Development of a method of statistical analysis and reporting framework for Coal Services monitoring of airborne dust data for the New South Wales Coal Industry

University of Newcastle

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This study was conducted and reported by:

Dr Maya Guest, *(PhD)*, Lecturer in Occupational Health and Safety from the University of Newcastle

Dr May Boggess, *(PhD)*, Lecturer in Statistics, from Arizona State University and con-joint lecturer at the University of Newcastle
# Table of Contents

1 Introduction and Background ................................................................................. 1
2 Literature Review ................................................................................................. 1
3 Methods .................................................................................................................. 2
   3.1 Data source ....................................................................................................... 2
   3.2 Statistical checks .............................................................................................. 3
   3.3 Standardised report ......................................................................................... 3
   3.4 Historic data .................................................................................................... 4
4 Results .................................................................................................................... 4
   4.1 The advent of MineCheck report .................................................................... 4
   4.2 Statistical checks .............................................................................................. 4
   4.3 Sampling requirements and reporting guidelines ........................................... 5
   4.4 Standardised report ......................................................................................... 6
   4.5 Historic data .................................................................................................... 7
4.6 Database problems identified ............................................................................ 7
5 Conclusion ............................................................................................................... 8
6 References ............................................................................................................. 8
7 Appendices ............................................................................................................ 10
   .............................................................................................................................. 1
   .............................................................................................................................. 1

Mine Name: ??? ....................................................................................................... 1

Mine Type: Underground ......................................................................................... 1

Introduction ............................................................................................................ 1

Executive Summary: Level of control in the last 6 months ................................... 1

How to Interpret Graphical Results ...................................................................... 2

A.1 Respirable Dust - (Underground - Longwall) .................................................. 4
A.2 Respirable Quartz containing Dust - (Underground - Longwall) ..................... 6
A.3 Inhalable Dust - (Underground - Longwall) ...................................................... 8
B.1 Respirable Dust - (Underground – Continuous Mining) .................................. 10
B.2 Respirable Quartz-Containing Dust - (Underground – Continuous Mining) ... 12
B.3 Inspirable Dust - (Underground – Continuous Mining) .................................. 14
C.1 Inhalable Dust - (Underground – Where cement products are being applied) .. 15

D.1 Respirable Dust - (Underground – Other) ......................................................... 16

CMTS > OH............................................................................................................. 16

D.1 Respirable Dust - (Underground – Other) ......................................................... 16

CMTS > OH............................................................................................................. 17
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

D.2 Respirable Quartz-Containing Dust - (Underground – Other) ...........................................17

CMTS > OH.........................................................................................................................18

D.3 Respirable Dust - (Underground – Other) ........................................................................18

Attachment 1: Sampling schedule as required by Order 42 ..............................................19

Contacts for Additional Information...................................................................................22
1 Introduction and Background

Mining it is an ancient occupation that has been long recognised as being arduous and liable to injury and disease. Historically, one of the concerns was coal workers exposure to dust and the development of coal workers pneumoconiosis.

In the Australian state of New South Wales (NSW) the Hygiene Service of Coal Services Pty Ltd have been undertaking personal gravimetric and airborne dust monitoring in all NSW coal mines since 1983 to measure and report exposures to inhalable and respirable dust. Since 2001, this monitoring is conducted on a regular, scheduled basis in accordance with Order 42. The results are stored in a specific database. Following each instance of monitoring each mine is provided with regular report (mg/m$^3$) which identifies any exceedance of the occupational exposure limit. If the monitoring identifies that additional, specific follow up action is required at a mine a report is provided to the Standing Dust Committee. To date, no further use is made of these results that are a valuable source of data.

At an organisational level, mining company office holders and mine managers, who have a responsibility to ensure the maintenance of a healthy and safe work environment, are required to have in place systems to monitor hazards and risk. This is to ensure that the control measures in place to manage risk to health are working effectively. Leading performance indicators, such as personal exposure the monitoring of airborne dust data, provide ongoing information that enables responsible persons to determine whether the risks are adequately controlled. Failures or exceedances, can also provide and early warning of weaknesses in the control system.

At the industry level, the Mine Safety Advisory Council has been promoting a program of the systematic management of those hazards with known risks to human health. Part of this program of work includes the promotion of leading indicators to monitor industry performance over time. Both the Department of Industry and Investment NSW (I&I) and Coal Services bear a legislative responsibility for collecting, analysing and making available quantitative information relating to workplace health and safety so that industry can make informed decisions about health and safety management.

2 Literature Review

in the late 80s and early 90s much research activity surrounded the establishment of an exposure-response relationship between coal workers pneumoconiosis and dust exposures. These studies utilised extensive dust sampling surveys undertaken in Britain and the United States.

The use of routinely collected dust monitoring data has been previously be detailed. Farry reported that BHP Billiton Central Queensland coal mining operations established an Occupational Hygiene
Technical Committee (OTC) in 2001 who identified the need to establish an exposure monitoring program and conduct statistical analysis on the exposure data in order to lay the foundation for the BHP Billiton Hygiene Management Plan.\textsuperscript{3} The OTC concluded that exposure data collected over the previous 30 years at their operations was either collected in a reactive fashion, incomplete or lost over the decades due to staff turnover and failed to provide ‘a legally robust statistical depiction of occupational exposures.’ Farry concluded that the Hygiene Risk Control Plans have benefited their business by focusing resources on the more highly ranked risks placing “occupational hygiene on a more sustainable footing… (and providing) a ‘step change’ in preventative and protective occupational hygiene management.”

In 2009 the International Council of Mining and Metals (ICMM) published the guide, ‘Good Practice Guidance on Occupational Health Risk Assessment’,\textsuperscript{4} to provide a framework for estimating exposure levels and assessing the effectiveness of controls. This guide also outlines the importance of quality analysis and reporting and promotes a risk assessment process where the risk rating creates an action threshold requiring a standardised risk management response. The guide provides criteria for estimating exposure levels and the level of risk.

The data exists for NSW to enable activities such as detailed above to be undertaken. The aim of this project is to formulate a concise report to the management of coalmines as to their current level of exposure levels for a variety of settings and activities and a quantitative and qualitative depiction of their level of airborne dust control.

