# FINAL REPORT

## APPIN MINE AND WEST CLIFF COLLIERY PARTICULATE MATTER CONTROL BEST PRACTICE POLLUTION REDUCTION PROGRAM

## BHP BILLITON ILLAWARRA COAL

### ENVIRONMENT PROTECTION LICENCE 2504

**Job No:** **6623**

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# APPENDICES

# 1 INTRODUCTION

Illawarra Coal Holdings Pty Ltd (ICHPL, a wholly owned subsidiary of BHP Billiton Pty Limited) owns and operates, through subsidiary Endeavour Coal Pty Ltd, longwall underground mining operations at their Bulli Seam Operations which includes the sites of Appin Mine and West Cliff Colliery. Coal from these underground operations is processed at the West Cliff Coal Preparation Plant which is located adjacent to the West Cliff Colliery. The operations are referred to collectively as Bulli Seam Operations (BSO) Complex.

The BSO Complex sites are located approximately 25 kilometres north-north-west of Wollongong, New South Wales (NSW), near the town of Appin. The operations are comprised of three pit-tops (West Cliff, Appin East and Appin West) and a processing plant, West Cliff Coal Processing Plant (WCCPP). The mine currently produces approximately 6.1 million tonnes of run of mine (RoM) coal and 4.4 million tonnes per annum (Mtpa) of clean (product) coal, all of which is transported by truck to Port Kembla.

This report has been prepared to comply with condition U1 of the Endeavour Coal Environment Protection Licence (EPL) 2504 (**Appendix A**).

## 1.1 OEH Best Practice

In 2011 NSW Office of Environment and Heritage (OEH) published the document '*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining'* (hereafter referred to as the 'Best Practice Report') (**Donnelly et al., 2011**). As an outcome of the Best Practice Report, OEH developed a Pollution Reduction Program (PRP) to be included in the EPL for each coal mine in NSW.

## 1.2 PRP Requirements

The PRP requires the Licensee (Endeavour Coal) to conduct a site-specific Best Management Practice (BMP) and to prepare a report on the practicability of implementing measures to reduce emissions of particulate matter (PM). The Licensee must prepare a report which includes, but is not necessarily limited to the following:

- The identification, quantification and justification of the measures that are currently being used to reduce PM emissions.
- The identification, quantification and justification of 'best practice' measures that could be used to minimise PM emissions.
- An evaluation of the practicability of implementing the best practice measures.
- A proposed timeframe for implementing all practicable best practice measures.

The PRP process is based upon the following three metrics:

- Total suspended particulate (TSP)
- Particulate matter with an aerodynamic diameter of less than 10 µm ($PM_{10}$)
- Particulate matter with an aerodynamic diameter of less than 2.5 µm ($PM_{2.5}$)

In preparing the report the Licensee must refer to the document entitled *Coal Mine Particulate Matter Control Best Practice – Site Specific Determination Guideline* (referred to as the Guideline) **(OEH, 2011)**, which details the process to be followed in the PRP (**Appendix B**). It also provides the required content and format of the PRP. **Table 1.1** presents a summary of the Guideline requirements and a reference to the relevant section in this report.

**Table 1.1: PRP Guideline requirements and report reference**

| EPL U1.2 | Guideline Requirement | Report Reference |
|---|---|---|
| 1) Identification, quantification and justification of current measures that are being used to minimise particle emissions | a. Estimate baseline emissions of TSP, $PM_{10}$ and $PM_{2.5}$ (tonne per year) from each mining activity using US EPA AP-42 emission estimation techniques for both uncontrolled emissions (with no particulate matter controls in place) and controlled emissions (with current particulate matter controls in place). | **Section 2.1 and Section 2.2** |
| | b. Rank the controlled emission estimates for TSP, $PM_{10}$ and $PM_{2.5}$ emitted by each mining activity from highest to lowest. | **Section 2.3** |
| | c. Identify the top mining activities that contribute the highest emissions of TSP, $PM_{10}$ and $PM_{2.5}$. | **Section 2.4** |
| 2) Identification, quantification and justification of best practice measures that could be used to minimise particle emissions | a. For each of the top activities identified in Step 1(c) identify the measures that could be implemented to reduce emissions. | **Section 3.1** |
| | b. For each of the top activities identified in Step 1(c) estimate emissions of TSP, $PM_{10}$ and $PM_{2.5}$ from each mining activity following the application of the measures identified in Step 2 (a). | **Section 3.2** |
| 3) Evaluation of the practicability of implementing these best practice measures | a. For each of the best practice measures identified in Step 2(a), assess the practicability associated with their implementation, by taking into consideration:<br>i. Implementation costs<br>ii. Regulatory requirements<br>iii. Environmental impacts<br>iv. Safety implications and<br>v. Compatibility with current processes and proposed future developments. | **Section 4.1** |
| | b. Identify those best practices that will be implemented at the premises to reduce particle emissions. | **Section 4** |
| 4) A proposed timeframe for implementing all practicable best practice measures | a. For each of the best practice measures identified as being practicable in step 3(b), provide a timeframe for their implementation. | **Section 5** |

## 1.3 Overview of Mining Operations

**Figure 1.1** shows the layout of the BSO complex, consisting of the following major areas and infrastructure:

- Appin East pit top, where ROM coal is conveyed to the surface into ROM bins and either transported directly by trucks via road to the WCCPP or temporarily stockpiled at the Appin East Stockpile;
- West Cliff Colliery, where ROM coal is transferred by conveyor and winder to the WCCPP.
- Appin West pit top, where workers and equipment are transferred to the underground operation;
- The West Cliff Coal Preparation Plant (WCCPP), which receives, stockpiles and washes coal from the underground operations and loads product coal into trucks for transport to Port Kembla;
- No. 1, No.2 and No. 3 shaft sites;
- Douglas North Substation; and
- No. 6 shaft site (road construction completed, shaft construction not yet commenced).

The potential significant dust sources for the BSO Complex are located at or around the:

- Appin East Pit Top;
- Appin West Pit Top;
- West Cliff Pit Top; and
- WCCPP.

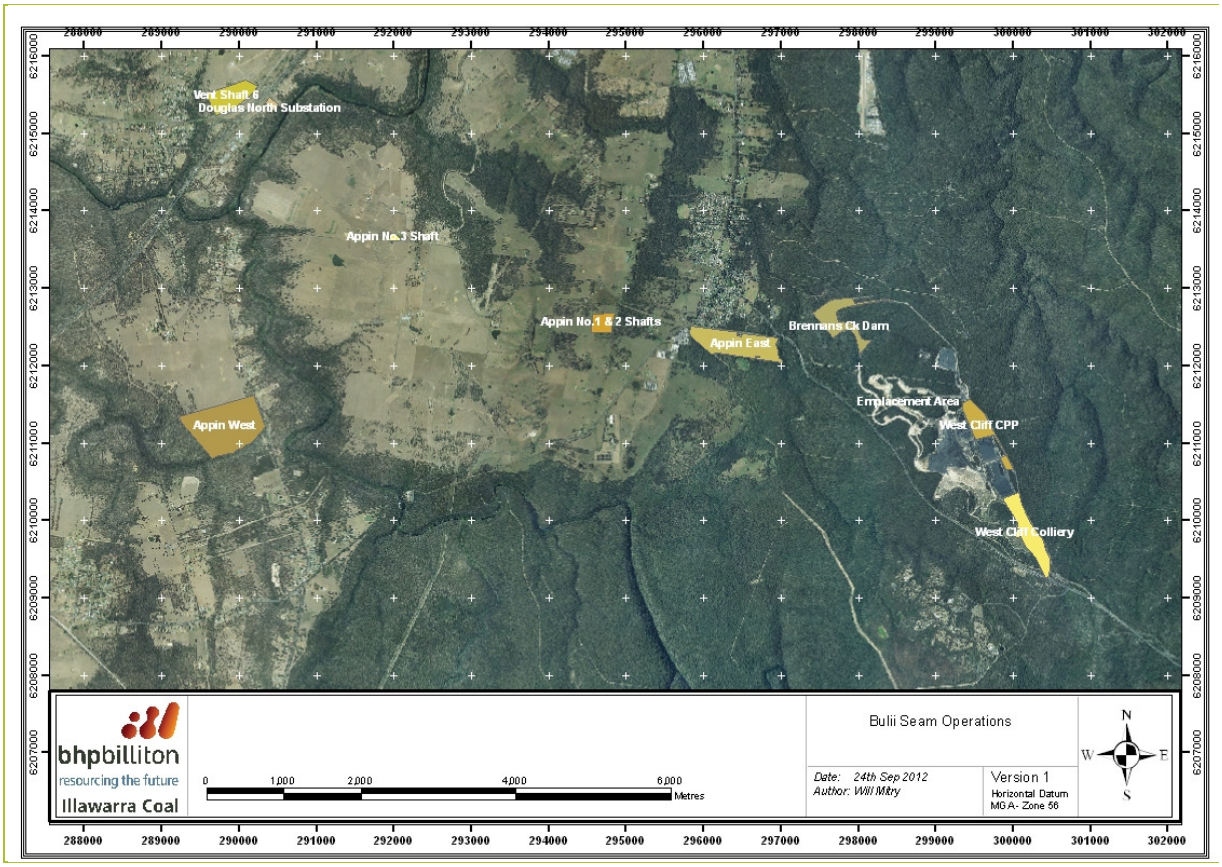


**Figure 1.1: Layout of BSO Complex**

## 1.4 Mining activities and associated emission factors

The PRP defines the following mining activities which generate particulate matter (PM):

- Wheel generated particulates on unpaved roads
- Wind erosion of overburden
- Loading and dumping overburden
- Blasting**
- Bulldozing coal
- Trucks unloading overburden
- Bulldozing overburden
- Front-end loaders on overburden
- Wind erosion of exposed areas
- Wind erosion of coal stockpiles
- Unloading from coal stockpiles
- Dragline*
- Trucks unloading coal
- Loading coal stockpiles
- Graders
- Drilling
- Coal crushing
- Material transfer of coal
- Scrapers on overburden*
- Train loading*
- Screening
- Material transfer of overburden

* Activity not undertaken at BSO Mine Complex.
** Blasting only undertaken underground

The relevant emission factors for each of these activities are presented in **Table 1.2**. **Section 2.1** presents the calculated emissions for the activities relevant to the BSO complex. **Appendix C** details the input parameters for the emission factors, which were sourced from BSO Operators during site visits by PAEHolmes.

**Table 1.2: Emission factors for TSP, $PM_{10}$ and $PM_{2.5}$ by mining activity**

| Mining activity | Units | TSP Emission Factor | $PM_{10}$ Emission Factor | $PM_{2.5}$ Emission Factor | Source |
|---|---|---|---|---|---|
| Wheel generated particulates on unpaved roads | kg/VKT | $\left(\frac{0.4536}{1.6093}\right) \times 4.9 * \left(\frac{s}{12}\right)^{0.7} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$ | $\left(\frac{0.4536}{1.6093}\right) \times 1.5 * \left(\frac{s}{12}\right)^{0.9} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$ | $\left(\frac{0.4536}{1.6093}\right) \times 0.15 * \left(\frac{s}{12}\right)^{0.9} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$ | AP42 13.2.2 |
| Wind erosion of overburden[(a)] | kg/ha/h | 0.1 | 0.5 x TSP (0.5 from AP42 13.2.5) | 0.075 x TSP (0.075 from AP42 13.2.5) | AP42 11.9.7 Table 11.9-4 |
| Loading and dumping overburden | kg/t | $0.74 \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right)$ | $0.35 \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right)$ | $0.053 \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right)$ | AP42 13.2.4 |
| Blasting | kg/blast | $0.00022 \times A^{1.5}$ | 0.52 x TSP | 0.03 x TSP | AP42 11.9.7 Table 11.9-2 |
| Bulldozing coal | kg/t | $35.6 \times \frac{s^{1.2}}{M^{1.3}}$ | $6.33 \times \frac{s^{1.5}}{M^{1.4}}$ | 0.022 x TSP | AP42 11.9.7 Table 11.9-2 |
| Front-end loaders on overburden | kg/t | $2.6 \times \frac{S^{1.2}}{M^{1.3}}$ | $0.3375 \times \frac{S^{1.5}}{M^{1.4}}$ | 0.105 x TSP | AP42 11.9.7 Table 11.9-2 |
| Wind erosion of exposed areas | kg/ha/h | 0.1 | 0.5 x TSP (0.5 from AP42 13.2.5) | 0.075 x TSP (0.075 from AP42 13.2.5) | AP42 11.9.7 Table 11.9-4 |
| Wind erosion of coal stockpiles | kg/ha/h | 1.8 x u | 0.5 x TSP (0.5 from AP42 13.2.5) | 0.075 x TSP (0.075 from AP42 13.2.5) | AP42 11.9.7 Table 11.9-2 |
| Unloading from coal stockpiles | kg/t | $\frac{0.580}{M^{1.2}}$ | $\frac{0.0447}{M^{0.9}}$ | 0.019 x TSP | AP42 11.9.7 Table 11.9-2 |
| Dragline [N/A] | kg/bcm | $0.0046 \times \frac{d^{1.1}}{M^{0.3}}$ | $0.002175 \times \frac{d^{0.7}}{M^{0.3}}$ | 0.017 x TSP | AP42 11.9.7 Table 11.9-2 |
| Trucks unloading coal | kg/t | $\frac{0.580}{M^{1.2}}$ | $\frac{0.0447}{M^{0.9}}$ | 0.019 x TSP | AP42 11.9.7 Table 11.9-2 |

| Mining activity | Units | TSP Emission Factor | $PM_{10}$ Emission Factor | $PM_{2.5}$ Emission Factor | Source |
|---|---|---|---|---|---|
| Loading coal stockpiles | kg/t | $0.74 \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right)$ | $0.35 \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right)$ | $0.053 \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right)$ | AP42 13.2.4<br>(Note: AP42 11.9-7 Table 11.9-4 has train loading emission factor, but footnote directs user to Chapter 13 for more accurate emissions factors) |
| Graders | kg/VKT | $0.0034 \times S^{2.5}$ | $0.00336 \times S^{2.0}$ | $0.0001054 \times S^{2.5}$ | AP42 11.9.7 Table 11.9-2 |
| Drilling overburden | kg/hole | 0.59 | 0.52 x TSP<br>($PM_{10}$ ratio assumed same as blasting AP42 11.9.7 Table 11.9-2) | 0.03 x TSP<br>($PM_{2.5}$ ratio assumed same as blasting AP42 11.9.7 Table 11.9-2) | AP42 11.9.7 Table 11.9-4 |
| Drilling coal | kg/hole | 0.1 | 0.52 x TSP | 0.03 x TSP | AP42 11.9.7 Table 11.9-4 |
| Coal crushing | kg/t | 0.0027 | 0.0012 | No data | AP42 11.19.2 Table 11.19.2-2 |
| Material transfer of coal | kg/t | $\frac{0.580}{M^{1.2}}$ | $\frac{0.0447}{M^{0.9}}$ | 0.019 x TSP | AP42 11.9.7 Table 11.9-2 |
| Scrapers on overburden | kg/t | 0.029 [(b)] | No data | No data | AP-42 11.9.7 Table 11.9-4 |

| Mining activity | Units | TSP Emission Factor | $PM_{10}$ Emission Factor | $PM_{2.5}$ Emission Factor | Source |
|---|---|---|---|---|---|
| Train loading | kg/t | $0.74 \times 0.0016 \times \left( \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$ | $0.35 \times 0.0016 \times \left( \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$ | $0.053 \times 0.0016 \times \left( \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$ | AP42 13.2.4<br>(Note: AP42 11.9-7 Table 11.9-4 has default train loading emission factor but footnote directs user to Chapter 13 for more accurate emissions factors.) |
| Screening | kg/t | 0.025 | 0.0087 | No data | AP42 11.19.2 Table 11.19.2-2 |
| Material transfer of overburden | kg/t | $0.74 \times 0.0016 \times \left( \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$ | $0.35 \times 0.0016 \times \left( \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$ | $0.053 \times 0.0016 \times \left( \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$ | AP42 13.2.4 |

