Centennial Coal

Newstan Colliery

Site Specific Particulate Matter Control Best Practice Assessment

Date September 2012

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Newstan Colliery

Site Specific Particulate Matter Control

Best Practice Assessment

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Best Practice Assessment

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EXECUTIVE SUMMARY

Background

Newstan Colliery is an existing underground coal mine owned and operated by Centennial Newstan. Newstan Colliery is regionally located approximately 25 kilometres (km) southwest of Newcastle and 140 km north of Sydney within the Lake Macquarie Local Government Area (LGA). The Newstan Colliery pit top and Surface Facilities Area is located approximately 4 km north of the township of Toronto.

Newstan Colliery began mining operations in 1887 and has since undertaken extensive mining within the Young Wallsend, Great Northern, Fassifern, Borehole and West Borehole coal seams. The Newstan Colliery produces both a semi soft coking coal and thermal coal for the domestic and export markets.

Newstan Colliery operates under development consent (DA 73-11-98 MOD4). DA 73-11-98 encompasses the Newstan Colliery Pit Top area, Coal Handling and Preparation Plant (CHPP), stockpile areas, the rail loop, haulage roads, Northern Reject Emplacement Area (NREA) and Southern Reject Emplacement Area (SREA).

Pollution Reduction Program

In 2011, the NSW Environmental Protection Authority (EPA) required, through a Pollution Reduction Program, that Newstan Colliery provide a report which examines in detail the potential measures which could be employed to further reduce particulate emissions from the mine. This is part of a larger program which aims to reduce particulate emissions from the coal mining industry as a whole in NSW.

Emissions were required to be quantified using United States Environmental Protection Agency approved emission factors without controls applied. Emission controls currently in place at Newstan Colliery were identified, and the control efficiency afforded by each applied measure, obtained through a literature review and site specific data were applied to these emissions.

A further assessment was performed which examined the potential emissions from the site, should a major upgrade to site infrastructure be approved. This upgrade is predicted to significantly reduce particulate emissions per tonne of ROM coal handled/processed when compared to current site operations.

Particulate emission sources were ranked according to the scale of emissions over a one year period with sources contributing to 95% of total site TSP emissions identified and taken forward for further assessment. The assessment required that additional controls (over and above those proposed to be implemented as part of the upgrade) were investigated, and the feasibility of implementing each control option was assessed with consideration to implementation costs, regulatory requirements, environmental impacts, safety implications and compatibility with current processes and any proposed future developments.

Following this feasibility assessment, a timeframe for implementation of particulate management measures was required to be provided if appropriate.

Findings

No further particulate control measures were identified that were suitable for implementation at the site, when the range of implementation costs, regulatory requirements, environmental impacts, safety implications and compatibility with current processes and any proposed future developments were considered. Three control measures were identified as being potentially feasible, however restrictive costs (>$20K per tonne of PM_{10} suppressed) made these measures impractical for implementation.

EXECUTIVE SUMMARY

The proposed upgrade will incorporate a number of additional particulate control measures (e.g. truck wheel wash, ROM dump hopper, skyline stacker). Given the significant costs associated with the proposed upgrade, it is not considered that further expenditure at the present time is justifiable.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by Centennial Newstan Pty Ltd (Centennial Newstan) to perform this assessment, which has included a site inspection, emissions estimation and the identification, quantification and justification of existing and proposed control measures for the site. The study was performed in accordance with the *Coal Mine Particulate Matter Control – Best Practice: Site Specific Determination Guideline*[1] issued by the New South Wales (NSW) Environmental Protection Authority (EPA) in November 2011.

The findings of this assessment are presented in the following report for submission to EPA.

1.1 Background

In 2010, the NSW EPA commissioned a detailed review of particulate matter (PM) emissions from coal mining activities in the Greater Metropolitan Region (GMR) of NSW. This review was completed in 2011 and issued as NSW (OEH) (2011) *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or minimise Emissions of Particulate Matter from Coal Mining* (hereafter 'the Katestone report'). One of the key recommendations of the study was that each mine should carry out a site-specific determination of best management practice. This recommendation has been adopted by the EPA through the implementation of the "*Dust Stop*" program.

The Dust Stop program aims to ensure that the most reasonable and practical particulate control options are implemented by each coal mine. Under this program, all coal mines in NSW are required to prepare a report that compares their current operation with international best practice. Mines are also required to report on the practicability of implementing each best practice measure and for any measures found to be practicable are required to provide a timetable for implementation. Once complete, copies of each report are required to be available on the mine's website.

The Dust Stop program is being implemented through pollution-reduction programs (PRPs) as operating conditions under the Environmental Protection Licence (EPL). A PRP was issued to Newstan in August 2011 requiring that a Site Specific Particulate Matter Control Best Practice Assessment be prepared for the site.

1.2 Guidance

EPA has provided guidance on the general structure and methodology of the assessment report. For clarification, the guidance provided has been reproduced in **Appendix A**.

Briefly, the process that is required is indicated below. For each required step in the procedure, reference has been provided to the relevant sections in this assessment report:

1. Identify, quantify and justify existing measures that are being used to minimise particle emissions — **Section 2**
2. Identify, quantify and justify best practice measures that could be used to minimise particle emissions — **Section 3**
3. Evaluate the practicability of implementing these best practice measures — **Section 4**
4. Propose a timeframe for implementing all practicable best practice measures — **Section 5**

Further to this provided guidance, EPA held a workshop for coal mining companies and their consultants on 8 May 2012. The outcome of this workshop was further clarified guidance relating to the requirements of EPA. These clarifications are summarised:

[1] http://www.environment.nsw.gov.au/resources/air/20110813coalmineparticulate.pdf

- The use of air quality monitoring data to identify that sites are complying with EPA ambient air quality criteria and therefore justify the need not to apply further controls is not acceptable. The aim of the PRP process is to reduce particulate emissions as a whole and is not primarily concerned with ambient concentrations.
- More site specific data is required. For example, material (silt/moisture), meteorology, vehicles (weights, speeds) and activity data. Where such data is not available, the justification of what *is* used is required, with potentially a recommendation and commitment by the site to collect this data in the future.
- Reports are required to be transparent and consistent with the mine AEMR.
- Reports need to include further detail on the control effectiveness of measures applied to each source. Although the guideline document identifies that the Katestone report should be referred to, blindly following the Katestone report is not acceptable practice.
- When control measures are recommended for implementation, some form of confirmation that controls are effective is required, or at least some indication of how the success of each measures implemetation will be measured. This might include KPI's, methods of monitoring, the location, frequency and duration of monitoring, and procedures for management.
- Economic review of each identified measure needs to consider depreciation (ATO rule TR2011/2012 for Coal Mining (Code 06000 and 10900). For off-highway trucks (including articulated, rigid dump, service, fuel and water trucks), the life of assets is classed as 10 years by the ATO.
- The salvage value of, for example trucks also needs to be considered (end of mine life and replacements).
- Implementation commitments will be written into Environmental Protection Licences in some form, but will be flexible if measures are not deemed to be viable at a later date.
- Although the guidance document identifies that the top 4 emission sources should be assessed, some professional judgement is required. The top 4 should not be blindly assessed. For example, if the top 4 only contribute 50% to total site emissions then more sources should be included. The top 4 sources should cover about 95% of total site emissions.

1.3 Description of the Coal Mine

1.3.1 Background to Newstan Colliery

Newstan Colliery is an existing underground coal mine owned and operated by Centennial Newstan. Newstan Colliery is regionally located approximately 25 kilometres (km) southwest of Newcastle and 140 km north of Sydney within the Lake Macquarie Local Government Area (LGA). The Newstan Colliery pit top and Surface Facilities Area is located approximately 4 km north of the township of Toronto.

Newstan Colliery began mining operations in 1887 and has since undertaken extensive mining within the Young Wallsend, Great Northern, Fassifern, Borehole and West Borehole coal seams. The Newstan Colliery produces both a semi soft coking coal and thermal coal for the domestic and export markets.

1.3.2 Mining and Coal Processing Operations

The Newstan Colliery is approved to produce and process up to 4 Million tonnes per annum (Mtpa) of ROM coal and export up to 3 Mtpa of coal through the rail loading facility. The 4 Mtpa of coal approved to be handled and processed at Newstan Colliery may include up to 4 Mtpa of coal from the Mandalong Mine and up to 0.88 Mtpa of coal from the Awaba Colliery. Newstan Colliery is approved to transport up to 2 Mtpa of coal directly to Eraring Power Station using the privately owned Newstan-Eraring haul road.

Coal from the Newstan Colliery is transported directly to the Coal Processing Plant (CPP) via the Newstan Colliery coal handling facilities. Excess coal may be stacked out onto the ROM stockpile area via the stack-out conveyor for reclaiming and processing at a later date. The reclaim process involves the use of dozers to push coal into reclaim feeders.

Coal transported by truck from the Cooranbong and Awaba Collieries may also be tipped and stockpiled onto the ROM stockpile for processing through the CPP via the same coal handling facilities. The ROM stockpile has a capacity of 150,000 t.

The coal from the mine and/or the ROM stockpile is fed into the CPP where it is processed, resulting in a reduction of ash in the product coal and the generation of a high-ash reject material. The coarse reject material is trucked to the Newstan Southern Reject Emplacement Area (SREA) or Northern Reject Emplacement Area (NREA). The tailings are pumped to a tailings dam located within the SREA.

The coal has been assumed to contain 10% moisture and 6 % silt as confirmed by the Proponent.

Although the foregoing details the maximum approved quantities of coal mined, accepted, processed and exported from the site, during the most recent Annual Environmental Management Report (AEMR) period of 2011 (1 January 2011 to 31 December 2011), the quantities of coal production and waste generation were reported as presented in **Table 1** (replicated from Section 2.4, 2.5 and 2.6, Newstan AEMR, 2011 p10, Table 3 Mandalong AEMR 2011, p15 and Table 6 Awaba AEMR 2011, p15). Also presented are the quantities approved for extraction/processing where relevant.

Table 1 Production Summary - Centennial Newstan 2011

Parameter	Reporting Period 1 January to 31 December 2011	Approved Operations
Newstan Colliery ROM Production	55,189 tonnes	4,000,000 tonnes
Coal from Cooranbong	1,770,404 tonnes	2,000,000 tonnes
Coal from Awaba	643,814 tonnes	880,000 tonnes
CPP Throughput	2,461,310 tonnes	4,000,000 tonnes
Saleable Production	2,016,388 tonnes	-
Washery Waste – Coarse Reject	196,192 tonnes	-
Washery Waste – Fine Reject	248,730 tonnes	-
Washery Waste – Total	444,922 tonnes	-

Taken from Sections 2.4, 2.5 and 2.6, Newstan AEMR 2011 p10, Table 3 Mandalong AEMR 2011, p15 and Table 6 Awaba AEMR 2011, p15

1.3.3 Product Coal Stockpiling and Load-Out

Product coal from the CPP is transported by enclosed conveyors to two truck loading bins. Trucks haul the coal from the truck loading bins to the Newstan rail loop or the Eraring Power Station using the privately owned Newstan- Eraring haul road. Project approvals allow the transport of up to 3 Mtpa of coal to be transported off site by rail, and up to 2 Mtpa to the Eraring power station by road.

Coal haulage is undertaken 24 hours per day, 7 days per week.

Coal is stockpiled in a 200,000 t capacity stockpile at the rail loop where it is loaded by front end loader to trains.

1.3.4 Summary of Project Activities

Activities at the site can be summarised as follows:

- Operate activities 24 hours per day 7 days a week;
- Extract up to 4 Mtpa of ROM coal;
- Receive up to 2 Mtpa of coal from the Cooranbong Colliery;
- Receive up to 888,000 tpa of coal from the Awaba Colliery;
- Process up to 4 Mtpa of ROM coal through the CPP;
- Export up to 3 Mtpa through rail loading facilities by train;
- Transport 2 Mtpa of coal to Eraring Power Station by truck using the Eraring-Newstan private haul road;
- Transport coarse reject from the CPP to the Northern Reject Emplacement Area by truck;
- Transport coarse reject from the CPP to the Southern Reject Emplacement Area by truck;
- Construction of Southern Reject Emplacement Area to RL60; and
- Rehabilitation of the Northern Reject Emplacement Area.

For the purposes of this assessment it has been assumed that all activities will be operating at maximum approved capacity. It is considered that by applying such an approach, the major dust sources during any year will be highlighted for further controls.

1.4 Activity Rates

1.4.1 Material Handling

Annual activity data for the activities occurring at the Newstan Site are provided in **Table 2** for material handling operations.

Table 2 Annual Activity Data for Material Handling Operations

Operation / Activity	Activity Rate (Annual)	Units	Notes
Coal from Newstan UG to Coal Handling Facility	4,000,000	tonnes	Maximum approved rate
Coal Handling Facility to CPP	4,000,000	tonnes	Maximum approved rate
Dozer reclaim on ROM Stockpile to CHF Feed	8,760	hrs	Assumed to be operational 24hrs per day / 7 days per week
Coal From Cooranbong - Truck dumping to ROM Stockpile	2,000,000	tonnes	Maximum approved rate
Coal from Awaba - Truck dumping to ROM Stockpile	880,000	tonnes	Maximum approved rate
Conveyor from ROM Stockpile to CHF	2,880,000	tonnes	Sum of maximum approved rates for Cooranbong and Awaba
Primary crushing - CPP	4,000,000	tonnes	Maximum approved rate
Screening - CPP	4,000,000	tonnes	Maximum approved rate
Washed - CPP	4,000,000	tonnes	Maximum approved rate
Saleable Domestic Coal to Truck Loading Bin (Conveyor)	2,000,000	tonnes	Assumed 82% of processed coal is saleable
Saleable Export Coal - Truck Loading Bin to Trucks	3,000,000	tonnes	Maximum approved rate
Trucks Dumping Saleable Export Coal to Product Stockpile	3,000,000	tonnes	Maximum approved rate
Saleable Domestic Coal - Truck Loading Bin to Trucks	2,000,000	tonnes	Maximum approved rate
Fine reject pumped to tailings dam at SREA	400,000	tonnes	Assumed 10% of washed coal (from AEMR,2011)
Coarse reject loaded to trucks	320,000	tonnes	Assumed 8% of washed coal (from AEMR,2011)
Coarse reject dumped at SREA/NREA	320,000	tonnes	Assumed 8% of washed coal (from AEMR,2011)
FEL on export coal at Product Stockpile	3,000,000	tonnes	As per maximum approved export coal
FEL to Train Wagons	3,000,000	tonnes	As per maximum approved export coal
Dozer at SREA/NREA	2,044	hrs	Assumed 5.5 hours per day

1.4.2 Material Movement by Truck

As previously outlined, material can be transported to and around the Newstan Colliery by haul truck. Product coal is transported off site by a combination of trains and trucks.

The length of each haul road is presented in **Table 3** with information on the haul road width, annual use and mean vehicle weight. Road silt content has been taken to be 6.4% for the purposes of calculating annual uncontrolled particulate emissions from each road.

Table 3 Details of Haul Roads

Haul Road	Length (m)	Width (m)	Average Vehicle movements per hour / hours of operation/year*	Vehicle Kilometres Travelled (VKT) per Year	Mean Vehicle Weight (tonnes)
CPP to Eraring Haul Road	704	8	14 / 7,300	72,270	32.2
Eraring Haul Road to SREA	1,000	8	16.5 / 3,915	64,597	32.2
SREA Internal Haul Road	3,300	8	2.5 / 3,915	32,494	32.2
CPP to Coal Deliveries Area Haul Road	450	8	14 / 3,915	24,664	32.2
CPP to NREA Haul Road	695	8	2.5 / 3,915	6,656	32.2
Truck Loading Bin to Eraring Haul Road	542	8	42 / 7,300	166,440	32.2
Rail Loop Haul Road	60	8	21 / 3,915	5,090	32.2
Eraring Haul Road	12,600	8	14 / 7,300	1,274,580	32.2

*: Taken from AQIA, September, 2011

1.4.3 Material Movement by Conveyor

Several conveyors are located at the Newstan site to transfer coal. Details of conveyors are presented in **Table 4**.