3 Methods

3.1 Data source

This project utilised the monitoring of airborne dust data collected 1983 – 2011 by the Coal Services Hygiene Team for all coalmines in New South Wales. The use of this data is appropriate for this project for a number of reasons:

1. It is the only source of complete data in existence for the state of NSW
2. The data has been stored in a database in a consistent manner with defined data fields for the entire period
3. The sampling and physical analysis methods have remained consistent since monitoring commenced, other than that required by the change in the Australian Standard (AS 2895-2004\textsuperscript{5} and AS 3640-1989\textsuperscript{6}) on pump flow rate. At that time, data was collected for a period using the old and new flow rates and a correction factor determined.

This data was retrievable from the database for the fields listed in Table 1 below.
Table 1: Available Data Fields 1983 - 2011

<table>
<thead>
<tr>
<th>Variables used from the Coal Services Hygiene Database</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date and time</td>
<td>Sample type (statutory or special)</td>
</tr>
<tr>
<td>Mine</td>
<td>Inhalable or respirable sample</td>
</tr>
<tr>
<td>Sample and filter number</td>
<td>Silica present (where present, amount)</td>
</tr>
<tr>
<td>Seam</td>
<td>Tonnes mined on shift</td>
</tr>
<tr>
<td>Result</td>
<td>Ventilation rate</td>
</tr>
<tr>
<td>Occupation</td>
<td>Position within seam mining</td>
</tr>
<tr>
<td>Silica present</td>
<td>Type of mining activity</td>
</tr>
<tr>
<td>Use of respirator</td>
<td>Suppression methods in use</td>
</tr>
<tr>
<td>Beard</td>
<td></td>
</tr>
</tbody>
</table>

3.2 Statistical checks
The following statistical plan was used:

1. Completeness of the dataset will be assessed by determining the proportion of missing observations for each variable listed above;

2. Descriptive statistics determined for each variable, e.g., mean, median, standard deviation, and range, in both graphical and tabled formats

3. Re-examine the correction factor for the change in sampling pump flow rates to enable comparison of pre and post 2004 data to ensure its validity for the purposes of the framework;

4. Determine the use mining districts as benchmark groups based on sampling results;

5. Determine similar exposure groups (SEGs) based on sampling results;

6. Determine similar operational tasks (SOTs) based on sampling results; and

7. Describe historical exposure trends, by mine using time series analysis.

3.3 Standardised report

8. Determine statistical analysis techniques suitable for use by Coal Service Hygiene Service sampling employees for compiling current, historical, district, mine, SEG and SOT data reports

9. To develop the format of the report

10. To create the report proforma and the mechanism for importing data into the report; i.e. to semi-automate the production of the report.
3.4 Historic data
1. Historical dataset for use in preparing ongoing statistical reports. Dataset to include individual mine data by location of sampling and activities of persons sampled for the following sampling types:
   a) sampling of respirable dust
   b) sampling of respirable quartz containing dust
   c) sampling of inhalable dust.
2. Produce a report on the historical exposure trends for the NSW mining industry

4 Results

4.1 The advent of MineCheck report
At that time of commencement of this project corporate office of Coal Services instigated the development of a series of reports for individual mines, known as MineCheck reports. The 6 monthly reports cover a variety of topics including occupational hygiene sampling data, the development of this report changed the focus of this project. Feedback on the OH MineCheck report was that it was not easy to interpret. An example of this report is provided in Appendix 1. Therefore we were asked to refocus of aim of the project to producing an easier to interpret and more informative OH MineCheck report with the facilitate automated production.

4.2 Statistical checks
A total of 62,077 sampling results were obtained from Coal Services Occupational Hygiene Services for the period 1994 to 2012. Of these, 24,100 were taken in the most recent 5 years and were retained for this analysis. There were five districts: BHP Billiton, Newcastle, Singleton, West Mines and Woonona in use between January 2008 and December 2012.

As described in section 3.2 above. We conducted extensive checks of the dataset and report the following findings:

1. We found the dataset to be largely free of any years missing data for the variables listed in Table 1 above.
2. Descriptive statistics were used to check the consistency of the data in both graphical and tabulated formats (see Appendix 2).
3. We were unable to re-examine the correction factor for the change in sampling pump flow rates to enable comparison of pre-and post-2004 data as services are were not able to supply the report documenting the process.
4.3 Sampling requirements and reporting guidelines

Order the 42 sets out the monitoring of airborne dust for any coal operation. It requires the monitoring of airborne dust at regular collection and analysis of samples of airborne dust from the breathing zone of people whose health may be affected by the dust. The frequency of sampling, places and persons to be sampled in each part of the coal operation is specified. Table 2 below gives minimum locations, frequencies and persons with sampling only and only allows deviations where difficult, dusty or unusual circumstances occur.

<table>
<thead>
<tr>
<th>Location</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>In each part of the coal operation where longwall mining is</td>
<td>Frequency of sampling respirable dust</td>
<td>Frequency of sampling respirable Quartz containing dust</td>
<td>Frequency of sampling inhalable dust</td>
<td>Persons to be sampled</td>
</tr>
<tr>
<td>fish carried out.</td>
<td>Each producing shift at intervals not exceeding six months</td>
<td>Each producing shift at intervals not exceeding six months</td>
<td>Each producing shift at intervals not exceeding 12 months</td>
<td>Samples to be collected from the breathing zone of at least five persons including, where possible: A shearer operator Two powered support operators A deputy One other person selected by Coal Services Pty. Ltd.</td>
</tr>
<tr>
<td>In each part of the coal operation where continuous mining</td>
<td>Each producing shift at intervals not exceeding 12 months</td>
<td>Each producing shift at intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>Samples to be collected from the breathing zone of at least five persons including, where possible: a continuous miner driver a side man or cable handler a shuttle car driver a deputy a bid end attendant or other person selected by Coal Services Pty. Ltd.</td>
</tr>
<tr>
<td>machine operates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In any part of an underground coalmine operation where cement products are being applied.</td>
<td></td>
<td></td>
<td>At intervals not exceeding 12 months</td>
<td>Sample is to be collected from the breathing zone of at least two persons including, where possible: Person loading cement into a mixer persons spraying or applying cement products</td>
</tr>
<tr>
<td>In any place in or about an underground coal operation other than those referred to A, B or C.</td>
<td>At intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>Samples to be collected from the breathing zone of at least one person</td>
</tr>
</tbody>
</table>

Table 2: Sampling schedule as required by Order 42
4.4 Standardised report

In formulating a statistical analysis technique and presentation of findings suitable for summarising data reports we took into account the requirements of Order 42. As well as presenting the findings of the last 6 months of sampling, it is important to provide historical trends in the form of the last 5 years for that of the individual mine site, the mine district and the state. It presents sampling results by type of mining operation, location within the mine and mining tasks being undertaken at the time of sampling. This allows mine owners/operators to compare their performance with others in the industry.