Where:

| | | |
|---|---|---|
| A | = | horizontal area ($m^2$) |
| M | = | material moisture content (%) |
| s | = | material silt content (or surface silt content in unpaved roads) (%) |
| u | = | wind speed (m/s) |
| d | = | drop height (m) |
| W | = | mean vehicle weight (tonnes) |
| S | = | mean vehicle speed (km/h) |

### 1.4.1 Site-specific measurements

#### 1.4.1.1 Haul Road Surface Silt Content

Haul road silt sampling was undertaken by PAEHolmes and analysed by a NATA-accredited laboratory (**SGS, 2012**). Sampling was completed in accordance with the USEPA AP-42 sampling method (**USEPA, 1993**). A summary of these data is included in **Appendix D**. A silt value (defined as material < 75 µm) of 1.01% was determined as an average value in the analysis and used as an input in the emission inventory (**Appendix C**).

#### 1.4.1.2 Coal and Topsoil Silt and Moisture Content

ROM Coal, product coal from both Appin and West Cliff, coal wash and topsoil samples were collected by PAEHolmes and analysed by a NATA-accredited laboratory for silt and moisture contents (**SGS, 2012**). Sampling was completed in accordance with the USEPA AP-42 sampling method (**USEPA, 1993**). A summary of these data is included in **Appendix D**.

Two samples of coal wash were analysed, one from a recently unloaded stockpile and another that had been stockpiled for 2-3 months. The recently unloaded sample was deemed a more representative sample for the moisture content of the coal wash that is being loaded and loaded. These values were used as inputs into the emissions inventory, as shown in **Appendix C**.

#### 1.4.1.3 Moisture of Product Coal

Product coal is continuously sampled for moisture content at the WCCPP by BSO. An average of these values was used as a representative product coal moisture value in the emission inventory (**Appendix C**).

# 2 CURRENT MEASURES USED TO MINIMISE PARTICLE EMISSIONS

This section provides estimates of particulate matter emissions from all identified activities for the two scenarios: uncontrolled emissions (with no particulate matter controls in place) and controlled emissions (with current particulate matter controls in place).

Emissions were calculated using the relevant USEPA AP-42 emission estimation calculations (see **Table 1.2**) for both uncontrolled emissions and controlled emissions. TSP, $PM_{10}$ and $PM_{2.5}$ emission estimates have been calculated for mining activities that occurred during financial year 2012 (July 2011 – June 2012) at the BSO Complex.

## 2.1 Estimated Emissions with No Particulate Controls

The total site emissions were calculated from each movement of material and combined into the groupings defined by the PRP. **Table 2.1** gives the total particulate matter (PM) emissions from the site under current conditions without any controls in place.

**Table 2.1: Summary of PM emissions with no controls in place**

| Mining Activity | TSP (t/year) | $PM_{10}$ (t/year) | $PM_{2.5}$ (t/year) |
|---|---|---|---|
| Wheel generated particulates on unpaved roads | 429 | 80 | 8 |
| Trucks unloading overburden | 1 | 1 | 0 |
| Wind erosion of exposed areas | 18 | 9 | 1 |
| Wind erosion of coal stockpiles | 957 | 478 | 72 |
| Unloading from coal stockpiles | 39 | 3 | 1 |
| Trucks unloading coal | 239 | 33 | 5 |
| Graders | 8 | 3 | 0 |
| Material transfer of coal | 345 | 55 | 8 |
| Material transfer of overburden | 1 | 1 | 0 |
| Topsoil activities | 0 | 0 | 0 |
| **Total** | **2,037** | **663** | **95** |

## 2.2 Estimated Emissions with Current Particulate Controls

Emissions were then recalculated taking into account various control factors for the PM controls in place at the BSO complex. The controls currently implemented are listed in **Table 2.2**. The control factors listed are taken from the Best Practice Report (**Donnelly et al., 2011**). Some of the controls used on site are illustrated in photographs taken during PAEHolmes site inspection (**Figure 2.1** to **Figure 2.4**).

**Table 2.2: Current PM control measures implemented at BSO**

| Mining Activity | Control measure currently in place | Level of control applied |
|---|---|---|
| Hauling on unsealed roads | Water carts operating at 2 $L/m^2/h$ [(b)] | 50% |
| Grading roads | Reduced speed to 8 km/h and keep travel routes moist | 50% |
| Hauling (surface treatment) | Paved road (Appin East) | 90% |
| Loading and unloading coal to stockpile | Water sprays on ROM bin or sprays on ROM stockpile | 50% |
| Unloading coal from stockpile to hopper | Water sprays on ROM bin or sprays on ROM stockpile | 50% |
| Unloading ROM directly to hopper | Enclosed dump hopper (3 sides) plus water sprays | 70% |
| Wind erosion of exposed areas | Watering of exposed areas | 50% |
| Wind Erosion From Stockpiles | Water Sprays on Appin East ROM stockpiles | 50% |

After the application of these control factors to the uncontrolled emission rates, the resulting emissions are shown in **Table 2.3**.

**Table 2.3: Summary of PM emissions with current controls in place**

| Mining Activity | TSP (t/year) | $PM_{10}$ (t/year) | $PM_{2.5}$ (t/year) |
|---|---|---|---|
| Wheel generated particulates on unpaved roads* | 191 | 36 | 4 |
| Trucks unloading overburden | 1 | 1 | 0 |
| Wind erosion of exposed areas | 10 | 5 | 1 |
| Wind erosion of coal stockpiles | 922 | 461 | 69 |
| Unloading from coal stockpiles | 39 | 3 | 1 |
| Trucks unloading coal | 220 | 30 | 4 |
| Graders | 4 | 1 | 0 |
| Material transfer of coal | 202 | 28 | 4 |
| Material transfer of overburden | 1 | 1 | 0 |
| Topsoil activities | 0 | 0 | 0 |
| **Total** | **1,590** | **566** | **83** |

* Some roadways are paved and this is accounted for in a control factor of 90% (**Donnelly et al., 2011**)


**Figure 2.1: Water cart operating on unsealed road at WCCPP**

**Figure 2.2: Watercart operating on unsealed roads at WCCPP**

**Figure 2.3: Covered conveyor at Appin East Colliery**


**Figure 2.4: Water sprays operating on the stockpile at Appin East**

**Figure 2.5: Rehabilitation area at West Cliff Colliery**


**Figure 2.6: Continuous loading to trucks using clam shell technology**

## 2.3 Ranking of Activities with Current PM Controls

The calculated emissions from the mining activities (controlled) listed in **Table 2.3** were combined into activity groups corresponding to those listed in the OEH Guideline, and ranked from highest to lowest according to total mass. In accordance with the Guideline, the top four ranked activities in terms of emissions of TSP, $PM_{10}$ and $PM_{2.5}$ are shown in bold in **Table 2.4.**

Table 2.4: Ranked activities by mass – controlled emission

| Rank | Mining Activity | tonne/year |
|---|---|---|
| **TSP** | | |
| **1** | **Wind erosion of coal stockpiles** | **922** |
| **2** | **Trucks unloading coal** | **220** |
| **3** | **Material transfer of coal** | **202** |
| **4** | **Wheel generated particulates on unpaved roads** | **191** |
| 5 | Unloading from coal stockpiles | 39 |
| 6 | Wind erosion of exposed areas | 10 |
| 7 | Graders | 4 |
| 8 | Material transfer of overburden | 1 |
| 9 | Trucks unloading overburden | 1 |
| 10 | Topsoil activities | 0 |
| **$PM_{10}$** | | |
| **1** | **Wind erosion of coal stockpiles** | **461** |
| **2** | **Wheel generated particulates on unpaved roads** | **36** |
| **3** | **Trucks unloading coal** | **30** |
| **4** | **Material transfer of coal** | **28** |
| 5 | Wind erosion of exposed areas | 5 |
| 6 | Unloading from coal stockpiles | 3 |
| 7 | Graders | 1 |
| 8 | Trucks unloading overburden | 1 |
| 9 | Material transfer of overburden | 1 |
| 10 | Topsoil activities | 0 |
| **$PM_{2.5}$** | | |
| **1** | **Wind erosion of coal stockpiles** | **69** |
| **2** | **Trucks unloading coal** | **4** |
| **3** | **Material transfer of coal** | **4** |
| **4** | **Wheel generated particulates on unpaved roads** | **4** |
| 5 | Unloading from coal stockpiles | 1 |
| 6 | Wind erosion of exposed areas | 1 |
| 7 | Graders | 0 |
| 8 | Trucks unloading overburden | 0 |
| 9 | Material transfer of overburden | 0 |
| 10 | Topsoil activities | 0 |

## 2.4 Highest Ranking PM-Generating Activities

The top four ranked activities according to mass particulate emissions at BSO are therefore:

- Wind erosion of coal stockpiles
- Trucks unloading coal
- Material transfer of coal
- Wheel generated particulates on unpaved roads

# 3 BEST PRACTICE MEASURES

**Section 3.1** summarises the best practice control measures that are available for each of the highest ranking activities identified in **Section 2.4**. An estimation of the emissions through application of these measures is then provided in **Section 3.2**.

## 3.1 Best Practice Measures for Highest Ranking PM contributors

**Table 3.1** to **Table 3.3** summarise the emission control factors for the different control measures that are applicable to the highest ranking activities identified in **Section 2.4**. Both the control measures and the control efficiencies are taken from the Best Practice Report (**Donnelly *et al*., 2011**). Where implemented, the current control measure adopted by BSO is shown in bold.

### 3.1.1 Wind erosion of coal stockpiles

**Table 3.1: Best practice control measures to reduce PM emissions from coal stockpiles**

| | Control Measure | Control |
|---|---|---|
| Avoidance | **Bypass stockpiles*** | **100% reduction in wind erosion for coal bypassing stockpile** |
| Surface stabilisation | **Water spray** | **50%** |
| | Chemical wetting agents | 80-99% |
| | Surface crusting agent | 95% |
| Enclosure | Silo with bag house | 95-100% |
| | Cover storage pile with a tarp during high winds | 99% |
| Wind speed reduction | Vegetative wind breaks | 30% |
| | Reduce pile height | 30% |
| | Wind screens/wind fences | 75-80% |
| | Erect 3-sided enclosure around storage piles | 75% |

* A significant proportion of coal from Appin and West Cliff mines avoids being stockpiled through direct feed into the Washery and the use of ROM and product bins at the two sites.

### 3.1.2 Hauling on unpaved roads

**Table 3.2: Best practice control measures to reduce PM emissions from hauling on unpaved roads**

| | Control Measure | Control |
|---|---|---|
| Surface improvements | Pave the surface | 90% |
| | Low silt aggregate | 30% |
| | Oil and double chip surface | 80% |
| Surface treatments | **Level 1 watering (up to 2 L/m$^2$/h)** | **50%** |
| | Level 2 watering (> 2 l/m$^2$/h) | 75% |
| | **Watering grader routes** | **50%** |
| | Chemical dust suppressants | 85% |

### 3.1.3 Trucks unloading coal

No best practice control measures quantified for this activity.

### 3.1.4 Material transfer of coal

**Table 3.3: Best practice control measures to reduce PM emissions from material transfer of coal**

| Control Measure | | | Control |
|---|---|---|---|
| Conveyor and transfers | Conveyors | **Application of water at transfers** | **50%** |
| | | **Wind shielding - roof or side wall** | **40%** |
| | | **Wind shielding - roof AND side wall** | **70%** |
| | | **Belt cleaning and spillage minimisation** | **Not quantified** |
| | Transfers | **Enclosure** | **70%** |
| | | Enclosure and fabric filters | - |
| Stacking and reclaiming product coal | Avoidance | **Bypass coal stockpiles*** | **100%** |
| | Loading coal stockpiles | Variable height stack | 25% |
| | | Boom tip water sprays | 50% |
| | | Telescopic chute with water sprays | 75% |
| | | Total enclosure | - |
| | Unloading product stockpiles | Bucket wheel, portal or bridge reclaimer with | 50% |
| | | Water sprays | - |
| | | Wind breaks | - |

* A large proportion of product coal avoids being stockpiled as a result of coal being loaded directly to port from product bins.

## 3.2 Estimated resultant emissions

This section presents the resultant mass emissions for activities after applying the best practice measures identified in **Section 3.1**. **Table 3.4** presents the result emissions of TSP, $PM_{10}$ and $PM_{2.5}$.

