Addendum

Date: Thursday, 10 December 2020

Jackson Environment and Planning Pty Ltd

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FAO: Mark Jackson

Project Name:	**Kariong Sand and Soil Supplies - Air Quality Assessment – RTS**
Reference:	**18.1021.L2V4**

The following letter has been prepared by Northstar Air Quality Pty Ltd on behalf of Jackson Environment and Planning Pty Ltd and provides a response to submissions (RTS) associated with the Air Quality Impact Assessment (AQIA) which was prepared to support the Kariong Sand and Soil Supplies EIS (SSD 8660).

Submissions have been provided by NSW Department of Planning, Industry and Environment (DPIE), NSW Environment Protection Authority (EPA), NSW Central Coast Local Health District, and Worthington BMW, in relation to the AQIA. A peer review of the AQIA has been performed by Todoroski Air Sciences on behalf of Accent Superannuation Pty Ltd, and DPIE has requested that a response to those comments also be provided.

If you require any further information or clarification, please do not hesitate to contact the undersigned at your convenience.

For and on behalf of

Northstar Air Quality Pty Ltd

Martin Doyle

Director & Air Quality Scientist

Reviewed by: GCG

Introduction

All AQIA for proposed developments are based on a range of data with inherent uncertainty. It is acknowledged in the AQIA that there exist uncertainties in, for example, the quantification of meteorological data which might best represent the project site, or the quantification of potential emissions. To acknowledge and account for that uncertainty, the proponent is willing to adopt a staged approach to approvals with initial approval sought for a 100 000 tonnes per annum (tpa) operation (i.e. half that subject to quantitative assessment in the AQIA). This is stated in the EIS and in the supporting AQIA. The proponent will also install a meteorological monitoring station at the site and air quality monitoring equipment surrounding the site to:

i. characterise the meteorological environment of the project site; and,
ii. provide air quality monitoring data with which to assess the performance of the project at 100 000 tpa to ensure the adequacy and performance of the air quality controls in place. This data will also support the scale-up approvals to 150 000 tpa and 200 000 tpa in due course, and subject to review.

Review of air quality monitoring data would be performed regularly to assess the performance of the project and, in conjunction with site specific meteorological measurements, determine the potential incremental impact of the project (through assessment of upwind/downwind air pollutant concentrations).

An Air Quality Management Plan (AQMP) would also be produced prior to project operation which would include the range of management and mitigation measures to be included as part of the project, and how these would be implemented and reviewed as required. A Trigger Action Response Plan (TARP) would be included in the AQMP which would:

- detail proactive measures to minimise air quality impacts;
- identify real-time boundary monitoring trigger levels for remedial action; and,
- detail the remedial action that will be taken if trigger levels are exceeded.

Given the limitations of dispersion modelling, such proactive measures cannot be included in the AQIA even though they represent significant operational controls. The results of the dispersion modelling exercise should be viewed with that in mind.

After a minimum of a full 12 months of measurements have been obtained, we propose that an update to the AQIA would be performed which would adopt the site-specific meteorological measurements. This would remove any uncertainty associated with the meteorological data adopted in the initial AQIA. The updated AQIA would examine predicted impacts of the project at 100 000 tpa throughput and compare these predictions with monitoring data to allow 'ground-truthing' of the predictive modelling outputs.

Should air quality monitoring data indicate that the project is being operated to ensure that impacts on the surrounding environment meet required conditions of consent, the AQIA would also be updated to predict impacts at a throughput of 150 000 tpa. The same process would be performed for the scale-up approval to 200 000 tpa.

At each stage of the process, all relevant stakeholders (including NSW EPA, DPIE, and the surrounding community) would have opportunity to review those measurements and predictions and provide comments prior to the scale-up approvals. This approach has been suggested by the proponent, and is not a usual course of action, which shows the commitment of the proponent to operating in a responsible manner.

The air quality predictions presented in the initial AQIA reflect operations at 200 000 tpa throughput and therefore present potential impacts at the maximum proposed throughput. It is stressed that these predictions showed compliance with the relevant air quality criteria, although subsequent AQIA would be performed (at least twice more) to ensure that any impacts on the surrounding community are not unacceptable. Any improvements required to the project operation would be identified through review of air quality monitoring data and reflected in any updated AQIA submitted to support scale up approvals.

The following provides a response to the issues raised on the initial AQIA, submitted to support the project at the maximum 200 000 tpa throughput (i.e. twice the initial throughput proposed).

Re-modelling of the project has been performed in response to some of the issues raised through submissions. The resulting incremental impacts have increased due to the use of even more conservative emission factors, although compliance with all air quality criteria is still demonstrated. The emissions inventory for the project has been adjusted to include:

- Emissions from the movement of haulage vehicles on paved and unpaved roads at the project site, with the adoption of a conservative silt content in calculations.
- Inclusion of full enclosure on all materials processing activity, and full justification for the level of emissions controls achieved.
- Conservative assessment of wind erosion from the entire 3.9 hectare (ha) area of the project site.