In considering the graphical presentation of the sampling results we took the lead put forward by Logan et. al.7 who undertook a study of Occupational Exposure Judgements and the American Industrial Hygiene Association Exposure Category Rating Scheme. This scheme provides an exposure rating and descriptively proposes a Control Zone description. We consider that this will further enhance the notion that it is not sufficient to not have exceedances. Table 3 below provides the rating scheme as presented in the proposed standardised report.

Table 3: How to Interpret Graphical Results

<table>
<thead>
<tr>
<th>Exposure Rating</th>
<th>Control zone description</th>
<th>General description</th>
<th>AIHA statistical interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Poorly controlled</td>
<td>95th percentile of exposures exceeds the OEL.</td>
<td>OEL &lt; X_{0.95}</td>
</tr>
<tr>
<td>3</td>
<td>Controlled</td>
<td>95th percentile of exposures rarely exceeds the OEL.</td>
<td>0.5 OEL &lt; X_{0.95} ≤ OEL</td>
</tr>
<tr>
<td>2</td>
<td>Well controlled</td>
<td>95th percentile of exposures rarely exceeds 50% of the OEL.</td>
<td>0.10 OEL &lt; X_{0.95} ≤ 0.5 OEL</td>
</tr>
<tr>
<td>1</td>
<td>Highly Controlled</td>
<td>95th percentile of exposures rarely exceeds 10% of the OEL.</td>
<td>X_{0.95} ≤ 0.10 OEL</td>
</tr>
</tbody>
</table>

The graph shows the 95th percentile of sample results. For example, if 100 samples were taken, these 100 results would be sorted and the 95th largest is known as the 95th percentile. In other words, 5 out of 100 samples would be greater than the 95th percentile.

You will note that your graphs are colour coded. The legend for the colours are shown in the table below. The ratings of control have been discussed extensively in the research literature. To quote "a properly designed sampling strategy showing that all employees exposed below the Permissible Exposure Limit, at least with a 95% certainty, is compelling evidence that the exposure limits are being achieved..."
4.5 Historic data
1. We have produced a dataset of historical data for use in producing the revised MineCheck reports. This is supplied in an electronic form.

2. Journal article: we are preparing the Journal article for submission to the Journal of Occupational and Environmental Hygiene which will describe the historical exposure trends for the New South Wales mining industry.

4.6 Database problems identified
As mentioned above a total of 62,077 sampling results were obtained from Coal Services Occupational Hygiene Services for the period 1994 to 2012. Of these, 24,100 were taken in the most recent 5 years and were retained for this analysis. There were five districts: BHP Billiton, Newcastle, Singleton, West Mines and Woonona in use between January 2008 and December 2012. There were five districts: BHP Billiton, Newcastle, Singleton, West Mines and Woonona in use between January 2008 and December 2012. After removing 638 results without a district name, 23462 remained. Seventy five mines were sampled in 2012, after removing 1,500 results from closed mines, 21,962 remained.

Missing or erroneous data
Whilst the database was mostly complete and free from missing data we did find many inconsistencies that would make the automation of the revised report difficult. These inconsistencies would need to be addressed.

Mine Name Recoding
Substantial recoding of the mine name was necessary since the names were spelt in a variety of ways. For example, PTY LTD could be PYT LIMITED the following year, or P/L another year. What might be NO. one year, could be NO (without the period) the following year.

Consistency in names is crucial if one is to be able to count the number of samplings done at a mine, and the number of tests within each sampling, correctly.

Occupation Recoding
This is where the greatest inconsistency was found. For example, CHOCKMAN could be listed as CHOCKMAN MAINGATE, CHOCKMAN/CAVER, M/G CHEARER/CHOCK OP, or T/G CHEARER/CHOCK OP. There were 24 different types of drivers, such as: MULE, TAXI, RAM CAR, LOCO, 913 EIMCO. There were 6 types of bolters. Even after recoding chockmen, shearer, shuttle drivers, miner drivers, electricians, boilermakers, bolters, driller, general, trainees, drivers and examiners, there were still 92 distinct occupations.
Again, consistency is key for occupations, if one is to be able to determine if the correct worker occupations have been samples in accordance with order 42.

**Order 42 Reason: Cement Sampling**

There was no field in the data supplied by Coal services that identified samples that were collected from workers using cement. We attempted to determine them by selecting the work description as aquacrete or cement mix and the occupation was one of concreter, contractor, grouting, hopper, mixer, pump operator, pumper, roof bolter, sprayer or ventilation sealer, but not chockman, driver, geologist, SMV transport, road header operator, shearer or shiftman.

A summary of database problems are:

1. District name missing
2. Consistency in naming of mine; often spelt in a variety of ways
3. Inconsistency in coding of occupations
4. Cement sampling

### 5 Conclusion

The Coal Services Occupational Hygiene database is an invaluable resource. To improve the use and quality of reporting back to stakeholders we put forward an alternative standardised report which presents the sampling data in a more user friendly way.

### 6 References

7 Appendices

Appendix 1 – Example of a MineCheck Report.

![MineCheck Logo](image)

**Environment Summary**

Occupational Hygiene Services (OHys) undertakes the statutory dust sampling at your mine to meet the requirements of the Coal Mines Health and Safety Regulation 2006. Dust sampling refers to both respirable dust – sampled in accordance with AS 2885 – 2009 and inhalable dust – AS 3640-2009.

Diesel Particulate monitoring is recommended as an essential component of a mine's diesel particulate management plan outlined in section 5.5 of Mine Design Guideline 29 (MDG 29).

This report presents results for diesel particulate, respirable dust by mining method and inhalable dust by mining method. It excludes special sampling, static results and non-statutory dust sampling.

**Diesel Results**

The results of any diesel sampling undertaken at your mine during the reporting period are presented below with reference to the recommended limit outlined in MDG29.

