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Michelle Frankham
Environment and Community Coordinator
Moolarben Coal Operations Pty Ltd
Via email: Michelle.Frankham@yancoal.com.au

RE: Review of Moolarben Coal Complex Particulate Emission Controls

Dear Michelle,
Todoroski Air Sciences have reviewed the current air quality controls implemented at the Moolarben Coal Complex (MCC). This review is required per Reference 7 of the Statement of Commitments of Project Approval 08_0315 which states; "*MCM will complete a review of particulate emission controls implemented at the MCC against industry best practice on a three yearly basis and report the findings in the relevant Annual Review*".

Background
The Moolarben Coal Operations Pty Ltd (MCO) is the operator of the MCC. The current mining operations at the MCC are conducted in accordance with the requirements of the Project Approvals (05_0117 and 08_0135) Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691 and ML 1715 granted under the Mining Act (1992).

The MCC operates two stages, Stage 1 and Stage 2 concurrently with a total run-of-mine (ROM) coal extracted (open cut and underground mining) limited to 21 million tonnes in any calendar year. Stage 1 comprises three open cut mines (OC1, OC2 and OC3), a longwall underground mine (UG4), and mining related infrastructure (including coal processing and transport facilities). Stage 2 has commenced and at full development will comprise one open cut mine (OC4), two longwall underground mines (UG1 and UG2), and mining related infrastructure.

Air quality emissions arising from the MCC are managed per the *Air Quality Management Plan* (**Moolarben Coal Operations, 2017**).

Review of Operations
There are a number of identified dust emission sources at the MCC.

Figure 1 provides a summary of the annual portion of PM_{10} particulate emissions associated with each of the identified activities. Hauling is identified as the activity contributing to the highest percentage of the PM_{10} emissions at 58%.

The data indicate that it is most important to focus on the particulate emissions from hauling, wind erosion, loading and unloading and dozer activities.

Other activities include drilling and blasting, grading roads, diesel exhaust and other miscellaneous activities. Whilst other activities may not contribute as significantly to the annual average effects, they may have significant short term effects (e.g. blasting) and need to be considered in any best practice management system for an open cut mine. Forecasting and reactive systems are used to manage and mitigate the short term off-site effects from such activities.