Table 4 Details of Conveyors

Name	Number	Length (m)	Number of Transfer Points	Quantity of Coal Conveyed (per year)
Newstan Underground Drift to Coal Handling Facility	1	150	1	4 Mt
Coal Handling Facility to ROM Stockpile	1	85	1	-
Underground Reclaim from ROM Stockpile to Coal Handling Facility Loading Bin	1	55	1	-
Coal Handling Facility to Coal Processing Plant	1	95	1	-
CPP to Truck Loading Bin – For Road Transport to Eraring	1	73	1	2 Mt
CPP to Truck Loading Bin – For Stockpiling in Rail Loop	1	73	1	3 Mt

1.4.4 Wind Erosion

Several areas at Newstan are sources for wind erosion as presented in **Figure 1**. Details of the area of each of these sources is presented in **Table 5**.

Table 5 Annual Activity Data for Wind Erosion Sources

Open Area	Total Area (ha)	Active Area (ha)
1: Maintenance Area 1	1.3	1.3
2: ROM Stockpile	3.7	3.7
3: CPP Stockpile	0.8	0.8
4: Southern Reject Emplacement Area	29.3	29.3
5: Northern Reject Emplacement Area 1	7.9	7.9
6: Maintenance Area 2	1.1	1.1
7: Northern Reject Emplacement Area 2	10.2	10.2
8: Pit Top	1.8	1.8
9: Product Stockpile	5.2	5.2

Figure 1 Wind Erosion Source Locations

Source: Google Earth

1.5 Project Approval Conditions

Newstan Colliery operates under development consent (DA 73-11-98 MOD4) granted by the (then) Minister for Planning on 14 May 1999 which was modified on 23 September 2007 to allow the mining of LW24 and the construction of a ventilation shaft at Awaba, on 1 December 2009 to allow for the Washing of Mandalong Coal, on 26 November 2010 to allow for the Washing of Awaba Coal and on 16 March 2012 to allow the mining in of the Main West mining area. DA 73-11-98 encompasses the Newstan Colliery Pit Top area, Coal Handling and Preparation Plant (CHPP), stockpile areas, the rail loop, haulage roads, Northern Reject Emplacement Area (NREA) and Southern Reject Emplacement Area (SREA).

Project Approval Conditions for the Newstan Colliery under Section 76(A)9 & 80 (MOD 4) of the *Environmental and Planning Assessment Act 1979*, dated 16 March 2012 include air quality criteria to ensure that the dust emissions generated by the Colliery do not cause additional exceedances of air quality criteria. These criteria are outlined in **Table 6** and are not to be exceeded at any residence on privately owned land, or on more than 25% of any privately owned land.

Table 6 Impact Assessment Criteria for Particulate Matter and Dust Deposition

Pollutant	Averaging Period	Criterion	
Total suspended particulate matter (TSP)	Annual	90 µg/m^3	
Particulate matter <10 µm (PM$_{10}$)	Annual	30 µg/m^3	
	24 hour	50 µg/m^3	
		Maximum increase in deposited dust level	**Maximum total deposited dust level**
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

1.6 Environmental Licence Conditions

The EPA regulates the operations conducted at Newstan through an Environmental Protection Licence issued under the Protection of the Environment Operations Act 1997 (POEO Act). Environmental Protection Licence number 395 contains the following conditions in relation to dust (with the exception of the requirements in condition U1, which are considered within this report):

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

O3.2 Activities occurring in or on the premises must be carried out in a manner that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.

O3.3 All trafficable areas, coal storage areas and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the generation, or emission from the premises, of wind-blown or traffic generated dust.

O3.4 Trucks transporting coal from the premises must be covered immediately after loading to prevent wind blown emissions and spillage. The covering must be maintained until immediately before unloading the trucks.

O3.5 The tailgates of all haulage trucks leaving the premises must be securely fixed prior to loading or immediately after unloading to prevent loss of material.

O3.6 Coal stockpiles must be maintained in a condition that will minimise the generation and emission of dust on the premises.

Newstan operates a complaints recording and management system as part of their over-arching management system and in accordance with Condition M5 of the EPL. In 2011, Newstan Colliery received two complaints relating to air quality.

EPA do not have any current Notices issued to Newstan.

1.7 Environmental Performance

Considering the requirements of both the Project approval and EPL, Newstan Colliery operates an air quality monitoring program for TSP, PM_{10} and dust deposition.

Newstan Colliery operates an air quality monitoring network surrounding its operations. The air quality monitoring network includes:

- Eight (8) dust deposition gauges [D1-D7, D9]
- Two (2) PM_{10} high volume air samplers (Hilltop and Watertank) [HVS1, HVS2]
- Two (2) TSP high volume air samplers (Hilltop and Watertank) [NVS1, HVS2]

Monitoring results for dust deposition for 2011 indicate that all dust deposition gauges recorded annual average results of less than 4 g/m^2/month with the exception of DG9. DG9 is located adjacent to the Stage 2 Tailings Dam within the SREA. The slightly elevated average dust levels for DG9 in 2011 are as a direct result of an anomalous result recorded in July 2011. The particulate monitoring result for July 2011 at DG9 was 47.3g/m^2/month, with visual analysis estimating the sample contained 70% vegetation matter and 20% insect material.

During 2011, Newstan continued spraying chemical dust suppressants on gravel roads and hardstand areas to minimise dust emissions.

High volume dust sampling was undertaken to monitor concentrations of TSP and PM_{10}. The Hill Top High Volume dust sampling point (HVS1) is located to the north of the NREA near Culgan's property. The Water Tank High Volume Dust Sampling point (HVS2) is located to the south of Newstan Colliery near the Fassifern Railway Station.

Results of PM_{10} and TSP monitoring between 2007 and 2011 are presented in **Table 7** and **Table 8** for PM_{10} and TSP, respectively. The annual average TSP and PM_{10} concentrations are shown to be below the criteria specified in **Table 6** and in general, concentrations are shown to be reducing year on year.

Table 7 Annual Average PM_{10} Concentrations – Newstan Colliery 2007 - 2011

Year	Annual Average PM_{10} (µg/m^3)	
	Hill Top (HVS1)	Water Tank (HVS2)
2007	18.6	25.6
2008	16.0	25.8
2009	16.6	19.4
2010	11.6	16.2
2011	14.3	17.7

Table 8 Annual Average TSP Concentrations – Newstan Colliery 2007 - 2011

Year	Annual Average TSP (µg/m^3)	
	Hill Top (HVS1)	Water Tank (HVS2)
2007	32.2	47.3
2008	33.0	53.2
2009	31.5	38.5
2010	22.5	30.3
2011	24.2	33.7

In the most recent full year of PM_{10} monitoring (2011), maximum 24 hour PM_{10} concentrations have been shown to be 44.0 µg/m^3 at the Water Tank site and 49.0 µg/m^3 at the Hill Top site, both concentrations in compliance with the criteria outlined in **Table 6**.

1.8 Proposed Upgrade to the Newstan Colliery

A significant upgrade to the Newstan Colliery and surface facilities is currently undergoing an Environmental Assessment. The Newstan Extension of Mining Project and Coal Logistics Project have the following attributes relevant to particulate emissions:

Newstan Extension of Mining Project

- Expand its underground mining operations both within and beyond the existing approved Newstan Colliery Life Extension Area utilising a combination continuous miner and longwall mining methods;
- Extract up to 4.5 Mtpa of run of mine (ROM) coal (increased from 4 Mtpa); and
- Utilise and upgrade the existing surface infrastructure of the Newstan and Awaba collieries;

Coal Logistics Project

- Transport up to 4 Mtpa of coal from the Mandalong Mine – Cooranbong Entry Site to the Newstan Colliery Surface Site by truck using the existing Mandalong Mine and Newstan-Eraring private haul roads;
- Upgrade the surface infrastructure of the Newstan Colliery to enable the handling and processing of up to 8 Mtpa of Run of Mine (ROM) consisting of up to 4.5 Mtpa from the Newstan Colliery and up to 4 Mtpa from the Mandalong Mine through the Newstan Colliery Coal Preparation Plant (CPP) and coal handling infrastructure;
- Increase the coal stockpile capacity at the Newstan Colliery Surface Site;
- Transport up to 8 Mtpa of coal from the Newstan CPP or coal handling infrastructure through the Newstan Colliery rail loading facilities by train to the Port of Newcastle or Port Kembla;
- Transport up to 4.5 Mtpa of coal product from the Newstan Colliery to the Eraring Power Station or the Mandalong Mine - Cooranbong Entry Site by truck using the existing Newstan-Eraring and/or Mandalong Mine private haul roads; and
- Transport reject material to the Newstan Colliery Northern Reject Emplacement Area (NREA), the Newstan Colliery Southern Reject Emplacement Area (SREA) or the Lake Macquarie City Council (LMCC) owned Hawkmount Quarry via private haul roads.

A summary of the existing approved operations versus those proposed as part of the upgrade relevant to this PRP assessment are presented in **Table 9**.

Table 9 Approved and Proposed Quantities of Coal Receipt, Processing and Transport – Newstan Coliery

Project Element	Current Approval (up to)	Proposed Upgrade (up to)
ROM Coal Mined from Newstan UG	4 Mtpa	4.5 Mtpa
Coal Receipt from Cooranbong	2 Mtpa	6 Mtpa
Material (coal and stone) Receipt from Awaba	0.88 Mtpa	0.88 Mtpa
Coal Processing at Newstan CPP	4 Mtpa	8 Mtpa
Product Coal Transport by Rail	3 Mtpa	8 Mtpa
Product Coal Transport by Road	2 Mtpa	4.5 Mtpa

It is clear that the quantities of coal sought to be received, processed and transported off site following the proposed upgrade are to increase significantly. Emissions of particulate, if not appropriately managed, would also increase correspondingly.

Several measures are proposed as part of the upgrade which will act to reduce particulate emissions. In summary these measures include:

Train Loading – currently performed by front end loader, proposed to be carried out via a train loading bin. In addition, dozer used to push coal to reclaim tunnel.

ROM Coal Dumping at ROM Stockpile – currently dumped straight to stockpile, proposed to be carried out via a dump hopper and stacker with water sprays.

Product Coal to Product Coal Stockpile – currently loaded to haul trucks and dumped at stockpile, proposed to be loaded direct from CPP via skyline stacker with water sprays.

Haul Roads – several roads are currently unpaved, proposed that all trucks will travel on paved roads.

Truck Wheel Wash – All trucks leaving site will be directed through the truck wheel wash prior to leaving site

In order to address these proposed changes within the PRP assessment framework, baseline (uncontrolled emissions and emissions including existing control measures) have been estimated for the current operation as well as for the proposed future operations after implementation of the Newstan Colliery Extension of Mining and Coal Logistics Projects. The review of potential additional control options however, has only been performed for the proposed future operations (i.e. assuming full implementation of the Newstan Colliery Extension of Mining and Coal Logistics Projects).

In summary, this PRP report has been constructed as follows:

1 Existing uncontrolled particulate emissions from current operations have been calculated.

2 Existing controlled particulate emissions from current operations have been calculated.

3 The impact on particulate emissions due to the proposed upgrade (controlled) have been calculated.

4 The top 95% of particulate emission sources following upgrade have been identified and further controls investigated for these sources.

2 IDENTIFICATION OF EXISTING CONTROL MEASURES & EMISSION ESTIMATION

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 AP-42 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).*

Notes: These particulate matter controls must be clearly identified, quantified and justified with supporting information. This means adding supporting information and evidence, including monitoring data, record keeping, management plans and/or operator training.

1.2 Using the results of the controlled emission 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 $PM_{2.5}$.

2.1 Estimation of Baseline Particulate Emissions

In the estimation of baseline emissions of particulate matter, United States Environmental Protection Agency (USEPA) AP-42, *Compilation of Air Pollutant Emission Factors* estimation techniques have been utilised, as prescribed in the methodology presented in **Appendix A** and reproduced above.

AP-42 Chapter 11 (Mineral Products Industry) and AP-42 Chapter 13 (Miscellaneous Sources) have been referenced to estimate emissions from mining activities occurring at Newstan Colliery.

Table 10 presents a summary of the AP-42 reference sections for the various emission factors used in this assessment report.

Table 10 Particulate Emissions Sources and Relevant USEPA AP-42 Emission Factors

Emissions Source	AP-42 Chapter	Notes
Bulldozing coal	Chapter 11.9 Western Surface Coal Mining (1998)	
Front end loaders and excavators on coal	Chapter 11.9 Western Surface Coal Mining (1998)	
Material transfer of coal by conveyor	Chapter 11.9 Western Surface Coal Mining (1998)	
Loading coal stockpiles	Chapter 11.9 Western Surface Coal Mining (1998)	
Wind erosion of coal stockpiles	Chapter 11.9 Western Surface Coal Mining (1998)	
Coal crushing	Chapter 11.24 Metallic Minerals Processing (1982)	Adopted in the NPI in absence of coal specific factors
Coal screening	Chapter 11.24 Metallic Minerals Processing (1982)	
Loading coal to trains	Chapter 11.9 Western Surface Coal Mining (1998)	
Loading coal to trucks	Chapter 11.9 Western Surface Coal Mining (1998)	
Wheel generated particulates on unpaved roads	Chapter 13.2.2 Unpaved Roads (2006)	

Appendix B outlines the emission factors used for each activity occurring at Newstan Colliery.

A discussion of the annual activity related to each action and the subsequent calculated emission rates of TSP, PM_{10} and $PM_{2.5}$ are provided in **Section 1.3**. As required by the EPA, emissions are presented firstly as uncontrolled emissions, and secondly as emissions with controls currently employed in place.