**Table 3.4: TSP emissions applying best practice measures (t/y)**

| ACTIVITY | Best Practice Control | | % Reduction from uncontrolled emission | Best Practice Emissions |
|---|---|---|---|---|
| Hauling on unpaved roads | Surface improvements | Pave the surface | >90% | < 29 |
| | | Low silt aggregate | 30% | 200 |
| | Surface treatments | Watering (standard procedure) | 10-74% | 74 - 258 |
| | | Watering Level 1 (2 L/m$^2$/h) | 50% | 143 |
| | | Watering Level 2 (>2 L/m$^2$/h) | 75% | 72 |
| | | Watering grader routes | 50% | 143 |
| | | Suppressants | 84% | 46 |
| | | Hygroscopic salts | 45%-82% | 52 - 157 |
| | | Lignosulphonates | 66-70% (over 23 days) | 86 - 94 |
| | | Polymer emulsions | 70% over 58 days | 86 |
| | | Tar and bitumen emulsions | 70% over 20 days | 86 |
| | | Sealed or salt-encrusted | - | 286 |
| | Other | Use of larger vehicles | 90t to 220t: 40% | 172 |
| | | | 140t to 220t; 20% | 229 |
| | | | 140t to 360t: 45% | 157 |
| | | Conveyors | >95% | 14 |
| Wind erosion - coal stockpiles | Avoidance | Bypassing stockpiles | 100% | 0 |
| | Surface stabilisation | Water sprays | 50% | 461 |
| | | Chemical wetting agents | 80-99% | 9 - 184 |
| | | Surface crusting agent | 95% | 46 |
| | | Carry over wetting from load in | 80% | 184 |
| | Enclosure | Silo with bag house | 95-100% | 46 |
| | | Cover storage pile with a tarp during high winds | 99% | 9 |
| | Wind speed reduction | Vegetative windbreaks | 30% | 645 |
| | | Reduced pile height | 30% | 645 |
| | | Wind screens/fences | 75->80% | 184 - 230 |
| Conveyor and transfers | Conveyors | Application of water at transfers | 50% | 102 |
| | | Wind shielding - roof or side wall | 40% | 122 |
| | | Wind shielding - roof AND side wall | 70% | 61 |
| | | Belt cleaning and spillage minimisation | Not quantified | - |
| | Transfers | Enclosure | 70% | 61 |
| | | Enclosure and fabric filters | - | - |
| Stacking and reclaiming product coal | Avoidance | Bypass coal stockpiles | 100% | 0 |
| | Loading coal stockpiles | Variable height stack | 25% | 165 |
| | | Boom tip water sprays | 50% | 110 |
| | | Telescopic chute with water sprays | 75% | 55 |
| | | Total enclosure | - | - |
| | Unloading product stockpiles | Bucket wheel, portal or bridge reclaimer with water application | 50% | 110 |
| | | Water sprays | - | - |
| | | Wind breaks | - | - |

**Table 3.5: PM10 emissions applying best practice measures (t/y)**

| ACTIVITY | Best Practice Control | | % Reduction from uncontrolled emission | Best Practice Emissions |
|---|---|---|---|---|
| Hauling on unpaved roads | Surface improvements | Pave the surface | >90% | < 5 |
| | | Low silt aggregate | 30% | 37 |
| | Surface treatments | Watering (standard procedure) | 10-74% | 14 - 48 |
| | | Watering Level 1 (2 L/m$^2$/h) | 50% | 27 |
| | | Watering Level 2 (>2 L/m$^2$/h) | 75% | 13 |
| | | Watering grader routes | 50% | 27 |
| | | Suppressants | 84% | 9 |
| | | Hygroscopic salts | 45%-82% | 10 - 29 |
| | | Lignosulphonates | 66-70% (over 23 days) | 16 - 18 |
| | | Polymer emulsions | 70% over 58 days | 16 |
| | | Tar and bitumen emulsions | 70% over 20 days | 16 |
| | | Sealed or salt-encrusted | - | 53 |
| | Other | Use of larger vehicles | 90t to 220t: 40% | 32 |
| | | | 140t to 220t; 20% | 43 |
| | | | 140t to 360t: 45% | 29 |
| | | Conveyors | >95% | 3 |
| Wind erosion - coal stockpiles | Avoidance | Bypassing stockpiles | 100% | 0 |
| | Surface stabilisation | Water sprays | 50% | 125 |
| | | Chemical wetting agents | 80-99% | 5 - 92 |
| | | Surface crusting agent | 95% | 23 |
| | | Carry over wetting from load in | 80% | 92 |
| | Enclosure | Silo with bag house | 95-100% | 23 |
| | | Cover storage pile with a tarp during high winds | 99% | 5 |
| | Wind speed reduction | Vegetative windbreaks | 30% | 323 |
| | | Reduced pile height | 30% | 323 |
| | | Wind screens/fences | 75->80% | 92 - 115 |
| Conveyor and transfers | Conveyors | Application of water at transfers | 50% | 14 |
| | | Wind shielding - roof or side wall | 40% | 17 |
| | | Wind shielding - roof AND side wall | 70% | 9 |
| | | Belt cleaning and spillage minimisation | Not quantified | - |
| | Transfers | Enclosure | 70% | 9 |
| | | Enclosure and fabric filters | - | - |
| Stacking and reclaiming product coal | Avoidance | Bypass coal stockpiles | 100% | 0 |
| | Loading coal stockpiles | Variable height stack | 25% | 23 |
| | | Boom tip water sprays | 50% | 15 |
| | | Telescopic chute with water sprays | 75% | 8 |
| | | Total enclosure | - | - |
| | Unloading product stockpiles | Bucket wheel, portal or bridge reclaimer with water application | 50% | 15 |
| | | Water sprays | - | - |
| | | Wind breaks | - | - |

**Table 3.6: PM2.5 mass emissions applying best practice measures (t/y)**

| ACTIVITY | Best Practice Control | | % Reduction from uncontrolled emission | Best Practice Emissions |
|---|---|---|---|---|
| Hauling on unpaved roads | Surface improvements | Pave the surface | >90% | < 1 |
| | | Low silt aggregate | 30% | 4 |
| | Surface treatments | Watering (standard procedure) | 10-74% | 1 - 5 |
| | | Watering Level 1 (2 L/m$^2$/h) | 50% | 3 |
| | | Watering Level 2 (>2 L/m$^2$/h) | 75% | 1 |
| | | Watering grader routes | 50% | 3 |
| | | Suppressants | 84% | 1 |
| | | Hygroscopic salts | 45%-82% | 1 - 3 |
| | | Lignosulphonates | 66-70% (over 23 days) | 2 |
| | | Polymer emulsions | 70% over 58 days | 2 |
| | | Tar and bitumen emulsions | 70% over 20 days | 2 |
| | | Sealed or salt-encrusted | - | 5 |
| | Other | Use of larger vehicles | 90t to 220t: 40% | 3 |
| | | | 140t to 220t; 20% | 4 |
| | | | 140t to 360t: 45% | 3 |
| | | Conveyors | >95% | 0 |
| Wind erosion - coal stockpiles | Avoidance | Bypassing stockpiles | 100% | 0 |
| | Surface stabilisation | Water sprays | 50% | 35 |
| | | Chemical wetting agents | 80-99% | 1 - 14 |
| | | Surface crusting agent | 95% | 3 |
| | | Carry over wetting from load in | 80% | 14 |
| | Enclosure | Silo with bag house | 95-100% | 3 |
| | | Cover storage pile with a tarp during high winds | 99% | 1 |
| | Wind speed reduction | Vegetative windbreaks | 30% | 48 |
| | | Reduced pile height | 30% | 48 |
| | | Wind screens/fences | 75->80% | 14 - 17 |
| Conveyor and transfers | Conveyors | Application of water at transfers | 50% | 2 |
| | | Wind shielding - roof or side wall | 40% | 2 |
| | | Wind shielding - roof AND side wall | 70% | 1 |
| | | Belt cleaning and spillage minimisation | Not quantified | - |
| | Transfers | Enclosure | 70% | 1 |
| | | Enclosure and fabric filters | - | - |
| Stacking and reclaiming product coal | Avoidance | Bypass coal stockpiles | 100% | 0 |
| | Loading coal stockpiles | Variable height stack | 25% | 3 |
| | | Boom tip water sprays | 50% | 2 |
| | | Telescopic chute with water sprays | 75% | 1 |
| | | Total enclosure | - | - |
| | Unloading product stockpiles | Bucket wheel, portal or bridge reclaimer with water application | 50% | 2 |
| | | Water sprays | - | - |
| | | Wind breaks | - | - |

## 3.3 Dust Management Measures

### 3.3.1 Predictive Meteorology for Dust Management

BSO have produced a dust emission forecast table based on predicted wind speeds and frequencies. These dust forecasts will lead to actions for controls associated with additional water cart and/or chemical suppressant use on haul roads and stockpiles. A daily email and SMS alert will be sent based on forecast wind conditions in the area. **Appendix F** shows an example Appin Wind Forecast from this system.

While the mitigation potential of this management measure cannot be explicitly quantified within the framework of the PRP process, it is anticipated that it will provide significant value in optimising operational dust control at the sites.

### 3.3.2 Washery Upgrade

An upgrade to the West Cliff Coal Preparation Plant was commissioned in December 2011. These changes will decrease the quantity of RoM coal that is stockpiled by increasing the rate at which coal is processed. The plant has increased from 840t/hour to 1200t/hour with the upgrade.

### 3.3.3 Dust Suppressant Trials

A number of dust suppressant trials have been undertaken at the BSO. These trials were undertaken to determine the practicability of these controls within the operations. Products trialled to date include:

- Dust Mag (MgCl) – Trial undertaken in 2011
- Dust Guard(MgCl) - Trial undertaken in 2011
- Extreme Dust Control (MgCl + carbohydrate) - Trial undertaken in 2011
- Dust bloc (Bitumen Emulsion) - Trial undertaken in 2012
- Petro tac (Bitumen Emulsion) - Trial undertaken in 2012

Results of the trials have shown mixed results with each product having different application requirements, cost profiles and results in different conditions. Further research into dust suppressant products is being undertaken with future trials of a polymer product planned.


**Figure 3.1 Suppressant trial on haul roads at West Cliff**

### 3.3.4 Appin East Dust Control Improvements

Illawarra Coal has focussed on Appin East dust control over the past few years with some significant projects implemented including automated stockpile sprays and the installation of a dual lane truckwash. **Figure 3.2** shows the current dust controls at Appin East. These projects have shown to be successful in lowering the generation of dust from the Appin East Site.

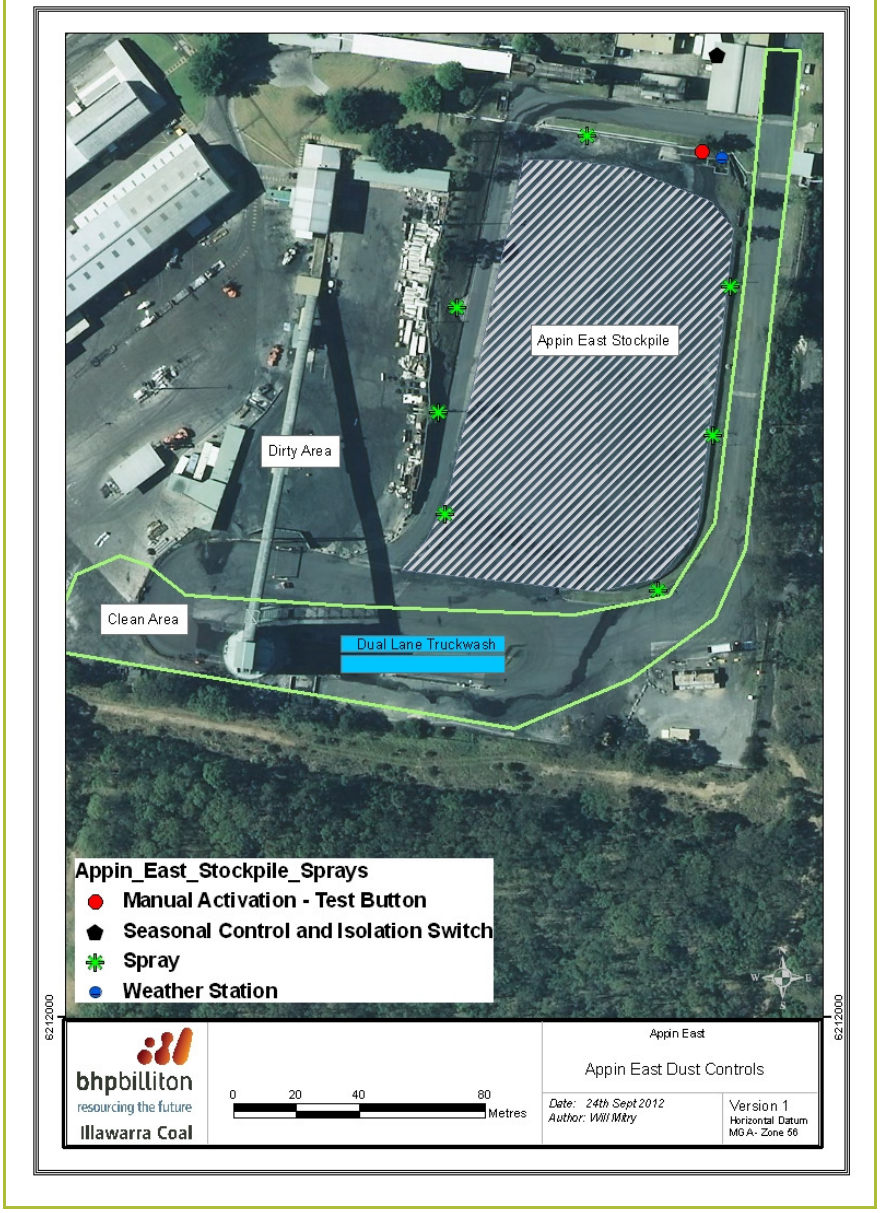


**Figure 3.2 Dust Controls at Appin East**

### 3.3.4.1 Stockpile Sprays

The Appin East Stockpile Sprays were upgraded in 2010 to include wind and seasonal activation through an automated PLC system. The Appin East stockpile sprays currently activate on set cycles (summer and winter) throughout the day and night. The summer cycle has increased frequency of spray activation compared to the winter cycle. The PLC is also programmed to activate the sprays in high winds. The sprays will remain on until the wind speeds drop below the set thresholds. At this point the sprays will be activated based on the normal summer or winter cycles. Further improvements to activate only the sprays upwind of the stockpile are being reviewed.

**Figure 3.3 Appin East Stockpile Sprays**

### 3.3.4.2 Dual-Lane Truckwash

In 2011 a new dual lane truckwash was installed at Appin East. The truckwash was installed by Fleetwash using their Deluge Heavy Vehicle Wash technology. The high volume of water applied to the wheels over three full rotations ensures the wheels are thoroughly washed before entering the sites clean haul road area, which are all sealed with bitumen. This project has enabled the Appin East site to maintain delineation between clean and dirty areas.

**Figure 3.4 Dual lane truckwash at Appin East**

### 3.3.5 Larger Vehicles

Trials have started using larger haulage trucks. This has been identified as a best practice method for the reduction of emissions from haulage activities. The current fleet of haulage trucks is composed of B-Doubles (introduced in 2011) which carry 43 tonne per load and Semi-trailers which carry 28 tonne per truck. The new trial using A-doubles will reduce the number of trucks on the haulage roads as they have a carrying capacity of 55 tonne. This size increase does not provide any additional control for the calculation of dust emissions from haul roads as it falls below the thresholds set in the EPA report.


