RESPIRABLE DUST RESULTS FROM NSW MINES AND
THE STANDING COMMITTEE ON DUST RESEARCH & CONTROL

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INTRODUCTION

Historically the Joint Coal Board was constituted under an arrangement between the Governor-General of Australia and the Governor of New South Wales made pursuant to the provisions of the Coal Industry Act, 1946 (Commonwealth) and the Coal Industry Act 1946 (NSW). In 2001 the Commonwealth withdrew from the Joint Coal Board and those Acts were repealed. As a replacement for the Joint Coal Board under the Coal Industry Act (NSW Govt 2001) a corporation was formed, Coal Services Pty Limited to oversee occupational health and welfare in the NSW coal industry. Coal Services is owned equally by the New South Wales Minerals Council and the CFMEU (mine workers union). The powers and functions of the corporation are stated in the provisions of the Act and includes the responsibility to monitor respirable dust in NSW coal mines.

Coal Services Health operates the dust sampling program, which is an occupational hygiene service and is complementary to the other health services provided which include mine workers biological monitoring from chest x-ray examination and lung function tests. Since July 1994 the dust sampling service has been on a fee-for-service basis.

HEALTH RISK

The health risk to mine workers has long been acknowledged as being related to prolonged exposure to high concentrations of respirable coal dust which can lead to pneumoconiosis, and when mining high quartz content material, silicosis. Coal mining has historically been associated with the occurrence of disabling chest diseases.

The International Labour Organization (ILO) Classification System, the international standard, is the system used by Coal Services Health to grade pneumoconiosis on chest radiographs of coal miners. Under this system, there are four major categories used to grade the severity of pneumoconiosis. Essentially, category 0 is the normal state (no pneumoconiosis), category 1 is mild pneumoconiosis, category 2 is moderate pneumoconiosis, and category 3 is severe pneumoconiosis. It is generally agreed by clinicians, that symptoms of pneumoconiosis are not experienced until category 2 is reached. At category 1, most individuals would be unaware of the presence of early pneumoconiosis, and would not normally be restricted in work or leisure activities.

When the Joint Coal Board was established in 1948 pneumoconiosis was prevalent among coal miners (16% all categories, 4.5% category 2 or worse). Today, the prevalence is so low that no new cases of pneumoconiosis have been detected in the last 15 years. The incidence of pneumoconiosis in the NSW coal industry is among the lowest in the world and over the last 10 years the rates of pneumoconiosis continues to be less than 0.5% (Coal Services 2002-2003)

STANDING COMMITTEE ON DUST RESEARCH AND CONTROL

The Joint Coal Board since its inception actively pursued the eradication of dust related disease among coal miners. In 1954 established a Standing Committee on Dust Research and Control to provide expert advice to the NSW coal industry on respirable dust issues. The committee was constituted from representatives of the colliery proprietors, mining unions, NSW government departments, technical and medical personnel from Coal Services Health, formerly the Joint Coal Board and JCB Health.
The main role of the Committee is to:

- Monitor the results of respirable dust sampling
- Evaluate dust hazards
- Research improved dust control methods
- Disseminate information
- Educate mine personnel in matters related to dust control

This committee in 1984 was instrumental in the introduction of the gravimetric sampling method and setting of the current exposure standards. The committee in 2003 made recommendations to the Chief Inspector of Coal mines on the content of the proposed Coal Mine Health & Safety Act Regulations on respirable dust, inhalable dust and diesel particulate. Coal Services Pty Limited is continuing those same objectives in 2004 by undertaking research projects on inhalable coal dust exposure limits and a proposed respirable exposure standard for crystalline silica under the 2004 Australian Standard AS 2985.

The Committee meets bi-monthly to review the results of Coal Services Health monitoring programs and evaluate and exchange information on technologies, innovations and problems in the industry related to respirable dust. Since the formation of Coal Services Pty Limited in January 2002 the Committee has held meetings at the following mines: Bloomfield O/C, Cumnock U/G, Baal Bone U/G, Newstan U/G, Southern Mines Rescue Station, United U/G, Beltana U/G, Testsafe-Londonderry, Awaba U/G, Dendrobium U/G, Myuna U/G, Dartbrook U/G, Mandalong Drift and Chain Valley U/G. The role of the committee in 2004 remains fundamental to the promotion of improved health standards for coal industry workers.