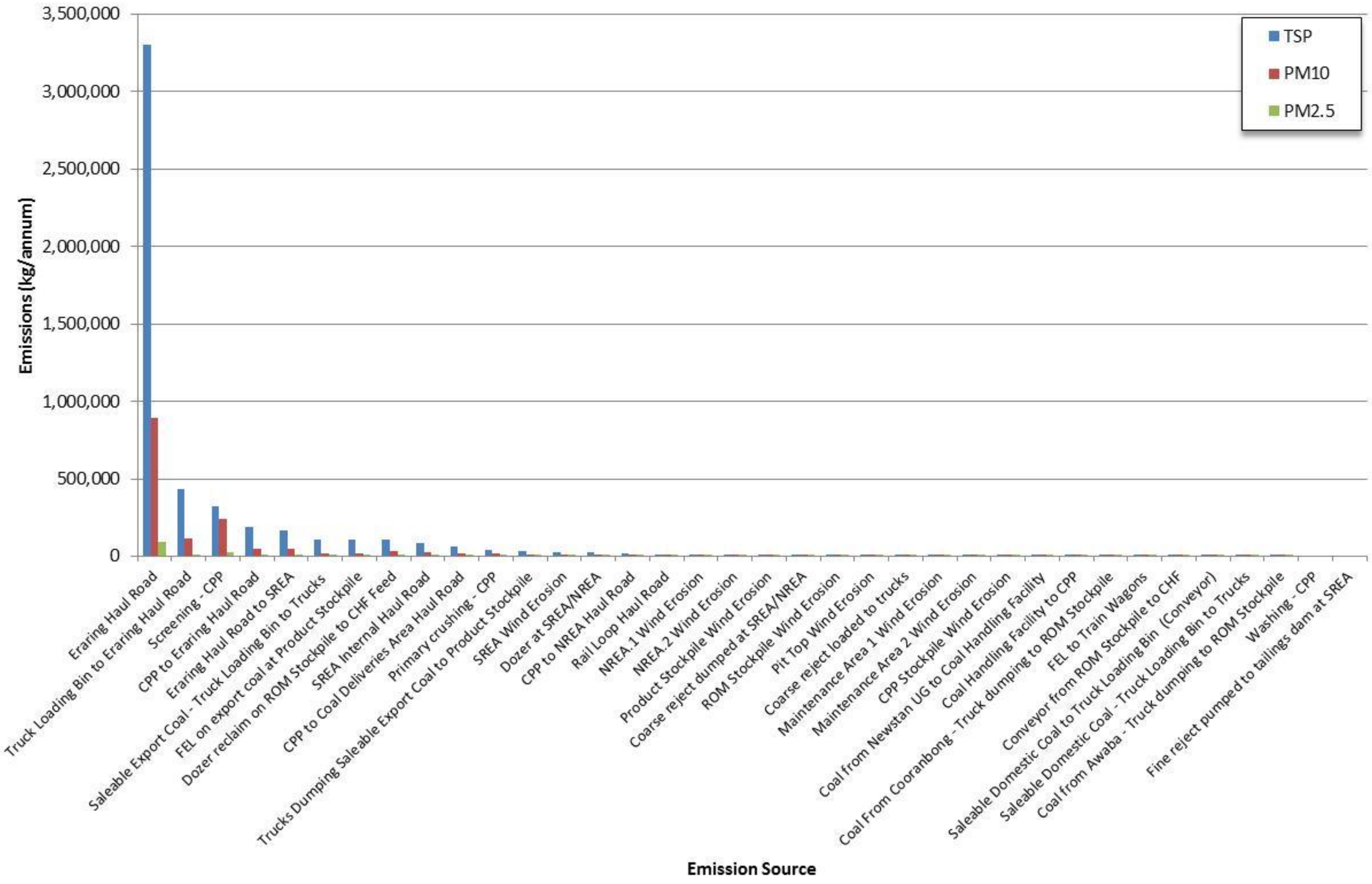
2.1.1 Uncontrolled Particulate Emissions

Using the emission factors calculated in **Appendix B** and the annual activity data presented in **Section 1.3**, the annual (uncontrolled) particulate emissions from Newstan Colliery are presented in **Table 11** and graphically in **Figure 2**.

Table 11 Uncontrolled Annual Particulate Emissions – Newstan Colliery

Emission Source	TSP Emissions (kg/year)	PM_{10} Emissions (kg/year)	$PM_{2.5}$ Emissions (kg/year)	Cumulative % Contribution to Total TSP Emissions
Eraring Haul Road	3,301,347	891,222	89,122	65.2
Truck Loading Bin to Eraring Haul Road	431,104	116,380	11,638	73.7
Screening – CPP	320,000	240,000	24,000	80.0
CPP to Eraring Haul Road	187,190	50,533	5,053	83.7
Eraring Haul Road to SREA	167,317	45,168	4,517	87.0
Saleable Export Coal - Truck Loading Bin to Trucks	109,787	16,882	1,688	89.2
FEL on export coal at Product Stockpile	109,787	16,656	1,666	91.4
Dozer reclaim on ROM Stockpile to CHF Feed	106,595	32,444	3,244	93.5
SREA Internal Haul Road	84,165	22,721	2,272	95.1
CPP to Coal Deliveries Area Haul Road	63,885	17,246	1,725	96.4
Primary crushing – CPP	40,000	16,000	1,600	97.2
Trucks Dumping Saleable Export Coal to Product Stockpile	30,000	12,600	1,260	97.8
SREA Wind Erosion	24,897	12,448	1,245	98.3
Dozer at SREA/NREA	24,872	7,570	757	98.7
CPP to NREA Haul Road	17,239	4,654	465	99.1
Rail Loop Haul Road	13,183	3,559	356	99.3
NREA.1 Wind Erosion	8,670	4,335	434	99.5
NREA.2 Wind Erosion	6,732	3,366	337	99.6
Product Stockpile Wind Erosion	4,386	2,193	219	99.7
Coarse reject dumped at SREA/NREA	3,200	1,344	134	99.8
ROM Stockpile Wind Erosion	3,111	1,556	156	99.9
Pit Top Wind Erosion	1,513	757	76	99.9
Coarse reject loaded to trucks	1,280	544	54	99.9
Maintenance Area 1 Wind Erosion	1,063	531	53	99.9
Maintenance Area 2 Wind Erosion	918	459	46	100.0
CPP Stockpile Wind Erosion	663	332	33	100.0
Coal Handling Facility to CPP	383	181	18	100.0
Saleable Coal to Truck Loading Bin (Conveyor)	383	181	18	100.0
Coal from Newstan UG to Coal Handling Facility	343	162	16	100.0
Coal From Cooranbong - Truck dumping to ROM Stockpile	287	136	14	100.0
FEL to Train Wagons	276	131	13	100.0
Conveyor from ROM Stockpile to CHF	192	91	9	100.0
Saleable Domestic Coal - Truck Loading Bin to Trucks	192	91	9	100.0
Coal from Awaba - Truck dumping to ROM Stockpile	151	71	7	100.0
Washing – CPP	0	0	0	100.0
Fine reject pumped to tailings dam at SREA	0	0	0	100.0
TOTAL	**5,065,108**	**1,522,543**	**152,254**	**-**

Figure 2 Uncontrolled Annual Particulate Emissions – Newstan Colliery



2.2 Existing Control Measures

Newstan Colliery operate an Air Quality Management Plan with the measures identified in the following sections being implemented as part of that plan. Where relevant, emission control factors for each dust suppression activity are provided. Control factors are sourced from a number of publications including:

- Katestone Environmental 2010, "*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining"*, December 2010.
- Australian Government Department of Sustainability, Environment, Water, Population and Communities 2012, "*National Pollutant Inventory Emission Estimation Technique for Mining", Version 3.1*, January 2012.
- Countess Environmental 2006, *"WRAP Fugitive Dust Handbook"*, September, 2006.
- US Department of Health and Human Services 2012, *"Dust Control Handbook for Industrial Minerals Mining and Processing"*, January 2012.

It is acknowledged that emission control factors can be highly variable, and are generally based on site and material specific field trials. Where possible, the entire range of control factors for each relevant activity from the references above are presented with the most appropriate factor, taking into consideration the source of the data, being taken forward for application within this report.

Where a considerable level of uncertainty exists, or where the emission source has the potential to contribute a significant percentage to the site dust balance, further work is proposed.

The control measures implemented at Newstan Colliery are presented in **Table 12**. Also presented are the applicable control factors which can be applied to each measure. These control factors have only been applied where they are implemented continuously. Those implemented during adverse conditions will also act to decrease particulate emissions, although the effect on annual particulate emissions cannot be quantified.

Table 12 Active Dust Control Measures

Source	Control Measure	Control Factor
Disturbed Areas	Completed overburden emplacement areas are rehabilitated as soon as practicable with a minimum of 100 mm of inert material and revegated. Regular assessment of meteorological conditions should be made to identify conditions which would be unfavourable in terms of dust levels to the northwest and the southeast of the site. Disturb only the minimum area necessary for on-site activities.	99% (Katestone, 2011) Not quantified 100% per m^2 of avoidance (Katestone, 2011)
Coal Handling Facilities	Maintain coal-handling areas in a moist condition using water carts or alternative means to minimise wind-blown and traffic generated dust.	50% (Katestone, 2011)
Coal Preparation Plant	Enclosed to retain particulate matter	70% (DSEWPC, 2012)
ROM Stockpiles	Water carts are utilised to keep stockpiles moist. Shaping and orientation should be maintained to minimise dust emissions. Fencing, bunding or shelterbelts to reduce ambient wind speeds (in some areas).	50% (Katestone, 2011) 60% (Katestone, 2011) 30% (Katestone, 2011)
Tailings	Areas of fine tailings are covered with coarse, heavy reject material to minimise the potential for wind-blown dust generation.	Not quantified
Transportation (Trucks)	Cover transport loads with tarpaulin or lid.	Not quantified
Haul Road Dust	All roads and trafficked areas are watered down using a water cart to minimise the generation of dust. Hard stand and sealed roads are swept by vacuum sweeper truck on a weekly basis. Haulage vehicles are restricted to the most direct route and minimal manoeuvring areas to prevent indiscriminate driving over non-active areas. Haul roads have designated speed limits (generally 40 km/h). Hard stand areas have a speed limit of 20 km/h. Scheduled grading and gravelling of heavy traffic areas (i.e intersections). Use of chemical dust suppressants.	50% (Katestone, 2011) Not quantified 44% (Countess, 2006) Not quantified 84% (Katestone, 2011)
Loading and Dumping	Minimise dump height wherever possible (reduce to 5 m). Water sprays implemented on ROM pad or ROM bin. Part enclosure of ROM bin.	30% (Katestone, 2011) 50% (Katestone, 2011) 70% (Katestone, 2011)
Coal Handling and Preparation Plant	Conveyors shielded on top and a minimum of one side, and automatic sprays fitted at transfer points. Belt cleaning should be undertaken at regular intervals and spillages minimised.	40% (shielding) and 50% (water sprays) (Katestone, 2011) Not quantified
Processing Area	Fit water sprays at key transfer points. Transfers enclosure.	50% (Katestone, 2011)
Plant and Equipment	All plant and equipment installed at the mine is maintained and operated in a proper and efficient condition.	Not quantified
Excessive Dust Events[1]		
Overburden Emplacement Areas	Relocation or modification of exposed operations such as topsoil removal or overburden dumping.	Not quantified
Disturbed Areas	Where relocation or modification is not possible, temporary halting of activities and resuming when weather conditions have improved should be considered.	Not quantified

Note 1: An excessive dust event includes prolonged visual dust in a particular area or following receipt of dust monitoring results in exceedance of the Project criteria.

Presented in **Table 13** are the calculated particulate emissions from current operations at Newstan Colliery with current emission controls applied. These are also presented graphically in **Figure 3**. A comparison of the total emissions by source (controlled and uncontrolled) are presented in **Figure 4.**

Table 13 Controlled Annual Particulate Emissions – Newstan Colliery

Emission Source	TSP Emissions (kg/year)	PM_{10} Emissions (kg/year)	$PM_{2.5}$ Emissions (kg/year)	Cumulative % Contribution to Total TSP Emissions
Eraring Haul Road	330,135	89,122	8,912	39.8
Saleable Export Coal - Truck Loading Bin to Trucks	109,787	16,882	1,688	53.0
Screening – CPP	96,000	72,000	7,200	64.6
FEL on export coal at Product Stockpile	54,893	8,328	833	71.2
Dozer reclaim on ROM Stockpile to CHF Feed	53,297	16,222	1,622	77.6
Truck Loading Bin to Eraring Haul Road	43,110	11,638	1,164	82.8
SREA Wind Erosion	24,897	12,448	1,245	85.8
Dozer at SREA/NREA	24,872	7,570	757	88.8
CPP to Eraring Haul Road	18,719	5,053	505	91.1
Primary crushing – CPP	12,000	4,800	480	92.5
Trucks Dumping Saleable Export Coal to Product Stockpile	10,500	4,410	441	93.8
NREA.1 Wind Erosion	8,670	4,335	434	94.9
Eraring Haul Road to SREA	7,496	2,024	202	95.8
NREA.2 Wind Erosion	6,732	3,366	337	96.6
CPP to Coal Deliveries Area Haul Road	6,388	1,725	172	97.3
Product Stockpile Wind Erosion	4,386	2,193	219	97.9
SREA Internal Haul Road	3,771	1,018	102	98.3
ROM Stockpile Wind Erosion	3,111	1,556	156	98.7
Coarse reject dumped at SREA/NREA	2,240	941	94	99.0
Pit Top Wind Erosion	1,513	757	76	99.2
Rail Loop Haul Road	1,318	356	36	99.3
Coarse reject loaded to trucks	1,280	544	54	99.5
Maintenance Area 1 Wind Erosion	1,063	531	53	99.6
Maintenance Area 2 Wind Erosion	918	459	46	99.7
CPP to NREA Haul Road	772	208	21	99.8
CPP Stockpile Wind Erosion	663	332	33	99.9
Coal Handling Facility to CPP	192	91	9	99.9
Saleable Coal to Truck Loading Bin (Conveyor)	192	91	9	99.9
Coal from Newstan UG to Coal Handling Facility	192	91	9	100.0
Saleable Domestic Coal - Truck Loading Bin to Trucks	144	68	7	100.0
FEL to Train Wagons	120	57	6	100.0
Coal From Cooranbong - Truck dumping to ROM Stockpile	96	45	5	100.0
Coal from Awaba - Truck dumping to ROM Stockpile	53	25	2	100.0
Conveyor from ROM Stockpile to CHF	0	0	0	100.0
Washing – CPP	0	0	0	100.0
Fine reject pumped to tailings dam at SREA	0	0	0	100.0
TOTAL	**829,518**	**269,284**	**26,928**	**-**