**Figure 3.5 A-Double (55t) preparing to load from the WCCPP product bins**

### 3.3.6 Appin West

Appin West is a low dust generation site because no coal is brought to the surface at this site. Most of the site is sealed or vegetated. One short unsealed road is controlled with water sprays. Dust gauges located on site indicate minimal dust generation from this site.

**Figure 3.6 Road Sprays on the unsealed road at Appin West**

# 4 PRACTICABILITY OF IMPLEMENTING BEST PRACTICE MEASURES

This section provides an assessment of the practicability and cost associated with the implementation of each of the best practice measures identified in **Section 3.1**. As outlined in the OEH Guideline, the assessment takes into consideration the following criteria:

- Regulatory requirements
- Environmental impacts
- Safety implications
- Compatibility with current processes and proposed future developments

Measures considered practical on these grounds were taken forward for costing.

## 4.1 Assessment of practicability

**Table 4.1** presents a summary of the practicability assessment for the activities that can potentially be further managed by best practice controls. Those activities which are considered impractical on a regulatory, environmental, safety or compatibility basis were not costed.

**Table 4.1: Review of the practicability of best practice measures for West Cliff**

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| Hauling on unpaved roads | Surface improvements | Pave the surface | N | N | N | N | Y | Y – Cost and changing routes on emplacement |
| | | Low silt aggregate | N | N | N | N | Y | Y - to investigate |
| | Surface treatments | Watering (standard procedure) | Y | N | N | N | Y | Y - Current watering rate is between 1 and 2L/sq/hr. BCD water licence limits water usage |
| | | Watering Level 1 (2 l/m$^2$/h) | Y | N | N | N | Y | Y - Current watering rate is between 1 and 2L/sq/hr. BCD water licence limits water usage |
| | | Watering Level 2 (>2 l/m$^2$/h) | N | N | N | N | Y | Y - Would require additional water cart resources on full time basis. BCD water licence limits water usage |
| | | Watering grader routes | Y – Best practice measures already in place. Watering hourly on all haul roads @ 1-2L/sqm/hr | | | | | |
| | | Watering twice a day for industrial unpaved road | Y – Best practice measures already in place. Watering hourly on all haul roads @ 1-2L/sqm/hr | | | | | |
| | | Suppressants | N – Trials undertaken | N | N | N | Y | Y |
| | | Hygroscopic salts | N – Trials undertaken | N | N | N | Y | Y |
| | | Lignosulphonates | N | N | N | N | N | N - not practical on our internal haul roads |
| | | Polymer emulsions | N | N | N | N | Y | Y |
| | | Tar and bitumen emulsions | N – Trials undertaken | N | N | N | Y | Y |
| | | Sealed or salt-encrusted | N | N | Y | N | N | N – Site is located in the Upper Georges River Catchment. No salt allowed on roads |
| | Other | Use of larger vehicles | Y - Already using large dump trucks for emplacement. | N | N | N | Y | Y - Already using large dump trucks for emplacement (30t). Trialing 55t A Double for coal haulage |

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| | | | Trialling 90t A Double for coal haulage | | | | | |
| | | Conveyors | Y - Conveyors used for West Cliff Rom Coal | N | Y | N | N | N – Conveyor use has already been maximised. Consent does not allow conveyor from Appin East to West Cliff. Not practical to emplacement due to constant change |
| Wind erosion - Exposed areas (active pit/active rehab areas) & overburden emplacement areas | Avoidance | Minimise pre-strip | Y - Best Practice measures already in place. Prestrip is minimised to area of active emplacement. | | | | | |
| | Surface stabilisation | Watering | Y | N | N | N | Y | Y - Currently watering exposed areas in the emplacement. |
| | | Chemical suppressants | N | N | N | N | N | N- Emplacement operations frequently changing |
| | | Paving and cleaning | N | N | N | N | N | N |
| | | Application of gravel to stabilise disturbed open areas | N | N | N | N | Y | Y - Already emplacing coal wash which acts like gravel |
| | | Rehabilitation goals | Y - Best practice measures already in place. Maintain exposed areas to 18 hectares | | | | | |
| | Wind speed reduction | Fencing, bunding, shelterbelts or in-pit dump | N | N | N | N | N | N - Too large an area |
| | | Vegetative ground cover | Y - Best practice measures already in place. Progressive rehabilitation of coal wash yearly. | | | | | |
| | | Primary rehabilitation | Y - Best practice measures already in place. Progressive rehabilitation of coal wash yearly. | | | | | |
| | Avoidance | Bypassing stockpiles | Y - Best practice measures already in place. ROM coal from West Cliff bypasses stockpiles at maximum possible rate. Only stacked out onto stockpile when Washery is down for maintenance. | | | | | |
| Wind erosion - coal stockpiles | Surface stabilisation | Water sprays | Y water carts used | N | N | N | Y | Y |
| | | Chemical wetting agents | N | N | N | N | Y | Y |

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| | | Surface crusting agent | N | N | N | N | Y | Y |
| | Enclosure | Silo with bag house | N | N | N | Y | N | N - Not practical due to safety implications and size of stockpiles |
| | | Cover storage pile with a tarp during high winds | N | N | N | N | N | N - Not practical due to size of stockpiles |
| | Wind speed reduction | Vegetative windbreaks | Y | N | N | N | Y | Y - Site has vegetative windbreaks for No4 Stockpile. |
| | | Reduced pile height | Y | N | N | N | Y | N - Stockpile height is minimised as much as practical through building benches in sequence with lower benches completed before higher benches |
| | | Wind screens/fences | N | N | N | N | N | N - Stockpile areas too large |
| | | Pile shaping / orientation | N | N | N | Y | N | N- Must use existing stockpile design due to capacity constraints |
| | | Erect 3-sided enclosure around storage piles | N | N | N | N | Y | N - Stockpile area too large |
| Bulldozers | Minimise travel speed and distance | | Y | N | N | N | Y | Y – in place |
| | Keep travel routes and materials moist | | Y | N | N | N | Y | Y – in place |
| Loading and dumping overburden (Excavators) | Minimising drop height | Reduce from 3m to 1.5 m | NA | N | N | N | N | NA |
| Loading and dumping overburden (Trucks) | Minimising drop height | Reduce from 3m to 1.5 m | Y | N | N | N | N | Y |
| | Water application | | Y | N | N | N | Y | Y - Coal wash has high moisture content from Washery |
| | Modify activities in windy conditions | | N | N | N | N | N | N - Cannot change activities due to limited pre strip area |

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| Unloading trucks | Water sprays | | N | N | N | N | N | N - Coal wash has high moisture content from Washery. Very low dust generations |
| Loading and dumping ROM coal | Avoidance | Bypass ROM stockpiles | Y - Best practice measures already in place. ROM coal from West Cliff bypasses stockpiles at maximum possible rate. Only stacked out onto stockpile when Washery is down for maintenance. | | | | | |
| | Truck or loader dumping ROM coal | Minimise drop height (10 m to 5 m) | Y | N | N | N | N | N |
| | | Water sprays on ROM pad | N | N | Y | N | Y | Y - Review use of sprays. BCD water licence limits water usage |
| | Truck or loader dumping to ROM bin | Water sprays on ROM bin or sprays on ROM pad | N | N | N | N | Y | NA - No truck loading for West Cliff Coal |
| | | Enclosed dump hopper (3 sides and a roof ) | N | N | N | Y | N | N - Flammable range for methane due to gas content of BSO coal |
| | | Enclosed dump hopper (3 sides and a roof ) plus water sprays | N | N | N | Y | N | N - Flammable range for methane due to gas content of BSO coal |
| | | Enclosure with control device | N | N | N | Y | N | N - Flammable range for methane due to gas content of BSO coal |
| Conveyor and transfers | Conveyors | Application of water at transfers | Y - Best practice controls already in place. Water sprays at ROM conveyor transfer points | | | | | |
| | | Wind shielding - roof or side wall | Y - Best practice controls already in place - Conveyors have rooves and or sidewalls | | | | | |
| | | Wind shielding - roof AND side wall | Y - Best practice controls already in place - Conveyors have rooves and or sidewalls | | | | | |
| | | Belt cleaning and spillage minimisation | Y - Best practice controls already in place - belt cleaning routinely undertaken | | | | | |
| | Transfers | Enclosure | Y - Best practice controls already in place - coalwash conveyor fully enclosed | | | | | |
| | | Enclosure and fabric filters | N | N | N | N | N | N - Sufficient control already exists at transfers |

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| Stacking and reclaiming product coal | Avoidance | Bypass coal stockpiles | Y - Best practice controls already in use. Product coal is delivered to port directly from product bins as much as possible | | | | | |
| | Loading coal stockpiles | Variable height stack | NA | N | N | N | N | NA - no reclaimer at WC |
| | | Boom tip water sprays | N | N | N | N | Y | N - Product Coal has high moisture content already |
| | | Telescopic chute with water sprays | N | N | N | Y | N | N - conveyor is built on the structural limit |
| | | Total enclosure | N | N | N | Y | N | N - too large an area and safety implications |
| | Reclaim coal | Underground reclaim | N | N | N | Y | N | N - too large an area and safety implications |
| | Unloading product stockpiles | Bucket wheel, portal or bridge reclaimer with water application | N | N | N | N | N | N – Not practicable due to size of stockpiles |
| | | Water sprays | N | N | N | N | Y | Y - Water cart during loading/unloading of product stockpiles |
| | | Wind breaks | Y - Partial | N | N | N | Y | Y - Berms and vegetation on No3 and No 4 Stockpiles |

**Table 4.2: Review of the practicability of best practice measures for Appin**

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| Hauling on unpaved roads | Surface improvements | Pave the surface | Y - Best practice measures already in place | | | | | |
| | | Low silt aggregate | Y - Best practice measures already in place – Haul roads sealed | | | | | |
| | | Oil and double chip surface | | | | | | |
| | Surface treatments | Watering (standard procedure) | | | | | | |
| | | Watering Level 1 (2 l/m$^2$/h) | | | | | | |
| | | Watering Level 2 (>2 l/m$^2$/h) | | | | | | |
| | | Watering grader routes | | | | | | |
| | | Watering twice a day for industrial unpaved road | | | | | | |
| | | Suppressants | | | | | | |
| | | Hygroscopic salts | | | | | | |
| | | Lignosulphonates | | | | | | |
| | | Polymer emulsions | | | | | | |
| | | Tar and bitumen emulsions | | | | | | |
| | | Sealed or salt-encrusted | | | | | | |
| | Other | Use of larger vehicles | | | | | | |
| | | Conveyors | | | | | | |
| Wind erosion - Exposed areas (active pit/active rehab areas) & overburden emplacement areas | Avoidance | Minimise pre-strip | Y - Best practice measures already in place – Exposed areas controlled with water sprays | | | | | |
| | Surface stabilisation | Watering | | | | | | |
| | | Chemical suppressants | | | | | | |
| | | Paving and cleaning | | | | | | |
| | | Application of gravel to stabilise disturbed open areas | | | | | | |
| | | Rehabilitation goals | | | | | | |
| | Wind speed reduction | Fencing, bunding, shelterbelts or in-pit dump | | | | | | |
| | | Vegetative ground cover | | | | | | |
| | | Primary rehabilitation | | | | | | |
| | | Vegetation established but not demonstrated to be self-sustaining. Weed control and grazing control | | | | | | |
| Wind erosion - coal stockpiles | Avoidance | Bypassing stockpiles | Y - Best practice measures already in place. ROM coal from Appin bypasses stockpiles at maximum possible rate. Only stacked out onto stockpile when Washery is down for maintenance. or production is greater than truck availability | | | | | |
| | Surface stabilisation | Water sprays | Y - Best practice measures already in place. Water sprays automated depending on wind conditions. | | | | | |
| | | Chemical wetting agents | N | N | N | N | N | N - Not required due to fixed sprays |
| | | Surface crusting agent | N | N | N | N | N | N - Not required due to fixed sprays |
| | Enclosure | Silo with bag house | N | N | N | N | N | N - Not required due to fixed sprays |

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| | | Cover storage pile with a tarp during high winds | N | N | N | Y | N | N - Not required due to fixed sprays |
| | Wind speed reduction | Vegetative windbreaks | N | N | N | N | N | N - Not required due to fixed sprays |
| | | Reduced pile height | Y | N | N | N | Y | Y - Stockpiles size kept to minimum |
| | | Wind screens/fences | N | N | N | N | Y | N - Not required due to fixed sprays |
| | | Pile shaping / orientation | N | N | N | N | Y | N- Must use existing stockpile design |
| | | Erect 3-sided enclosure around storage piles | N | N | N | Y | N | N - Safety implications with flammable gas range. |
| Bulldozers | Minimise travel speed and distance | | NA | | | | | |
| | Keep travel routes and materials moist | | NA | | | | | |
| Loading and dumping overburden (Excavators) | Minimising drop height | Reduce from 3m to 1.5 m | NA | | | | | |
| Loading and dumping overburden (Trucks) | Minimising drop height | Reduce from 3m to 1.5 m | NA | | | | | |
| | Water application | | NA | | | | | |
| | Modify activities in windy conditions | | NA | | | | | |
| Unloading trucks | Water sprays | | NA | | | | | |
| Loading and dumping ROM coal | Avoidance | Bypass ROM stockpiles | Y - Best practice measures already in place. ROM coal from Appin bypasses stockpiles at maximum possible rate. Only stacked out onto stockpile when Washery is down for maintenance or production is greater than truck availability. | | | | | |
| | Truck or loader dumping ROM coal | Minimise drop height (10 m to 5 m) | NA - no drop height greater then 5m | | | | | |
| | | Water sprays on ROM pad | Y - Best practice measures already in place. Water sprays automated depending on wind conditions and seasonal cycles. | | | | | |
| | Truck or loader dumping to ROM bin | Water sprays on ROM bin or sprays on ROM pad | Y - Best practice measures already in place. Water sprays automated depending on wind conditions and seasonal cycles. | | | | | |
| | | Enclosed dump hopper (3 sides and a roof ) | Y - Best practice measures already in place. ROM bin fully enclosed, with water sprays. Water cart and sprays used when loading off the stockpile | | | | | |
| | | Enclosed dump hopper (3 sides and a roof ) plus water sprays | Y - Best practice measures already in place. ROM bin fully enclosed, with water sprays. Water cart and sprays used when loading off the stockpile | | | | | |
| | | Enclosure with control device | Y - Best practice measures already in place. ROM bin fully enclosed, with water sprays. Water cart and sprays used when loading off the stockpile | | | | | |
| Conveyor and transfers | Conveyors | Application of water at transfers | Y - Best practice measures already in place. Water sprays installed on conveyors | | | | | |
| | | Wind shielding - roof or side wall | Y - Best practice measures already in place. ROM bin fully enclosed, with water sprays. | | | | | |
| | | Wind shielding - roof AND side wall | Y - Best practice measures already in place. ROM conveyor fully enclosed, with water sprays. | | | | | |
| | | Belt cleaning and spillage minimisation | Y - Best practice measures already in place. Belt cleaned with fine residue reporting to sump which is regularly cleaned out | | | | | |

| Activity | Best Practice Control | | Current Assumption of Use (Y or N) | Regulatory Requirements (Y or N) | Environmental Impacts (Y or N) | Safety Implications (Y or N) | Compatibility with current processes and proposed future developments (Y or N) | Practicability (Y or N) |
|---|---|---|---|---|---|---|---|---|
| | Transfers | Enclosure | Y - Best practice measures already in place. ROM transfers fully enclosed. | | | | | |
| | | Enclosure and fabric filters | N | N | N | N | Y | N - Not required due to high moisture coal and water sprays. |
| Stacking and reclaiming product coal | Avoidance | Bypass coal stockpiles | NA - No product coal at Appin | | | | | |
| | Loading coal stockpiles | Variable height stack | | | | | | |
| | | Boom tip water sprays | | | | | | |
| | | Telescopic chute with water sprays | | | | | | |
| | | Total enclosure | | | | | | |
| | Reclaim coal | Underground reclaim | | | | | | |
| | Unloading product stockpiles | Bucket wheel, portal or bridge reclaimer with water application | | | | | | |
| | | Water sprays | | | | | | |
| | | Wind breaks | | | | | | |

## 4.2 Implementation costs

The costs associated with the introduction of the practicable measures summarised in **Table 4.1**, based on a costing exercise undertaken by the operators of BSO, is presented in **Appendix E**. This costing exercise was consistent with the requirements of the OEH Site-Specific Determination Guideline.

