Re: 2017 Dust Monitoring Program Summary

1.0 INTRODUCTION

Greencap was commissioned by the Mining and Quarrying Occupational Health and Safety Committee (MAQOHSC) to undertake respirable dust monitoring at various mines and quarries as part of the 2016 2017 Dust Monitoring Program Summary.

Static and personal dust monitoring was undertaken over 39 monitoring events across 33 stakeholders between December 2016 and August 2017. The monitoring program included the collection of static and personal respirable dust samples, collection of static noise measurements at selected areas within each site and general observations relating to the use of dust and noise mitigation measures.

The primary objective of the monitoring program was to assess whether workers are exposed to respirable dust and respirable silica (quartz) dust at concentrations that may lead to an adverse risk to health based on current exposure standards. Determination of noise levels within various areas throughout each site was used to compare noise levels with the noise exposure standards as defined by the SA WHS Regulations to identify areas and/or processes generating excessive noise levels. Observations relating to the use and adequacy of respiratory and hearing personal protective equipment as well as implementation of current dust mitigation strategies were made at each site to provide an understanding of the adequacy of such measures in place.

This summary should be read in conjunction with a technical report which has been presented under separate cover for this project that summarises the findings of the monitoring program: ‘Health Surveillance – Dust Monitoring Program 2016-2017, Mining & Quarrying Occupational Health & Safety Committee, South Australian Mines & Quarries, SA. July 2017’.

2.0 BACKGROUND

MAQOHSC, established under the Occupational Health, Safety and Welfare Act, 1986 and now operating under the Work Health & Safety Act 2012 (SA) administers expenditure generated from the Mining and Quarrying Industries Fund. The fund is designed to fund MAQOHSC initiatives intended to minimise injury and disease, as well as promoting safe work practices in the industry.

As part of the 2016-2017 dust monitoring program, MAQOHSC seeks to further develop a greater understanding of current silica-related health risks associated with the mining and quarrying industry in South Australia to enable greater industry awareness, facilitate improvements in dust mitigation measures, and to provide a more available means of information and education to the workforce.
The data is intended to support the dust monitoring program completed in 2016 during which 20 mines and quarries were assessed.

2.1 2016 Monitoring Program

A total of 20 sites were assessed during the 2016 monitoring program during which 138 personal samples and 47 static samples were collected. Results exceeding the adopted exposure standards were reported for 22 (16%) and 28 (20%) respirable dust and respirable silica samples respectively. One or more personal respirable dust exceedances were reported at all sites, whilst one or more personal respirable silica dust exceedances were reported at 17 of the 20 sites assessed.

Elevated respirable dust and/or respirable silica (quartz) dust concentrations were reported for the following similar exposure groups:
- SEG 1 – Driller, Drilling & Cutting;
- SEG 4 – Crusher Operator;
- SEG 7 – Quarry Supervisor/Manager;
- SEG 8 – Excavator Operator;
- SEG 11 – Mine Technicians;
- SEG 13 – Maintenance Worker; and
- SEG 24 – Quarryman.

The SEGs above represented those that were considered more likely to be exposed to activities in which products were being disturbed – i.e. drilling and cutting, being processed through a crusher or being moved using plant such as an excavator. The material types in which the highest levels of exposure to silica were sandstone and slate, both of which recorded high quantities of silica in the airborne component of the raw products.

The results indicated that the health risk associated with the inhalation of dust and silica dust at the levels generated were likely to be successfully mitigated by the adequate use of respiratory PPE. It is noted that the application of PPE is considered the last response in the hierarchy of controls, alternative measures such as substitution, engineering and administration controls should be investigated and implemented to further reduce dust levels. Compliance with the use of respiratory PPE was low (50%) with failure to wear PPE and/or incorrect fit of PPE were the most common reasons for non-compliance.

Plant and equipment generating noise in excess of the exposure standard was commonplace and present at every site. This equipment is typically located in crushing and screening areas, as well as rock processing areas in which equipment such as saws and pneumatic tools are being used. Compliance with the use of hearing PPE was more evident than that of respiratory PPE, although the PPE supplied and/or in use was not always ideally suited to the levels of noise being generated at all locations.

2.2 Dust & Dust Mitigation

Silica occurs most types of rock, sand, clay, shale and gravel and presents a health risk as a result of inhalation which may lead to the development of silicosis.