Results above the recommended limit indicate the potential for elevated exposure to diesel particulate to operators in the vicinity. The most common causes of elevated results are: maintenance problems with specific machines; high number of machines operating in a ventilation district; and work being performed in areas that have low ventilation.

![Diesel Results Graph](image)

**OHys Recommends**

- Diesel Particulate Matter (DPM) exposures < 0.03 mg/m³ controls are adequate
- DPM exposures > 0.05 mg/m³ & < 0.1 mg/m³ investigation is required to assess controls, including PPE
- DPM exposures > 0.1 mg/m³ suggests that operations should be modified; stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.

MineCheck © Coal Services Pty Limited 2011

Report period 01/01/2011 to 31/12/2011
The results of your statutory sampling (only) for the period indicated are presented below for underground - longwall, with reference to the relevant specified limit.

Results above specified limits indicate existing control failures require investigation. The primary causes of exceedances have been identified as: ventilation related issues; water suppression issues and operator positioning.

**Dust Results - Respirable (Underground - Longwall)**

Respirable dust refers to dust below 5μm in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure.

**OHyS Recommends**
- Respirable Dust exposures < 0.6 mg/m³ indicates controls are satisfactory.
- Exposures > 0.6 mg/m³ but < 1.5 mg/m³, investigation required to assess controls, including PPE.
- Respirable Dust exposure > of 1.5 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.

**Dust Results - Inhalable (Underground - Longwall)**

Inhalable dust refers to dust below 100μm in diameter that may reach the upper respiratory tract and exacerbate asthma and bronchitis with elevated exposure.

**OHyS Recommends**
- Inhalable Dust exposures < 2.5 mg/m³ indicates controls are satisfactory.
- Exposures > 2.5 mg/m³ but < 5.0 mg/m³, investigation required to assess controls, including PPE.
- Inhalable Dust exposure > of 5.0 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

The results of your statutory sampling (only) for the period indicated are presented below for underground - other than longwall, with reference to the relevant specified limit.

Results above specified limits indicate existing control failures require investigation. The primary causes of exceedances have been identified as: ventilation related issues; water suppression issues; and operator positioning.

Dust Results - Respirable (Underground - Other than Longwall)

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure.

OHyS Recommends
- Respirable Dust exposures < 0.6 mg/m³ indicates controls are satisfactory.
- Exposures > 0.6 mg/m³ but < 1.5 mg/m³, investigation required to assess controls, including PPE.
- Respirable Dust exposure > of 1.5 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.

Dust Results - Inhalable (Underground - Other than Longwall)

Inhalable dust refers to dust below 100um in diameter that may reach the upper respiratory tract and exacerbate asthma and bronchitis with elevated exposure.

OHyS Recommends
- Inhalable Dust exposures < 2.5 mg/m³ indicates controls are satisfactory.
- Exposures > 2.5 mg/m³ but < 5.0 mg/m³, investigation required to assess controls, including PPE.
- Inhalable Dust exposure > of 5.0 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.
The results of your statutory sampling (only) for the period indicated are presented below for underground - other than longwall, with reference to the relevant specified limit.

Results above specified limits indicate existing control failures require investigation. The primary causes of exceedances have been identified as: ventilation related issues; water suppression issues; and operator positioning.

**Dust Results - Respirable (Underground - Other than Longwall)**

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure.

**OHyS Recommends**
- Respirable Dust exposures < 0.5 mg/m³ indicates controls are satisfactory.
- Exposures > 0.5 mg/m³ but < 1.5 mg/m³, investigation required to assess controls, including PPE.
- Respirable Dust exposure > of 1.5 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.

**Dust Results - Inhalable (Underground - Other than Longwall)**

Inhalable dust refers to dust below 100um in diameter that may reach the upper respiratory tract and exacerbate asthma and bronchitis with elevated exposure.

**OHyS Recommends**
- Inhalable Dust exposures < 2.5 mg/m³ indicates controls are satisfactory.
- Exposures > 2.5 mg/m³ but < 5.0 mg/m³, investigation required to assess controls, including PPE.
- Inhalable Dust exposure > of 5.0 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.

MinaCheck © Coal Services Pty Limited 2011

Report period 01/01/2011 to 31/12/2011
The results of the analysis for Respirable Crystalline Silica performed upon samples conducted at your mine are presented below, with reference to the specified limit under the NSW gazettel notice No. 188 of 2007.

Results above specified limits indicate existing control failures require investigation. The primary causes of exceedances have been identified as: ventilation related issues, water suppression issues, and operator positioning.

**Respirable Crystalline Silica (Quartz) (Underground - Longwall)**

Quartz Results - Respirable

- Respirable Crystalline Silica (RCS) is a group 1 carcinogen (IARC 1997), therefore every effort should be made to reduce exposures to the lowest possible level.

**Respirable Crystalline Silica (Quartz) (Underground - Other than Longwall)**

Quartz Results - Respirable

- Respirable Crystalline Silica (RCS) is a group 1 carcinogen (IARC 1997), therefore every effort should be made to reduce exposures to the lowest possible level.

**CHyS Recommends**

- Respirable Crystalline Silica exposure < 0.02 mg/m³ indicates controls are satisfactory.
- Respirable Crystalline Silica exposures > 0.02 mg/m³ but < 0.06 mg/m³, investigation required to assess controls, including PPE.
- Respirable Crystalline Silica exposure > of 0.06 mg/m³ suggests that operations should be modified, stricter controls and/or other methods of operation should be encouraged until exposures sources are identified and controlled.
Additional Information

The attached graphs represent the results of any statutory dust samples that have been undertaken at the site in the past six months. These results include Inhaled and Respirable Dust, Respirable Crystalline Silica as well as any DPM samples that have been conducted at your mine site by Coal Services Pty Ltd Occupational Hygiene Group.

As a result of customer feedback received from the January 2011 MineCheck report we have made two changes to the CHyS MineCheck report:

- The first change is the new addition of the Respirable Crystalline Silica (Quartz) test results produced.
- The second change is the diesel exposure standard reference that has been updated to International Agency for Research on Cancer (IARC 2012), from US EPA 2002. This represents the most recent published information by the World Health Organisation with respect to diesel exposure.