**Table 4.3** is an outline of the proposed spending on each control measure, based on the information presented in **Appendix E**.

**Table 4.3: Project cost per year**

| Activity/BPM | FY13 | FY14 | FY15 | FY16 | FY17 |
|---|---|---|---|---|---|
| Implementation of predictive meteorology to determine Dust Forecast Ranking | $5000 | $5000 | $5000 | $5000 | $5000 |
| Additional water cart (with water cannon) for stockpiles during windy periods | $35,000 | $52,000 | $52,000 | $52,000 | $52,000 |
| Water cannon installed on additional water cart | $10,000 | | | | |
| Suppressant practicability trial (yr1) and ongoing annual usage if deemed practicable | $20,000 | | | | |
| Polymer suppressants on internal haul Roads (if deemed practicable) | | $70,000 | $70,000 | $70,000 | $70,000 |
| Water sprays on road hopper | | | $65,000* | | |

* Audits of dust generation at the Road Hopper will be undertaken to determine if dust emissions are occurring from this unloading process. Implementation of Road Hopper sprays will occur if this is confirmed as a source of dust generation.

# 5 PROPOSED TIMEFRAME FOR IMPLEMENTATION OF BEST PRACTICE MEASURES

Based on the evaluation presented in **Section 4**, the following BPM are proposed for implementation at BSO.

**Table 5.1: Best practice measures to be implemented**

| Activity/BPM | Proposed implementation date |
|---|---|
| Implementation of predictive meteorology to determine Dust Forecast Ranking | From FY13 |
| Additional water cart (with water cannon) for stockpiles during windy periods | From FY13 |
| Water cannon installation on additional water cart | From FY13 |
| Polymer suppressant practicability trial | From FY13 |
| Polymer suppressants on internal haul roads (if deemed practicable) | From FY14 |
| Water sprays on road hopper (Capital and dust source confirmation dependant) | FY15 |

# 6 MONITORING AND TRACKING THE EFFECTIVENESS OF PM CONTROLS AT THE BSO COMPLEX

On 8 May 2012 the EPA (formerly OEH) held an information session and workshop to provide feedback to consultants and mining companies on the dust PRPs received to date. A key outcome of the workshop (referred to as 'Key Message 3' (**EPA, 2012**)) was that the control effectiveness of both current and proposed BPM should be measured and reported, as follows:

"*Control effectiveness must be supported by:*

- Key performance indicator
- Monitoring method
- Location, frequency and duration of monitoring
- Monitoring data records and analysis
- Management procedures"

In accordance with EPA expectations, the following Key Performance Indicators (KPIs) are proposed as options for the BSO complex.

## 6.1 Proposed KPIs

KPI 1 to 4 will be assessed against the following criteria to determine the effectiveness of dust controls:

1. Long term criteria for Particulate matter – measured monthly:
    a. annual TSP ≤90µg/m3
    b. annual PM10 ≤30µg/m3
2. Short term criteria for Particulate matter – measured monthly:
    a. 24 hour period ≤50µg/m3
3. Long term criteria for deposited dust
    a. 2g/m2/month (maximum increase)
    b. 4g/m2/month (overall)
4. Use of NPI dust control effectiveness annually (as below)

*NPI control effectiveness* - The TSP and PM10 dust is calculated annually using the NSW Minerals Council NPI database Version 3.00.

These dust levels are used to calculate the Mine's TSP and PM10 Emission Rates.

These rates are compared year on year for the Mine Site and against the NSWMC - nil controls, good controls and maximum controls.

## 6.2 Reporting

Data from 1, 2 and 3 reported in the BSO Quarterly Monitoring Report and the AEMR.

# 7 CLOSING/CONCLUSIONS

This study identified that the highest ranking activities at the BSO Mine Complex in terms of particulate generation, when emissions alone are evaluated include:

- Wind erosion of coal stockpiles
- Trucks unloading coal
- Material transfer of coal
- Wheel generated particulates on unpaved roads

Potential Best Practice control measures for the above activities were identified, and their practicability and cost evaluated. Measures identified as potentially achievable for the BSO complex were:

- Dust forecasting using predictive meteorology
- Additional wart cart during windy periods
- Water canon on additional water cart
- Suppressant practicability trial
- Water sprays on road hopper (if confirmed as significant dust source)

# 8 REFERENCES

Donnelly S-J, Balch A, Wiebe A, Shaw N, Welchman S, Schloss A, Castillo E, Henville K, Vernon A and Planner J (2011). NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and / or Minimise Emissions of Particulate Matter from Coal Mining. Prepared by Katestone Environmental Pty Ltd for NSW Office of Environment and Heritage June 2011.

OEH (2011). Coal Mine Particulate Matter Control Best Practice - Site-specific determination guideline. November 2011. New South Wales Office of Environment and Heritage, Sydney. November 2011.
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OEH (2012). Environmental Protection Licence 2504 – Endeavour Coal Pty Ltd. March 2012.

USEPA (1993). AP-42 Procedures for Sampling Surface/Bulk Dust Loading, July 1993. http://www.epa.gov/ttnchie1/ap42/appendix/app-c1.pdf

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USEPA (2006a). AP-42 Compilation of Emission Factors, Section 13.2.2 - Unpaved Roads. November 2006. http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0202.pdf

USEPA (2006b). AP-42 Compilation of Emission Factors, Section 13.2.4 - Aggregate Handling And Storage Piles, November 2006. http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0204.pdf

## Appendix A: Copy of PRP as contained in Endeavour Coal Pty Ltd EPL 2504

## U2 PRP17 - Coal Mine Particulate Matter Control Best Practice

U2.1 Pollution Reduction Program 17 - Coal Mine Particulate Matter Control Best Practice
The Licensee must conduct a site specific Best Management Practice (BMP) determination to identify the most practicable means to reduce particle emissions.

The Licensee must prepare a report which includes, but is not necessarily limited to, the following:

- identification, quantification and justification of existing measures that are being used to minimise particle emissions;
- identification, quantification and justification of best practice measures that could be used to minimise particle emissions;
- evaluation of the practicability of implementing these best practice measures; and
- a proposed timeframe for implementing all practicable best practice measures.

In preparing the report, the Licensee must utilise the document entitled *Coal Mine Particulate Matter Control Best Practice – Site Specific Determination Guideline - November 2011*.

All cost related information is to be included as Appendix 1 of the report.

The report required must be submitted by the Licensee to the EPA by 28 September 2012

The report required by this condition, except for cost related information contained in Appendix 1 of the Report, must be made publicly available on the Licensee's website by 5 October 2012.

Source: **EPL 2504 22-Mar-2012**

## Appendix B: Copy of Coal Mine Particulate Matter Control Best Practice – Site Specific Determination Guideline August 2011

# COAL MINE PARTICULATE MATTER CONTROL BEST PRACTICE – SITE SPECIFIC DETERMINATION GUIDELINE AUGUST 2011

## PURPOSE OF THIS GUIDELINE

The purpose of this guideline is to provide detail of the process to be followed in conducting a site specific determination of best practice measures to reduce emissions of particulate matter from coal mining activities.

This guideline also provides the required content and format of the report required for the Pollution Reduction Program "*Coal Mine Particulate Matter Best Practice*".

## THE SITE SPECIFIC DETERMINATION PROCESS

In preparing the Report, the following steps must be followed, as a minimum:

1. ***Identify, quantify and justify existing measures that are being used to minimise particle emissions***

   1.1. Estimate baseline emissions of TSP, $PM_{10}$ and $PM_{2.5}$ (tonne per year) from each mining activity. This estimate must:
   - utilise USEPA AP42 emission estimation techniques (or other method as approved in writing by the EPA);
   - calculate uncontrolled emissions (with no particulate matter controls in place); and
   - calculate controlled emissions (with current particulate matter controls in place).

   Note: These particulate matter controls must be clearly identified, quantified and justified with supporting information).

   1.2. Using the results of the controlled emissions estimates generated from Step 1.1, rank the mining activities according to the mass of TSP, $PM_{10}$ and $PM_{2.5}$ emitted by each mining activity per year from highest to lowest.

   1.3. Identify the top four mining activities from Step 1.2 that contribute the highest emissions of TSP, $PM_{10}$ and $PM_{2.5}$.

2. ***Identify, quantify and justify the measures that could be used to minimise particle emissions***

   2.1. For each of the top four activities identified in Step 1.3, identify the measures that could be implemented to reduce emissions taking into consideration:

   - the findings of Katestone (June 2011), *NSW Coal Mining Benchmarking Study - International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*, Katestone Environmental Pty Ltd, Terrace 5, 249 Coronation Drive, PO Box 2217, Milton 4064, Queensland, Australia;
   - any other relevant published information; and
   - any relevant industry experience from either Australia or overseas.

2.2. For each of the top four activities identified in Step 1.3, estimate emissions of TSP, $PM_{10}$ and $PM_{2.5}$ from each mining activity following the application of the measures identified in Step 2.1.

3. ***Evaluate the practicability of implementing these best practice measures***
   3.1. For each of the best practice measures identified in Step 2.1, assess the practicability associated with their implementation, by taking into consideration:
   - implementation costs;
   - regulatory requirements;
   - environmental impacts;
   - safety implications; and
   - compatibility with current processes and proposed future developments.

   3.2. Identify those best practice measures that will be implemented at the premises to reduce particle emissions.

4. ***Propose a timeframe for implementing all practicable best practice measures***
   4.1. For each of the best practice measures identified as being practicable in Step 3.2, provide a timeframe for their implementation.

**REPORT CONTENT**

The report must clearly identify the methodologies utilised and all assumptions made.

The report must contain detailed information justifying and supporting all of the information used in each step of the process. For example, in calculating controlled emissions in Step 1, current particulate matter controls being used at the mine must be clearly identified, quantified and justified with supporting information and evidence including monitoring data, record keeping, management plans and/or operator training etc.

In evaluating practicability in Step 3, the licensee must document the following specific information:

- estimated capital, labour, materials and other costs for each best practice measure on an annual basis for a ten year period. This information must be set out in the format provided in Appendix A and included as an attachment to the report;
- The details of any restrictions on the implementation of each best practice measure due to an existing approval or licence;
- Quantification of any new or additional environmental impacts that may arise from the application of a particular best practice measure, such as increased noise or fresh water use;
- The details of safety impacts that may result from the application of a particular best practice measure;
- The details of any incompatibility with current operational practices on the premises; and
- The details of any incompatibility with future development proposals on the premises.

**REPORT FORMAT**

The report must be structured according to the process outlined above and submitted in both electronic format as .PDF format and hard copy format in triplicate. All emission estimates, costs and supporting calculations must be submitted in electronic format as .XLS format.

**ABBREVIATIONS AND DEFINITIONS**

***USEPA AP42 Emission Estimation Techniques*** – all of the following:

- USEPA (1995), *AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, Technology Transfer Network - Clearinghouse for Inventories & Emissions Factors, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, USA. http://www.epa.gov/ttn/chief/ap42/index.html ;
- USEPA (1998), *AP 42, Chapter 11.9 Western Surface Coal Mining*, Technology Transfer Network - Clearinghouse for Inventories & Emissions Factors, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, USA. http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf ;
- USEPA (2006), *AP 42, Chapter 13.2.2 Unpaved Roads*, Technology Transfer Network - Clearinghouse for Inventories & Emissions Factors, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, USA. http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf ;
- USEPA (2006), *AP 42, Chapter 13.2.4 Aggregate Handling and Storage Piles*, Technology Transfer Network - Clearinghouse for Inventories & Emissions Factors, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, USA. http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf ; and
- USEPA (2006), *AP 42, Chapter 13.2.5 Industrial Wind Erosion*, Technology Transfer Network - Clearinghouse for Inventories & Emissions Factors, United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, USA. http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0205.pdf .

