the study concluded that 1 in 500 longwall miners may die from progressive massive fibrosis.

**Dust Emission Data**

An analysis was undertaken of samples collected by the Department of Natural Resources and Mines from 1995 to 2000 to assess the validity of the sampling frequency (Ham 2002) as shown in Table 2.

**Table 2: Dust and Silica failures and percentage failures**

| | Dust | | | Silica | | |
|---|---|---|---|---|---|---|
| Position | No of Samples | No of Failures | % of Failures | No of Samples | No of Failures | % of Failures |
| Bolter | 180 | 11 | **6.1** | 161 | 16 | **9.9** |
| Cablehand | 82 | 9 | **11.0** | 73 | 5 | **6.8** |
| Chocks | 205 | 31 | **15.1** | 199 | 33 | **16.6** |
| Continuous miner | 158 | 13 | **8.2** | 142 | 22 | **15.5** |
| Maingate | 54 | 6 | **11.1** | 48 | 5 | **10.4** |
| Shearer | 187 | 23 | **12.3** | 171 | 15 | **8.8** |
| Shuttle Car | 129 | 5 | **3.9** | 117 | 3 | **2.6** |
| All positions | 1,076 | 105 | **9.8** | 986 | 103 | **10.4** |

The high variability of the concentrations of respirable dust was identified as an issue that might adversely impact on a reliable estimation of cumulative exposures. The study identified that quarterly respiratory dust levels in surveys were generally related to mine production but did not otherwise fluctuate over time. This finding provided an opportunity to improve the previous estimate of the average variance. The power calculation was undertaken to estimate the number of samples that would be required to provide an reliable estimate of the mean exposure for each position at various mines. Given the long term nature of the exposure, it is argued that for the purpose of a safety management system, should allow an assessment of dose related change in the two of the five yearly health screening cycle at a reliability of 20% in the estimate of the mean. Using this approach, and considering the variability in dust measures at various mines, Table 3 makes recommendations as to sampling frequency. The key issue is that low variability leads to a more reliable estimate of exposure for a set number of samples. High variability may also be associated with less that adequate dust control.

**Table 3 Mean exposure of coal miners to respirable dust and recommended sampling**

| Mine | Position | Mean | Variance | Sample Number required given variability | | Samples/year |
|---|---|---|---|---|---|---|
| | | | | 10% | 20% | 20% variability |
| A | Shearer | 1.79 | 1.442 | 475 | 119 | 12 |
| B | Chocks | 1.88 | 0.617 | 184 | 46 | 4 |
| B | Shearer | 2.05 | 1.497 | 375 | 94 | 9 |
| C | Bolter | 1.02 | 0.287 | 288 | 72 | 8 |
| C | Cable | 1.40 | 0.626 | 337 | 84 | 9 |
| C | Cont. Miner | 1.59 | 2.215 | 916 | 229 | 23 |
| C | Shuttle Car | 0.93 | 0.155 | 188 | 47 | 5 |
| D | Bolter | 0.78 | 0.046 | 79 | 20 | 2 |

**Estimation of Exposure**

The strategy planned for the estimation of dust exposure of individuals is to conduct structured interviews with longwall miners who volunteer to participate in the study. Data that will be collected includes:

- Face positions undertaken including data on mines and years,
- Type and frequency of respiratory protection used,
- Smoking history and
- A respiratory symptoms survey.

The participants will also be required to complete a Coal Industry Medical Release form to allow access to the participants' confidential medical information.

By correlating the exposure to respiratory dust and length of exposure, the cumulative dose will be estimated by applying a standard respiratory rate factor (Seixas et al., 1991).

**Acquisition of respiratory and related data**

The signed Coal Industry Medical Release forms will assist in obtaining the medical information from either the relevant medical practitioner or the Health Surveillance Unit of the Department of Natural Resources and Mines (Ham 2000). The change in respiratory function will be extracted with other relevant information needed for validity checks and to identify factors that have potential to impact on the validity of the analysis. This will include factors such as smoking habits, previous work in high dust environments and previous respiratory conditions.

**Analytical Approach**

The aim of the analysis is to separate out sub-groups with confounding factors such as tobacco smoking, previous dust exposure, previous respiratory disorders. Each of these sub-groups will be analysed separately provided the sub group is of a statistically valid size and the individuals identity cannot be determined by persons who do not have authorised access to confidential health information.

The analysis comprises four components comprising the following:

1 Estimate the dose for each longwall position in each mine over the study period.

2 From structured interviews, determine the period that each subject spent in each longwall position,
3 Determine the cumulative dose of each of the study subjects,
4 Determine the change in respiratory function for each study subject over the study period,
5 Correlate the cumulative dose against the change in respiratory function,
6 Determine the level of dose that becomes a significant predictor of an adverse health outcome.
7 Determine how other factors such as smoking habits, previous dust exposure and medical conditions such as asthma cause variance from predicted results

**Method Issues**

The data used for exposure data is based in quarterly dust surveys undertaken by the Department of Natural Resources and Mines as described by Bofinger, Cliff and Tiernan (1995). In order to reduce the variance of the estimates of average variance, the data has been further analysed to take into account variation caused by fluctuations in production and variation over time.