It should be noted that the emissions calculations associated with the proposed project operation are heavily reliant on the availability of factors in the relevant literature. With regards to particulate matter, there are no industry specific emission estimation techniques for the waste and recycling industry, and practitioners generally default to techniques developed for the mining and quarrying industries, which can be viewed as highly conservative given that the materials to be handled and processed at the site are not directly comparable.

Although it is the purpose of review to identify potential weaknesses in any assessment to ensure that the community are protected from adverse air quality impacts, it should be recognised that there are also levels of conservatism built into the assessment, especially with regard to assessment of maximum 24-hour emissions. The results of the assessment should be viewed with that conservatism in mind, with results presented to compare with criteria to ensure that the project can be operated without giving rise to exceedances of the relevant criteria. The likelihood of maximum incremental impacts occurring have been calculated and are discussed in **Appendix B** for the maximum impacted receptor (R3).

The following submissions have been numbered by Northstar to allow cross reference.

NSW Environment Protection Authority, 6 November 2020

The EPA notes that the revised Air Quality Impact Assessment (AQIA, V2, 2020) has adopted additional control measures including:

- *Sorting and processing operations are conducted within a Secondary Sorting Warehouse, with accompanying misting systems;*
- *Partial enclosure of the tipping and spreading bays, with misting systems;*
- *Partial enclosure of the grinding and mulching operations, with accompanying misting systems; and*
- *Misting systems on outdoor storage bays for landscaping and civil supply materials.*

The incremental dust impacts predicted in the AQIA (V2, 2020) are still significant at some receptors, with PM_{10} impacts predicted up to 26% of the EPA's impact assessment criterion (24-hour). Also, there is still noted uncertainties arising from the meteorological modelling undertaken and the approach used to estimate cumulative impacts. The EPA also considers the estimated levels of dust control assumed in the assessment are high. Robust justification for the adopted levels of control has not been provided.

The EPA considers the risk of potential dust impacts arising from the project could be further reduced through the implementation of best practice controls, such as fully enclosed buildings around processing equipment and a proactive and reactive dust management strategy.

The EPA recommends:

1) prior to project determination, the proponent should undertake a detailed feasibility assessment of engineering controls for controlling dust, including a benchmarking study against best practice dust management. The assessment must consider the adoption of fully enclosed structures around all key waste processing activities.

2) the AQIA (V2, 2020) be revised to address the issues detailed below.

The project now includes full enclosure around all waste processing activities (crusher and mulcher building), enclosed conveyors and enclosed bunkers for the discharge of aggregate and mulch. Full enclosure is considered to represent best practice for operations of this nature. A full description of these improvements to the site, including the emissions reductions assumed, are provided in response to issue 2. In relation to all other sources of particulate matter, a description of how the site operations relate to best practice is also provided in response to issue 2.

The dispersion modelling assessment has been revised to take account of some of the comments received during submissions. Updated modelling results are included in **Appendix B**.

1. Assessment of the cumulative impacts from other significant emission sources in the area

a. Gosford Quarries, (existing operation) located approximately 250 m to the east of the project site. No dispersion modelling of the quarry has been performed, and the potential impacts associated with the quarry are discussed qualitatively. Emissions have been estimated based on an assumed extraction rate of 30,000 tpa. Annual average emissions rate for PM10 only have been considered as no further information was publicly available.

b. Somersby Resource Recovery Facility (Proposed development SSD 18_9265) located approximately 20 m to the north of the project site. The project, proposed by Bingo Recycling Pty Ltd, involves the construction of resource recovery facility with an annual throughput of up to 500,000 tpa of waste. Cumulative impacts were not quantified, due to a lack of available information. The EPA's review of DPIE's Major Planning portal found that the current status of the project is listed as 'withdrawn'.

Due to the geographical orientation of the Gosford quarries in relation to the Kariong Sand and Soil premises, those sensitive receivers nearest to the project may experience an increased frequency of impacts on an annual basis. As such, The EPA considers a more robust assessment of the nearby Gosford Quarries should have been undertaken to better quantify the associated emissions and potential for cumulative impacts. There is already noted uncertainty with the meteorological data adopted in the AQIA (V2, 2020) (See point 4). The qualitative approach used further increases the uncertainty regarding the potential for air quality impacts.

The EPA advises that there is still noted uncertainty associated with the cumulative assessment presented in the revised AQIA (V2, 2020). The EPA recommends a more robust assessment of cumulative impacts from the nearby Gosford quarries be undertaken in a revised assessment.*"*

An updated dispersion modelling assessment has been performed which includes the impact on annual average PM_{10} and $PM_{2.5}$ resulting from the operation of the quarry. Given the major uncertainties associated with the activities being performed, activity rate, and operational hours etcetera, an approach has been taken where the full 5.7 hectare (ha) area of the site is assumed to be available for wind erosion, and the sawing, loading and transport of sandstone occurs on every day of the year. Emissions from all activities have been spread over the 5.7 ha area of the site and the annual average impacts at all receptors have been modelled. Results for annual average PM_{10} associated with the Quarry operation are presented in **Appendix B** which demonstrate that increments are less than (<) 0.1 $\mu g \cdot m^{-3}$ at all receptor locations.