***$PM_{10}$*** – Particulate matter of 10 micrometres or less in diameter

***$PM_{2.5}$*** - Particulate matter of 2.5 micrometres or less in diameter

***Mining Activities*** – means:

- Wheel generated particulates on unpaved roads
- Wind erosion of overburden
- Loading and dumping overburden
- Blasting
- Bulldozing Coal
- Trucks unloading overburden
- Bulldozing overburden
- Front-end loaders on overburden
- Wind erosion of exposed areas
- Wind erosion of coal stockpiles
- Unloading from coal stockpiles

- Dragline
- Front-end loaders on overburden
- Trucks unloading coal
- Loading coal stockpiles
- Graders
- Drilling
- Coal crushing
- Material transfer of coal
- Scrapers on overburden
- Train loading
- Screening; or
- Material transfer of overburden

***TSP*** - Total Suspended Particulate Matter

# Appendix C: Emission Inventory Input Parameters

TSP

| ACTIVITY | TSP emission/year for FY11 in kg | Intensity | units | Emission factor | units | Variable 1 | units | Variable 2 | units | Variable 3 | units | Variable 4 | units | Silt | Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **APPIN EAST** | | | | | | | | | | | | | | | | | |
| CL - Transfer of ROM from conveyor to hopper | 35,538 | 3,507,159 | t/y | 0.06755 | kg/t | 6 | moisture content of coal in % | | | | | | | | | 85 | % control |
| CL - Loading ROM from hopper to truck | 569 | 3,507,159 | t/y | 0.00046 | kg/t | 6 | moisture content of coal in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | 65 | % control |
| CL - Hauling ROM coal to stockpile | 540 | 561,145 | t/y | 0.00963 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 0.32 | km/return trip | 0.9 | kg/VKT | 1.01 | % silt content | 90 | % control |
| CL - Unloading ROM coal at stockpile | 18,954 | 561,145 | t/y | 0.06755 | kg/t | 6 | moisture content of coal in % | | | | | | | | | 50 | % control |
| CL - Loading ROM coal from stockpile to trucks | 37,907 | 561,145 | t/y | 0.06755 | kg/t | 6 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Hauling ROM coal from stockpile/dump hopper to highway | 5,384 | 3,507,159 | t/y | 0.01535 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 0.5 | km/return trip | 0.9 | kg/VKT | 1.01 | % silt content | 90 | % control |
| WE - Exposed areas | 96 | 0.22 | ha | 0.1 | kg/ha/h | 8760 | h/y | | | | | | | | | 50 | % control |
| WE - Coal stockpile | 19,068 | 0.99 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | 65 | % control |
| **APPIN WEST** | | | | | | | | | | | | | | | | | |
| WE - Exposed areas | 1,104 | 1.26 | ha | 0.1 | kg/ha/y | 8760 | h/y | | | | | | | | | | % control |
| Grading roads | 208 | 2190 | km | 0.19007 | kg/VKT | 5 | speed of graders in km/h | 438 | grader h/y | | | | | | | 50 | % control |
| **WESTCLIFF COLLIERY PROCESSING PLANT (WCCPP)** | | | | | | | | | | | | | | | | | |
| TS - Loading topsoil to trucks | 178 | 112,500 | t/y | 0 | kg/t | 3 | Moisture content in % | 2 | Silt content in % | | | | | | | | % control |
| TS - Hauling topsoil to emplacement | 1,985 | 112,500 | t/y | 0 | kg/t | 37 | t/load | 63 | Vehicle gross mass (t) | 1.30 | km/return trip | 1.00430078 | kg/VKT | 1.01 | % silt content | 50 | % control |
| TS - Unloading topsoil at emplacement | 164 | 112,500 | t/y | 0 | kg/t | 3 | Moisture content in % | 2 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| OB - Loading coalwash to trucks | 1,018 | 2,405,927 | t/y | 0.00042 | kg/t | 7 | Moisture content in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| OB - Hauling coalwash to emplacement | 42,759 | 2,405,927 | t/y | 0.03555 | kg/t | 30 | t/load | 48 | Vehicle gross mass (t) | 1.2 | km/return trip | 0.9 | kg/VKT | 1.01 | % silt content | 50 | % control |
| OB - Unloading coalwash at emplacement | 898 | 2,405,927 | t/y | 0.00037 | kg/t | 7 | Moisture content in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| WE - Exposed Areas | 8,322 | 19 | ha | 0.1 | kg/ha/h | 8760 | h/y | | | | | | | | | 50 | % control |
| WE - Stockpile 1 | 244,885 | 4.45 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 2 | 131,522 | 2.39 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 3 | 236,630 | 4.3 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 4 | 170,594 | 3.1 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 5 | 56,681 | 1.03 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 6 | 62,184 | 1.13 | ha | 6.3 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| Grading roads - WCCPP | 3,871 | 7,200 | km | 1.07517 | kg/VKT | 10 | speed of graders in km/h | 720 | grader h/y | | | | | | | 50 | % control |

| ACTIVITY | TSP emission/year for FY11 in kg | Intensity | units | Emission factor | units | Variable 1 | units | Variable 2 | units | Variable 3 | units | Variable 4 | units | Silt | Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Westcliff Coal** | | | | | | | | | | | | | | | | | |
| CL - Transfer from WCCPP conveyor to stockpile No 5 | 28,373 | 548,973 | t/y | 0.05168 | kg/t | 7.5 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Transfer ROM from No 5 stockpile to road hopper via 988 loader | 28,373 | 548,973 | t/y | 0.05168 | kg/t | 7.5 | moisture content of coal in % | | | | | | | | | | % control |
| **Appin Coal** | | | | | | | | | | | | | | | | | |
| CL - Hauling ROM coal from highway to road hopper | 105,036 | 3,507,159 | t/y | 0.05990 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.99 | km/return trip | 0.9 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Unloading ROM coal from truck to road hopper | 200,339 | 3,507,159 | t/y | 0.05712 | kg/t | 6.9 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Transfer ROM from stockpile to road hopper via 988 loader | 32,054 | 561,145 | t/y | 0.05712 | kg/t | 6.9 | moisture content of coal in % | | | | | | | | | | % control |
| **Product Coal** | | | | | | | | | | | | | | | | | |
| CL - Loading product coal from washery bin to truck for delivery to port | 877 | 3,444,894 | t/y | 0.00025 | kg/t | 9.2 | moisture content of coal in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| CL - Hauling product coal from washery bin to product stockpile (No 2 or No 3) | 16,085 | 971,637 | t/y | 0.03311 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.1 | km/return trip | 0.9 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Unloading product coal from truck to product stockpile (No 2 or No 3) | 39,299 | 971,637 | t/y | 0.04045 | kg/t | 9.2 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Loading product coal from product stockpile to truck | 39,299 | 971,637 | t/y | 0.04045 | kg/t | 9.2 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Hauling product coal from stockpile (No 2 or No 3) to port | 19,010 | 971,637 | t/y | 0.03913 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.3 | km/return trip | 0.9 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Crushing coal at WCCPP | - | - | t/y | Sizing done underground | | | | | | | | | | | | | % control |
| CL - Screening coal at WCCPP | - | - | t/y | Process wet, no emissions | | | | | | | | | | | | | % control |
| | 1,589,806 | | | | | | | | | | | | | | | | |

PM10

| ACTIVITY | PM10 emission/year for FY11 in kg | Intensity | units | Emission factor | units | Variable 1 | units | Variable 2 | units | Variable 3 | units | Variable 4 | units | Silt | Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **APPIN EAST** | | | | | | | | | | | | | | | | | |
| CL - Transfer of ROM from conveyor to hopper | 4,688 | 3,507,159 | t/y | 0.00891 | kg/t | 6 | moisture content of coal in % | | | | | | | | | 85 | % control |
| CL - Loading ROM from hopper to truck | 269 | 3,507,159 | t/y | 0.00022 | kg/t | 6 | moisture content of coal in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | 65 | % control |
| CL - Hauling ROM coal to stockpile | 101 | 561,145 | t/y | 0.00180 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 0.32 | km/return trip | 0.2 | kg/VKT | 1.01 | % silt content | 90 | % control |
| CL - Unloading ROM coal at stockpile | 2,500 | 561,145 | t/y | 0.00891 | kg/t | 6 | moisture content of coal in % | | | | | | | | | 50 | % control |
| CL - Loading ROM coal from stockpile to trucks | 5,001 | 561,145 | t/y | 0.00891 | kg/t | 6 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Hauling ROM coal from stockpile/dump hopper to highway | 1,005 | 3,507,159 | t/y | 0.00286 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 0.5 | km/return trip | 0.2 | kg/VKT | 1.01 | % silt content | 90 | % control |
| WE - Exposed areas | 48 | 0.22 | ha | 0.1 | kg/ha/h | 8760 | h/y | | | | | | | | | 50 | % control |
| WE - Coal stockpile | 9,534 | 0.99 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | 65 | % control |
| **APPIN WEST** | | | | | | | | | | | | | | | | | |
| WE - Exposed areas | 552 | 1.26 | ha | 0.1 | kg/ha/y | 8760 | h/y | | | | | | | | | | % control |
| Grading roads | 92 | 2190 | km | 0.08400 | kg/VKT | 5 | speed of graders in km/h | 438 | grader h/y | | | | | | | 50 | % control |
| **WESTCLIFF COLLIERY PROCESSING PLANT (WCCPP)** | | | | | | | | | | | | | | | | | |
| TS - Loading topsoil to trucks | 82 | 112,500 | t/y | 0 | kg/t | 3 | Moisture content in % | 2 | Silt content in % | | | | | | | | % control |
| TS - Hauling topsoil to emplacement | 370 | 112,500 | t/y | 0 | kg/t | 37 | t/load | 63 | Vehicle gross mass (t) | 1.30 | km/return trip | 0.1874 0752 | kg/VKT | 1.01 | % silt content | 50 | % control |
| TS - Unloading topsoil at emplacement | 75 | 112,500 | t/y | 0 | kg/t | 3 | Moisture content in % | 2 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| OB - Loading coalwash to trucks | 596 | 2,405,927 | t/y | 0.00025 | kg/t | 5.5 | Moisture content in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| OB - Hauling coalwash to emplacement | 7,979 | 2,405,927 | t/y | 0.00663 | kg/t | 30 | t/load | 48 | Vehicle gross mass (t) | 1.2 | km/return trip | 0.2 | kg/VKT | 1.01 | % silt content | 50 | % control |
| OB - Unloading coalwash at emplacement | 596 | 2,405,927 | t/y | 0.00025 | kg/t | 5.5 | Moisture content in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| WE - Exposed Areas | 4,161 | 19 | ha | 0.1 | kg/ha/h | 8760 | h/y | | | | | | | | | 50 | % control |
| WE - Stockpile 1 | 122,442 | 4.45 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 2 | 65,761 | 2.39 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 3 | 118,315 | 4.3 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 4 | 85,297 | 3.1 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 5 | 28,341 | 1.03 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 6 | 31,092 | 1.13 | ha | 3.1 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |

| ACTIVITY | PM10 emission/year for FY11 in kg | Intensity | units | Emission factor | units | Variable 1 | units | Variable 2 | units | Variable 3 | units | Variable 4 | units | Silt | Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grading roads - WCCPP | 1,210 | 7,200 | km | 0.33600 | kg/VKT | 10 | speed of graders in km/h | 720 | grader h/y | | | | | | | 50 | % control |
| **Westcliff Coal** | | | | | | | | | | | | | | | | | |
| CL - Transfer from WCCPP conveyor to stockpile No 5 | 4,002 | 548,973 | t/y | 0.00729 | kg/t | 7.5 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Transfer ROM from No 5 stockpile to road hopper via 988 loader | 4,002 | 548,973 | t/y | 0.00729 | kg/t | 7.5 | moisture content of coal in % | | | | | | | | | | % control |
| **Appin Coal** | | | | | | | | | | | | | | | | | |
| CL - Hauling ROM coal from highway to road hopper | 19,600 | 3,507,159 | t/y | 0.01118 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.99 | km/return trip | 0.2 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Unloading ROM coal from truck to road hopper | 27,561 | 3,507,159 | t/y | 0.00786 | kg/t | 6.9 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Transfer ROM from stockpile to road hopper via 988 loader | 4,410 | 561,145 | t/y | 0.00786 | kg/t | 6.9 | moisture content of coal in % | | | | | | | | | | % control |
| **Product Coal** | | | | | | | | | | | | | | | | | |
| CL - Loading product coal from washery bin to truck for delivery to port | 415 | 3,444,894 | t/y | 0.00012 | kg/t | 9.2 | moisture content of coal in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| CL - Hauling product coal from washery bin to product stockpile (No 2 or No 3) | 3,002 | 971,637 | t/y | 0.00618 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.1 | km/return trip | 0.2 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Unloading product coal from truck to product stockpile (No 2 or No 3) | 3,029 | 971,637 | t/y | 0.00312 | kg/t | 9.2 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Loading product coal from product stockpile to truck | 5,894 | 971,637 | t/y | 0.00607 | kg/t | 9.2 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Hauling product coal from stockpile (No 2 or No 3) to port | 3,547 | 971,637 | t/y | 0.00730 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.3 | km/return trip | 0.2 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Crushing coal at WCCPP | - | - | t/y | Sizing done underground | | | | | | | | | | | | | % control |
| CL - Screening coal at WCCPP | - | - | t/y | Process wet, no emissions | | | | | | | | | | | | | % control |