Figure 3 Controlled Annual Particulate Emissions – Newstan Colliery

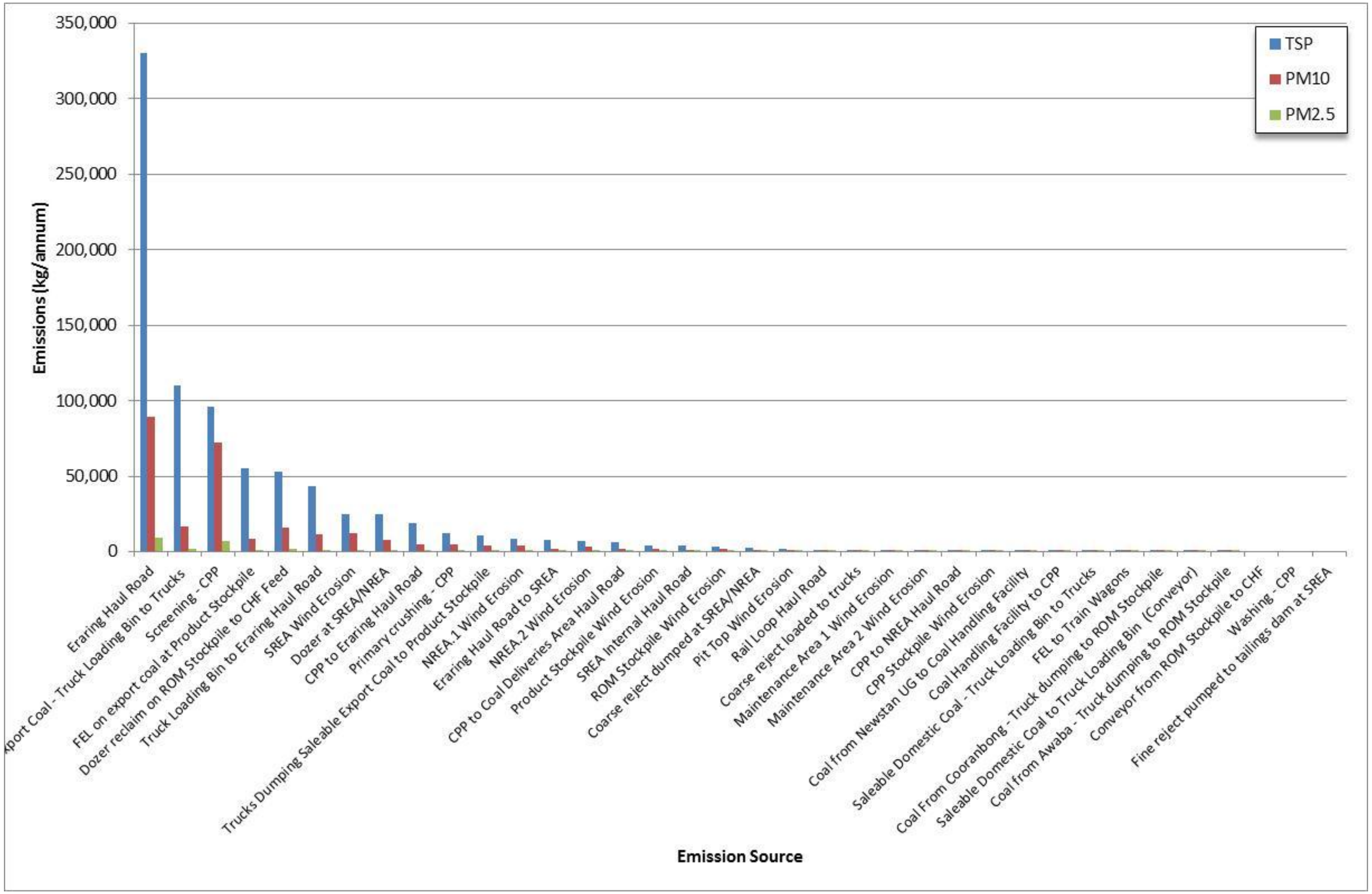
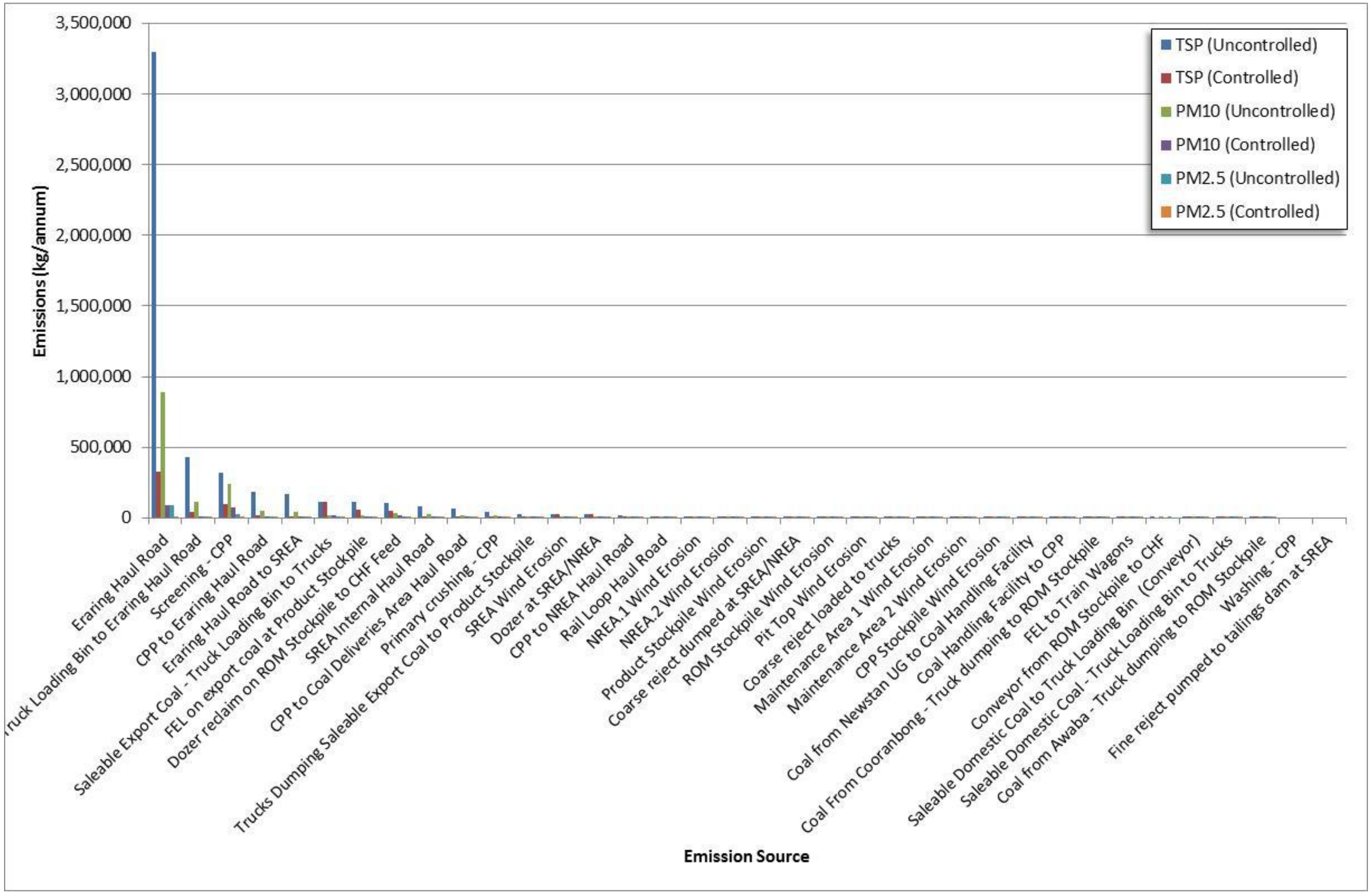


Figure 4 Comparison of Uncontrolled versus Controlled Particulate Emissions – Newstan Colliery

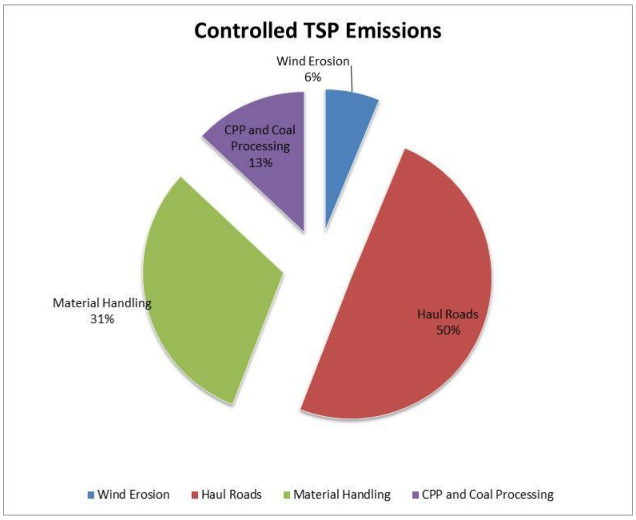


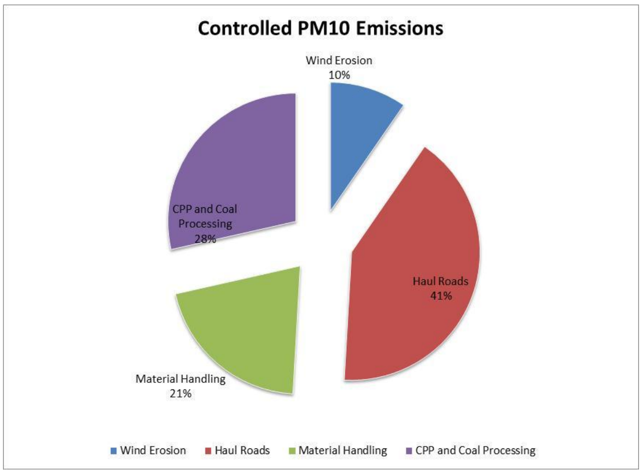
Particulate emissions are presented by source group (wind erosion, haul roads, material handling and extraction and CPP and coal loading operations at the CPP and product stockpile areas) in **Table 14**.

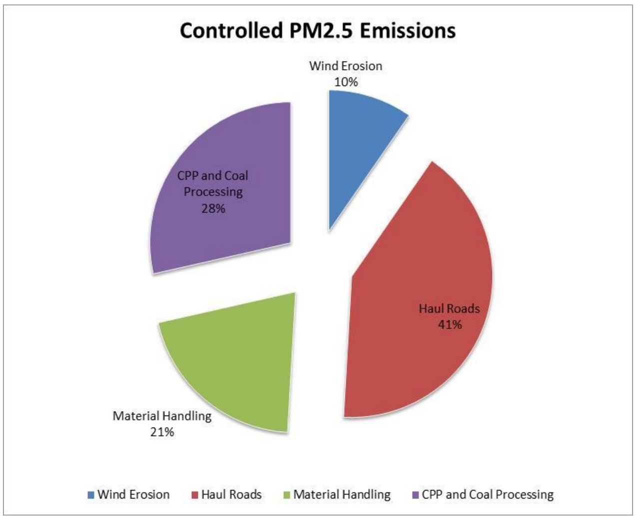
Table 14 Comparison of Uncontrolled and Controlled Particulate Emissions (Existing)

Emission Source Group	Existing Uncontrolled Emissions (kg/annum)			Existing Controlled Emissions (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Wind Erosion	51,952	25,976	2,598	51,952	25,976	2,598
Haul Roads	4,265,429	1,151,483	115,148	411,709	111,144	11,114
Material Handling and Extraction	387,727	89,084	8,908	257,857	55,364	5,536
CPP and Coal Load Out	360,000	256,000	25,600	108,000	76,800	7,680
TOTAL	**5,065,108**	**1,522,543**	**152,254**	**829,518**	**269,284**	**26,928**

Figure 5 Representation of Major Existing Controlled Particulate Emission Sources –Newstan Colliery







2.3 Assessment of Proposed Operations

The following section addresses the proposed upgrade to the Newstan Colliery and Surface Facilities through the implementation of the Newstan Extension of Mining and Coal Logistics Projects. The approach taken for the existing emissions assessment has been followed that is, it has been assumed that all activities will be operating at maximum approved capacity although is recognised that in reality such activities will not occur at these rates. It is however considered that by applying such an approach, the major dust sources during any year will be highlighted for further controls and a direct comparison between existing and proposed emissions can be performed.

2.4 Proposed Activity Rates

2.4.1 Material Handling

Annual activity data for the proposed activities occurring at the Newstan Site are provided in **Table 15** for material handling operations.

Table 15 Proposed Annual Activity Data for Material Handling Operations

Operation / Activity	Activity Rate (Annual)	Units	Notes
Trucks dumping coal at ROM Stockpile (to Dump Hopper)	6,000,000	tonnes	Maximum proposed rate
ROM Coal from Dump Hopper to Stacker	6,000,000	tonnes	Maximum proposed rate
ROM Coal from Stacker to Stockpile	6,000,000	tonnes	Maximum proposed rate
Dozer on ROM Stockpile (push to reclaim tunnel)	876	hrs	10% of year
Conveyor to CPP Module 1	6,000,000	tonnes	Maximum proposed rate
Conveyor from Newstan Drift to Newstan Coal ROM Stockpile	450,000	tonnes	Assumed 10% of coal to stockpile
Conveyor drop onto Newstan ROM Stockpile	450,000	tonnes	Assumed 10% of coal to stockpile
Conveyor from Newstan Drift to CPP Module 2	4,050,000	tonnes	Assumed 90% of coal direct to CPP
CPP Module 1 & CPP Module 2 & CHP- Crush/Screen/Wash	8,000,000	tonnes	Maximum proposed rate
Conveyor to Product Stockpile via Skyline Stacker	8,000,000	tonnes	Maximum proposed rate
Conveyor drop onto Product Stockpile	8,000,000	tonnes	Maximum proposed rate
Dozer on Product Stockpile	4,380	hrs	50% of year
Conveyor to Train Loading Bin	8,000,000	tonnes	Maximum proposed rate
Loading Train Loading Bin	8,000,000	tonnes	Maximum proposed rate
Loading Trains	8,000,000	tonnes	Maximum proposed rate
Conveyor to Truck Loading Bin	4,500,000	tonnes	Maximum proposed rate
Conveyor drop into Truck Loading Bin	4,500,000	tonnes	Maximum proposed rate
Loading Trucks via Truck Loading Bin	4,500,000	tonnes	Maximum proposed rate
Dozer at SREA/NREA/Hawkmount Quarry	3,066	hrs	Hawkmount Quarry also used for rejects during upgrade
Middlings loaded to Bin	262,800	tonnes	Assumed 1 truck load per hour, 60t truck payload and 12hrs/day operation
Middlings loaded to trucks	262,800	tonnes	
Reject loaded to Bin	919,800	tonnes	Assumed 3 truck load per hour, 60t truck payload and 14hrs/day operation
Reject loaded to Trucks	919,800	tonnes	
Trucks dumping rejects at REA	919,800	tonnes	

2.4.2 Proposed Material Movement by Truck

As previously outlined, material can be transported to and around Newstan by haul truck. Product coal is transported off site by a combination of trains and trucks.

The length of each haul road is presented in **Table 3** with information on the haul road width, annual use and mean vehicle weight. Road silt content has been taken to be 6.4% for the purposes of calculating annual uncontrolled particulate emissions from each road.

Table 16 Details of Haul Roads

Haul Road	Length (m)	Width (m)	Vehicle Trips per Hour	Vehicle Kilometres Travelled (VKT) per Year	Mean Vehicle Weight (tonnes)
Loading Bin to Eraring Power Station	12,600	8	13	1,434,888	32.2
Rejects to SREA	3,350	8	1	17,119	32.2
Rejects to NREA	1,100	8	1	18,907	32.2
Rejects to Hawkmount Quarry	11,100	8	1	56,721	32.2

1/3 of rejects assumed to be placed at SREA/NREA and Hawkmount Quarry

2.4.3 Material Movement by Conveyor

Several conveyors are proposed to be located at the upgraded Newstan site to transfer coal. Details of conveyors are presented in **Table 17**.

Table 17 Details of Conveyors

Name	Number	Length (m)	Number of Transfer Points	Quantity of Coal Conveyed (per year)
Newstan Underground Drift to Coal Handling Facility	1	150	1	4.5 Mt
Coal Handling Facility to ROM Stockpile	1	85	1	450,000 t
Underground Reclaim from ROM Stockpile to Coal Handling Facility Loading Bin	1	55	1	450,000 t
Coal Handling Facility to Coal Processing Plant	1	95	1	4.5 Mt
CPP to Product Stockpile	1	550	1	8 Mt
Reclaim Conveyor from Product Stockpile to Train Loading Bin	1	125	1	8 Mt
Reclaim Conveyor from Product Stockpile to Truck Loading Bin	1	100	1	4.5 Mt

2.4.4 Wind Erosion

Several areas at Newstan are sources for wind erosion as presented in **Figure 1**. Details of the area of each of these sources is presented in **Table 5**. It is noted that several areas are altered in area from the proposed operations when compared to of the current operations (refer **Table 18**). This is due to the opening of new reject area (Hawkmount Quarry) and the expansion of coal stockpile areas.

Table 18 Annual Activity Data for Wind Erosion Sources

Open Area	Total Area (ha)	Active Area (ha)
Maintenance Area 1	1.3	1.3
ROM Stockpile	0.8	0.8
Product Stockpile	4.6	4.6
Southern Reject Emplacement Area	45	45
Northern Reject Emplacement Area	8	8
Hawkmount Quarry	2.8	2.8
Maintenance Area 2	1.1	1.1
Pit Top	1.8	1.8

2.5 Proposed Control Measures

The additional particulate control measures proposed to be implemented at Newstan Colliery following upgrade are presented in **Table 19**. These will be implemented in addition to those presented in **Table 12**.