Dust mitigation measures vary amongst sites and operations. Mitigation measures, including the use of respiratory personal protective equipment were reviewed as part of the assessment.

2.3 Noise & Noise Mitigation

Plant and other machinery used in the mining and quarrying industry is often likely to generate elevated noise levels in the workplace. Occupational noise-induced hearing loss is defined as hearing impairment arising from exposure to excessive noise at work and therefore presents as a potential risk on such sites. As part of the dust monitoring program, Greencap collected static noise measurements in and around noise-generating plant and equipment to assess the levels of noise each site.

As per the dust management measures, noise mitigation measures vary amongst sites and operations. Mitigation measures, including the use of hearing personal protective equipment were reviewed as part of the assessment.
3.0 MONITORING PROGRAM SUMMARY

3.1 Scope of Works

The monitoring program was consistent with the 2016 monitoring program with the following activities undertaken at each site (see Table 1):

- Discussions with supervisors and workers regarding work practices in the areas of concern.
- Personal respirable dust monitoring of various mine/quarry workers.
- Static respirable dust monitoring within the mine/quarry.
- Static noise monitoring at various locations.
- Review of respiratory and hearing PPE.

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Monitoring Date</th>
<th>Mine/Quarry Type</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder 1</td>
<td>20 Dec 2016</td>
<td>Sand pit</td>
<td>Sand</td>
</tr>
<tr>
<td>Stakeholder 2</td>
<td>21 Dec 2016</td>
<td>Open cut quarry</td>
<td>Quartzite</td>
</tr>
<tr>
<td></td>
<td>16 Mar 2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder 3</td>
<td>19 Jan 2017</td>
<td>Open cut quarry</td>
<td>Bluestone (slate)</td>
</tr>
<tr>
<td></td>
<td>10 Mar 2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder 4</td>
<td>25 Jan 2017</td>
<td>Open cut quarry</td>
<td>Limestone</td>
</tr>
<tr>
<td>Stakeholder 5</td>
<td>26 Jan 2017</td>
<td>Open cut mine</td>
<td>Ore (iron)</td>
</tr>
<tr>
<td>Stakeholder 6</td>
<td>3 Feb 2017</td>
<td>Open cut mine</td>
<td>Ore (copper, gold)</td>
</tr>
<tr>
<td>Stakeholder 7</td>
<td>7 Feb 2017</td>
<td>Underground mine</td>
<td>Ore (copper, gold)</td>
</tr>
<tr>
<td></td>
<td>3 Aug 2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder 8</td>
<td>15 Feb 2017</td>
<td>Open cut quarry</td>
<td>Bluestone (slate)</td>
</tr>
<tr>
<td>Stakeholder 9</td>
<td>16 Feb 2017</td>
<td>Sand pit</td>
<td>Sand</td>
</tr>
<tr>
<td>Stakeholder 10</td>
<td>17 Feb 2017</td>
<td>Open cut quarry</td>
<td>Dolomite, Limestone</td>
</tr>
<tr>
<td>Stakeholder 11</td>
<td>21 Feb 2017</td>
<td>Sand pit</td>
<td>Sand</td>
</tr>
<tr>
<td>Stakeholder 12</td>
<td>23 Feb 2017</td>
<td>Open cut quarry</td>
<td>Quartzite, Sand</td>
</tr>
<tr>
<td>Stakeholder 13</td>
<td>24 Feb 2017</td>
<td>Open cut quarry</td>
<td>Dolomite, Limestone, Quartzite, Sand</td>
</tr>
<tr>
<td>Stakeholder 14</td>
<td>28 Feb 2017</td>
<td>Sand pit</td>
<td>Sand</td>
</tr>
<tr>
<td>Stakeholder 15</td>
<td>1 Mar 2017</td>
<td>Open cut mine</td>
<td>Limestone</td>
</tr>
<tr>
<td>Stakeholder 16</td>
<td>7 Mar 2017</td>
<td>Sand pit</td>
<td>Sand</td>
</tr>
<tr>
<td>Stakeholder 17</td>
<td>8 Mar 2017</td>
<td>Open cut quarry</td>
<td>Limestone</td>
</tr>
<tr>
<td>Stakeholder 18</td>
<td>15 Mar 2017</td>
<td>Open cut quarry</td>
<td>Dolomite</td>
</tr>
<tr>
<td>Stakeholder 19</td>
<td>17 Mar 2017</td>
<td>Open cut quarry</td>
<td>Quartzite</td>
</tr>
<tr>
<td>Stakeholder 20</td>
<td>20 Mar 2017</td>
<td>Open cut quarry</td>
<td>Dolomite, Limestone, Quartzite</td>
</tr>
<tr>
<td>Stakeholder 21</td>
<td>22 Mar 2017</td>
<td>Open cut quarry</td>
<td>Granite</td>
</tr>
<tr>
<td>Stakeholder 22</td>
<td>23 Mar 2017</td>
<td>Open cut quarry</td>
<td>Dolomite</td>
</tr>
<tr>
<td>Stakeholder 23</td>
<td>24 Mar 2017</td>
<td>Open cut quarry</td>
<td>Limestone</td>
</tr>
</tbody>
</table>
3.2 Dust Monitoring