565,569

$PM_{2.5}$

| ACTIVITY | PM2.5 emission/year for FY11 in kg | Intensity | units | Emission factor | units | Variable 1 | units | Variable 2 | units | Variable 3 | units | Variable 4 | units | Silt | Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **APPIN EAST** | | | | | | | | | | | | | | | | | |
| CL - Transfer of ROM from conveyor to hopper | 675 | 3,507,159 | t/y | 0.00128 | kg/t | 6 | moisture content of coal in % | | | | | | | | | 85 | % control |
| CL - Loading ROM from hopper to truck | 41 | 3,507,159 | t/y | 0.00003 | kg/t | 6 | moisture content of coal in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | 65 | % control |
| CL - Hauling ROM coal to stockpile | 10 | 561,145 | t/y | 0.00018 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 0.32 | km/return trip | 0.01741 | kg/VKT | 1.01 | % silt content | 90 | % control |
| CL - Unloading ROM coal at stockpile | 360 | 561,145 | t/y | 0.00128 | kg/t | 6 | moisture content of coal in % | | | | | | | | | 50 | % control |
| CL - Loading ROM coal from stockpile to trucks | 720 | 561,145 | t/y | 0.00128 | kg/t | 6 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Hauling ROM coal from stockpile/dump hopper to highway | 100 | 3,507,159 | t/y | 0.00029 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 0.5 | km/return trip | 0.01741 | kg/VKT | 1.01 | % silt content | 90 | % control |
| WE - Exposed areas | 7 | 0.22 | ha | 0.008 | kg/ha/h | 8760 | h/y | | | | | | | | | 50 | % control |
| WE - Coal stockpile | 1,430 | 0.99 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | 65 | % control |
| **APPIN WEST** | | | | | | | | | | | | | | | | | |
| WE - Exposed areas | 83 | 1.26 | ha | 0.008 | kg/ha/y | 8760 | h/y | | | | | | | | | | % control |
| Grading roads | 6 | 2190 | km | 0.00589 | kg/VKT | 5 | speed of graders in km/h | 438 | grader h/y | | | | | | | 50 | % control |
| **WESTCLIFF COLLIERY PROCESSING PLANT (WCCPP)** | | | | | | | | | | | | | | | | | |
| TS - Loading topsoil to trucks | 12 | 112,500 | t/y | 0 | kg/t | 3 | Moisture content in % | 2 | Silt content in % | | | | | | | | % control |
| TS - Hauling topsoil to emplacement | 37 | 112,500 | t/y | 0 | kg/t | 37 | t/load | 63 | Vehicle gross mass (t) | 1.30 | km/return trip | 0.01874 | kg/VKT | 1.01 | % silt content | 50 | % control |
| TS - Unloading topsoil at emplacement | 11 | 112,500 | t/y | 0 | kg/t | 3 | Moisture content in % | 2 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| OB - Loading coalwash to trucks | 90 | 2,405,927 | t/y | 0.00004 | kg/t | 5.5 | Moisture content in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| OB - Hauling coalwash to emplacement | 798 | 2,405,927 | t/y | 0.00066 | kg/t | 30 | t/load | 48 | Vehicle gross mass (t) | 1.2 | km/return trip | 0.01658 | kg/VKT | 1.01 | % silt content | 50 | % control |
| OB - Unloading coalwash at emplacement | 90 | 2,405,927 | t/y | 0.00004 | kg/t | 5.5 | Moisture content in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| WE - Exposed Areas | 624 | 19 | ha | 0.008 | kg/ha/h | 8760 | h/y | | | | | | | | | 50 | % control |
| WE - Stockpile 1 | 18,366 | 4.45 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 2 | 9,864 | 2.39 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 3 | 17,747 | 4.3 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 4 | 12,795 | 3.1 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 5 | 4,251 | 1.03 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |
| WE - Stockpile 6 | 4,664 | 1.13 | ha | 0.5 | kg/ha/h | 8760 | h/y | 3.49 | average of wind speed (m/s) | | | | | | | | % control |

| ACTIVITY | PM2.5 emission/year for FY11 in kg | Intensity | units | Emission factor | units | Variable 1 | units | Variable 2 | units | Variable 3 | units | Variable 4 | units | Silt | Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grading roads - WCCPP | 120 | 7,200 | km | 0.03333 | kg/VKT | 10 | speed of graders in km/h | 720 | grader h/y | | | | | | | 50 | % control |
| **Westcliff Coal** | | | | | | | | | | | | | | | | | |
| CL - Transfer from WCCPP conveyor to stockpile No 5 | 539 | 548,973 | t/y | 0.00098 | kg/t | 7.5 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Transfer ROM from No 5 stockpile to road hopper via 988 loader | 539 | 548,973 | t/y | 0.00098 | kg/t | 7.5 | moisture content of coal in % | | | | | | | | | | % control |
| **Appin Coal** | | | | | | | | | | | | | | | | | |
| CL - Hauling ROM coal from highway to road hopper | 1,960 | 3,507,159 | t/y | 0.00112 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.99 | km/return trip | 0.01741 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Unloading ROM coal from truck to road hopper | 3,806 | 3,507,159 | t/y | 0.00109 | kg/t | 6.9 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Transfer ROM from stockpile to road hopper via 988 loader | 609 | 561,145 | t/y | 0.00109 | kg/t | 6.9 | moisture content of coal in % | | | | | | | | | | % control |
| **Product Coal** | | | | | | | | | | | | | | | | | |
| CL - Loading product coal from washery bin to truck for delivery to port | 63 | 3,444,894 | t/y | 0.00002 | kg/t | 9.2 | moisture content of coal in % | 1.82 | average of (wind speed/2.2)^1.3 in m/s | | | | | | | | % control |
| CL - Hauling product coal from washery bin to product stockpile (No 2 or No 3) | 300 | 971,637 | t/y | 0.00062 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.1 | km/return trip | 0.01741 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Unloading product coal from truck to product stockpile (No 2 or No 3) | 747 | 971,637 | t/y | 0.00077 | kg/t | 9.2 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Loading product coal from product stockpile to truck | 747 | 971,637 | t/y | 0.00077 | kg/t | 9.2 | moisture content of coal in % | | | | | | | | | | % control |
| CL - Hauling product coal from stockpile (No 2 or No 3) to port | 355 | 971,637 | t/y | 0.00073 | kg/t | 31 | t/load | 53.5 | Vehicle gross mass (t) | 1.3 | km/return trip | 0.01741 | kg/VKT | 1.0 | % silt content | 50 | % control |
| CL - Crushing coal at WCCPP | - | - | t/y | Sizing done underground | | | | | | | | | | | | | % control |
| CL - Screening coal at WCCPP | - | - | t/y | Process wet, no emissions | | | | | | | | | | | | | % control |

82,569

## Appendix D: Silt and Moisture Sampling

SGS Australia Pty Ltd (ACN 000 964 278)

6A Metal Pit Drive
MAYFIELD WEST NSW 2304
PO Box 274
HUNTER REGION MC NSW 2310

Tel: (61 2) 49607800
Fax: (61 2) 49607844

# ANALYSIS REPORT

**Report Status:** FINAL

**Client:** Pacific Environment Limited

**Reported to:** Greer Laing
Email: greer.laing@paeholmes.com
Website: WWW.pelgroup.com

**SGS Reference:** NM01093

**Description:** Silt and Moisture Samples

**Date Received:** 7 August 2012

This report supersedes any previous reports which may have been issued.

**Date Reported:** 9 August 2012

**Reported By:** Louise Witt
Louise Witt
Deputy Manager - Newcastle

SGS Australia Pty Ltd (ACN 000 964 278)

| | |
|---|---|
| Report Status: | FINAL |
| Attention: | Greer Laing |
| Client: | Pacific Environment Limited |
| SGS Reference: | NM01093 |
| Description: | Silt and Moisture Samples |
| Samples Received: | August 7, 2012 |

## ANALYSIS RESULTS

| | | Total Moisture % | Sizing -0.075 |
|---|---|---|---|
| NM01093-009 | Topsoil | 2.7 | 1.97 |
| NM01093-010 | Coal Wash Dry | 4.0 | 2.11 |
| NM01093-011 | Coal Wash Wet | 7.0 | 0.85 |
| NM01093-012 | 2 x Haul Rd - Main Emplacement | 4.7 | 1.01 |
| NM01093-015 | Coal Westcliff | 7.5 | 3.89 |
| NM01093-016 | Coal Appin | 6.9 | 2.25 |
| NM01093-018 | Coal Stockpile 3 | 6.9 | 2.30 |

## Appendix E: Cost related information for potential control measures

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Pave the surface | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 43 | | | | | | | | | |
| | PM10 | 8 | | | | | | | | | |
| | PM2.5 | 1 | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 148 | | | | | | | | | |
| | PM10 | 28 | | | | | | | | | |
| | PM2.5 | 3 | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | Paving Main Haul Road | $2,600,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$2,600,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$2,600,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$2,600,000** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Maintenance | $0 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | **$450,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$0** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$450,000** |
| **Total costs** | | **$2,600,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$3,050,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $17,556 | $338 | $338 | $338 | $338 | $338 | $338 | $338 | $338 | $338 | **$20,594** |
| | PM10 | $92,857 | $1,786 | $1,786 | $1,786 | $1,786 | $1,786 | $1,786 | $1,786 | $1,786 | $1,786 | **$108,929** |
| | PM2.5 | $812,500 | $15,625 | $15,625 | $15,625 | $15,625 | $15,625 | $15,625 | $15,625 | $15,625 | $15,625 | **$953,125** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $60,606 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$60,606** |
| | PM10 | $325,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$325,000** |
| | PM2.5 | $3,250,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,250,000** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$2,600,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$50,000** | **$3,050,000** |

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Low silt aggregate | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 129 | | | | | | | | | | |
| | PM10 | 24 | | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 62 | | | | | | | | | | |
| | PM10 | 12 | | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | 200mm bed of Road Base over 40000sqm | $350,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$350,000** |
| | Maintenance road base | $0 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | **$135,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$350,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$485,000** |
| Labour costs including directly related on-costs (list each item) | Spreading of road base | $40,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$40,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$40,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$40,000** |
| **Total costs** | | **$390,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$525,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $6,260 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | **$8,427** |
| | PM10 | $32,500 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | **$43,750** |
| | PM2.5 | $243,750 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | **$328,125** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $3,030 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,030** |
| | PM10 | $16,250 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$16,250** |
| | PM2.5 | $162,500 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$162,500** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$390,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$525,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $6,260 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $8,427 |
| | PM10 | $32,500 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $43,750 |
| | PM2.5 | $243,750 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $328,125 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $6,260 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $241 | $8,427 |
| | PM10 | $32,500 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $1,250 | $43,750 |
| | PM2.5 | $243,750 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $9,375 | $328,125 |

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Watering Level 2 (>2 l/m2/h) | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 107 | | | | | | | | | | |
| | PM10 | 20 | | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 84 | | | | | | | | | | |
| | PM10 | 16 | | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | New Water cart @ $110/HR 12 HOURS PER DAY | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | **$4,800,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$4,800,000** |
| **Total costs** | | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$4,800,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | **$57,313** |
| | PM10 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | **$300,000** |
| | PM2.5 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | **$2,400,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $4,476 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$4,476** |
| | PM10 | $24,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$24,000** |
| | PM2.5 | $240,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$240,000** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$4,800,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $57,313 |
| | PM10 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $300,000 |
| | PM2.5 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $2,400,000 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $5,731 | $57,313 |
| | PM10 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $30,000 | $300,000 |
| | PM2.5 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $240,000 | $2,400,000 |

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Hygroscopic salts | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 150 | | | | | | | | | | |
| | PM10 | 28 | | | | | | | | | | |
| | PM2.5 | 3 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 41 | | | | | | | | | | |
| | PM10 | 8 | | | | | | | | | | |
| | PM2.5 | 1 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | | | | | | | | | | | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Monthly Application of Dust Guard (MgCl) | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | **$1,920,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$1,920,000** |
| **Total costs** | | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$1,920,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | **$47,001** |
| | PM10 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | **$240,000** |
| | PM2.5 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | **$1,600,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $1,279 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$1,279** |
| | PM10 | $6,857 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$6,857** |
| | PM2.5 | $68,571 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$68,571** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$1,920,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $47,001 |
| | PM10 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $240,000 |
| | PM2.5 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $1,600,000 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $4,700 | $47,001 |
| | PM10 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $24,000 | $240,000 |
| | PM2.5 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $160,000 | $1,600,000 |

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Lignosulphonates | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 137 | | | | | | | | | | |
| | PM10 | 26 | | | | | | | | | | |
| | PM2.5 | 3 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 54 | | | | | | | | | | |
| | PM10 | 10 | | | | | | | | | | |
| | PM2.5 | 1 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Lignosulphonate ($2.75/L at 1:1 with water weekly) | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | $2,860,000 | **$28,600,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$28,600,000** |
| **Total costs** | | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$28,600,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | **$532,390** |
| | PM10 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | **$2,750,000** |
| | PM2.5 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | **$19,861,111** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $20,833 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$20,833** |
| | PM10 | $111,719 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$111,719** |
| | PM2.5 | $1,117,188 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$1,117,188** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$2,860,000** | **$28,600,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $532,390 |
| | PM10 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $2,750,000 |
| | PM2.5 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $19,861,111 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $53,239 | $532,390 |
| | PM10 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $275,000 | $2,750,000 |
| | PM2.5 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $1,986,111 | $19,861,111 |

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Polymer emulsions | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 129 | | | | | | | | | |
| | PM10 | 24 | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 62 | | | | | | | | | |
| | PM10 | 12 | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | | | | | | | | | | | **$700,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | 4hr Water cart @ 110/hr | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Heavy water extreme (1:30000 in water cart 5 times daily) | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | $70,000 | **$700,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$700,000** |
| **Total costs** | | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$700,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | **$11,236** |
| | PM10 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | **$58,333** |
| | PM2.5 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | **$437,500** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $544 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$544** |
| | PM10 | $2,917 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$2,917** |
| | PM2.5 | $29,167 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$29,167** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$70,000** | **$700,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $11,236 |
| | PM10 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $58,333 |
| | PM2.5 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $437,500 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $1,124 | $11,236 |
| | PM10 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $5,833 | $58,333 |
| | PM2.5 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $43,750 | $437,500 |

| MINING ACTVITY: | Hauling on unpaved roads | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Tar and bitumen emulsions | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 191 | | | | | | | | | | |
| | PM10 | 36 | | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 129 | | | | | | | | | | |
| | PM10 | 24 | | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 62 | | | | | | | | | | |
| | PM10 | 12 | | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | **Total capital costs** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Weekly application of PetroTac by DCS | $230,000 | $230,000 | $230,000 | $230,000 | $230,000 | $230,000 | $230,000 | $230,000 | $230,000 | $230,000 | **$2,300,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | **Total material and other costs** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$2,300,000** |
| | **Total costs** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$2,300,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | **$36,918** |
| | PM10 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | **$191,667** |
| | PM2.5 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | **$1,437,500** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $1,787 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$1,787** |
| | PM10 | $9,583 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$9,583** |
| | PM2.5 | $95,833 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$95,833** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | **Total savings** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| | **Net costs** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$230,000** | **$2,300,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $36,918 |
| | PM10 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $191,667 |
| | PM2.5 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $1,437,500 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $3,692 | $36,918 |
| | PM10 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $19,167 | $191,667 |
| | PM2.5 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $143,750 | $1,437,500 |