Table 19 Proposed Dust Control Measures

Source	Control Measure	Control Factor
Trucks dumping ROM coal	Trucks will dump ROM coal into a hopper designed to control dust. Water sprays will be used to control dust	50% (Katestone, 2011)
Coal transport by conveyor	All new and existing conveyors will be enclosed Water sprays used on conveyor transfer points	70% (DSEWPC, 2012) 50% (Katestone, 2011)
Haul Road Dust	All haul roads will be paved and no vehicles will be allowed on unpaved areas of the site Wheel wash located prior to trucks leaving site	90% (Katestone, 2011) Unquantified

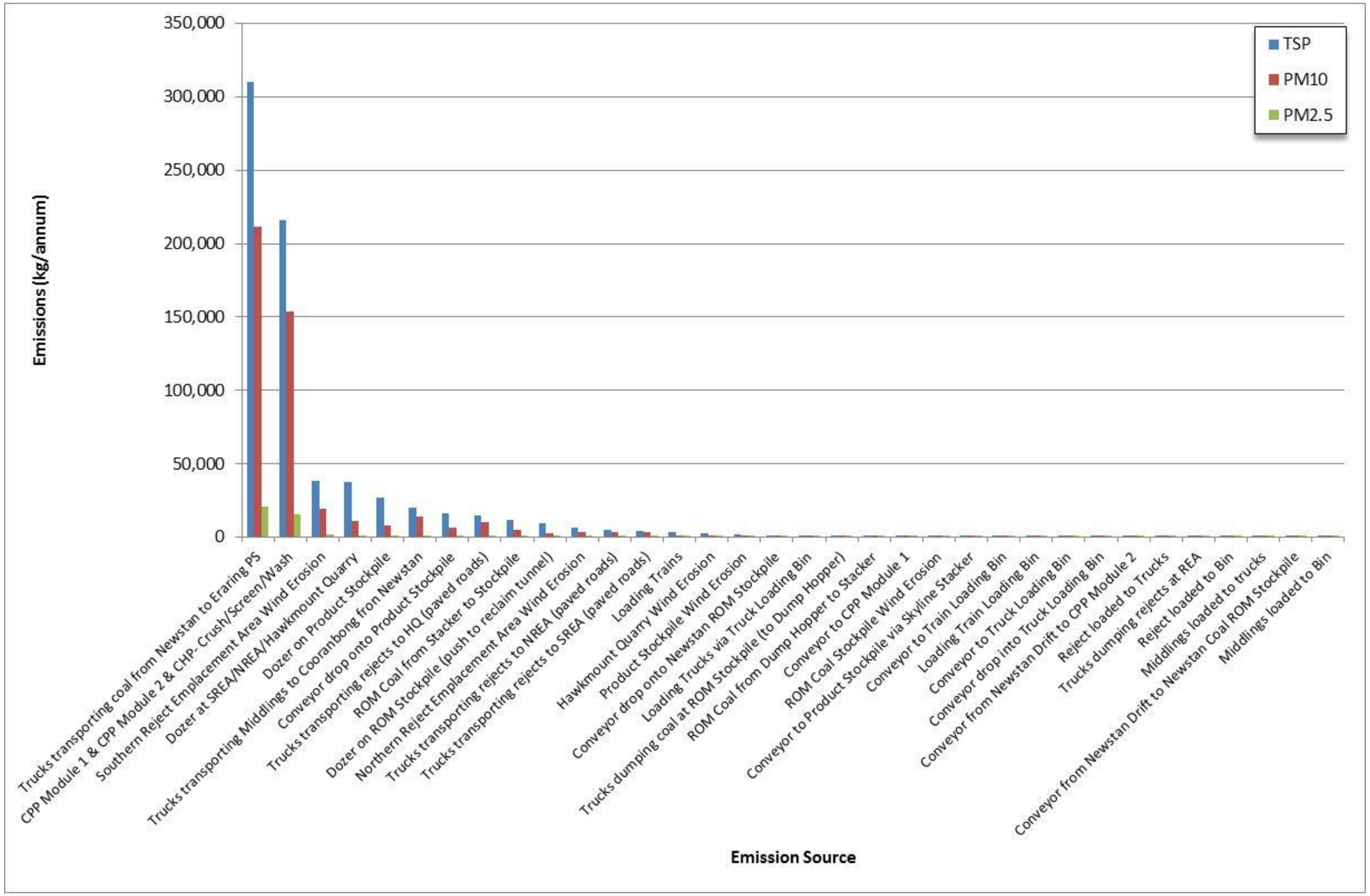
Presented in **Table 20** are the calculated particulate emissions from proposed operations at Newstan Colliery with proposed emission controls applied. These are also presented graphically in **Figure 6**.

Table 20 Controlled Annual Particulate Emissions – Newstan Colliery Proposed Operations

Emission Source	TSP Emissions (kg/year)	PM_{10} Emissions (kg/year)	$PM_{2.5}$ Emissions (kg/year)	Cumulative % Contribution to Total TSP Emissions
Trucks transporting coal from Newstan to Eraring PS	310,037	211,184	21,118	42
CPP Module 1 & CPP Module 2 & CHP-Crush/Screen/Wash	216,000	153,600	15,360	72
Southern Reject Emplacement Area Wind Erosion	38,250	19,125	1,913	77
Dozer at SREA/NREA/Hawkmount Quarry	37,308	11,355	1,136	82
Dozer on Product Stockpile	26,649	8,111	811	86
Trucks transporting Middlings to Cooranbong fron Newstan	20,105	13,694	1,369	89
Conveyor drop onto Product Stockpile	16,000	6,800	680	91
Trucks transporting rejects to HQ (paved roads)	14,877	10,134	1,013	93
ROM Coal from Stacker to Stockpile	12,000	5,100	510	95
Dozer on ROM Stockpile (push to reclaim tunnel)	9,536	2,902	290	96

Northern Reject Emplacement Area Wind Erosion	6,800	3,400	340	97
Trucks transporting rejects to NREA (paved roads)	4959.143	3377.967	337.797	98
Trucks transporting rejects to SREA (paved roads)	4,490	3,058	306	98
Loading Trains	3,200	1,360	136	99
Hawkmount Quarry Wind Erosion	2,380	1,190	119	99
Product Stockpile Wind Erosion	1,955	978	98	99
Conveyor drop onto Newstan ROM Stockpile	900	383	38	99
Loading Trucks via Truck Loading Bin	627	296	45	100
Trucks dumping coal at ROM Stockpile (to Dump Hopper)	449	212	32	100
ROM Coal from Dump Hopper to Stacker	449	212	32	100
Conveyor to CPP Module 1	449	212	32	100
ROM Coal Stockpile Wind Erosion	340	170	17	100
Conveyor to Product Stockpile via Skyline Stacker	334	158	24	100
Conveyor to Train Loading Bin	334	158	24	100
Loading Train Loading Bin	334	158	24	100
Conveyor to Truck Loading Bin	188	89	13	100
Conveyor drop into Truck Loading Bin	188	89	13	100
Conveyor from Newstan Drift to CPP Module 2	169	80	12	100
Reject loaded to Trucks	128	61	9	100
Trucks dumping rejects at REA	128	61	9	100
Reject loaded to Bin	38	18	3	100
Middlings loaded to trucks	37	17	3	100
Conveyor from Newstan Drift to Newstan Coal ROM Stockpile	19	9	1	100
Middlings loaded to Bin	11	5	1	100
TOTAL	**729,667**	**457,759**	**45,870**	**-**

Figure 6 Controlled Annual Particulate Emissions – Newstan Colliery Proposed Operations



Particulate emissions are presented by source group (wind erosion, haul roads, material handling and extraction and CHPP and coal loading operations at the CHPP and product stockpile areas) in **Table 21**.

Table 21 Controlled Particulate Emissions (Proposed)

Emission Source Group	Proposed Controlled Emissions (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$
Wind Erosion	49,725	24,863	2,486
Haul Roads	354,468	241,449	24,145
Material Handling and Extraction	109,474	37,847	3,879
CHPP and Coal Load Out	216,000	153,600	15,360
TOTAL	**729,667**	**457,759**	**45,870**

A comparison of controlled particulate emissions currently experienced at the Newstan Colliery, versus those anticipated following Project upgrade are presented in **Table 22**.

Table 22 Comparison of Controlled Particulate Emissions – Current and Proposed Operations

Emission Source Group	Existing Controlled Emissions (kg/annum)			Proposed Controlled Emissions (kg/annum)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Wind Erosion	51,952	25,976	2,598	49,725	24,863	2,486
Haul Roads	411,709	111,144	11,114	354,468	241,449	24,145
Material Handling and Extraction	257,857	55,364	5,536	109,474	37,847	3,879
CHPP and Coal Load Out	108,000	76,800	7,680	216,000	153,600	15,360
TOTAL	**829,518**	**269,284**	**26,928**	**729,667**	**457,759**	**45,870**

It is noted that particulate emissions are anticipated to increase following Project upgrade, although when examined alongside coal throughput at the site, emissions are significantly reduced per tonne coal. Using CPP throughput, emissions of TSP (kg/tonne ROM processed) are shown to be:

- 0.21 kg TSP/tonne ROM processed currently; and
- 0.09 kg TSP/tonne ROM processed following the proposed upgrade.

The distribution of particulate emissions by source indicates that at maximum approval quantities transported, emissions from haul roads are expected to be the major emission source at the Newstan Colliery, even with all haul roads being paved. Emissions from haul roads are spread over a large area and are not all contained within the Colliery Site. However, as part of this PRP assessment, all sources are assessed and potential control measures examined.

Discussion of further potential measures to mitigate particulate emissions from the Newstan Colliery is provided in **Section 3**.

2.6 Ranking of Mining Activities and Identification of Top Four PM Sources

NSW EPA requirements for the assessment of particulate control measures are provided in **Appendix A**. This advice requires the top four controlled particulate emissions sources are assessed for the feasibility of further control measures being applied.

However, further advice from the EPA has indicated that these top four sources should represent a significant proportion of mine emissions. Within this report, the assessment of further control measures has been applied to all sources which cumulatively represent 95% of total site emissions (of TSP). These sources, and the corresponding emission totals, are presented in **Table 23**. These data cover the broad emission sources of haul roads, coal processing, wind erosion from exposed areas and storage piles, the use of dozers on coal and rejects and the stacking of coal onto stockpiles.

Potential control measures to be applied to these sources are discussed in detail in **Section 3**.

Table 23 Controlled Particulate Matter Sources Representing 95% of Newstan Colliery TSP Emissions

Emission Source	TSP Emissions (kg/year)	PM_{10} Emissions (kg/year)	$PM_{2.5}$ Emissions (kg/year)	Cumulative % Contribution to Total TSP Emissions
Trucks transporting coal from Newstan to Eraring PS	310,037	211,184	21,118	42
CPP Module 1 & CPP Module 2 & CHP-Crush/Screen/Wash	216,000	153,600	15,360	72
Southern Reject Emplacement Area Wind Erosion	38,250	19,125	1,913	77
Dozer at SREA/NREA/Hawkmount Quarry	37,308	11,355	1,136	82
Dozer on Product Stockpile	26,649	8,111	811	86
Trucks transporting Middlings to Cooranbong from Newstan	20,105	13,694	1,369	89
Conveyor drop onto Product Stockpile	16,000	6,800	680	91
Trucks transporting rejects to Hawkmount Quarry (paved roads)	14,877	10,134	1,013	93
ROM Coal from Stacker to Stockpile	12,000	5,100	510	95

It is noted that the emissions calculated are based on proposed maximum activity rates. Therefore, the quantities of particulate emissions can be viewed as highly conservative. However, for the purposes of identifying potential major emission sources, the approach used is considered to be appropriate.

3 POTENTIAL CONTROL MEASURES

> ***2. Identify, quantify and justify best practice 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",*
> - *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 the emissions of TSP, PM_{10} and $PM_{2.5}$ from each mining activity after applying the measures identified in step 2.1.*
>
> *Current particulate matter controls being used at the mine must be clearly identified, quantified and justified. This means adding supporting information and evidence, including monitoring data, recorded keeping, management plans and/or operator training.*

The emission reductions quoted within this Section are generic published control factors which do not take into account the specific nature of proposed operations at Newstan Colliery. In the absence of costly site specific trials for each control measure being available, these generic factors are used to guide the selection of control measures which may be broadly appropriate for further investigation or application at the site.

Following an assessment of the feasibility of each measure (refer **Section 4**) some control measures are taken forward for an assessment of costs and benefits. Where a measure is identified as potentially providing particulate emissions reductions for a source at an acceptable cost, the implementation of the measure is committed to by Newstan Colliery, following site specific trials of the measure. These trials are essential and are proposed to:

1 Confirm particulate emissions from the source in question.

2 Confirm the potential particulate emissions reductions following control measure implementation.

It is not considered to be appropriate to commit to widespread implementation of potentially costly and ineffective particulate control measures on the basis of non-site specific data.

Trials of each control measure will be implemented within 6 months of upgrade completion, and a reassessment of the likely emission reductions afforded by each measure will be performed. Such reassessment will include field trials and data collection and analysis of control measure effectiveness.

Where measures are still identified as providing significant emission reductions at acceptable cost following these field trials, these will be implemented on a wider scale.

3.1 Haul Roads

The following haul roads have been identified as potentially generating significant quantities of particulate emissions:

- Trucks transporting coal from Newstan to Eraring power station;
- Trucks transporting middlings from Newstan to Cooranbong Entry Site; and,
- Trucks transporting rejects to Hawkmount Quarry.

As previously discussed, all roads used for the transportation of coal and reject material within site and off site will be paved and therefore a control factor of 90% has been applied (Katestone, 2011). Furthermore, control measures with unquantifiable reductions which will be employed are the use of water carts and sweepers on site and the use of the truck wheel wash prior to vehicles leaving the site.

The implementation of these control measures is considered to represent best practice. All paved haul roads at the site have been/will be designed and constructed to highway standards and therefore, any settled particulate will be washed off the roads during rain events, and collected in stormwater systems rather than be allowed to gather at the roadside. The use of the truck wheel wash at the site (and a further wheel wash at the Cooranbong Entry Site) will reduce the quantity of particulate being transported onto the road in the first instance.

Further options which help to limit emissions of particulate from these roads may include:

- Vehicle restrictions that limit the speed, weight or number of vehicles on the road.
- Replacement of roads with conveyor systems.

A summary of the potential control measures for minimising particulate emissions from paved haul roads and the corresponding estimate of their effectiveness is provided in **Table 24** (Katestone, 2011).

Table 24 Best Practice Control Measures - Haul Roads

Control Type	Control Measure	Effectiveness
Vehicle Restrictions [1]	Reduction from 75 km/hr to 50 km/hr	40-75
	Reduction from 65 km/hr to 30 km/hr	50-85
Other	Use larger vehicles rather than smaller vehicles to minimise number of trips	90t to 220t: 40% [2]
		140t to 220t: 20% [2]
		140t to 360t: 45% [2]
	Use conveyors in place of haul roads	>95%

Note: 1 Current vehicle speed limit on haul roads is 80 km/hr

Note: 2 Reductions achieved by the use of larger vehicles, conveyors and lower grader speeds have been calculated from the emission factors for these activities

SOURCE: Katestone (2011), Table 66

The use of larger vehicle relates to the use of large mining haul trucks rather than road vehicles. Currently, B-Double vehicles are used to transport coal and it is considered that given the road construction (width, turning circles etc), the use of these vehicles represents the maximum size of vehicle which could be used on these roads, and within the site. The use of larger vehicles to transport coal has therefore not been considered further within this report.

3.2 Coal Processing

Crushing and screening of coal at the upgraded Newstan site is shown to result in a significant emission of particulate matter, if operating at maximum capacity.

Katestone (2011) does not provide emission reduction factors for coal processing operations. The reduction factor of 70% applied to the uncontrolled emission rate for coal breaking, crushing and screening (**Section 2.5**) has been adopted from NPI (2011) and it is considered that enclosure of such operations is best practice.

Further control options for coal processing operations have not been considered further within this report, given that enclosure is considered to represent best practice control.