**DUST MONITORING SERVICE**

The Coal Services Health dust monitoring service is Quality Accredited and has been the sole organization involved with personal dust monitoring in the NSW coal industry since the current regulations (CMRA, 1982) were gazetted in March 1984. The service has the total support and acceptance of both management and unions.

The specified limit for respirable dust other than quartz-containing dust, is 3mg of respirable dust/m$^3$ of air sampled. The specified limit for quartz-containing dust is 0.15mg of respirable quartz/m$^3$ of air sampled (CMRA, 1982). The details are in the attachment (Appendix A).

The frequency of sampling, places and persons to be sampled in each part of a mine are specified in the table (Appendix B). In NSW sample collection commences at the time of leaving the crib room at the start of the shift and ceases on arrival at the crib room at the end of the shift. The sampling period, if practicable should be not less than five hours (CMRA, 1982).

While it is the responsibility of mine management to meet the frequency of sampling required by the CMRA the Coal Services Health monitoring programs are structured in such a manner that management’s obligations are fulfilled were possible.

The integrity of results is guaranteed by a Coal Services Health employee present in the workplace during the sampling shift recording such information as ventilation quantities, blocked sprays, operator location, water pressures or anything which may affect results. Results are used solely to identify problem areas which may exist and are not used at any time for punitive measures. Where areas of high dust concentrations are found efforts are directed to these areas in order to rectify the problems. These efforts in many cases involve Management, Union and Coal Services Health initiatives.

Results of the sampling are forwarded to the Colliery Manager, Senior Government Inspector of Coal Mines, United Mineworkers District Check Inspector and included in the Coal Services Health dust database.

If the result of any sample exceeds the specified limit a re-sample must be taken within seven working days in similar circumstances to those existing when the sample was collected. If the resample still exceeds the specified limit the district inspector of coal mines may, in writing direct the colliery manager to carry out additional procedures to reduce the concentration of airborne dust (NSW Govt. 1999).
During the period 1984-2003 the number of underground mines reduced from 67 to 27, mainly with the closure of non-longwall mines. Open cut mines increased in that period from 18 to 27 mines. Total raw coal production in the period increased from 68.3 million tonnes in 1984 to 144.6 million tonnes in 2003. Underground production increased from 42.2 million tonnes to 47.5 million tonnes and open cut production did substantially increase from 30.7 million tonnes to 97.1 million tonnes during the same period. Raw coal production from open cuts in 2003 was over two thirds (67%) of NSW total production. Longwall mining during 2003 represented over three quarters (75%) of underground raw coal output (Coal Services 2003).

In 1984 nearly 19,000 people were employed in the NSW coal industry. The underground mines employed over 15,000 and the open cuts only 4,000 people. In 2003 the average number of employees in the underground sector was just over 5,000 people and the open cuts nearly the same at just under 5,000 people. On average an open cut mine worker produces twice as much coal per hour as an underground employee.

Coal Services Health Dust Database Results

By the end of 2003, after nearly 20 years of sampling, over 50,000 personal dust samples (including re-samples which is the worse case scenario) had been collected from nearly 10,000 mining locations. Sampling locations were 30% longwall faces, 62% underground other than longwall (mainly continuous miner panels) and 8% open cut/washeries. From 1984 to 1997 the sampling location mix was 65% underground other than longwall and 5% open cut/washeries, increased sampling at open cuts in the last 4 years has seen that % change. An average of over 2,500 personal dust samples at over 500 mining locations were collected per annum from 1984 to 2003.

Analysis of the data is based upon the results obtained during the standard frequency sampling and re-samples. The results of re-samples taken for the requirements of CMRA have been included in the data analysis in Table 1.