| MINING ACTVITY: | Wind erosion of coal stockpiles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Chemical wetting agents | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 922 | | | | | | | | | | |
| | PM10 | 461 | | | | | | | | | | |
| | PM2.5 | 69 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 109 | | | | | | | | | | |
| | PM10 | 55 | | | | | | | | | | |
| | PM2.5 | 8 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 813 | | | | | | | | | | |
| | PM10 | 406 | | | | | | | | | | |
| | PM2.5 | 61 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | Dosing pump purchase, installation and commissioning. Years 5 and 10 - replacement of pump/s | $10,000 | $0 | $0 | $0 | $10,000 | $0 | $0 | $0 | $0 | $10,000 | **$30,000** |
| | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | **Total capital costs** | **$10,000** | **$0** | **$0** | **$0** | **$10,000** | **$0** | **$0** | **$0** | **$0** | **$10,000** | **$30,000** |
| Labour costs including directly related on-costs (list each item) | Water Cart Applications | $160,600 | $160,600 | $160,600 | $160,600 | $160,600 | $160,600 | $160,600 | $160,600 | $160,600 | $160,600 | **$1,606,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Wetting agent (160L/day) | $175,200 | $175,200 | $175,200 | $175,200 | $175,200 | $175,200 | $175,200 | $175,200 | $175,200 | $175,200 | **$1,752,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | **Total material and other costs** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$3,358,000** |
| | **Total costs** | **$345,800** | **$335,800** | **$335,800** | **$335,800** | **$345,800** | **$335,800** | **$335,800** | **$335,800** | **$335,800** | **$345,800** | **$3,388,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $425 | $413 | $413 | $413 | $425 | $413 | $413 | $413 | $413 | $425 | **$4,167** |
| | PM10 | $852 | $827 | $827 | $827 | $852 | $827 | $827 | $827 | $827 | $852 | **$8,345** |
| | PM2.5 | $5,669 | $5,505 | $5,505 | $5,505 | $5,669 | $5,505 | $5,505 | $5,505 | $5,505 | $5,669 | **$55,541** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $3,172 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,172** |
| | PM10 | $6,287 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$6,287** |
| | PM2.5 | $43,225 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$43,225** |
| Cost saving from implementing each best practice measure (list each item) | Coal saved for sale | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | $192,000 | **$1,920,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | **Total savings** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$192,000** | **$1,920,000** |
| | **Net costs** | **$153,800** | **$143,800** | **$143,800** | **$143,800** | **$153,800** | **$143,800** | **$143,800** | **$143,800** | **$143,800** | **$153,800** | **$1,468,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $189 | $177 | $177 | $177 | $189 | $177 | $177 | $177 | $177 | $189 | $1,806 |
| | PM10 | $379 | $354 | $354 | $354 | $379 | $354 | $354 | $354 | $354 | $379 | $3,616 |
| | PM2.5 | $2,521 | $2,357 | $2,357 | $2,357 | $2,521 | $2,357 | $2,357 | $2,357 | $2,357 | $2,521 | $24,066 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | -$191,811 | -$191,823 | -$191,823 | -$191,823 | -$191,811 | -$191,823 | -$191,823 | -$191,823 | -$191,823 | -$191,811 | -$1,918,194 |
| | PM10 | $379 | $354 | $354 | $354 | $379 | $354 | $354 | $354 | $354 | $379 | $3,616 |
| | PM2.5 | $2,521 | $2,357 | $2,357 | $2,357 | $2,521 | $2,357 | $2,357 | $2,357 | $2,357 | $2,521 | $24,066 |

| MINING ACTVITY: | | Wind erosion of coal stockpiles | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | | Surface Crustings Agents | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 922 | | | | | | | | | | |
| | PM10 | 461 | | | | | | | | | | |
| | PM2.5 | 69 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 64 | | | | | | | | | | |
| | PM10 | 32 | | | | | | | | | | |
| | PM2.5 | 5 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 858 | | | | | | | | | | |
| | PM10 | 429 | | | | | | | | | | |
| | PM2.5 | 64 | | | | | | | | | | |
| Year | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| Cost specific capital items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | Water cart cost | $22,880 | $22,880 | $22,880 | $22,880 | $22,880 | $22,880 | $22,880 | $22,880 | $22,880 | $22,880 | **$228,800** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Crusting agent 16 hectares @ $0.6 per sqm - once per week | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | $4,608,000 | **$46,080,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$46,308,800** |
| **Total costs** | | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$4,630,880** | **$46,308,800** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $5,397 | $5,397 | $5,397 | $5,397 | $5,397 | $5,397 | $5,397 | $5,397 | $5,397 | $5,397 | **$53,973** |
| | PM10 | $10,795 | $10,795 | $10,795 | $10,795 | $10,795 | $10,795 | $10,795 | $10,795 | $10,795 | $10,795 | **$107,946** |
| | PM2.5 | $72,358 | $72,358 | $72,358 | $72,358 | $72,358 | $72,358 | $72,358 | $72,358 | $72,358 | $72,358 | **$723,575** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $72,358 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$72,358** |
| | PM10 | $144,715 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$144,715** |
| | PM2.5 | $926,176 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$926,176** |
| Cost saving from implementing each best practice measure (list each item) | Coal saved for sale | $202,650 | $202,650 | $202,650 | $202,650 | $202,650 | $202,650 | $202,650 | $202,650 | $202,650 | $202,650 | **$2,026,500** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$202,650** | **$2,026,500** |
| **Net costs** | | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$4,428,230** | **$44,282,300** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $5,161 | $5,161 | $5,161 | $5,161 | $5,161 | $5,161 | $5,161 | $5,161 | $5,161 | $5,161 | $51,611 |
| | PM10 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $103,222 |
| | PM2.5 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $691,911 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$197,489 | -$1,974,889 |
| | PM10 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $10,322 | $103,222 |
| | PM2.5 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $69,191 | $691,911 |

| MINING ACTVITY: | Wind erosion of coal stockpiles | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Surface Stabilisation - water sprays + chemical wetting agents during high winds | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 922 | | | | | | | | | |
| | PM10 | 461 | | | | | | | | | |
| | PM2.5 | 69 | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 897 | | | | | | | | | |
| | PM10 | 448 | | | | | | | | | |
| | PM2.5 | 67 | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 25 | | | | | | | | | |
| | PM10 | 13 | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | Predictive meteorology | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | **$50,000** |
| | Water cart dedicated to Stockpiles during high winds | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | **$500,000** |
| Cost of specific materials and other items (list each item) | Chemical wetting agent | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | **$250,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$800,000** |
| **Total costs** | | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$800,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | **$32,000** |
| | PM10 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | **$61,538** |
| | PM2.5 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | **$400,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $89 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$89** |
| | PM10 | $179 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$179** |
| | PM2.5 | $1,194 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$1,194** |
| Cost saving from implementing each best practice measure (list each item) | Coal saved for sale | | | | | | | | | | | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$80,000** | **$800,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $32,000 |
| | PM10 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $61,538 |
| | PM2.5 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $400,000 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $3,200 | $32,000 |
| | PM10 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $6,154 | $61,538 |
| | PM2.5 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $400,000 |

| MINING ACTVITY: | Wind erosion of coal stockpiles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Surface Stabilisation - water sprays | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 922 | | | | | | | | | | |
| | PM10 | 461 | | | | | | | | | | |
| | PM2.5 | 69 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 470 | | | | | | | | | | |
| | PM10 | 235 | | | | | | | | | | |
| | PM2.5 | 35 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 452 | | | | | | | | | | |
| | PM10 | 226 | | | | | | | | | | |
| | PM2.5 | 34 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| Labour costs including directly related on-costs (list each item) | Water cart dedicated to Stockpiles | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | $480,000 | **$4,800,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$4,800,000** |
| **Total costs** | | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$480,000** | **$4,800,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $1,062 | $1,062 | $1,062 | $1,062 | $1,062 | $1,062 | $1,062 | $1,062 | $1,062 | $1,062 | **$10,619** |
| | PM10 | $2,124 | $2,124 | $2,124 | $2,124 | $2,124 | $2,124 | $2,124 | $2,124 | $2,124 | $2,124 | **$21,239** |
| | PM2.5 | $14,118 | $14,118 | $14,118 | $14,118 | $14,118 | $14,118 | $14,118 | $14,118 | $14,118 | $14,118 | **$141,176** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $1,021 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$1,021** |
| | PM10 | $2,043 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$2,043** |
| | PM2.5 | $13,714 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$13,714** |
| Cost saving from implementing each best practice measure (list each item) | Coal saved for sale | $106,800 | $106,800 | $106,800 | $106,800 | $106,800 | $106,800 | $106,800 | $106,800 | $106,800 | $106,800 | **$1,068,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$106,800** | **$1,068,000** |
| **Net costs** | | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$373,200** | **$3,732,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $826 | $826 | $826 | $826 | $826 | $826 | $826 | $826 | $826 | $826 | $8,257 |
| | PM10 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $16,513 |
| | PM2.5 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $109,765 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$105,974 | -$1,059,743 |
| | PM10 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $1,651 | $16,513 |
| | PM2.5 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $10,976 | $109,765 |

| MINING ACTVITY: | Wind erosion of coal stockpiles | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Water sprays on stockpile 5 | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 922 | | | | | | | | | |
| | PM10 | 461 | | | | | | | | | |
| | PM2.5 | 69 | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 893 | | | | | | | | | |
| | PM10 | 447 | | | | | | | | | |
| | PM2.5 | 67 | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 29 | | | | | | | | | |
| | PM10 | 14 | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | No5 Stockpile Sprays | $240,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$240,000** |
| | booster pump | $25,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$25,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$265,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$265,000** |
| Labour costs including directly related on-costs (list each item) | Installation | $25,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$25,000** |
| | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Maintenance | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | $5,000 | **$45,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$30,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$75,000** |
| **Total costs** | | **$295,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$340,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $10,172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | **$11,724** |
| | PM10 | $21,071 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | **$24,286** |
| | PM2.5 | $147,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | **$170,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $330 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$330** |
| | PM10 | $660 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$660** |
| | PM2.5 | $4,403 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$4,403** |
| Cost saving from implementing each best practice measure (list each item) | Coal saved for sale | | | | | | | | | | | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$295,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$5,000** | **$340,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $10,172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $11,724 |
| | PM10 | $21,071 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $24,286 |
| | PM2.5 | $147,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $170,000 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $10,172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $172 | $11,724 |
| | PM10 | $21,071 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $357 | $24,286 |
| | PM2.5 | $147,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $2,500 | $170,000 |

| MINING ACTVITY: | Wind erosion of coal stockpiles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Vegetative Windbreaks (all stockpiles) | | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 922 | | | | | | | | | | |
| | PM10 | 461 | | | | | | | | | | |
| | PM2.5 | 69 | | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 651 | | | | | | | | | | |
| | PM10 | 325 | | | | | | | | | | |
| | PM2.5 | 49 | | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 271 | | | | | | | | | | |
| | PM10 | 136 | | | | | | | | | | |
| | PM2.5 | 20 | | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | Tree planting | $125,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$125,000** |
| | Earth works | $75,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$75,000** |
| | Top soil | $400,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$400,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$600,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$600,000** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | Watering/maintenace | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | $15,000 | **$150,000** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$150,000** |
| **Total costs** | | **$615,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$750,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $2,269 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | **$2,768** |
| | PM10 | $4,522 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | **$5,515** |
| | PM2.5 | $30,750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | **$37,500** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $945 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$945** |
| | PM10 | $1,892 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$1,892** |
| | PM2.5 | $12,551 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$12,551** |
| Cost saving from implementing each best practice measure (list each item) | Coal saved for sale | $0 | $0 | $0 | $0 | $0 | | | | | | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$615,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$15,000** | **$750,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $2,269 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $2,768 |
| | PM10 | $4,522 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $5,515 |
| | PM2.5 | $30,750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $37,500 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $2,269 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $55 | $2,768 |
| | PM10 | $4,522 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $110 | $5,515 |
| | PM2.5 | $30,750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $750 | $37,500 |

| MINING ACTVITY: | Loading and dumping ROM coal | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific best practice measure | Water sprays on ROM Road hopper | | | | | | | | | | |
| Current Controlled Emissions (tonnes/year) | TSP | 220 | | | | | | | | | |
| | PM10 | 30 | | | | | | | | | |
| | PM2.5 | 4 | | | | | | | | | |
| Mass emissions through application of best practice (tonnes/year) | TSP | 110 | | | | | | | | | |
| | PM10 | 15 | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | |
| Total emission reduction from use of best practice measure (tonnes/year) | TSP | 110 | | | | | | | | | |
| | PM10 | 15 | | | | | | | | | |
| | PM2.5 | 2 | | | | | | | | | |
| **Year** | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
| Cost specific capital items (list each item) | Excavation | $10,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | Water lines | $15,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$15,000** |
| | Control panel | $30,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$30,000** |
| | Electrical supply | $20,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$20,000** |
| | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total capital costs** | | **$65,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$65,000** |
| Labour costs including directly related on-costs (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| Cost of specific materials and other items (list each item) | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total material and other costs** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Total costs** | | **$65,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$65,000** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $591 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$591** |
| | PM10 | $4,333 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$4,333** |
| | PM2.5 | $32,500 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$32,500** |
| Estimate additional cost per tonne of particulate matter suppressed from TSP, PM10 and PM2.5* | TSP | $591 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$591** |
| | PM10 | $4,333 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$4,333** |
| | PM2.5 | $32,500 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$32,500** |
| Cost saving from implementing each best practice measure (list each item) | No cost saving. | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Total savings** | | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** |
| **Net costs** | | **$65,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$65,000** |
| Estimate net cost per tonne of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $591 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $591 |
| | PM10 | $4,333 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $4,333 |
| | PM2.5 | $32,500 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $32,500 |
| Estimate net cost per tonne per ha of particulate matter suppressed for TSP, PM10 and PM2.5 * | TSP | $591 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $591 |
| | PM10 | $4,333 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $4,333 |
| | PM2.5 | $32,500 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $32,500 |

## Appendix F: Predictive wind forecasting tool

| Time | Maximum Wind Gust (km/hr) | Frequency of 40km/h> wind gusts | Dust Forecast Ranking |
|---|---|---|---|
| 0900 – 1200 | 10-15km/h | N/A | Negligible |
| 1200 – 1500 | 30-40km/h | Low | Low |
| 1500 – 1800 | 50-60km/h | Moderate | Moderate |
| 1800 – 2100 | 70-80km/h | High | High |
| 2100 – 0000 | 50-60km/h | Very high | High |
| 0000 – 0300 | 35-45km/h | Low | Moderate |
| 0300 – 0600 | 30-35km/h | Low | Low |
| 0600 - 0900 | 15-20km/h | N/A | Negligible |

| | Actions required | |
|---|---|---|
| **Dust Forecast Ranking** | **West Cliff** | **Appin** |
| Low | Normal water cart operations + monitor for additional water cart requirements | Normal Stockpile Spray operation - Automated spray based on wind speed thresholds. |
| Moderate | Normal water cart operations + Additional watercart operating during predicted high wind period | Normal Stockpile Spray operation - Automated spray based on wind speed thresholds.+ Pre watering (manual activation) before wind hits |
| High | Normal water cart operations + Additional watercart operating during predicted high wind period + | Normal Stockpile Spray operation - Automated spray based on wind speed thresholds.+ Pre watering (manual activation) before wind hits + no manual loading of stockpile |

| Dust Forecast Ranking | | Frequency/intensity | | | | |
|---|---|---|---|---|---|---|
| | | | Low | Medium | High | Very high |
| | | Rank | 1 | 2 | 3 | 4 |
| Max wind gusts (km/hr) | 0-40 | 0 | Low | Low | Low | Low |
| | 40-55 | 1 | Low | Low | Moderate | Moderate |
| | 55-70 | 2 | Moderate | Moderate | High | High |
| | 70+ | 3 | Moderate | High | High | High |