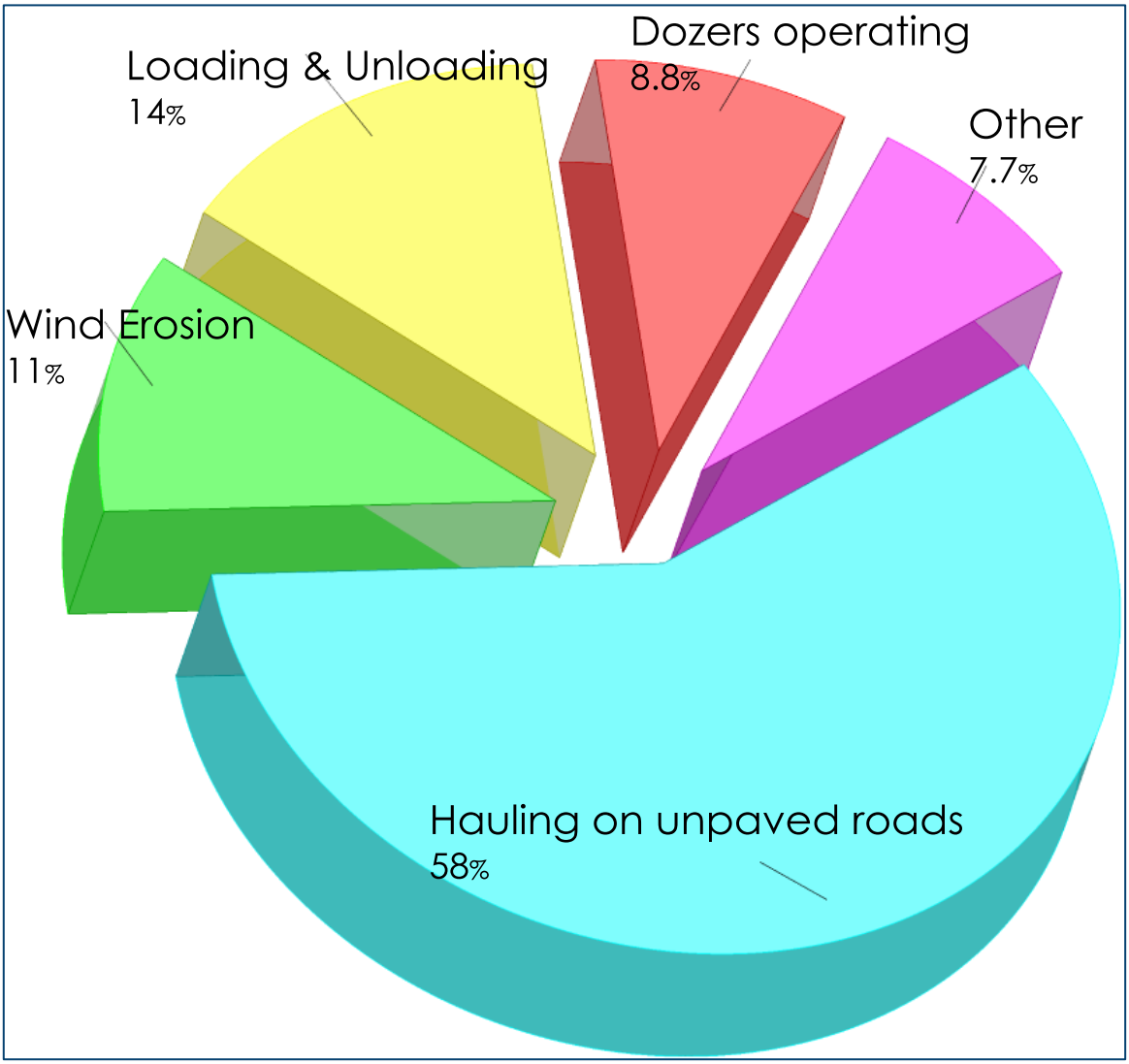

Figure 1: Contribution of mining activities to total particulate emissions (Source: Moolarben Coal Operations NPI Report 2017)

Review of Particulate Emission Control Options

Table 1 provides a summary of best practice particulate emission controls available to the mining industry for various mining activities and makes a comparison to those particulate emission controls currently implemented at the MCC. For each of the controls, those implemented at MCC are identified and a comment on the feasibility of each control is provided.

Summary and Conclusions

This review has investigated the range of potential best practice dust controls applicable for MCC.

MCC currently apply a number of air quality management measures designed to minimise the impact on the surrounding environment due to on-site activities.

Overall, the air quality controls applied at MCC can be considered to be equivalent with industry best practice.

Yours faithfully,
Todoroski Air Sciences

Aleks Todoroski

References

Katestone (2011)

"NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining", prepared for the Office of Environment and Heritage by Katestone Environmental Pty Ltd, June 2011.

Moolarben Coal Operations (2017)

"Air Quality Management Plan", prepared by Moolarben Coal Operations Pty Ltd, November 2017.

PAE Holmes (2012)

"Moolarben Coal Particulate Matter Control Best Practice Pollution Reduction Program", prepared by PAE Holmes, January 2012.

TAS (2014)

"Particulate Matter Control Best Practice Implementation wheel Generated Dust & Disturbing and Handling Overburden in Adverse Weather Conditions", prepared by Todoroski Air Sciences, August 2014.