Static respirable dust and respirable silica (quartz) dust samples were collected in accordance with Australian Standard AS2985-2009, *Workplace atmospheres – Method for sampling and gravimetric determination of respirable dust*.

Personal samples were collected in the breathing zone of the worker. Static respirable dust samples were collected at approximately 1.5m above ground level. The numbers of dust samples collected are summarised in Table 2.

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Monitoring Date</th>
<th>Mine/Quarry Type</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder 24</td>
<td>28 Mar 2017</td>
<td>Open cut quarry</td>
<td>Limestone, Marble</td>
</tr>
<tr>
<td></td>
<td>12 Jul 2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder 25</td>
<td>29 Mar 2017</td>
<td>Open cut quarry</td>
<td>Dolomite, Limestone, Sand, Bluestone (slate)</td>
</tr>
<tr>
<td>Stakeholder 26</td>
<td>31 Mar 2017</td>
<td>Sand Pit</td>
<td>Sand</td>
</tr>
<tr>
<td>Stakeholder 27</td>
<td>3 Apr 2017</td>
<td>Open cut quarry</td>
<td>Dolomite, Quartzite</td>
</tr>
<tr>
<td>Stakeholder 28</td>
<td>4 Apr 2017</td>
<td>Open cut quarry</td>
<td>Limestone</td>
</tr>
<tr>
<td>Stakeholder 29</td>
<td>6 Apr 2017</td>
<td>Open cut quarry</td>
<td>Basalt</td>
</tr>
<tr>
<td>Stakeholder 30</td>
<td>12 Apr 2017</td>
<td>Open cut mine</td>
<td>Ore (iron)</td>
</tr>
<tr>
<td>Stakeholder 31</td>
<td>7 &amp; 8 Jun 2017</td>
<td>Open cut quarry</td>
<td>Dolomite</td>
</tr>
<tr>
<td>Stakeholder 32</td>
<td>14 Jun 2017</td>
<td>Open cut quarry</td>
<td>Quartzite</td>
</tr>
<tr>
<td>Stakeholder 33</td>
<td>15 Jun 2017</td>
<td>Open cut quarry</td>
<td>Dolomite</td>
</tr>
</tbody>
</table>

### Table 2 – Dust Monitoring Sample Quantities

<table>
<thead>
<tr>
<th></th>
<th>Respirable Dust &amp; Silica Dust – Personal</th>
<th>Respirable Dust &amp; Silica Dust – Static</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>299</td>
<td>147</td>
<td>446</td>
</tr>
<tr>
<td>Average (per monitoring event)</td>
<td>7.7</td>
<td>3.8</td>
<td>11.4</td>
</tr>
</tbody>
</table>

3.3 Noise Monitoring

Static noise measurements were taken using a Type 1 integrating sound level meter capable of simultaneously measuring time weighted average and peak noise levels.

Static noise measurement were collected various locations throughout the sites, focusing on the noise generating areas and activities such as crushing plants, sawing/cutting and in the cabins of mobile plant. A total of 305 locations were measured throughout the monitoring program.
3.4 Occupational Exposure Standards

3.4.1 Respirable Dust

The criteria used to assess occupational exposures to airborne toxic substances in the workplace are based on exposure standards published by Safe Work Australia (formerly the National Occupational Health and Safety Commission) in *Workplace Exposure Standards for Airborne Contaminants, 18 April 2013*.