The monitoring procedures collect only respirable dust but research by Jennings and Flahive (2005) suggest that the coarser inhalable dust may have a contribution to certain respiratory disorders. Given that the mining operations are in similar geological conditions, the respirable dust is a reasonable proxy for the total respiratory dust burden

The use of personal protective equipment is expected to have a significant impact on long term respiratory health outcomes. Protection practice should be recorded in the structured interview and considered as a study variable. The reliability of this self-reported factor is of some concern, but some of this error may be reduced by clustering the groups from each mine. The use of respiratory protection is required as a part of the mines' health and safety management systems, but variation in application between mines and mining crews may be a cultural issue in the longwall mining environment. This might be reflected in differences in health outcomes appearing between mines that are otherwise very similar.

**Assessment of Risk**

Soutar, Hurley and Miller (2004) reported that the epidemiological work undertaken as a part of the study into dust concentrations and respiratory risks in coal miners as a part of the British Pneumoconiosis Field Research Project confirmed numerically that respiratory disease is an indicator of reduced life expectancy. More importantly, the study also determined that cumulative exposure in the absence of clinical symptoms was also a significant indicator of reduced quality of life and reduced life expectancy. The outcome of the current project is to use a dust related decline in respiratory function or the advent of respiratory symptoms as an indicator of the increased risk of an adverse health outcome.

**Statistical Issues**

In order to reduce the variance of the estimates of average dust exposure, the data has been analysed to take into account variation caused by fluctuations in production and variation over time. Previous work in a Coal Services Project indicated that in some, but not all mines, there was a strong correlation between dust and production. Because the variation in dust levels was not shown to be time dependent, the variance of the mean exposure can be influenced by data points peripheral to the time periods in question. This will have the effect of narrowing the

variance of the estimate of the mean exposure estimate and improving the confidence as to whether or not there is a statistically significant relationship.

**Further Work**

The concepts discussed in this paper have been developed as part of a pilot study to test issues of methodology and data variability. A pilot programs needs to be undertaken and critically reviewed as a part of developing a far wider comprehensive study that provided the necessary evidence to demonstrate the risk associated with exposure to dust in coal mines is effectively managed.

**References**


Bofinger C. M., Cliff D. I, and Tiernan G. 1995. Dust and noise exposures of longwall workers in the Bowen Basin, Queensland Australia' in 26th International Conference of Safety in MinesResearch Institutes, Central Mining Institute, Katowice Poland.

Bofinger C. M. and Ham B. W., 2002, Heart Disease Risk Factor in Coal Miners, , Coal Services Health and Safety Trust Research Report, Report Library [On line] Available: http:// www.coalservices.com.au/research/reports.pdf [Accessed 2004, February 17]

Ham B. W., 2000, The Role of the Health Surveillance Program in the Queensland Coal Mining Industry, Thesis for the award of Master of Applied Science (OHS) School of Public Health, Queensland University of Technology.

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Ham B. W. 2004. 'Analysis of coal miners mortality data' poster at International Conference on Epidemiology in Occupational Health, Melbourne.

Ham B. W., 2006. Measurement of Risk from Occupational Exposures in the Mining Industry- a Case for the Disability Adjusted Life-Year Lost Approach, 14th Annual Safety Institute of Australia Conference, Yeppoon

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Kizil G. V. and Donoghue A. M., 2001. Coal dust exposures of longwall miners in New South Wales: a respiratory health risk assessment using Joint Coal Board exposure data from 1985 to 1999. Mineral Industry Safety and Health Centre web site – www.mishc.uq.edu.au/ {accessed March 2004}

Rathus M. and Abrahams R.A.1984. Report on the Queensland Coal Board Coal Miners' Health Scheme. Queensland Coal Board, Brisbane.

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Senate Report, 2006. Workplace exposure to toxic dust, Commonwealth of Australia

Seixas, N.S., Moulton, L.H., Robins, T. G., Rice, C. H., Attfield, M. D. and Zeller, E. T. (1991) Estimation of cumulative exposures for the National study of Coal Workers Pneumoconiosis', in *Applied Occupational Environmental Hygiene*, 6 1032 - 1041

Soutar CA, Hurley JF, Miller BG, 2004. Dust concentrations and respiratory risks in coal miners: key risk estimates from the British Pneumoconiosis Field Research. *Occup Environ Med* 61(6): 477–81.