Table 1: Summary of particulate emission controls

Best practice emission control	Applied at MCC (Y/N/NA)	Comment	Site control level [1] (%)	Benchmark control [2] (%)
Hauling of materials (35.4%)				
Use of defined onsite haul roads	Y	Use of constructed roads, minimisation of access roads and removal of obsolete access roads Clear definition of edges of haul roads with marker posts or equivalent to control their locations, especially when crossing large overburden emplacement areas	-	-
Suitable design of haul roads including base materials and compaction	Y	Roads are constructed to achieve a compact, stable and durable surface using material with a low silt/fines content	-	-
Paving of road surfaces	Y	Permanent surfaces near infrastructure areas and roads heavily trafficked by light vehicles are paved or surfaced with gravel (e.g. helipad road) Note that paving is not practical on haul roads at MCC due to the transient nature of these roads	90	90
Scheduled grading of heavy traffic areas	Y	Grading undertaken on trafficable surfaces including heavy traffic areas including haul roads	-	-
Regular maintenance and management of haul roads	Y	Regular maintenance of haul roads to maintain a smooth surface, define road edges and removal of excessively fine/silty material. Rehabilitation of disused roads as soon as practicable.	-	-
Use of watering and suppressants	Y	Use of water carts as necessary and practicable on all trafficked areas to minimise excessive visible dust. Use of chemical suppression if necessary	>92 [3]	10-92
Restrict vehicle speed limits	Y	Enforcement of speed limits to 60 km/hr on all surface types	40-85	40-85
Minimise distances travelled	Y	Optimisation of fleet to reduce vehicle kilometres travelled, including use of ultraclass trucks	20-45	20-45
Use of conveyors instead of haul roads	Y	Overland conveyor utilised for coal movement from OC4 and UG1 to CHPP	>95	>95
Wind erosion from exposed areas (22.9%) and stockpiles (0.5%)				
Watering of stockpiles	Y	Use of water sprays on stockpiles during adverse weather conditions. Sprays include automatic, manual and water cart based.	50	50
Chemical suppressants	Y	Use of chemical suppression if necessary such as soil binders	80-99	70-99
Paving exposed areas	Y	Key areas near permanent infrastructure are paved (or covered in gravel etc. see below) Not applicable to pave over the large exposed mine areas, however other materials are applied (see below)	-	>95
Apply gravel and other material to stabilise disturbed open areas	Y	Application of interim stabilisation measures for exposed areas during periods of inactivity, includes the use of cleared trees and woody material, branches and boulders for stabilising rehabilitated landforms	-	84
Surface crusting	Y	Naturally occurring following rainfall/ watering with material left inactive for extended periods	95	65-95

Best practice emission control	Applied at MCC (Y/N/NA)	Comment	Site control level [1] (%)	Benchmark control [2] (%)
Seeding of rehab and stockpiles	Y	Utilised where practical on rehabilitation, including temporary rehabilitation	-	80-90
Surface covering of stockpiles with tarp	NA	Not practical on large overburden emplacement areas and coal stockpiles associated with large mines	-	99
Stockpile spillage clean up	Y	Minimisation of spillage from loading/unloading and clean-up of any spillage as soon as practicable	-	-
Rehabilitation	Y	Adoption of progressive rehabilitation of mining operations to minimise exposed soils	-	85-99
Reduce stockpile height	Y	Stockpile height is limited	30	30
Bypassing stockpiles	Y	Underground ROM coal bypasses the CHPP and goes directly to the product stockpile (avoids all emissions with additional handling when washing the coal). Bypass coal contains higher moisture content than open-cut coal.	-	100
Pile shaping and orientation	Y	Progressive reshaping of topsoil and overburden emplacement areas	-	<60
Wind screen/ wind breaks	-	Some limited screening effects arise from the noise bunds	-	75-80
Enclosure around stockpiles	NA	Not practical for large mines	-	75
Vegetative ground cover	Y	Use of temporary cover crops to stabilise rehabilitation areas and use of cleared trees and branch material for stabilising rehabilitated landforms Active maintenance of vegetation Revegetation of long-term topsoil stockpiles (i.e. those not used for over six months)	30	70
Loading and unloading of material (18.9%)				
Minimise drop heights for dumping and excavators	Y	Minimisation of fall distance of materials. Adoption of slower, more precise, low drop height loading during adverse weather conditions.	Up to 30	Up to 30
Bypass	Y	Bypass unloading and loading of underground coal at CHPP	100	-
Manage bench heights	Y	Managed to average of 20m (10m to 30m typical range)	-	-
Block/ paddock dumping	Y	Used for 1st lift	-	-
Water application	Y	Use of water carts and/or sprays on all coal-handling and stockpile areas to minimise dust generations as necessary and practicable	50	50
Fogging cannon on loading plume	N	Not practical, results in safety issues	-	-
Pre-soaking overburden	N	Not feasible or practical	-	40
Pre-wetting work areas	Y	Where feasible	-	-
Irrigating work bench with water cart mounted cannon	N	Not feasible or practical, results in safety issues	-	70
Modify activities in adverse/ windy conditions	Y	Modification of operations during periods of adverse weather conditions Relocation/rescheduling of activities known to produce excessive visible dust plumes under adverse weather conditions.	-	-