The exposure standard is defined as a time-weighted average (TWA) exposure for a normal eight-hour workday and a five-day working week to which nearly all workers may be repeatedly exposed, it is believed without adverse effect to his/her health. As no Australian exposure standard exists for respirable dust, the trigger value developed by the Australian Institute of Occupational Hygienists (AIoH) was adopted. Exposure standards adopted for the monitoring program are presented in Table 3.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Safe Work Australia Exposure Standard 8 h TWA (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respirable Dust</td>
<td>1.1</td>
</tr>
<tr>
<td>Respirable Silica Dust</td>
<td>0.1</td>
</tr>
</tbody>
</table>

1 No Australian exposure standard for respirable dust – AIoH trigger value adopted

For shifts worked over periods of longer than eight hours, the exposure standards need to be adjusted according to the shift duration. Various adjusted exposure standards were required for this monitoring program as presented in the technical summary and individual site reports.

Action levels are generally defined as half of the exposure standard and are intended to be used as a trigger to investigate the nature of exposures with a goal of implementing mitigation measures and controls to enable the levels of exposure to be reduced below the action level. Results were also screened against action levels to identify areas/issues that may warrant further consideration.

3.4.2 Noise

Noise level exposure standards are presented in Chapter 4, Part 1 of the *Work Health and Safety Regulations 2012*. The regulations present an exposure standard to which an employer must ensure an employee whilst at work, does not exceed as:

- an eight-hour equivalent continuous A-weighted sound pressure level, $L_{Aeq8h}$ of 85 dB(A) referenced to 20 micropascals; and
- a C-weighted peak sound pressure level, $L_{peak}$ of 140 dB(C) referenced to 20 micropascals.

As per dust exposure standards, adjustment factors apply for extended shifts. Adjusted exposure standards were required for this monitoring program are presented in the technical summary and individual site reports.

3.5 PPE Review

A high level review of the use and adequacy of respiratory and hearing PPE on each site was undertaken during the monitoring program. The following aspects were assessed for each:

- Is respiratory/hearing PPE required (based on monitoring results)?
- Was PPE observed to be in use where required?
- Was the PPE supplied/in use considered appropriate for the task (based on observations and monitoring results)?
- Is the application of PPE considered compliant?
4.0 MONITORING PROGRAM SUMMARY

4.1 Similar Exposure Groups

Figure 1 presents the distribution of SEGs assessed during the monitoring program.

![Figure 1 – Distribution of SEGs monitored throughout monitoring program](image)

Loader operators, crusher operators and dump truck drivers represent nearly 50% of the representative SEGs monitored throughout the program.

4.2 Respirable Dust Results

Respirable dust average concentrations were reported to exceed the adopted trigger values for 2 of 16 (12.5%) similar exposure groups (SEGs) and 3 of the 11 (27%) products being extracted and/or processed as follows:

- SEG 4 (crusher operator) – consistent with 2016 monitoring program results.
- SEG 24 (quarryman).
- Basalt and granite.
- Marble – consistent with 2016 monitoring program results.

The action level was exceeded for a further five SEGs (1, 7, 11, 13 and 23) and one product (slate).

Statistical assessment of the data using a 95% upper confidence limit (UCL) indicates that on average, respirable dust concentrations exceeding the trigger value are likely to exist for:

- Seven of the 16 (44%) SEGs assessed – SEGs 1, 4, 7, 11, 13, 23 and 24 with the highest results reported for SEG 24 (quarryman) and SEG 4 (crusher operator). This trend is consistent with the 2016 monitoring program. SEG 8 (excavator operator), reported in 2016 has been replaced by SEG 23 (other tasks).
- Five of the 11 (45%) material types – basalt, granite, limestone, marble and slate with the highest result reported for basalt.

All UCLs for SEGs and material types, with the exception of basalt, are less than 10 times the trigger value, suggesting that if appropriate respiratory PPE is utilised, the levels of exposure would be considered acceptable.
4.3 Respirable Silica (Quartz) Dust Results

Respirable silica (quartz) dust average concentrations were reported to exceed the exposure standard for three SEGs (19%) and two (18%) products being extracted and/or processed as follows:

- SEG 4 (crusher operator).
- SEG 11 (mine technicians) – consistent with 2016 monitoring program results.
- SEG 24 (quarryman).
- Quartzite.
- Slate – consistent with 2016 monitoring program results.

The average concentration for dolomite was equal to the exposure standard.