3.3 Wind Erosion

Wind erosion from the Southern Reject Emplacement Area has been identified as potentially contributing up to 5% of total site particulate emissions.

To control the generation and/or propagation of particulate emissions due to wind erosion, the following techniques have been identified as relevant to the Southern Reject Emplacement Area, including those proposed as options in the Katestone report:

- Fencing, bunding or shelterbelts to reduce near-surface wind speed and the resultant wind-shear velocity across open areas and/or overburden storage piles.
- The temporary revegetation of exposed areas to minimise emissions of particulate matter from areas that may be exposed for an extended period of time.
- Rehabilitation of land after use by revegetation and land contouring to produce the final post-mining land form.
- Surface watering to reduce weathering through increased soil particle cohesion, and the suppression of dust emissions.
- The addition of chemical suppressants to minimise surface dust emission ('lift-off').

The Reject Emplacement Areas are currently rehabilitated as soon as practicable with a minimum of 100 mm of inert material, and revegetated (refer **Table 12**). This practice will continue following Project upgrade.

A summary of the potential control measures for minimising particulate emissions from wind erosion in exposed areas, and their effectiveness, is provided in **Table 25**, reproduced from Katestone (2011).

Table 25 Best Practice Control Measures – Wind Erosion of Exposed Areas

Control Type	Control Measure	Effectiveness
Surface stabilisation	Watering	50%
	Chemical suppressants	70%
Wind speed reduction	Fencing, bunding or shelterbelts. Height should be greater than the height of the erodible surface	30%

SOURCE: Katestone (2011), Table 71

3.4 Bulldozers

The operation of bulldozers on the product coal stockpile and on rejects at the Reject Emplacement Areas has been identified as contributing up to 8% of total site TSP emissions.

Katestone (2011) presents a comprehensive summary of an options appraisal conducted by Connell Hatch for the control of particulate emissions from bulldozers at the RG Tanna Coal Terminal. Options considered in the study included:

- Minimising travel speed and travel distance.
- Stabilising bulldozer travel routes and use of water or suppressants on travel routes.
- Manage coal moisture to ensure coal is sufficiently moist when working.
- Modify design of the bulldozer to minimise emissions.

Based upon the data available, the emission of particulate from bulldozer operation can only be quantified by hours of operation, and not the speed of the vehicles.

A summary of the potential control measures for minimising particulate emissions from bulldozers, and their effectiveness, is provided in **Table 26** (Katestone, 2011).

Table 26 Best Practice Control Measures – Bulldozers

Control Measure		Effectiveness
Bulldozer	Minimise travel speed and distance	Not quantified
	Keep travel routes and materials moist	50%

SOURCE: Katestone (2011), Table 76

The maintenance of moisture content on stockpiles is currently and will be implemented post-upgrade as water sprays are used to keep the product moist. Therefore, the control measures for bulldozers on the product stockpile are considered to represent best practice. Further control measures for this source are not considered further within this report.

The measure is considered for the operation of bulldozers on the Reject Emplacement Areas (NREA, SREA and Hawkmount Quarry).

3.5 Loading Coal to Stockpiles by Conveyor

Stacking of coal (ROM and Product) to stockpiles has been calculated to potentially result in approximately 4% of total site TSP emissions.

Stacking of coal on stockpiles can produce particulate emissions due to the turbulence induced by dropping coal from height. Emissions of particulate are enhance when there is a significant cross wind present.

The measures outlined in **Table 27** can applied to minimise emissions of particulate matter from stacking.

Table 27 Best Practice Control Measures – Coal Stacking

Control Type	Control Measure	Effectiveness
Avoidance	Bypass Coal Stockpiles	100% reduction for bypassing coal; stacker
Loading Stockpiles	Variable height stack	25%
	Boom tip water sprays	50%
	Telescopic chute with water sprays	75%

SOURCE: Katestone (2011), Table 97

Water sprays are currently proposed for the stacking of coal, both on the stockpile surface and on the transfer tip point and are not considered further within this report

3.6 Quantification of Potential Particulate Management Measures

Table 28 presents the emission control factors assumed in this assessment for the potential particulate management measures identified.

Table 28 Control Factors Assumed for Potential Control Measures

Emission Source	Control Measure	Control Effectiveness (%)
Paved Haul Roads	Vehicle Speed Reduction from 75 km/hr to 50 km/hr	40-75
	Vehicle Speed Reduction from 65 km/hr to 30 km/hr	50-85
	Use conveyors in place of haul roads	>95%
Bulldozer on Rejects	Keep travel routes and materials moist	50%
Wind Erosion of Exposed Areas	Watering	50%
	Chemical suppressants	70%
	Fencing, bunding or shelterbelts. Height should be greater than the height of the erodible surface	30%
Stockpile Loading by Stacker	Bypass Coal Stockpiles	100% reduction for bypassing coal; stacker
	Variable height stack	25%
	Telescopic chute with water sprays	75%

Note: Where a range of control efficiency is quoted, the lower value is used within this assessment.
Although haul road speed is currently 80 km/hr, control factor for speed reduction from 75 km/hr to 50 km/hr assumed to be applicable.

In **Table 29** to **Table 34**, the reported "*Emissions (Controlled)*" refer to the TSP, PM_{10} and $PM_{2.5}$ emission estimates presented in **Table 23** (post upgrade).

Table 29 Estimated Emissions Trucks Transporting Coal to Eraring PS – Potential Controls

Emission Source	Control Option	Reduction Efficiency (%)	Reference	Emissions (Controlled)			Emissions (Controlled) plus Further Control		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Trucks transporting coal from Newstan to Eraring PS	Vehicle Speed Reduction from 75 km/hr to 50 km/hr	40	Katestone (2011)	310,037	211,184	21,118	186,022	126,711	12,671
	Vehicle Speed Reduction from 65 km/hr to 30 km/hr	50	Katestone (2011)				155,018	105,592	10,559
	Use conveyors in place of haul roads	95	Katestone (2011)				15,502	10,559	1,056

Table 30 Estimated Emissions Trucks Transporting Middlings to Cooranbong – Potential Controls

Emission Source	Control Option	Reduction Efficiency (%)	Reference	Emissions (Controlled)			Emissions (Controlled) plus Further Control		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Trucks transporting Middlings to Cooranbong from Newstan	Vehicle Speed Reduction from 75 km/hr to 50 km/hr	40	Katestone (2011)	20,105	13,694	1,369	12,063	8,217	822
	Vehicle Speed Reduction from 65 km/hr to 30 km/hr	50	Katestone (2011)				10,052	6,847	685
	Use conveyors in place of haul roads	95	Katestone (2011)				1,005	685	68

Table 31 Estimated Emissions Trucks Transporting Rejects to Hawkmount Quarry – Potential Controls

Emission Source	Control Option	Reduction Efficiency (%)	Reference	Emissions (Controlled)			Emissions (Controlled) plus Further Control		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Trucks transporting Rejects to Hawkmount Quarry	Vehicle Speed Reduction from 75 km/hr to 50 km/hr	40	Katestone (2011)	14,877	10,134	1,013	8,926	6,080	608
	Vehicle Speed Reduction from 65 km/hr to 30 km/hr	50	Katestone (2011)				7,439	5,067	507
	Use conveyors in place of haul roads	95	Katestone (2011)				744	507	51

Table 32 Estimated Emissions Dozers Operating at Reject Emplacement Areas – Potential Controls

Emission Source	Control Option	Reduction Efficiency (%)	Reference	Emissions (Controlled)			Emissions (Controlled) plus Further Control		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Dozer at Reject Emplacement Areas	Keep travel routes and materials moist	50	Katestone (2011)	37,308	11,355	1,136	18,654	5,678	568

Table 33 Estimated Emissions Wind Erosion at SREA – Potential Controls

Emission Source	Control Option	Reduction Efficiency (%)	Reference	Emissions (Controlled)			Emissions (Controlled) plus Further Control		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Southern Reject Emplacement Area Wind Erosion	Watering	50	Katestone (2011)	38,250	19,125	1,913	19,125	9,563	956
	Chemical suppressants	70	Katestone (2011)				11,475	5,738	574
	Fencing, bunding or shelterbelts. Height should be greater than the height of the erodible surface	30	Katestone (2011)				26,775	13,388	1,339

Table 34 Estimated Emissions Conveyor Drop onto ROM Stockpile – Potential Controls

Emission Source	Control Option	Reduction Efficiency (%)	Reference	Emissions (Controlled)			Emissions (Controlled) plus Further Control		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
ROM Coal from Stacker to Stockpile	Bypass Coal Stockpiles	100	Katestone (2011)	12,000	5,100	510	0	0	0
	Variable height stack	25	Katestone (2011)				9,000	3,825	383
	Telescopic chute with water sprays	75	Katestone (2011)				3,000	1,275	128

A comparison of emissions following each control measure application against post upgrade (with already proposed controls) emissions of particulate are presented in **Figure 7** to **Figure 12**.

Figure 7 Potential Reductions in PM Emissions due to Additional Controls Haulage on Newstan to Eraring Haul Road

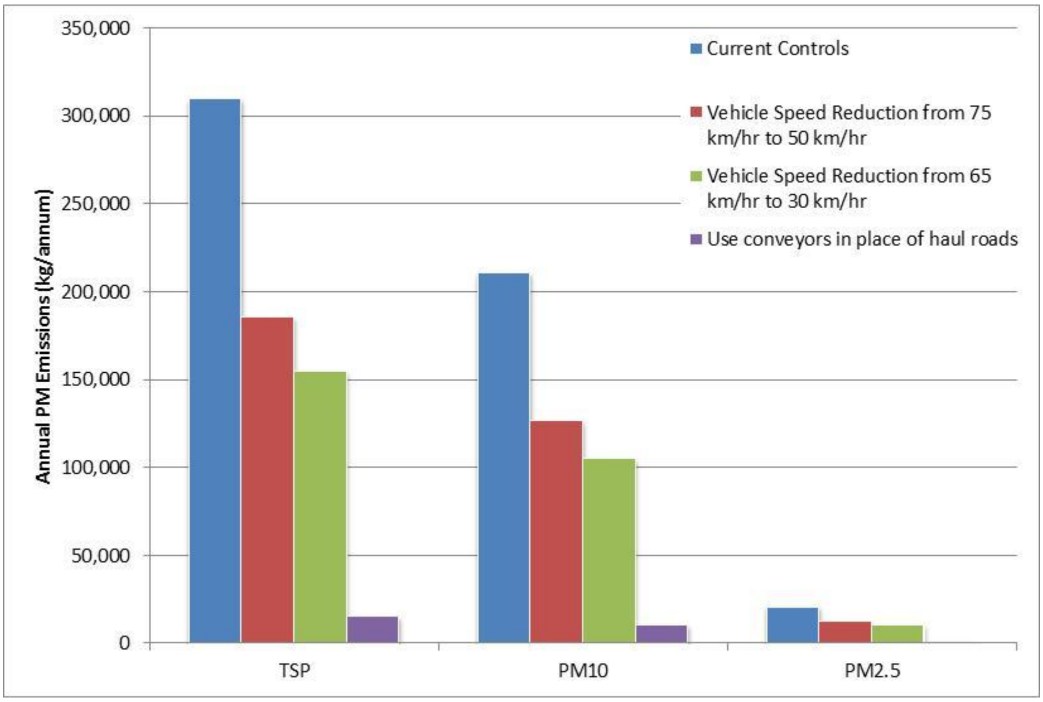


Figure 8 Potential Reductions in PM Emissions due to Additional Controls Haulage (Middlings) from Cooranbong to Newstan

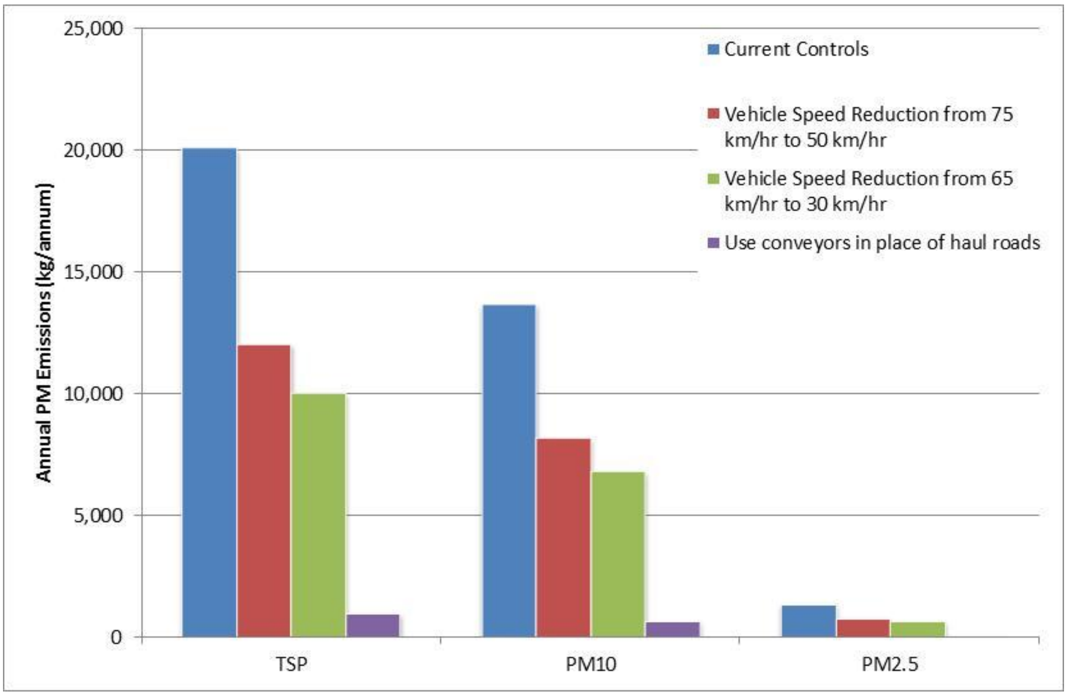


Figure 9 Potential Reductions in PM Emissions due to Additional Controls Haulage – Transport of Rejects to Hawkmount Quarry

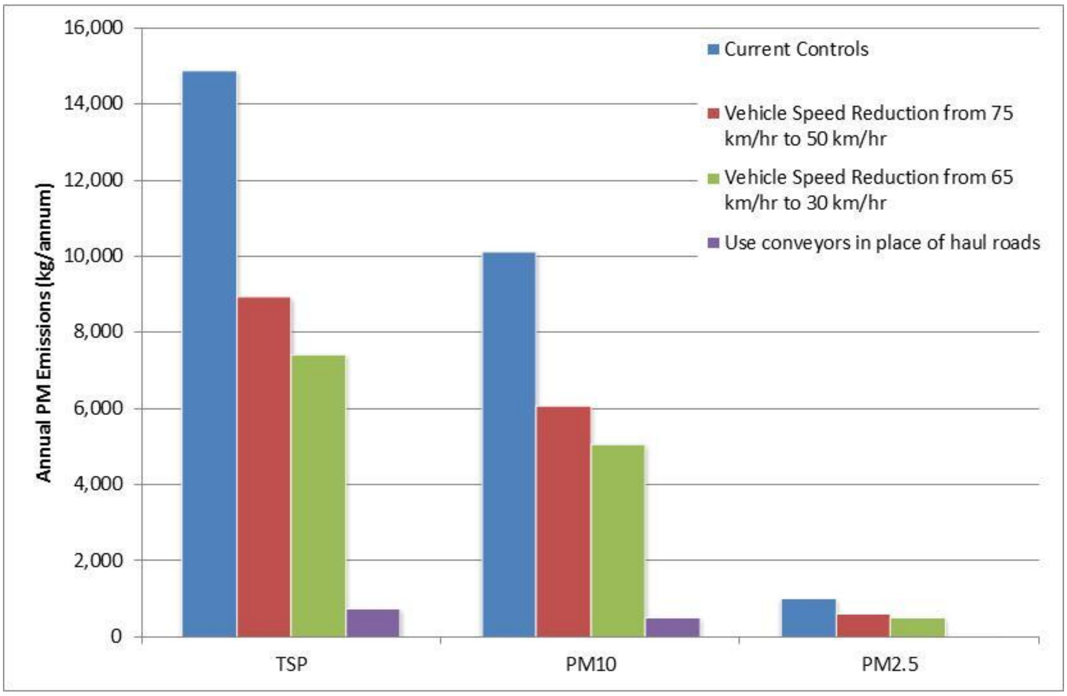


Figure 10 Potential Reductions in PM Emissions due to Additional Controls Dozer on Rejects