Best practice emission control	Applied at MCC (Y/N/NA)	Comment	Site control level [1] (%)	Benchmark control [2] (%)
Roofing and 3 sided enclosure of ROM bin and water sprays	Y	Enclosure of dump hopper and water sprays Use of sheltered dumping during adverse weather conditions	85	85
Stockpile spillage clean up	Y	Minimisation of spillage from loading/unloading and clean-up of any spillage as soon as practicable	-	-
Bulldozing activity (18.7%)				
Minimise travel speed and distance	Y	Dozer travel speeds are minimised during adverse weather	Up to 75	-
Keep travel routes moist	Y	Use of water carts as necessary and practicable on travel routes to minimise excessive visible dust	75	50
Avoid operations on exposed overburden areas during high dust periods	Y	Relocation/rescheduling of activities known to produce excessive visible dust plumes under adverse weather conditions where practicable.	-	-
Grading roads (1.4%)				
Watering of road surfaces	Y	Use of water carts as necessary and practicable on all trafficked areas to minimise excessive visible dust	75	50
Drilling and Blasting activity (1.2%)				
No blasting during adverse weather conditions	Y	Blasting during adverse weather conditions is limited as described in the Blast Management Plan.	-	-
Adhere to blast protocol	Y	All measures outlined in the Blast Management Plan are adhered to.	-	-
Blast during day only	Y	Blasting for open cut operations is only carried out at between 9.00 am and 5.00 pm Monday to Saturday inclusive. No blasting is allowed on Sundays, public holidays, or at any other time without the written approval of the Secretary of the DP&E	-	-
Advise local residents of blasting times	Y	Notifications are given to external stakeholders prior to blasting	-	-
Gravel stemming blast holes	Y	The Blast Management Plan states that adequate burden, stemming lengths and stemming material to be used to confine explosives	-	-
Coordination with surrounding mines	Y	Scheduling of blasts is coordinated with the other mines to minimise adverse amenity impacts on the community as required by the Director General Assessment report	-	-
Drill rigs have dust curtains	Y	Dust aprons are used during drilling	-	-
Water sprays on the drill	Y	Use of water injection systems on all drills	70	9-96
Stemming of drill holes	Y	Use of adequate stemming in drill holes at all times	-	-

Best practice emission control	Applied at MCC (Y/N/NA)	Comment	Site control level [1] (%)	Benchmark control [2] (%)
Drill area moistened	Y	Application of water on areas prone to excessive dust lift off prior to drilling and post drilling, where safe and practicable	-	-
Fabric filters on the drill	N	Not feasible due to other controls	-	80-99
Processing and handling of coal				
Water suppression at transfers	Y	Appropriate dust suppression methods fitted to stationary plant	-	50
Wind shielding	Y	Enclosed conveyor transfers and partial enclosure of raw control transfer and rejects conveyor	-	40-70
Belt cleaning and spillage minimisation	Y	Fitting of all conveyors with appropriate cleaning and collection devices	-	-
Bypass ROM stockpiles	Y	Aim to dump ROM directly to hopper. Stockpiles used for overflow.	-	50
Variable height stacker	N	Not feasible	-	25
Boom tip water sprays	NA	Not applicable	-	50
Telescopic chute with water sprays	Y	Used for coal loading to trains	75	75
Bucket-wheel portal or bridge reclaimer with water application	NA	Not applicable.	-	50
Enclosure of transfers	Y	Use of enclosed chutes. Use of enclosed conveyor transfers. Partial enclosure of raw coal transfer and rejects conveyors where possible	-	70
Maintain a consistent profile load (coal wagons)	Y	Loading of rail wagons with a streamlined and consistent profile, where possible	-	-
Apply water or suppressant to surface of coal profile (coal wagons)	N	Water sprays in head chutes, however further specific wetting of surface is not required due to the moisture content of the coal	-	-
Remove parasitic coal from surface of coal wagons before leaving mine site	Y	Regular cleaning of areas where spilt material can build up Regular collection and disposal of coal spillage	-	-
Cover train loads	NA	Not applicable	-	-
Topsoil stripping				
Minimise pre-strip	Y	Disturbance of only the minimum area necessary for mining	-	100% per m^2 of pre-strip avoided