Statistical assessment of the data using a 95% UCL data indicates that on average, respirable silica (quartz) dust concentrations exceeding the exposure standard are likely to exist for:

- Five of the 16 (44%) SEGs assessed – SEGs 2, 4, 7, 11 and 24 with the highest results reported for SEG 24 (quarryman) and SEG 7 (supervisor/manager). This trend is somewhat consistent with the 2016 monitoring program. SEGs 1 (driller), 8 (excavator operator) and 13 (maintenance workers), reported in 2016 have been replaced by SEG 2 (blast crew).
- Action levels are also likely to be exceeded for SEGs 1 (driller) and 13 (maintenance worker).
- Four of the eleven (36%) material types – marble, ore (copper and gold), quartzite and slate. Marble, quartzite and slate were also reported in the 2016 monitoring program.
- Action levels are also likely to be exceeded for dolomite, granite, iron ore, limestone and sandstone.

These results are generally consistent with the respirable dust results. As per above it is noted that the majority of UCLs are less than 10 times the exposure standard imply that the appropriate use of respiratory PPE would sufficiently mitigate the risk of silica dust inhalation. The result for SEG 24 (quarryman) exceeds 10 x the exposure standard indicating that the use of basic respiratory PPE alone may not be a sufficient dust inhalation mitigation measure.

4.4 Noise Monitoring Results

Plant and equipment generating noise in excess of the exposure standard is present at every site as reported in 2016. The majority of elevated results were detected in areas where plant was operating (i.e. crushing and screening areas).

These areas were typically designated hearing protection areas. Different grades of hearing protection are required at different sites dependent on the levels of noise required. Observations relating to the use and supply of PPE are presented in Section 4.6 on the technical summary and discussed further below.

4.5 PPE Compliance Results

4.5.1 Respiratory Personal Protective Equipment

Respiratory Protective Equipment (RPE) was not considered to be required at eight of the sites, six of which are sand pits/quarries and the other two are iron ore and limestone quarries. These results may be indicative of the nature of the process, i.e. sand extraction and wet screening generates less airborne dust.

The failure to use RPE where required was identified at 64% of the sites even though adequate RPE was available at all but three of these sites. The RPE supplied and/or is use was generally appropriate for the conditions. Four sites were observed to be using and/or supplying RPE that was either non-compliant with Australian Standards or incorrectly fitted.

Overall, compliance with the supply and use of respiratory PPE was considered to be achieved for 50% of the sites assessed.

4.5.2 Hearing Personal Protective Equipment

Hearing Protective Equipment (HPE) was required in all but two of the sites assessed. Noise monitoring data indicates that these areas are most commonly crushing and screening areas.
HPE use was observed in use at 60% of sites where applicable. It was not observed to be in use at four sites where noise levels exceeded the appropriate exposure standard. Appropriate HPE was supplied/available at all but two sites for which the equipment provided at these sites did not provide the level of protection required. It is noted that the HPE in use was often of a higher class than required. The use of such HPE should be reviewed as this may provide excessive noise reduction.

Overall, compliance with the supply and use of hearing PPE was considered to be achieved for 83% of the sites assessed.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Elevated respirable dust and/or respirable silica (quartz) dust concentrations were reported for the following similar exposure groups:

- SEG 1 – Driller, Drilling & Cutting;
- SEG 2 – Blast Crew;
- SEG 4 – Crusher Operator;
- SEG 7 – Quarry Supervisor/Manager;
- SEG 11 – Mine Technicians;
- SEG 13 – Maintenance Worker;
- SEG 23 – Other Tasks; and
- SEG 24 – Quarryman.

These exceedances are consistent with 2016 with SEGs 2 and 23 replacing SEG 8 (excavator operator). As reported previously, the SEGs above represent those that may be considered more likely to be exposed to activities in which products are being disturbed. The material types in which the highest levels of exposure to silica were marble, ore, quartzite and slate. Sandstone and slate were reported to have the highest levels of exposure to silica in the 2016 monitoring program.

A comparison of key dust-related statistics reported in the 2016 and 2017 monitoring programs is presented in Table 4.