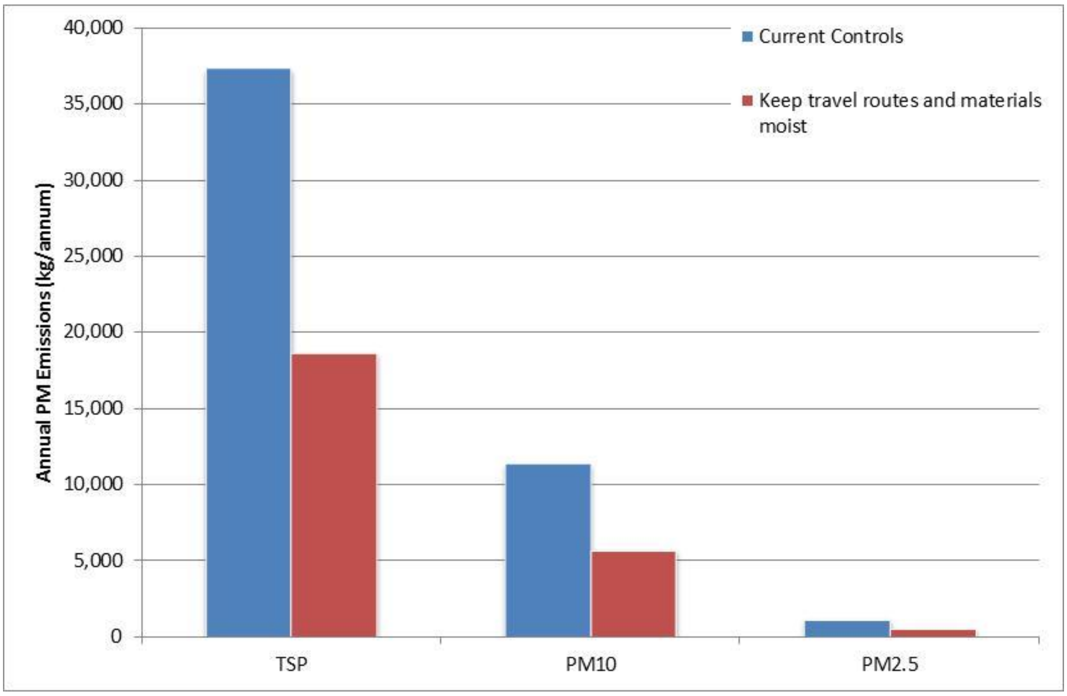


Figure 11 Potential Reductions in PM Emissions due to Additional Controls Wind Erosion at SREA

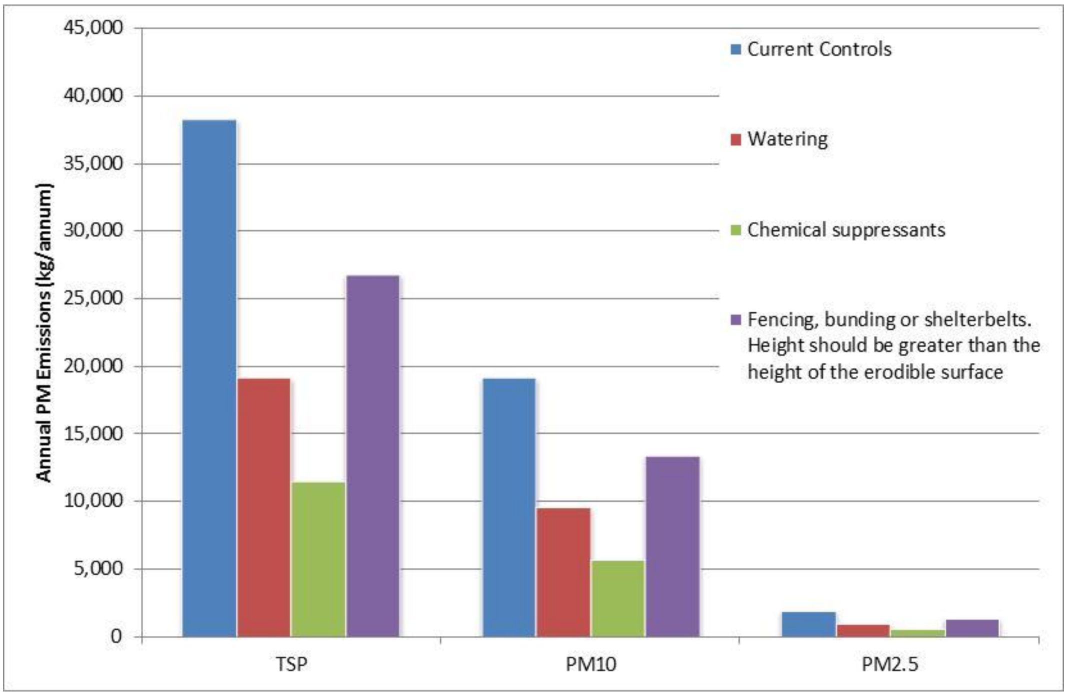
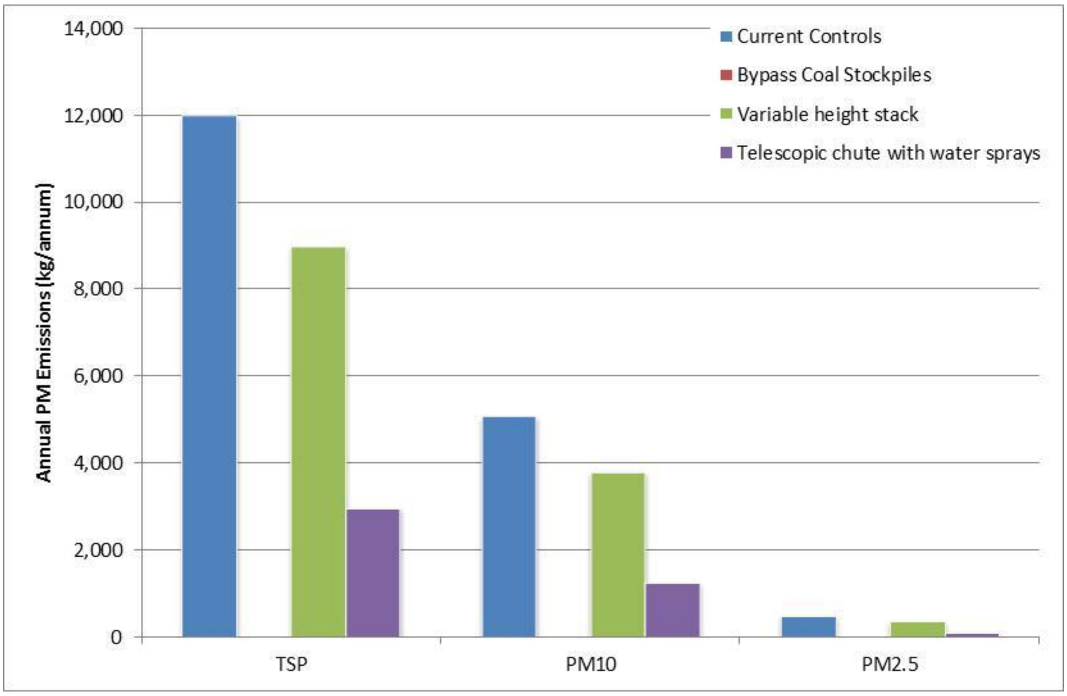


Figure 12 Potential Reductions in PM Emissions due to Additional Controls ROM Coal from Stacker to Stockpile



4 EVALUATION OF ADDITIONAL CONTROL MEASURES

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 how practicable each one is to implement 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.

As required by EPA, the practicability of implementing each of the particulate control options identified in **Section 3** is to be assessed with due consideration given to:

- implementation costs.
- regulatory requirements.
- environmental impacts.
- safety implications.
- compatibility with current processes and proposed future developments.

The following sections examine the measures that may constrain the implementation of the particulate control measures outlined in **Table 28,** namely the regulatory requirements, environmental impacts, safety implications and compatibility with current processes and future development.

Each measure is provided a risk rating (**low**, **medium** or **high**) which identifies the constraints which may result in the implementation of the measure not being practical at Newstan Colliery. Where any of the four measures of practicability are rated as high, these measures are not taken forward for an assessment of cost implication and feasibility.

Section 4.1 examines the potential control measures identified for haul road sources, **Section 4.2** for operation of bulldozers on coal and reject material, **Section 4.3** for wind erosion of exposed areas and **Section 4.4** for the loading of stockpiles by stacker.

4.1 Evaluation Findings – Haul Roads

4.1.1 Practicality of Implementation

Table 35 provides a discussion of the feasibility of control measures for haul roads.

Table 35 Practicability of Implementing Control Measures on Haul Roads

Control Measure – Haul Roads	Regulatory Requirements RISK	Environmental Impacts RISK	Safety Implications RISK	Compatibility with Current Processes and Future Developments RISK	Conclusions of Evaluation
Vehicle Speed Reductions	RISK = LOW No adverse impacts	RISK = LOW No adverse impacts	RISK = LOW No adverse impacts	RISK = HIGH Lowering vehicle speeds on roads is not considered to be practicable given that lowering speeds would require a doubling of vehicles to maintain the coal supply rate.	✘ Not considered further in this assessment
Use conveyors in place of haul roads	RISK = LOW Already considered for existing conveyors	RISK = HIGH Given that paved haul roads are already in use between the Newstan site and the REA and Cooranbong Entry Sites, the removal of these significant quantities of material and replacement with conveyors is clearly not sustainable.	RISK = LOW Already considered for existing conveyors	RISK = HIGH Further changes in potential future waste emplacement areas etc would potentially require costly changes in conveyor routes and infrastructure.	✘ Not considered further in this assessment

All roads at the Newstan Colliery and between the Colliery and the Cooranbong Entry Site, Reject Emplacement Areas and Eraring Power Station are sealed and as such, this control measure is considered to represent best practice. Consideration of further particulate control measures have been shown not to be practicable and these measures are not considered further within this report.

4.2 Evaluation Findings – Bulldozers on Reject Material

4.2.1 Practicality of Implementation

Table 37 provides a discussion of the feasibility of control measures for the operation of bulldozers on reject material.

Table 36 Practicability of Implementing Control Measures for the Operation of Bulldozers on Reject Material Wind Eroded Areas – Overburden Dumps

Control Measure – Wind Erodible Areas	Regulatory Requirements RISK	Environmental Impacts RISK	Safety Implications RISK	Compatibility with Current Processes and Future Developments RISK	Conclusion of Evaluation
Keep Travel Routes and Material Moist	RISK = LOW Ensure that run off is appropriately captured, filtered and discharged or recycled to on-site dams	RISK = LOW Ensure that run off is appropriately captured, filtered and discharged or recycled to on-site dams	RISK = MEDIUM Ensure electrical equipment is appropriately isolated. Ensure mists and sprays do not hinder mobile equipment operator vision	RISK = LOW Compatible	✓ Adopted potential measure **BD1**

4.2.2 Implementation Costs

As required by EPA, the cost implication of each potential particulate control measure has been assessed, taking into account (where applicable):

- Estimated capital expenditure.
- Labour costs.
- Material costs.
- Potential cost savings.

An estimation of the cost and net cost per tonne of TSP, PM_{10} and $PM_{2.5}$ suppressed is provided for each mitigation measure **APPENDIX C**.

4.3 Evaluation Findings – Wind Erosion of Exposed Areas

4.3.1 Practicality of Implementation

Table 37 provides a discussion of the feasibility of control measures for wind erosion of exposed areas at the Southern Reject Emplacement Area.

Table 37 Practicability of Implementing Control Measures on Wind Eroded Areas – Overburden Dumps

Control Measure – Wind Erodible Areas	Regulatory Requirements RISK	Environmental Impacts RISK	Safety Implications RISK	Compatibility with Current Processes and Future Developments RISK	Conclusion of Evaluation
Watering	RISK = LOW Ensure that run off is appropriately captured, filtered and discharged or recycled to on-site dams	RISK = LOW Ensure that run off is appropriately captured, filtered and discharged or recycled to on-site dams	RISK = MEDIUM Ensure electrical equipment is appropriately isolated. Ensure mists and sprays do not hinder mobile equipment operator vision	RISK = LOW Compatible	✓ Adopted potential measure **WE1**
Chemical suppressants	RISK = LOW Ensure all chemicals are registered on-site with relevant MSDS at Stores	RISK = LOW Ensure that application rate is appropriate to avoid run off into watercourses. Ensure application is performed during appropriate meteorological conditions to avoid wash/blow off onto other areas Based on the MSDS, a spill management program should be formulated.	RISK = MEDIUM Appropriate PPE required for water truck operative, and personnel involved in the mixing of suppressants with water (if required). If onsite storage required, appropriate signage required and emergency management plan required in event of spill/leakage	RISK = LOW Compatible	✓ Adopted potential measure **WE2**
Fencing, bunding, shelterbelts or in-pit dump.	RISK = LOW None	RISK = LOW None	RISK = LOW None	RISK = HIGH Not compatible – erection of fences would hinder the transport and dumping of rejects. Fences would likely be continuously knocked down and require constant relocation.	✘ Not considered further in this assessment

4.3.2 Implementation Costs

As required by EPA, the cost implication of each potential particulate control measure has been assessed, taking into account (where applicable):

- Estimated capital expenditure.
- Labour costs.
- Material costs.
- Potential cost savings.

An estimation of the cost and net cost per tonne of TSP, PM_{10} and $PM_{2.5}$ suppressed is provided for each mitigation measure **APPENDIX C**.

4.4 Evaluation Findings – Stockpile Loading

4.4.1 Practicality of Implementation

Table 38 provides a discussion of the feasibility of control measures for loading of coal stockpiles.

Table 38 Practicability of Implementing Control Measures for Stockpile Loading

Control Measure – Wind Erodible Areas	Regulatory Requirements RISK	Environmental Impacts RISK	Safety Implications RISK	Compatibility with Current Processes and Future Developments RISK	Conclusion of Evaluation
Bypassing stockpiles	RISK = LOW None	RISK = LOW None	RISK = LOW None	RISK = HIGH Not compatible. Storage areas are required for periods when coal cannot be accepted at the CHP or loaded to trains .	✘ Not considered further in this assessment
Variable Height Stacker	RISK = LOW None	RISK = LOW None	RISK = LOW None	RISK = HIGH A skyline stacker is proposed to be constructed to traverse the stockpile. A variable height stacker is not compatible with such a large stockpile.	✘ Not considered further in this assessment
Telescopic Chute with Water Sprays	RISK = LOW None	RISK = LOW None	RISK = LOW None	RISK = HIGH A skyline stacker is proposed to be constructed to traverse the stockpile. A telescopic chute is not compatible. Water sprays to be installed on skyline stacker.	✘ Not considered further in this assessment

NB * Measures combined with identical control factors, activity rates and risks

4.4.2 Implementation Costs

As required by EPA, the cost implication of each potential particulate control measure has been assessed, taking into account (where applicable):

- Estimated capital expenditure.
- Labour costs.
- Material costs.
- Potential cost savings.