<table>
<thead>
<tr>
<th>Mining Method</th>
<th>Number of Personal Samples (Including Re-Samples)</th>
<th>Number &gt; 3mg/m³</th>
<th>Percentage Exceeding Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longwall Faces</td>
<td>14170</td>
<td>1002</td>
<td>7.1</td>
</tr>
<tr>
<td>Other Underground</td>
<td>29040</td>
<td>468</td>
<td>1.6</td>
</tr>
<tr>
<td>Open Cut/Washeries</td>
<td>2790</td>
<td>21</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Examination of the dust results by mining method gives a clearer understanding of the situation shown in Table 1:
- Longwall operations - over 14,000 samples and 7.1% exceeded the limit.
- Other underground (mainly continuous miner panels) - 29,000 samples and 1.6% exceed the limit.
- Opencut/washeries - 2,790 samples and only 0.8% exceed the limit.

This clearly shows that the area of main concern has been the results from the longwall faces.

Longwall Respirable Dust Results

In 1984 there were 12 longwall faces, which progressively rose to 25 faces by 1997 but had reduced to 18 by 2003. It should be noted that two significant changes occurred in the 1984-2003 period. Firstly the number of longwall faces had doubled during the period and the average shift longwall face output increased by more than 100%. During 2003 NSW longwall production was from 18 mines with the coalfield details as follows:

- Hunter Coalfield - 12.2 million raw tonnes from 6 faces
- Newcastle Coalfield - 7.1 million raw tonnes from 3 faces
- Western Coalfield - 9.0 million raw tonnes from 4 faces
- Southern Coalfield - 8.1 million raw tonnes from 5 faces
- Total NSW Coalfields - 36.4 million raw tonnes from 18 faces
Longwall samples over the last 18 year period (up to 2001) have resulted in over 7% of the samples exceeding the 3mg/m³ level. Details of the results are shown in Table 2 where significant improvement has been achieved in the results over the period. During the 1980s the percentage of results exceeding the limit peaked at over 18%. From 1990 substantial initiatives by coal companies achieved the present situation where only 6% of results exceed the limit but longwall mining results still remain the main area of concern. The overall trend during the period has been a reduction in the percentage of samples exceeding the limit. There had been a slight deterioration in the late1990’s and this was attributed to a few particular longwalls where there were operational problems. These are being addressed and the trend in results exceeding the limit is expected to continue going down in the future.

Longwall dust suppression has been very successful in the following areas:

- sealing the covers on the BSL and enclosing the BSL discharge on the belt to reduce intake contamination
- homotropol ventilation has been very successful in allowing clean uncontaminated air onto the longwall face
- water infusion in the Bulli seam utilising in-seam gas drainage holes has been reasonably successful in putting some moisture back into the seam
- operator location with emphasis on face operating procedures has been a major contributor to the improved longwall face dust results. The ‘Hund’ instrument has been an excellent tool to highlight areas of high dust levels and indicate the best location for face operators
- shearer initiation of chocks (shields) has also moved people from the return side of the shearer.

A few longwall mines are still exceeding the respirable dust limit and diligence is required to achieve lower exposure levels for those mineworkers. Some continuous miner operations also require attention to improved ventilation techniques and additional dust suppression strategies.

**RESPIRABLE QUARTZ RESULTS**

Analysis of the quartz data is based upon the results obtained during the standard frequency sampling and re-samples. The results of re-samples taken for the requirements of CMRA have been included in the data analysis.

The 50,000 personal samples taken around 5,000 were sent for quartz analysis. The samples sent for analysis were from those locations where the mining practice or material was expected to contain high quartz containing dust and where the sample failed the respirable dust limit. In the case of longwall samples 25% were sent for quartz analysis. Samples from longwalls sent for quartz analysis had a 1 in 3 chance of exceeding the specified limit of 0.15mg of respirable quartz/m³. Those samples exceeding the specified limit for different mining methods for the period 1984 - 2001 are detailed in Table 3.

<table>
<thead>
<tr>
<th>Mining Method</th>
<th>Number Of Personal Samples (including re-samples)</th>
<th>Number &gt; 0.15mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opencut/Washeries</td>
<td>2790</td>
<td>38</td>
</tr>
<tr>
<td>Longwall Faces</td>
<td>14 170</td>
<td>536</td>
</tr>
<tr>
<td>Other Underground</td>
<td>29040</td>
<td>382</td>
</tr>
</tbody>
</table>

Some longwall mines in the Hunter and Western coalfield have to operate with respirable dust levels at half the specified limit to achieve respirable quartz results of < 0.15 mg/m³ because of the high inherent quartz in the seam or the requirement to regularly cut stone bands or roof.