<table>
<thead>
<tr>
<th>Item</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling Days/Events</td>
<td>20</td>
<td>39</td>
</tr>
<tr>
<td>Personal Samples</td>
<td>138</td>
<td>299</td>
</tr>
<tr>
<td>Static Samples</td>
<td>47</td>
<td>147</td>
</tr>
<tr>
<td>Total No of Samples</td>
<td>185</td>
<td>446</td>
</tr>
<tr>
<td>Void Samples</td>
<td>2 (1%)</td>
<td>7 (1%)</td>
</tr>
<tr>
<td>Respirable Dust &gt; Exposure Standard (personal)</td>
<td>22 (16%)</td>
<td>40 (13%)</td>
</tr>
<tr>
<td>Respirable Silica &gt; Exposure Standard (personal)</td>
<td>28 (20%)</td>
<td>29 (10%)</td>
</tr>
<tr>
<td>Respirable Dust &gt; Exposure Standard (static)</td>
<td>5 (11%)</td>
<td>39 (27%)</td>
</tr>
<tr>
<td>Respirable Silica &gt; Exposure Standard (static)</td>
<td>6 (13%)</td>
<td>29 (20%)</td>
</tr>
</tbody>
</table>

The results indicate that the health risk associated with the inhalation of dust and silica dust at the levels generated are likely to be successfully mitigated by the adequate use of respiratory PPE in the majority of scenarios assessed.
Exclusions apply and this includes elevated exposures reported for quarrymen and maintenance workers. It is also important to note that the application of PPE is considered the last response in the hierarchy of controls, alternative measures such as substitution, engineering and administration controls should be investigated and implemented to further reduce dust levels. Success of respiratory PPE is also strongly dependent on appropriate use consistency of working conditions. Compliance with the use of respiratory PPE was low with failure to wear PPE and/or incorrect fit of PPE were the most common reasons for non-compliance.

Plant and equipment generating noise in excess of the exposure standard is commonplace and was present at every site. This equipment is typically located in crushing and screening areas. Compliance with the use of hearing PPE was more evident than that of respiratory PPE, although the PPE supplied and/or in use was not always ideally suited to the levels of noise being generated at all locations.

5.2 Recommendations

5.2.1 Dust Management

Various recommendations have been made in each of the individual site reports relevant to the conditions observed and specific monitoring results for each site. The most frequent recommendations included:

- Ensure haul roads and stockpiles are wetted to ensure windblown and traffic generated dust is minimised.
- Mobile plant cabins are to be regularly cleaned and maintained, in particular window and door seals are inspected for leaks. Air conditioning systems and filters should be regularly cleaned to ensure they operate effectively.
- Appropriate awareness training is provided to staff working in and around the dust generating areas (i.e. crushing plants).
- Respiratory protection provided is to be worn at all times when working in areas where airborne dust is being generated (e.g. crushing plants). Workers must wear appropriate PPE:
  - If required to wear disposable type respiratory protection, workers are to be clean shaven.
  - Powered air purifying respirators (PAPR) should be supplied to workers with facial hair growth (beards).
  - All staff should have been given training in the use and fitting of respirators.

As reported in 2016, achieving reductions in dust levels and identifying the sources and nature of dust generation issues can be better managed via the implementation of site-specific Dust Management Plans. The key objective of a site-specific Dust Management Plan is to reduce the levels of dust generated to acceptable levels.

Successful dust management is supported and implemented in three main phases governed by a site-specific Dust Management Plan:

- Identify – e.g. investigate the drivers behind the requirement for dust management, sources of dust, at risk exposure groups and identify processes to reduce dust and exposure to dust.
- Control – e.g. implement controls recommended in the identification phase.
- Monitor – assess the success of the control measures via ongoing monitoring.

A successful Dust Management Plan is cyclic and forms a means of continuous improvement. Reporting on the implementation and success is necessary to demonstrate the effectiveness of the plan and to demonstrate a commitment to reducing dust levels. Regular review of the effectiveness of the plan will allow for the identification of areas of improvement and will maximise the benefits of implementing such a plan. The process of a site-specific Dust Management Plan is integral to the successful implementation of the Health Surveillance Program as demonstrated in Figure 2.
5.2.2 Noise Management

Recommendations relating to managing noise exposure are typically focused on the implementation of a hierarchy of control measures in accordance with Regulation 36 of the WHS Regulations 2012 to reduce noise exposures to personal required to work in the identified noise hazard areas.

The control measures for each site will differ depending on the nature of the noise hazard areas, noise-generating plant/equipment and opportunities to implement the hierarchy as summarised below:

1. **Substitution:**
   Incorporate criteria for noise in the procurement processes to ensure that new equipment purchased has lower noise levels (i.e. Buy Quiet Policy).