# Submission 2 – Safety Management Systems for occupational dust exposure - Coal Workers' Pneumoconiosis (CWP) Select Committee Inquiry

**Introduction**

This submission relates to the need to develop a safety management program to effectively manage the health threat from the prolonged dust exposure of coal miners. The demand for such a program is cast in the Coal Mining Health and Safety Regulation 2000. Regulations in Sections 49 and 53 include dust exposures and are framed in Part 6 'Fitness to work', Division 2 Coal mine workers' health scheme. See Appendix 1.

The coal industry has failed to understand the meaning of these regulations mean and how such safety management programs should be developed. Coal Workers Pneumoconiosis is only one of a number of respiratory disorders that may be caused or exacerbated by atmospheric exposures in coal mines. Reliable information about coal miners' respiratory conditions is scarce and fragmented. The range of disorders is complex and the disorders usually have long latency periods. The collection and analysis of data demands a cooperative approach that includes miners, mine operators, health professionals and institutions that are able to compile the relevant data on adverse health outcomes and related respiratory hazard exposures.

**History of Dust Disease in Queensland Coal Miners**

It is important to examine the occurrence of dust disease in the context of the prevailing mining technologies. Before the mid 1950's, coal was largely hand worked. Coal, blasted from the coal face, was hand loaded into skips for haulage to the surface. The 1950s & 1960s saw the introduction of continuous miners (large machines) which cut coal and loaded it into shuttle cars which delivered coal to a conveyor system. In Australia, this method uses a ventilation system in which miners only work in fresh air. From 1986, longwall mining was introduced into Queensland. While this is a very productive mining system, it is much harder to control dust and dust exposure of coal miners who no longer work only in fresh air. A feature of the longwall system is the high ventilation velocities. At higher velocities, both fine and coarse dust particles are airborne, thus producing an additional hazard.

The 1949 Powell Duffryn Technical Services Ltd Report estimated that about 350 coal miners out of a workforce of 2320 (15%) contracted pneumoconiosis each year. Rathus and Abrahams (1984) reported 499 cases of 8007 workers and retired workers (6%) had abnormal respiratory function. Of the 499, there were 75 cases of actual or suspected coal workers pneumoconiosis. Ham (2000) reported 15 cases of adverse X-ray results from the 1993 Coal Board Health Surveillance program (1993 to 1998). Of these, 5 had asbestosis, and 3 silicosis. One affected employee from Rathus study was still in the industry. Five workers who were clear in the Rathus study, subsequently developed a pneumoconiosis classification. One employee starting after 1983 developed a respiratory condition.

Ham (2003) reported on an analysis of death and total permanent disability data (for superannuation payouts) that had been held by the Queensland Coal and Shale Oil Superannuation Fund. This revealed that between 1998 and 2002, 4 of 267 cases received early superannuation payments due to respiratory disorders. Bofinger and Ham (2002) compiled a Heart Diseases Risk

Study for the NSW Coal Services Health and Safety Trust. This study included cross-matching the register of coal miners in Queensland (and NSW) with the Deaths Index held by the Australian Institute of Health and Welfare (AIHW) in Canberra for the period of 1980 to 2001. This analysis revealed 188 deaths of which 12 were related to respiratory disease. The average age of miners at death was 56 years for all causes compared to 72 years for deaths due to respiratory disorders. The AIHW reported that the average at death for respiratory disease was 77 years for the general population. Over the period from 1980 to 2000, life expectancy for males increased from 71.2 years to 76.6 years (AIWH data)

**Concepts of a Safety Management System for occupational dust exposure**

*The aim of the safety management system is to identify trigger points where interventions can be implemented when an elevated risk is indicated rather than when adverse outcome is reached.* Such an approach requires a comprehensive data set showing change in affected persons in comparison with equivalent exposed and non-exposed groups.

Dust diseases are generally the response of the body to a cumulative dose. In this respect, there some similarities to hearing loss and radiation exposure. Adverse respiratory responses are highly variable and vary with personal attributes, previous history, recreational determinants (tobacco smoking). The adverse reaction to occupational exposure will vary with substance (coal and diesel particulates and toxic gasses) and the range of particle size and concentration.

The strategy of applying a hierarchy of controls demands that where practical, the hazard should be eliminated, otherwise a barrier placed between the worker and the hazard or alternatively subsequent less rigorous strategies. The NSW Coal Services and their Standing Dust Committee are the authority in these high level strategies.

Health surveillance related strategies need analysis of the current cases of respiratory disorders and their related exposure history in order to identify trigger points where it is prudent to remove miners from dust exposure in order to reduce risk to acceptable levels. A comprehensive data-set on non-affected workers needs to be compiled to identify these trigger points as being abnormal. Such data needs to be stratified for smoking status, non-coal exposure, non-occupational respiratory disorders and age at first exposure. The trigger points may be either related to health criteria (as per noise exposure) or a cumulative dose (as per radiation)

In the longer term, the safety management strategies need to be validated by processes developed internationally and include the analysis of data from the other Australian coal mining jurisdiction (NSW). A mechanism to compile a leading practice review of safety management systems for coal mining respiratory hazard could be to fund a Churchill Fellowship Association Scholarship to examine global leading practice program in this area and inform Australian data analysis strategies.