If any further clarification of results or more information is required, please contact the Coal Industry Act Inspector that services your site. Please find below the direct contact numbers:

**Singleton (Hunter Valley)**
- Mr. Neil Wilson 0428 494 705  
- Mr. Brad Lambert 0419 210 721  
- Mr. Shaun Greer 0417 267 300  
- Mr. Michael Land 0458 216 131  

**Lithgow/Western District**
- Mr. Chris Maw 0428 264 088  
- Mr. Brett Palmer 0448 463 075  
- Mr. Malcolm Cliff 0418 373 838  

**Argenton (Newcastle)**
- Mr. Mark Shepherd 0408 839 928  
- Mr. Glenn Goodwin 0438 641 569  
- Mr. John Jennings 0418 271 858  
- Mr. Michael Land 0458 216 131  

**Wollongong (Southern)**
- Mr. Andy Staudacher 0417 490 183  
- Mr. Lucas Boyle 0411 478 118  
- Mr. Greg Lalimer 0417 483 853

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MineCheck © Coal Services Pty Limited 2011
Appendix 2 – Coal Dust 2005-2006 Data Summary.

Table 4. Seam

<table>
<thead>
<tr>
<th>Seam</th>
<th>Count</th>
<th>Seams</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arties</td>
<td>24</td>
<td>Lithgow</td>
<td>526</td>
</tr>
<tr>
<td>Barretts</td>
<td>5</td>
<td>Not Supplied</td>
<td>38</td>
</tr>
<tr>
<td>Bulli</td>
<td>856</td>
<td>Pikes Gully</td>
<td>262</td>
</tr>
<tr>
<td>Fassifern</td>
<td>243</td>
<td>Ravensworth</td>
<td>5</td>
</tr>
<tr>
<td>Great Northern</td>
<td>343</td>
<td>Ulan</td>
<td>127</td>
</tr>
<tr>
<td>Great Northern &amp; Fassifern</td>
<td>5</td>
<td>Wallarah</td>
<td>32</td>
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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry
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## Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Table 13: Nature.

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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### Table 14: Mine and Nature.

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### Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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### Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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**Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry**

43
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

Bengalla | Le Tourneau L 1800 | 10 | Mt Owen | Caterpillar/Dozer | 5
Berrima | Joy 12cm 12 | 5 | Mt Thorley Warkworth | Komatsu | 5
Bloomfield CPP | Screens-Crushers | 4 | Muswellbrook O/C | Caterpillar | 5
Bloomfield O/C | Caterpillar | 10 | Muswellbrook O/C | Ingersoll Rand | 5
Bloomfield O/C | Trucks & Shovels | 5 | Muswellbrook O/C | Komatsu | 5
Boggabri O/CDowner Edi | Caterpillar | 5 | N.R.E. No. 1 | Eimco Dash 3 | 15
Bulga | Dresser Dump Truck | 11 | N.R.E. No. 1 | Joy 12 Cm | 5
Bulga | Ingersoll Rand | 5 | N.R.E. No. 1 | Joy 12cm 14 | 5
Bulga | Komatsu | 14 | N.R.E. No. 1 | Joy 12cm 15 | 5
Camberwell | Caterpillar | 5 | N.R.E. No. 1 | Joy 12cm 30 | 15
Camberwell | Caterpillar Loader | 5 | Newpac No. 1 | Caterpillar | 6
Cen Angus Place | Crusher-Screens-Sizer | 2 | Newpac No. 1 | Dbt 30mb | 5
Cen Angus Place | Joy 12cm 12 | 5 | Newpac No. 1 | Joy | 5
Cen Angus Place | Joy 12cm 20 | 5 | Newpac No. 1 | Joy 12 Cm | 5
Cen Angus Place | Joy 12cm 30 | 39 | Newpac No. 1 | Joy 12cm 11 | 135
Cen Angus Place | Joy 4ls D.E.R.D.S. | 55 | Newpac No. 1 | Mitsui Miike | 5
Cen Angus Place | Roof Bolter | 3 | Newpac No. 1 | Mitsui Miike S200 | 15
Cen Manda- Coor | Eimco | 24 | Pine Dale O/C | Cat Dump Trucks | 5
Cen Manda- Coor | Eimco Dash 3 | 15 | Ravensworth East | Caterpillar | 5
Cen Manda- Coor | Joy 7ls | 97 | Rixs Creek | Cat Dump Trucks | 5
Cen Manda- Coor | Meyco Piccola Pump | 4 | Rixs Creek | Marion Dragline | 5
Cen Manda- Coor | Mitsui Miike S200 | 15 | Springvale | Crusher-Transfer Points | 3
Cen Manda- Coor | Roof Bolter | 9 | Springvale | Joy 12cm 12 | 10
Cen Manda- Coor | Voest Alpine A.B.M. 25 | 173 | Springvale | Joy 12cm 30 | 35
Cen Manneri(Wyee) | Dbt 1038 | 19 | Springvale | Joy 4ls D.E.R.D.S. | 58
Cen Manner (Wyee) | Joy 12cm 12 | 103 | Springvale | Roof Bolter | 1
Cen Munmorah | Dbt 1038 | 5 | Springvale | Washery | 2
Cen Myuna | Joy 12cm 12 | 93 | Stratford | Caterpillar | 5
Cen Myuna | Joy 12cm 14 | 5 | Stratford | Caterpillar Loaders Dozers | 5
Cen Myuna | Joy 14cm 15 | 20 | Stratford | Dozer & Loader | 4
Cen Myuna | Mevco Piccone Pump | 5 | Stratford | Drilltech - Caterpillar | 5
Cen Myuna | Meyco Piccola Pump | 6 | Tahmoor | Joy 7ls | 55
Cen Myuna | Mitsui Miike S200 | 15 | Tahmoor | Joy 12cm 20 | 10
Cen Newstan | Breaker-Crusher-Screens | 2 | Tahmoor | Joy 12cm 30 | 120
Cen Newstan | Eimco | 8 | Tahmoor | Washery | 2
Cen Newstan | Joy 7ls | 131 | Tarrawonga O/C | Caterpillar | 5
Cen Newstan | Loader-Bradford Breaker-Crushe | 5 | Tarrawonga O/C | Hitachi-Caterpillar-Reedrill | 5
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### Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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<th>Count</th>
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<td>Whitehaven CPP</td>
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<td>Whitehaven O/C</td>
<td>10</td>
</tr>
<tr>
<td>Lamberts Gully O/C</td>
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<td>Wilpinjong O/C(Thiess)</td>
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#### Table 19: Mines that have Rain recorded.