Increased sampling of open cut shotfirers and overburden drillers has highlighted an area of concern. The NSW Mining Industry Occupational Health & Safety Conference, 25-27 July 2004, Leura, NSW
results have shown that 20 out of 218 quartz samples (9.2%) exceeded the specified limit over the last 10 years and this has increased to 17 out of 149 quartz samples (11.4%) over the last 5 years. Operating procedures and practices need to be addressed with these mineworkers to reduce those exposure levels.

PERSONAL PROTECTION

Where dust exposure cannot be maintained below the specified limit, personal protection should be introduced but due to the protection factor of respirators being relative to facial fit and wear time (uncontrolled factors), they should only be used as a last line of defence and must not take the place of prevention or dust suppression techniques.

COAL SERVICES ORDER 40 - ABATEMENT OF DUST ON LONGWALLS

Another initiative of the Joint Coal Board and continued by Coal Services by its role in the area of airborne dust was the issue of Order 40 on 5 July 1990. This order requires the manager or owner of any mine operating by longwall or shortwall mining methods to obtain Coal Services approval prior to the commencement of production in any longwall or shortwall block. Results of dust samples from previous longwalls are examined prior to approval. Most approvals granted are subject to some form of imposed conditions.

The advent of Order 40 appears to have created a more positive and co-operative attitude towards dust control measures by both management and unions.

DUST CONCLUSIONS

Results of the Coal Services Health dust monitoring programs combined with epidemiology studies indicate that adherence to the current maximum exposure standards outlined earlier is sufficient to maintain a healthy industry workforce.

Even though occupational lung diseases are currently well controlled in the NSW industry, it is essential that face management is vigil to ensure that longwall machinemen adhere to face operating procedures, to limit dust exposure and that dust suppression equipment is maintained through engineering maintenance programs.

In mines operating in seams with high levels of inherent quartz and where there is a need to cut roof stone, it is necessary for operators to achieve lower than required dust levels in order to meet the specified levels of respirable quartz. Similarly additional dust suppression techniques may be required in development panels where conditions are such, that stone roof or floor must be continually mined.

Although recent annual reports from Coal Services and former organization the Joint Coal Board have been indicating prevalence rates of pneumoconiosis in the NSW coal industry of less than 0.5%, respirable dust control management plans should still be a high priority.

REFERENCES:

NSW Govt. 1982 Coal Mines Regulation Act 1982 No 67. NSW Govt. Printer: Sydney
NSW Govt. 1999 Coal Mines (Underground) Regulation 1999. NSW Govt. Printer: Sydney
NSW Govt. 2001 Coal Industry Act 2001. NSW Govt. Printer: Sydney
## Table 2
**All Respirable Dust Results (Including Re-samples) New South Wales Coal Mines 1984 - 2001**

<table>
<thead>
<tr>
<th>Years</th>
<th>Underground Longwall Face</th>
<th>Other Underground</th>
<th>OpenCut and Washeries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Personal Samples (including re-samples)</td>
<td>Number &gt;3mg/m³</td>
<td>Percentage exceeding limit</td>
</tr>
<tr>
<td>1984</td>
<td>238</td>
<td>40</td>
<td>16.8</td>
</tr>
<tr>
<td>1985</td>
<td>340</td>
<td>32</td>
<td>9.4</td>
</tr>
<tr>
<td>1986</td>
<td>307</td>
<td>38</td>
<td>12.4</td>
</tr>
<tr>
<td>1987</td>
<td>592</td>
<td>102</td>
<td>17.2</td>
</tr>
<tr>
<td>1988</td>
<td>553</td>
<td>118</td>
<td>21.3</td>
</tr>
<tr>
<td>1989</td>
<td>426</td>
<td>64</td>
<td>15.0</td>
</tr>
<tr>
<td>1990</td>
<td>645</td>
<td>61</td>
<td>9.5</td>
</tr>
<tr>
<td>1991</td>
<td>1112</td>
<td>61</td>
<td>5.5</td>
</tr>
<tr>
<td>1992</td>
<td>1275</td>
<td>60</td>
<td>4.7</td>
</tr>
<tr>
<td>1993</td>
<td>1198</td>
<td>37</td>
<td>3.1</td>
</tr>
<tr>
<td>1994</td>
<td>1078</td>
<td>31</td>
<td>2.9</td>
</tr>
<tr>
<td>1995</td>
<td>922</td>
<td>48</td>
<td>5.2</td>
</tr>
<tr>
<td>1996</td>
<td>981</td>
<td>53</td>
<td>5.6</td>
</tr>
<tr>
<td>1997</td>
<td>1010</td>
<td>39</td>
<td>3.9</td>
</tr>
<tr>
<td>1998</td>
<td>1079</td>
<td>53</td>
<td>4.9</td>
</tr>
<tr>
<td>1999</td>
<td>866</td>
<td>59</td>
<td>6.8</td>
</tr>
<tr>
<td>2000</td>
<td>727</td>
<td>57</td>
<td>7.8</td>
</tr>
<tr>
<td>2001</td>
<td>817</td>
<td>49</td>
<td>6.0</td>
</tr>
</tbody>
</table>
COAL MINES REGULATION ACT 1982
COAL MINES (UNDERGROUND) REGULATION 1999
COAL MINES (OPEN CUT) REGULATION 1999