Best practice emission control	Applied at MCC (Y/N/NA)	Comment	Site control level [1] (%)	Benchmark control [2] (%)
Watering of road surfaces	Y	Watering of access tracks used by topsoil stripping equipment.	75	50
Air quality management tools				
Assess performance against environmental criteria	Y	To assess compliance with the approval criteria, and to meet the monitoring requirement of the EPL, ambient air quality monitoring is conducted at various locations representative of residential receivers in the areas that may potentially be influenced by mining operations.	-	-
Communication strategy	Y	The Environment and Community Manager (or delegate) has direct responsibility for responding to community complaints and reporting management and monitoring outcomes. MCO provides information on its environmental performance (including air quality) through various reporting and communication mechanisms such as through the Community Consultative Committee (CCC), annual review and on its website, as required by the conditions of NSW Project Approvals (05_0117 and 08_0135). MCO maintains a Community Response/Complaints Line (Phone Number 1800 556 484) that is dedicated to the receipt of community complaints. The Community Response Line is publicly advertised and operates 24 hours per day, seven days a week, to receive any complaints from neighbouring residents or other stakeholders. The Community Response Line is advertised in the local media and is also available on the Moolarben Coal Website and in the community newsletters.	-	-
System and performance review	Y	The annual review and improvement of the air quality management plan includes a comprehensive review of the monitoring results and complaints records of MCO operations over the previous calendar year. MCO completes a review of particulate emission controls at the Moolarben Coal Complex against industry best practice on a three yearly basis and report the findings in the relevant Annual Review.	-	-
Monitoring strategy	Y	Ambient air quality monitoring is conducted at various locations that are considered representative of residential receivers in the areas that may potentially be influenced by mining operations. Additional air quality monitoring data is available to MCO under a data sharing agreement from both the neighbouring Ulan and Wilpinjong mines, with data made accessible upon request from MCO.	-	-
Meteorological monitoring	Y	Meteorological monitoring is undertaken at MCO, in accordance with NSW Project Approval and EPL requirements. MCO has an Automatic Weather Station (AWS) which measures a full meteorological complement. The AWS is linked into the real-time monitoring system and is the main weather station for reporting purposes. Other weather stations are used to supplement weather data as required.	-	-
Dust deposition gauges	Y	Dust deposition is monitored at eleven locations around the MCC.	-	-
TEOMs	Y	PM_{10} is measured using a Tapered Element Oscillating Mass Balance (TEOM) at four locations around MCC.	-	-
HVAS	Y	Two HVAS monitors measuring PM_{10} will be operated by MCO, one at Ulan Village (PM01) and one south-west of OC1 and west of OC2 (PM02) to monitor impacts on the Ridge Road area.	-	-
SMS alarm system during high winds	Y	Real-time air quality monitoring data are used to identify when ambient levels of PM_{10} in the surrounding environment are elevated and require contingency action. Dust real-time response triggers have been established and are designed to provide a system to warn operational personnel (via SMS) of levels that are approaching a relevant criterion and to provide	-	-

Best practice emission control	Applied at MCC (Y/N/NA)	Comment	Site control level [1] (%)	Benchmark control [2] (%)
		management/control actions. The dust alarm triggers and positions of real-time air quality -monitoring locations is reviewed annually (i.e. as mining progresses) and as part of a contingency response, if required.		
Forecasting system	Y	The predictive air quality forecasting system is used to alert operators about possible elevated dust levels, assisting with any plan to temporarily modify operations and minimise the risk of elevated dust dispersion.	-	-
Reactive system	Y	The monitoring system informs operators about elevated dust levels, triggering actions to ameliorate as necessary. Mine personnel investigate air quality related triggers.	-	-
Air quality training	Y	Include air quality requirements in site inductions to ensure employee awareness of potential dust impacts.	-	-

1 Source: PAEHolmes 2012

2 Source: Katestone 2011

3 Source: TAS 2014