2. **Isolation/Engineering:**
   Consider the installation of noise barriers or engineering controls to enable the operator to stand in a location isolated from noisy machinery.

3. **Administrative Controls:**
   Where practicable implement job rotation programs to rotate staff between noisy and quiet areas to reduce the exposure to noise.

4. **Personal Protective Equipment (PPE):**
   Where the noise levels cannot be reduced to a level below the exposure standard of 85 dB(A) mandate the use of hearing protectors for the persons working in these areas.
Specific improvements identified included:

- Implementation of the Hierarchy of Controls and Hearing Conservation Programs.
- Review of adequacy and class of supplied PPE.
- Personal noise dosimetry programs to further assess exposure to different SEGs.
- Equipment replacement and maintenance.

Yours sincerely

Dylan Burford
Regional Practice Manager

Attached Graphs:
- Respirable Dust Concentrations by SEG
- Respirable Dust Concentrations by Product
- Respirable Silica (Quartz) Dust Concentrations by SEG
- Respirable Silica (Quartz) Dust Concentrations by Product
### Respirable Dust Concentration by SEG

<table>
<thead>
<tr>
<th>SEGs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Driller, Drilling &amp; Cutting</td>
</tr>
<tr>
<td>2</td>
<td>Blast Crew</td>
</tr>
<tr>
<td>3</td>
<td>Truck Driver, Dump</td>
</tr>
<tr>
<td>4</td>
<td>Crusher Operator</td>
</tr>
<tr>
<td>5</td>
<td>Loader Operator</td>
</tr>
<tr>
<td>6</td>
<td>Truck Driver, Bin &amp; Other</td>
</tr>
<tr>
<td>7</td>
<td>Quarry Supervisor/Manager</td>
</tr>
<tr>
<td>8</td>
<td>Excavator Operator</td>
</tr>
<tr>
<td>9</td>
<td>Pug Mill Operator</td>
</tr>
<tr>
<td>10</td>
<td>Lab Tech</td>
</tr>
<tr>
<td>11</td>
<td>Mine Technician</td>
</tr>
<tr>
<td>12</td>
<td>Surveyors &amp; Geologists</td>
</tr>
<tr>
<td>13</td>
<td>Maintenance Worker</td>
</tr>
<tr>
<td>14</td>
<td>Dozer Operator</td>
</tr>
<tr>
<td>15</td>
<td>Water Truck Driver</td>
</tr>
<tr>
<td>16</td>
<td>Quarryman</td>
</tr>
<tr>
<td>17</td>
<td>Other Tasks (not included in SEGs)</td>
</tr>
</tbody>
</table>

#### Dust Concentration (mg/m³)

- **Respirable Dust Concentration (mg/m³)**
- **95% UCL**
- **Trigger Value**
Respirable Dust Concentration by Product

Products –
1 = Basalt
2 = Ore (Copper, Gold, Iron Oxide)
3 = Dolomite
4 = Granite
5 = Iron Ore
6 = Limestone
7 = Marble
8 = Quartzite
9 = Sand
10 = Sandstone
11 = Slate

Dust Concentration (mg/m^3)

Respirable Dust Concentration (mg/m^3)
95% UCL
Exposure Standard
Similar Exposure Groups (SEGs)

- Driller, Drilling & Cutting
- Blast Crew
- Truck Driver, Bin & Other
- Crusher Operator
- Loader Operator
- Truck Driver, Bin & Other
- Quarry Supervisor/Manager
- Excavator Operator
- Pug Mill Operator
- Lab Tech
- Mine Technician
- Surveyors & Geologists
- Quarryman
- Bagging
- Other Tasks (not included in SEGs)

Dust Concentration (mg/m³)

Respirable Silica Concentration by SEG

- Respirable Silica Concentration (mg/m³)
- 95% UCL
Respirable Dust Concentration by Product

- Respiration Silica Concentration (mg/m³)
- 95% UCL
- Exposure Standard

Products –
1 = Basalt
2 = Ore (Copper, Gold, Iron Oxide)
3 = Dolomite
4 = Granite
5 = Iron Ore
6 = Limestone
7 = Marble
8 = Quartzite
9 = Sand
10 = Sandstone
11 = Slate