**Compensation for Affected Workers**

The denial by the industry of the existence of serious and permanent injury due to exposure to coal dust has left many miners to fund the assessment of the disease or simply suffer in silence. The trail of respiratory disorders dates back to the 1984 Rathus and Abrahams Report. By the workers compensation standards of today, these miners and former miners are eligible for a level of compensation for both medical expenses, loss of amenity and reduced life expectancy.

The assessment of disability, loss of amenity and reduced life expectancy related to permanent damage to respiratory function is particularly difficult to assess as the risk of premature death due to respiratory disease rises sharply with age even in the non-exposed population. A court case following a study of British coal miners respiratory risk by the Institute of Occupational Health in Scotland, determined that the risk of premature death from exposure to coal dust warranted compensation for loss of amenity to both affected and non-affected mines workers who had been exposed to significant levels of coal dust.

**Competence and its Maintenance**

The Report on the Inquiry into the 1994 Moura Mine Disaster recommended that a system of maintenance of competence implemented for the mining industry. All recommendations except this were implemented. The Mine Managers Association and the Australasian Institute of Mining and Metallurgy (AusIMM) have continuing professional development programs. Both these lack significant occupational health competency elements.

The Mine Managers Association program is not subject to external review and is self administered. The AusIMM Chartered Professional program falls within the Queensland Board of Professional Engineers Program that regulates the supply of professional engineering services in Queensland. This program includes senior and operational managers and other professionals at coal mines. The Queensland government, through the Queensland Board of Professional Engineers has the opportunity to call in the AusIMM Chartered Professional program to ensure that there is an understanding of the requirements for a safety management system of occupational exposures such as coal dust.

**Regulatory Capture**

The analysis of the health surveillance database was a key element of the 1993 Queensland Coal Board program. With this analysis being connected to adverse health outcomes, an opportunity emerged for early interventions in occupational health disorders. Much of this was published up to 2002. The aim of this program was to promote better occupational health outcomes for both mine workers and mining companies. The availability of the data also had potential to drive compensation claims by mine works for occupational related diseases and disorders.

Little published work exists following the 2003 Review of the Health Surveillance Unit.

To have a reasonable chance of success of a comprehensive dust disease management program, either the industry needs to be brought on-side, or very strong measures need to be implemented to ensure adverse industry intervention can be contained.

**Conclusions and Recommendations**

All dust related disorders in the coal mining industry need to be covered by an occupational health monitoring program and related safety management systems.

The aim of the safety management system is to identify trigger points where interventions can be implemented when an elevated risk is indicated rather than when adverse outcome is reached.

Efforts need to be taken to right the wrongs arising from the mining industry's failure recognise the issues and address the consequences of occupational dust and respiratory health related exposures.

The health database is an essential tool in identifying population health changes. Data needs to be current and the system made ready for data analysis.

Analysis of deteriorating respiratory function and cumulative dust dose needs to be conducted to identify trigger points where interventions are needed for current miners.

The methodologies and results from overseas programs need to be researched to validate the processes being adopted on Queensland.

Related datasets of miners' adverse occupational health outcomes should be compiled to get a true picture of the burden of ill health that is inflicted by the industry on mine workers.

Education and professional development materials need to be developed and transferred to key managers at all operations. Mechanisms to ensure such competency is maintained need to be developed.

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## APPENDIX 1 Extracts from the Coal Mining Safety and Health Regulation 2000

**Section 6 Basic elements**

A coal mine's safety and health management system must provide for the following basic elements—
(a) risk identification and assessment;
(b) hazard analysis;
(c) hazard management and control;
(d) reporting and recording relevant safety and health information and data.

**Section 49 Monitoring for workers' exposure to hazards**

(1) A coal mine's safety and health management system must provide for periodic monitoring of the level of risk from hazards at the mine that are likely to create an unacceptable level of risk.
(2) The system must also provide for notice of any appreciable increase in the level of risk to a coal mine worker at the mine to be given to the worker's employer.
(3) An employer who is given a notice under subsection (2) must give a copy of the notice to the employer's nominated medical adviser.
(4) An employer must ensure that, if a coal mine worker employed by the employer is exposed to a hazard at a coal mine that may increase the level of risk to the worker, the worker's exposure to the hazard is periodically monitored to assess the level of risk to the worker.

**Section 53 Records of monitoring for workers' exposure to hazards**

(1) The site senior executive must ensure a record about monitoring carried out under section 49 is kept for 30 years after it is made or the lesser period agreed with the chief executive.