File No.  C99/0691
Date:  1 September 1999

SPECIFIED LIMITS FOR AIRBORNE DUST

FOR the purposes of clause 161 of the Coal Mines (Underground) Regulation 1999 and clause 29 of the Coal Mines (Open Cut) Regulation 1999, (definition of ‘specified limit’), it is hereby notified that the limit specified in respect of certain types of dust is as follows:

Specified Limit for Quartz-Containing Dust:

The specified limit for quartz-containing dust is 0.15 milligrams of respirable quartz per cubic metre of air sampled.

Specified Limit for Respirable Dust (other than quartz-containing dust):

The specified limit for respirable dust (other than quartz-containing dust) is 3 milligrams of respirable dust per cubic metre of air sampled.

Definitions:

In this notice:

- “quartz-containing dust” means dust which contains five per cent or more by mass of respirable quartz
- “respirable dust” has the same meaning as it has in Australian Standard 2985
- “respirable quartz” means the quartz present in respirable dust
- “breathing zone” has the same meaning as it has in Australian Standard 2985

PAUL THOMAS HEALEY,
CHIEF INSPECTOR OF COAL MINES.
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Frequency of Sampling</td>
<td>Persons to be Sampled</td>
</tr>
<tr>
<td>(a) in each part of the mine where longwall mining is carried out.</td>
<td>each producing shift at intervals not exceeding six months.</td>
<td>samples to be collected from the breathing zone of at least five persons including, where possible: - a shearer-loader operator, - two powered support operators, - a deputy, and - one other person to be selected by the manager.</td>
</tr>
<tr>
<td>(b) in each part of the mine where a continuous mining machine operates.</td>
<td>each producing shift at intervals not exceeding twelve months.</td>
<td>samples to be collected from the breathing zone of at least five persons in each unit including, where possible: - a continuous miner driver, - a sideman or cable handler, - a shuttle car driver, - a deputy, and - a boot end attendant or other person to be selected by the manager.</td>
</tr>
<tr>
<td>(c) in any place in or about an underground mine other than those referred to in (a) or (b) above, but including crusher stations and wateriest</td>
<td>at intervals not exceeding twelve months.</td>
<td>samples to be collected from the breathing zone of at least one person.</td>
</tr>
<tr>
<td>(d) in any place in or about an open-cut mine where dust may be present.</td>
<td>at intervals not exceeding twelve months.</td>
<td>samples to be collected from the breathing zone of at least one person.</td>
</tr>
</tbody>
</table>

**NOTE:**

(1) Any further samples required by regulation will be additional to these prescribed frequencies.

(2) In the case of (c) or (d) the manager shall select those activities where workmen are likely to be exposed to airborne dust. Such selection shall be notified on a yearly basis to the District Inspector who may require additional activities to be sampled.

(3) Samples and analyses conducted by or for the Joint Coal Board may be used by the manager as part or the whole of the required number of samples to be collected for a given period.

(4) Persons sampled shall, as far as possible, remain at the same job for the duration of the test.