<table>
<thead>
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<td>Liddell Cpp</td>
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<td>15</td>
<td>Liddell O/C</td>
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<td>12</td>
<td>Metropolitan</td>
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<td>Baal Bone Open Cut</td>
<td>9</td>
<td>Mt Arthur Coal Pty Limited</td>
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<td>90</td>
<td>Mt Owen</td>
<td>32</td>
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<td>Bloomfield Cpp</td>
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<td>Mt Thorley Warkworth</td>
<td>11</td>
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<td>Bloomfield O/C</td>
<td>16</td>
<td>Muswellbrook O/C</td>
<td>23</td>
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<td>Boggabri Open Cut (Downer Edi)</td>
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<td>Narama</td>
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<tr>
<td>Bulga</td>
<td>40</td>
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<td>20</td>
<td>Ravensworth East</td>
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<td>Ulan Cpp</td>
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## Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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### Table 20: Occupation.

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<tr>
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<td>Materials Driver</td>
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<td>Boot End Man</td>
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<td>Open Cut Examiner</td>
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<td>Outbye Man</td>
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<td>R/H Roof Bolter</td>
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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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<tr>
<td>L/H Roof Bolter</td>
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<td>Undermanager</td>
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<td>Loader Driver</td>
<td>52</td>
<td>Uni-Hauler Driver</td>
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<td>Loading Shot</td>
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<td>Ventilation-Sealer</td>
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<tr>
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<td>Wagner L.H.D.</td>
</tr>
<tr>
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<td>1</td>
<td>Washery Operator</td>
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Table 21: Seam Height and Thickness.

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Table 21: Seam Height and Thickness.

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Table 22: Occupation and Mine Type.

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<td>Underground - Longwall</td>
<td>M/G Operator</td>
<td>72</td>
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<tr>
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<td>Boilermaker/Operator</td>
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<td>Underground - Longwall</td>
<td>Machine Man/General</td>
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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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54
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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Table 23: Airway Height and Width A.

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Table 24: Airway Height and Width B.

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

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| 2.4 5.7 | 2.75 5.5 | 3 5.7 | . 4.2 |
| 2.4 6 | 2.75 5.8 | 3 5.8 | . 4.6 |
| 2.45 5.4 | 2.8 4.3 | 3.05 5.5 | . 4.7 |
| 2.45 5.8 | 2.8 4.8 | 3.1 4.6 | . 4.8 |
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| 2.5 4.8 | 2.8 5.1 | 3.1 5.2 | . 5 |
| 2.5 5.2 | 2.8 5.2 | 3.1 5.3 | . 5.1 |
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| 2.6 5.45 | 2.9 5.4 | 3.3 5 | |
| 2.6 5.5 | 2.9 5.5 | 3.3 5.2 |
| 2.6 5.6 | 2.9 5.55 | 3.3 5.3 |
Table 25: Air Quantity and Velocity 1.

Table 26: Air Quantity and Velocity 2.
Table 27: Air Quantity and Velocity 3.
Table 28: Air Quantity and Velocity 4.
Table 29: Air Quantity and Velocity 5.
Table 30: Air Quantity and Velocity 6.
Table 31: Air Quantity and Velocity.

Table 32: Drum sprays.
Table 33: Clearer sprays.

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Table 34: Shearer sprays.

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Table 35: Loader sprays.

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Table 36: Crusher sprays.

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Table 37: Brattice to and from.

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

Table 38: Temperature.

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Table 39: Wind speed.

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Table 41: Result.

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Table 42: Result and Quartz.

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Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

![Respirable Quartz Distribution](image1)

![Inhalable Quartz Distribution](image2)
Appendix 3 – Example of Reformated MineCheck Report.

Order 42 Compliance Report

Mine Name: ???

Mine Type: Underground

Introduction
Coal Service’s Occupational Hygiene Services (OHyS) undertakes the statutory dust sampling at your mine to meet the requirements of the Coal Mines Health and Safety Regulation 2006 and the Coal Industry Act 2001 (Order No 42). The Order requires Dust Sampling of both respirable dust, sampled in accordance with AS 2985-2009 and inhalable dust in accordance with AS 3640-2009. For further details of the Order’s sampling requirements, see Attachment 1.

This report presents statutory dust sampling results taken at your mine in accordance with Order 42 for your mine. It presents sampling results by type of mining operation, location within the mine and mining tasks being undertaken at the time of sampling. In addition, it shows your mine in comparison to your district and the state of the last 5 years. For guidance in interpreting, the level of control and the graphs in this report see Attachment 2.

Executive Summary: Level of control in the last 6 months

<table>
<thead>
<tr>
<th>LONGWALL</th>
<th>CONTINUOUS MINING</th>
<th>CEMENT PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respirable Dust</td>
<td>Respirable Quartz-Containing Dust</td>
<td>Respirable Dust</td>
</tr>
<tr>
<td>Respirable Quartz-Containing Dust</td>
<td>Inhalable Dust</td>
<td>Respirable Dust</td>
</tr>
</tbody>
</table>
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

### Summary of results

(EXAMPLE OF FEEDBACK) LONGWALL:
- Respirable dust was well controlled
- Respirable dust with quartz was highly controlled in the current reporting period. In fact, the 95th percentile of respirable coal dust and dust with quartz was lower than that of the remainder of the state.
- Inhalable dust was poorly controlled, as it has been frequently in the last 5 years. Existing control failures for inhalable coal dust require urgent investigation.

CONTINUOUS MINING
- Respirable dust was well controlled
- Respirable quartz-containing dust was well controlled
- Inhalable dust was controlled. Existing control measure need evaluation to bring these activities back to well controlled.

CEMENT PRODUCTS:
- Inhalable dust

UNDERGROUND OTHER:
- Respirable dust
- Respirable dust with quartz
- Inhalable dust

### How to Interpret Graphical Results

The graph shows the 95th percentile of sample results. For example, if 100 samples were taken, these 100 results would be sorted and the 95th largest is known as the 95th percentile. In other words, 5 out of 100 samples would be greater than the 95th percentile.