An estimation of the cost and net cost per tonne of TSP, PM_{10} and $PM_{2.5}$ suppressed is provided for each mitigation measure **APPENDIX C**.

4.5 Summary of Evaluation Findings

A summary of the evaluation process for each control measure identified in **Section 4** is presented in **Table 39**. Any control options rated as high risk for any of the feasibility considerations (regulatory considerations, environmental impacts, safety implications or site compatibility) have not been evaluated for their implementation costs, and are not presented in this summary table.

Table 39 Summary of Control Options Evaluation

Emission Source	Control Measure	Regulatory Considerations	Environmental Impacts	Safety Implications	Site Compatibility
Bulldozers on Reject Material	BD1: Keep Travel Routes and Material Moist	Low	Low	Medium	Low
Wind Erosion of Southern Reject Emplacement Area	WE1: Watering	Low	Low	Medium	Low
	WE2: Chemical suppressants	Low	Low	Medium	Low

4.6 Identification of Dust Control Measures for Newstan Colliery

The methodology followed above is consistent with the broad outline methodology proposed by NSW EPA, which is reproduced in **Appendix A**.

Through the adoption of this procedure, Newstan Colliery's emissions of particulate matter have been quantified with and without the range of existing control measures implemented on-site, and anticipated emissions following a major proposed upgrade have been assessed to identify the top sources contributing to the cumulative 95% of TSP emitting sources identified.

The particulate control measures that are already implemented at Newstan Colliery are summarised in **Table 12**. Further proposed dust mitigation measures to be implemented following Project upgrade are also presented in **Table 19**. It is noted that through the implementation of current controls, the monitoring undertaken around the Newstan Colliery demonstrates that the air quality criteria outlined in Project Approval conditions (refer to **Table 6**) are not exceeded. In this regard, it may be determined that the current controls implemented at the Newstan Colliery and the additional controls proposed to be implemented through the upgrades proposed by the Coal Logistics Project are adequate in controlling the impact of the mining operations and demonstrates compliance with the Project Approval and EPL conditions concerning the control of particulate emissions.

However, it is acknowledged that this process is designed to determine further controls which may assist in reducing particulate matter emissions from Newstan Colliery as far as practicable. A range of additional control options for the processes operated at Newstan Colliery has been investigated. All identified control options have been assessed to account for the risk associated with compliance with regulatory requirements, the potential environmental impacts, safety implications and their compatibility with current processes and future developments approved or anticipated at the Newstan Colliery. Through this initial screening, any options that were considered to be high risk for the above measures were discounted, resulting in a range of three measures for which implementation costs were estimated.

The cost estimates have been prepared with reference to published and referenced data sources, experience or estimates from Newstan Colliery and a range of assumptions. All assumptions have been provided for clarification and transparency.

This analysis has identified that all control options providing a significant potential to reduce the total emission of particulates from all sources at site are shown to have an excessive cost (>$20,000/tonne PM_{10} suppressed – refer **Appendix C**).

The proposed upgrade to the coal handling, transport and storage infrastructure at the Newstan Colliery (as part of the Coal Logistics Project) is a major upgrade to the site and as discussed in **Section 2.6** will result in the reduction of particulate emissions per tonne ROM coal handled. The particulate control measures to be implemented as part of this upgrade (e.g. truck wheel wash, skyline stackers, ROM dump hopper) are not financially inconsequential improvements and it is therefore considered that the implementation of these measures will be considered to represent best practice particulate control once installed.

Given the above, it is not considered to be appropriate at this time to commit to further excessively costly particulate reduction measures.

5 IMPLEMENTATION TIMEFRAME

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.

As discussed in **Section 4**, a range of particulate control measures have been assessed for cost effectiveness. All measures which were identified as being potentially compatible with site operations, environmental considerations, safety and regulatory risk were taken forward for detailed costing. However, it has been shown that none of the three measures taken forward for costing will provide particulate reductions at a reasonable cost. All measures are shown to have associated costs of >$20K per tonne PM_{10} suppressed.

Given the major costs of the proposed Project upgrade, upgrades which are shown to result in a reduction in site particulate emissions (per tonne ROM coal handled), further costs are not considered to represent value for money in terms of particulate suppression and have not been committed to.

6 REFERENCES

- Countess Environmental (2006), WRAP Fugitive Dust Handbook.
- Katestone (2010), NSW Coal Mining Benchmarking Study - International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining.
- US Department of Health and Human Services (2012), Dust Control Handbook for Industrial Minerals Mining and Processing.
- 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.
- 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
- USEPA (1982), AP 42, Chapter 11.24 Metallic Minerals Processing, 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
- 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
- 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.
- 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.
- DCCEE (2011), National Pollutant Inventory Emission Estimation Technique Manual for Mining , Version 3, Australian Government Department of Sustainability, Environment, Water, Population and Communities.
- Newstan Colliery (2011), Annual Environmental Management Report

7 CLOSURE

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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

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 - Assessment and Report*".

THE SITE SPECIFIC DETERMINATION PROCESS

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

5. ***Identify, quantify and justify existing measures that are being used to minimise particle emissions***
   5.1. 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;
   - 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).
   5.2. 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.
   5.3. Identify the top four mining activities from Step 1.2 that contribute the highest emissions of TSP, PM_{10} and $PM_{2.5}$.

6. ***Identify, quantify and justify best practice measures that could be used to minimise particle emissions***
   6.1. For each of the top four activities identified in Step 1.3, identify the best practice measures that could be implemented to reduce emissions taking into consideration:
   - the findings of Katestone (2010), *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. http://www.environment.nsw.gov.au/resources/air/KE1006953coalminebmpreport.pdf ;
   - any other relevant published information; and
   - any relevant industry experience from either Australia or overseas.

   6.2. 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 best practice measures identified in Step 2.1.

7. ***Evaluate the practicability of implementing these best practice measures***
   7.1. 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.

   7.2. Identify those best practice measures that will be implemented at the premises to reduce particle emissions.
8. ***Propose a timeframe for implementing all practicable best practice measures***
   8.1. 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;
- 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
- 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

Bulldozing coal

The emission factors for bulldozing coal are taken from Table 11.9-2 of Chapter 11.9 of AP-42 (USEPA, 1998):

$$TSP\ (kg/hr) = \frac{35.6(s)^{1.2}}{(M)^{1.3}}$$

$$PM_{10}\ (kg/hr) = \left(\frac{8.44(s)^{1.5}}{(M)^{1.4}}\right) \times 0.75$$

$$PM_{2.5}\ (kg/hr) = \left(\frac{35.6(s)^{1.2}}{(M)^{1.3}}\right) \times 0.022$$

Where M is equal to the coal moisture content and s is equal to the coal silt content.

Front end loaders and excavators on coal and overburden

Specific emission factors for the operation of front end loaders and excavators on coal and overburden are not provided within AP-42. However, a default factor for TSP of 0.018 kg/t is provided in Table 11.9-4 of Chapter 11.9 of AP-42 (USEPA, 1998) for the activity of "truck loading by power shovel (batch drop)". The note provided with this figure however, encourages the user to make use of the predictive emission factor equations in Chapter 13 of AP-42 instead.

The quantity of particulate emissions (kg) generated by a batch drop process (per tonne) (e.g. a truck dumping to a storage pile, or loading out from a pile to a truck) may be estimated using the following expression:

$$EF\ (kg/t) = k\ \times 0.0016\ \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where EF is the emission factor for TSP, PM_{10} or $PM_{2.5}$, k is the aerodynamic size multiplier (0.74 for TSP, 0.35 for PM_{10} and 0.053 for $PM_{2.5}$), U is the mean wind speed in m/s and M is the moisture content of coal and overburden.

An average wind speed of 1.9 m/s has been adopted for the Newstan Colliery, based on onsite meteorological monitoring for calendar year 2011.

Material transfer of coal by conveyor

Specific emission factors for the transfer of material by conveyor at transfer points are not provided within AP-42. The Environment Australia Document "*National Pollutant Inventory for Mining (Version 3.0)*" (June, 2011) identifies that emissions of particulates at miscellaneous transfer points (including conveying) are estimated using the same emission factor as outlined in **Front end Loaders and excavators on coal** and this emission factor has been adopted within this report, using specific information for coal.

Loading coal stockpiles

See **Front end Loaders and excavators on coal**.

Wind erosion of coal stockpiles and overburden/disturbed areas

Emission Factors

The emission factors for wind erosion of coal stockpiles and overburden are taken from Table 11.9-2 of Chapter 11.9 of AP-42 (USEPA, 1998).

$$TSP\ (kg/ha/hr) = 1.8u$$

Where ***u*** is equal to the wind speed (m/s). Hourly wind speed data from the Newstan Colliery for 8,760 hours monitored during 2008 has been adopted.

Based on this data, an emission rate of TSP of 37,882 kg/ha/yr has been applied within this assessment. This equates to an average emission rate of 4 kg/ha/hr.

As discussed in Section **2.1**, the application of the AP-42 emission factor equation relating to industrial wind erosion of overburden (Chapter 13.2.5) yielded unrealistic emissions when the threshold friction velocity for overburden (and coal dust) was applied. Therefore the emission factor for coal stockpiles has been applied to all areas subject to wind erosion.

No emission factors for PM_{10} are provided for this emission source within Table 11.9-2 of Chapter 11.9 of AP-42. An assumption that 50% of the TSP is emitted as PM_{10} has been adopted for the purposes of this assessment. This is in line with the PM_{10}/TSP ratio quoted within the "*National Pollutant Inventory for Mining (Version 3.0)*" (June, 2011) for wind erosion sources.

Certain emission factors contained within the US EPA emission factor handbook AP-42 do not contain emission factors for $PM_{2.5}$ as often little validated research has been undertaken to assess the fraction of PM_{10} which would be emitted as $PM_{2.5}$ from the wide range of sources involved.

Limited research has been conducted by the Midwest Research Institute (MRI) on behalf of the Western Regional Air Partnership (WRAP) with findings published within the document entitled *'Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors'* (MRI, 2006). This document provides seven proposed $PM_{2.5}$/PM_{10} ratios for fugitive dust source categories as presented in **Table 40**.

Table 40 Proposed $PM_{2.5}$ / PM_{10} Particle Size Ratios

Fugitive Dust Source	AP-42 Section	Proposed $PM_{2.5}$ / PM_{10} Ratio
Paved Roads	13.2.1	0.15
Unpaved Roads	13.2.2	0.1
Aggregate Handling and Storage Piles	13.2.4	0.1
Industrial Wind Erosion	13.2.5	0.15
Open Area Wind Erosion	-	0.15

The $PM_{2.5}$ / PM_{10} ratios presented in **Table 40** have been used within this report to calculate the emissions of $PM_{2.5}$ attributable to the activities occurring at Newstan Colliery, where specific $PM_{2.5}$ emission factors or scaling factors are not provided.

Coal crushing and screening

Emission factors for coal crushing are not provided specifically in AP-42 but are taken from AP-42 Chapter 11.24 Metallic Minerals Processing (1982). This approach is also taken within the National Pollutant Inventory for Mining (Version 3.0, June 2011).

Of relevance to this report are emission factors relating to primary coal crushing of high moisture (>4% by weight) coal and coal screening. Default emission factors for TSP and PM_{10} are provided for coal crushing as:

$$TSP\ (kg/t) = 0.01$$

$PM_{10}\ (kg/t) = 0.004$

And for screening as:

$TSP\ (kg/t) = 0.08$

$PM_{10}\ (kg/t) = 0.06$

Loading coal to trains

The emission factors for loading coal to trains are taken from Table 11.9-4 of Chapter 11.9 of AP-42 (USEPA, 1998):

$TSP\ (kg/t) = 0.014$

No PM_{10} or $PM_{2.5}$ emission factors are available for this source within AP-42, and as previously discussed, the PM_{10} emission factor is derived by applying a factor of 0.5 to the TSP emission factor whilst the emission factor for $PM_{2.5}$ is derived by applying the appropriate ratio of 0.1 (refer **Table 40**) to the PM_{10} emission factor. Resulting emission factors for PM_{10} and $PM_{2.5}$ are presented below.

$PM_{10}\ (kg/t) = 0.007$

$PM_{2.5}\ (kg/t) = 0.0007$

Loading coal to trucks

The emission factors for loading coal to trucks are taken from Table 11.9-2 of Chapter 11.9 of AP-42 (USEPA, 1998):

$$TSP\ (kg/t) = \frac{0.58}{(M)^{1.2}}$$

$$PM_{10}\ (kg/t) = \frac{0.0596}{(M)^{0.9}} \times 0.75$$

$$PM_{2.5}(kg/t) = \frac{0.58}{(M)^{1.2}} \times 0.019$$

Where M equals the material moisture content.

Bulldozing overburden

The emission factors for bulldozing overburden are taken from Table 11.9-2 of Chapter 11.9 of AP-42 (USEPA, 1998):

$$TSP\ (kg/hr) = \frac{2.6(s)^{1.2}}{(M)^{1.3}}$$

$$PM_{10}\ (kg/hr) = \left(\frac{0.45(s)^{1.5}}{(M)^{1.4}}\right) \times 0.75$$

$$PM_{2.5}\ (kg/hr) = \left(\frac{2.6(s)^{1.2}}{(M)^{1.3}}\right) \times 0.105$$

Where M is equal to the coal moisture content and s is equal to the coal silt content.

Loading and dumping of overburden

The emission factors for loading and dumping of overburden are taken from Table 11.9-4 of Chapter 11.9 of AP-42 (USEPA, 1998):

$$TSP\ (kg/t) = 0.001$$

No PM_{10} or $PM_{2.5}$ emission factors are available for this source within AP-42, and as previously discussed, the PM_{10} emission factor is derived by applying a factor of 0.5 to the TSP emission factor whilst the emission factor for $PM_{2.5}$ is derived by applying the appropriate ratio of 0.1 (refer **Table 40**) to the PM_{10} emission factor. Resulting emission factors for PM_{10} and $PM_{2.5}$ are presented below.

$$PM_{10}\ (kg/t) = 0.0005$$

$$PM_{2.5}\ (kg/t) = 0.00005$$

Wheel generated particulates on unpaved roads

The emission factors per vehicle kilometre travelled (VKT) for vehicles travelling on unpaved roads are taken from Chapter 13.2.2 of AP-42 (USEPA, 2006).

$$EF\ (kg/VKT) = k \times \left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b}$$

Where *EF* is the emission factor for TSP, PM_{10} or $PM_{2.5}$, k is the aerodynamic size multiplier (4.9 for TSP, 1.5 for PM_{10} and 0.15 for $PM_{2.5}$), *s* is the silt content of the road (%). *W* is the average weight of vehicles travelling on the road (in tonnes) and *a* and *b* are empirical constants (for TSP, *a* = 0.7 and 0.9 for PM_{10} and $PM_{2.5}$, *b* = 0.45 for TSP, PM_{10} and $PM_{2.5}$). A conversion from lb/VKT to kg/VKT is also applied where 1 lb = 281.9 g).

Graders operating on unpaved roads

The emission factors for graders is taken from Table 11.9-2 of Chapter 11.9 of AP-42 (USEPA, 1998):

$$TSP\ (kg/VKT) = 0.0034 \times (S)^{2.5}$$

$$PM_{10}\ (kg/VKT) = 0.0056 \times (S)^{2.0} \times 0.6$$

$$PM_{2.5}\ (kg/VKT) = 0.0034 \times (S)^{2.5} \times 0.031$$

Where *S* is equal to the silt content of roads.

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