You will note that your graphs are colour coded. The legend for the colours are shown in the table below. The ratings of control have been discussed extensively in the research literature. To quote “a properly designed sampling strategy showing that all employees exposed below the Permissible Exposure Limit, at least with a 95% certainty, is compelling evidence that the exposure limits are being...”
### Exposure Rating

<table>
<thead>
<tr>
<th>Exposure Rating</th>
<th>Control zone description</th>
<th>General description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Poorly controlled</td>
<td>95&lt;sup&gt;th&lt;/sup&gt; percentile of exposures exceeds the OEL.</td>
</tr>
<tr>
<td>3</td>
<td>Controlled</td>
<td>95&lt;sup&gt;th&lt;/sup&gt; percentile of exposures rarely exceeds the OEL.</td>
</tr>
<tr>
<td>2</td>
<td>Well controlled</td>
<td>95&lt;sup&gt;th&lt;/sup&gt; percentile of exposures rarely exceeds 50% of the OEL.</td>
</tr>
<tr>
<td>1</td>
<td>Highly Controlled</td>
<td>95&lt;sup&gt;th&lt;/sup&gt; percentile of exposures rarely exceeds 10% of the OEL.</td>
</tr>
</tbody>
</table>
Respirable dust refers to dust below 5μm in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated exposure. The OEL is 2.5 (TWA) mg/m³.

**Summary of results:**
- Number of workers sampled current period: 5
- Range of Results: 0.26 - 0.74
- Occupations sampled: Deputy (1), Other (1), Power Support Operator (2), Shearer (1)

**APPIN Longwall: A.1 Respirable Coal Dust**

- Poorly Controlled
- Controlled
- Well Controlled
- Highly Controlled

<table>
<thead>
<tr>
<th>Year</th>
<th>APPIN, N=5</th>
<th>WOONONA, N=55</th>
<th>State, N=208</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008h1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008h2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009h1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009h2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010h1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010h2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011h1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011h2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012h1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012h2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Level of control:</td>
<td>Well Controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## A.2 Respirable Quartz containing Dust - (Underground - Longwall)

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and with quartz exposure can cause silicosis with long-term repeated exposure. The OEL is 0.12 (TWA) mg/m³.

<table>
<thead>
<tr>
<th>Summary of results:</th>
<th>Number of workers sampled current period: 1</th>
<th>Range of Results: 0.020 - 0.020</th>
<th>Number of exceedances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupations sampled:</td>
<td>Shearer (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

Current Level of control:

- Well Controlled

OHyS recommendations:

- None
**A.3 Inhalable Dust - (Underground - Longwall)**

Inhalable dust refers to dust below 100um in diameter that may reach the upper respiratory tract and exacerbate asthma and bronchitis with elevated exposure. The OEL is 10 (TWA) mg/m³.

**Summary of results:**

| Number of workers sampled current period: | Range of Results: 6.60 - 16.00 | Number of exceedances: 2 |

| Occupations sampled: | Deputy (1), Other (1), Power Support Operator (2), Shearer (1) |

---

**APPIN Longwall: A.3 Inhalable Coal Dust**

![Graph showing the control levels from Poorly Controlled to Highly Controlled with data points for years 2008 to 2012 for APPIN, Woonona, and State levels.](graph.png)
Current Level of control: | Poorly Controlled
---|---
OHys recommendations | Existing control failures require urgent investigation
B.1 Respirable Dust - (Underground – Continuous Mining)

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure. The OEL of dust is 2.5 (TWA) mg/m³.

Summary:

<table>
<thead>
<tr>
<th>Occupation sampled:</th>
<th>Number of workers sampled: 39</th>
<th>Range of Results: 0.15 - 1.18</th>
<th>Number of exceedances: 0</th>
</tr>
</thead>
</table>

Continuous Miner Driver (7), Deputy (9), Other (1), Shuttle Car Driver (7), Sideman Or Cable Handler (15)
<table>
<thead>
<tr>
<th>Current Level of control:</th>
<th>Well Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
</tr>
</tbody>
</table>
B.2 Respirable Quartz-Containing Dust - (Underground – Continuous Mining)

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and with quartz exposure can cause silicosis with long-term repeated over exposure. The OEL is 0.1 (TWA) mg/m³.

Summary:

<table>
<thead>
<tr>
<th>Occupations sampled:</th>
<th>Number of workers sampled current period: 7</th>
<th>Range of Results: 0.000 - 0.040</th>
<th>Number of exceedances: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Miner Driver (1), Deputy (1), Shuttle Car Driver (1), Sideman Or Cable Handler (4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

<table>
<thead>
<tr>
<th>Current Level of control:</th>
<th>Well Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
</tr>
</tbody>
</table>
B.3 Inspirable Dust - (Underground – Continuous Mining)

Inhalable dust refers to dust below 100um in diameter that may reach the upper respiratory tract and exacerbate asthma and bronchitis with elevated exposure. The OEL for inhalable dust is 10 (TWA) mg/m³.

<table>
<thead>
<tr>
<th>Summary:</th>
<th>Number of workers sampled current period: 10</th>
<th>Range of Results: 1.30 - 5.80</th>
<th>Number of exceedances: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupations sampled:</td>
<td>Continuous Miner Driver (1), Deputy (3), Other (3), Shuttle Car Driver (1), Sideman Or Cable Handler (2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### APPIN Continuous Mining: B.3 Inhalable Coal Dust

- Poorly Controlled
- Controlled
- Well Controlled
- Highly Controlled

- APPIN, N=10
- WOONONA, N=114
- State, N=632
### C.1 Inhalable Dust - (Underground – Where cement products are being applied)

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure. The OEL is 2.5 (TWA) mg/m³.

<table>
<thead>
<tr>
<th>Summary:</th>
<th>Number of workers sampled current period: 191</th>
<th>Range of Results:</th>
<th>Number of exceedances:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupations sampled:</td>
<td>Chockman, Deputy, Fitter, General, Outbye Man, Shearer, Spare Man</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current Level of control:</th>
<th>Highly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
</tr>
</tbody>
</table>

Current Level of control: Controlled

OHyS recommendations: Existing control measure need evaluation

Summary:

Number of workers sampled current period: 191

Range of Results:

Number of exceedances:

Occupations sampled:

Chockman, Deputy, Fitter, General, Outbye Man, Shearer, Spare Man

Current Level of control:

Highly Controlled

OHyS recommendations:

None
D.1 Respirable Dust - (Underground – Other)
Respirable dust refers to dust below 5μm in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure. The OEL is 2.5 (TWA) mg/m³.

<table>
<thead>
<tr>
<th>Summary:</th>
<th>Number of workers sampled: 191</th>
<th>Range of Results:</th>
<th>Number of exceedances:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupations sampled:</td>
<td>Chockman, Deputy, Fitter, General, Outbye Man, Shearer, Spare Man</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Level of control:</td>
<td>Highly Controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Respirable Dust - (Underground – Other)
Respirable dust refers to dust below 5μm in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure. The OEL is 2.5 (TWA) mg/m³.
D.2 Respirable Quartz-Containing Dust - (Underground – Other)

Respirable dust refers to dust below 5um in diameter that may reach the alveoli in the lung and with quartz exposure can cause silicosis with long-term repeated over exposure. The OEL is 0.1 (TWA) mg/m³.

<table>
<thead>
<tr>
<th>Summary:</th>
<th>Number of workers sampled: 191</th>
<th>Range of Results:</th>
<th>Number of exceedances:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupations sampled:</td>
<td>Chockman, Deputy, Fitter, General, Outbye Man, Shearer, Spare Man</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Level of control:</td>
<td>Highly Controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D.3 Respirable Dust - (Underground – Other)
Respirable dust refers to dust below 5μm in diameter that may reach the alveoli in the lung and cause pneumoconiosis with long-term repeated over exposure. The OEL is 2.5 (TWA) mg/m³.

<table>
<thead>
<tr>
<th>Summary:</th>
<th>Number of workers sampled: 191</th>
<th>Range of Results:</th>
<th>Number of exceedances:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupations sampled:</td>
<td>Chockman, Deputy, Fitter, General, Outbye Man, Shearer, Spare Man</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Level of control:</td>
<td>Highly Controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHyS recommendations</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Attachment 1: Sampling schedule as required by Order 42**

Schedule 1 of the order is provided below. It outlines the minimum locations, frequencies and persons for sampling only. When difficult, dusty or unusual circumstances occur, then rigorous sampling arrangements suitable to the circumstances are undertaken.

The table gives minimum locations, frequencies and persons for sampling only. Where difficult, dusty or unusual circumstances occur, then rigorous sampling arrangements suitable to the circumstances will need to be undertaken. Stop.

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Frequency of sampling respirable dust</td>
<td>Frequency of sampling respirable Quartz containing dust</td>
<td>Frequency of sampling inhalable dust</td>
<td>Persons to be sample</td>
</tr>
<tr>
<td>In each part of the coal operation where longwall mining is fish carried out.</td>
<td>Each producing shift at intervals not exceeding six months</td>
<td>Each producing shift at intervals not exceeding six months</td>
<td>Each producing shift at intervals not exceeding 12 months</td>
<td>Samples to be collected from the breathing zone of at least five persons including, where possible: A shearer operator Two powered support operators A deputy One other person selected by Coal Services Pty. Ltd.</td>
</tr>
</tbody>
</table>
### Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

<table>
<thead>
<tr>
<th>In each part of the coal operation where continuous mining machine operates</th>
<th>Each producing shift at intervals not exceeding 12 months.</th>
<th>Each producing shift at intervals not exceeding 12 months.</th>
<th>At intervals not exceeding 12 months</th>
<th>Samples to be collected from the breathing zone of at least 5 persons including, where possible: a continuous miner driver a side man or cable handler a shuttle car driver a deputy a bid to end attendant or other person selected by Coal Services Pty. Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In any part of an underground coalmine operation where cement products are being applied.</td>
<td></td>
<td></td>
<td>At intervals not exceeding 12 months</td>
<td>Sample is to be collected from the breathing zone of at least two persons including, where possible: Person loading cement into a mixer persons spraying or applying cement products</td>
</tr>
<tr>
<td>In any place in or about an underground coal operation other than those referred to A, B or C.</td>
<td>At intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>Samples to be collected from the breathing zone of at least one person</td>
</tr>
</tbody>
</table>
### Development of a method of statistical analysis and reporting framework for the New South Wales Coal Industry

| In any place or about an open cut coal operation where dust may be present | At intervals not exceeding 12 months | At intervals not exceeding 12 months | At into walls not exceeding 12 months | Samples to be collected from the breathing zone of at least five persons including, where possible: 
- drill operators, shotfirers and stemmers 
- Mobile equipment operator |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In any place in or about a coal preparation plant located within a coal operation we are dust may be present</td>
<td>At intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>At intervals not exceeding 12 months</td>
<td>Sample is to be collected from the breathing zone of at least five persons where available</td>
</tr>
</tbody>
</table>
## Contacts for Additional Information

If any further clarification of results or more information is required, please contact the Coal Industry Act Inspector that services your site. Please find below the direct contact numbers:

<table>
<thead>
<tr>
<th>Singleton (Hunter Valley)</th>
<th>Argenton (Newcastle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Neil Wilson</td>
<td>0428 494 705</td>
</tr>
<tr>
<td>Mr. Brad Lambkin</td>
<td>0419 210 721</td>
</tr>
<tr>
<td>Mr. Shaun Greer</td>
<td>0417 267 300</td>
</tr>
<tr>
<td>Mr. Michael Land</td>
<td>0458 215 131</td>
</tr>
<tr>
<td>Mr. Mark Shepherd</td>
<td>0408 639 928</td>
</tr>
<tr>
<td>Mr. Glenn Goodwin</td>
<td>0438 641 569</td>
</tr>
<tr>
<td>Mr. John Jennings</td>
<td>0418 271 858</td>
</tr>
<tr>
<td>Mr. Michael Land</td>
<td>0458 215 131</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lithgow/Western District</th>
<th>Wollongong (Southern)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Chris Maw</td>
<td>0428 264 088</td>
</tr>
<tr>
<td>Mr. Brett Palmer</td>
<td>0448 463 075</td>
</tr>
<tr>
<td>Mr. Malcolm Clift</td>
<td>0416 373 836</td>
</tr>
<tr>
<td>Mr. Andy Staudacher</td>
<td>0417 490 183</td>
</tr>
<tr>
<td>Mr. Lucas Boyne</td>
<td>0411 478 118</td>
</tr>
<tr>
<td>Mr. Greg Latimer</td>
<td>0417 463 853</td>
</tr>
</tbody>
</table>

Coal Services Pty Limited under all circumstances complies with the **Federal Privacy Act 1988** and the **NSW Health Records and Information Privacy Act 2002** and the principles attached thereto.