Impacts associated with shorter term (i.e. 24 hour) time periods have not been modelled given the uncertainty which would be required to be included within the assessment, and the limited value that would be provided by such an assessment. Given that the closest receptors to the project site are located between the project site and the quarry, it is more likely that those receptors may be impacted by either operation (but not both operations) in the short term and therefore an assessment of short-term impacts is not considered to be either possible, or warranted.

2. Daily emission estimates that reflect a worst-case scenario

"The revised AQIA (V2, 2020) includes emission rates which represent peak day operations such as material processing rates at maximum throughout and increased vehicle movements.

Additional particulate control measures have also been adopted in the revised AQIA (V2, 2020) in response to EPA's comments and community concerns regarding dust emissions. These additional control measures include:

- *Partially enclosed buildings around crushing and shredding operations fitted with dust suppression (water sprays) with hopper loading being external to the building; and*
- *Partially enclosed building for the tip and spread area and the inclusion of water misting sprays.*

> *The EPA considers that partially enclosed structures, such as the ones proposed in the AQIA (V2, 2020), are not consistent with best practice emission control design. The achievable level of dust control using the proposed designs is expected to be low compared with a fully enclosed building, particularly under certain meteorological conditions and wind directions (dependent on the orientation of the structures). There is also no site representative meteorological data available which could be used to inform the optimal orientation of the building structures.*
>
> *Activities associated with material processing, such as crushing, screening, grinding and shredding have the potential to significantly increase the potential for dust emissions from a facility and must be appropriately managed and mitigated. The use of best practice engineering controls is recommended.*
>
> *The AQIA (V2, 2020) predicts emissions from activities associated with material handling and processing are still significant for the project based on equivalent annual average emissions data (calculated using 24-hour activity rates). Activities include;*
>
> *- Material chipped by shredder ~1030 kg/yr*
>
> *- Material loading (to vehicles, to screens, to crusher etc) ~125 kg/yr (each activity)*
>
> *The EPA considers that the proposed engineering controls could be further improved using fully enclosed structures and should be considered in the final design stages for the proposal.*
>
> ***Prior to project determination, the proponent should undertake a detailed feasibility assessment of engineering controls for controlling dust, including a benchmarking study against best practice dust management. The assessment must consider the adoption of fully enclosed structures around all key waste processing activities."***

The project has been redesigned to include full enclosure around all materials processing activities. These include:

Shredder/mulcher:

- full enclosure of the shredding/mulching activities in a treated steel sheet-clad (e.g. Colorbond®) building. Sliding doors allow access if required and will remain closed during operation;
- drop rubber curtain between the loading hopper and shredding/mulching activities to contain particulate within the building;
- inclusion of dust misting system inside the shredding/mulching building;
- full enclosure of the conveyor from the shredder/mulcher to the product receiving bunker; and,
- Enclosure of the product receiving bunker with concrete block walls, Colorbond® roof and a rubber curtain for front end loader access.

Crusher/screen:

- full enclosure of the crushing/screening activities in a Colorbond® building. Sliding doors allow access if required and will remain closed during operation;
- drop rubber curtain between the loading hopper and crushing/screening activities to contain particulate within the building;
- inclusion of dust misting system inside the crushing/screening building;
- full enclosure of the conveyor from the crusher/screen to the product receiving bunker; and,

- enclosure of the product receiving bunker with concrete block walls, Colorbond® roof and a rubber curtain for front end loader access.

Plans of these control measures are included as **Appendix A** to this letter.

The control efficiency of the updated controls has been taken to be:

Shredder/mulcher and crusher/screen:

- Performance of activities within an enclosed building – 70 % control; and,
- Application of water mists – 50 % control.

No controls have been applied to the loading of material to the hopper, as this would be outside of the enclosure.

The control factors applied are appropriate. A control factor of 100 % for such activities is generally reserved for enclosures which are fully sealed, with control measures (e.g. extraction and fabric filters) in place.

With reference to the control of particulate emissions through the inclusion of the proposed buildings, a 70 % control factor can be associated with:

- Three-sided and roofed enclosure (Table 95 of (Katestone, 2011)
- Enclosure of material transfers (Table 96 of (Katestone, 2011))
- Miscellaneous transfer and conveying (Table 4 of (NPI, 2012)

It is therefore likely that the enclosure of the materials processing activities would result in a greater than (>) 70 % particulate control efficiency, although sufficient quantitative data is not available to support a >70 % reduction at this time.

With reference to the control of particulate emissions through the inclusion of the water misting system within the proposed buildings, a 50 % control factor can be associated with:

- Application of water – 50 % control (Table 4 of (NPI, 2012)

The use of an enclosure with water mists provides a combined control efficiency of 85 % (i.e. 70 % × 50 %) as outlined in (Katestone, 2011). As stated in NPI (2012):

"Controls are multiplicative when more than one control is applied to a specific operation or activity"

It is considered that the above controls represent best practice, and their application within the updated AQIA is appropriate.

In relation to the EPA requirement to provide a detailed benchmarking study of dust controls, it is considered that the enclosure of all materials processing activities now represents best practice for operations of this type. The use of sealed asphalt roads surfaces, and the use of water carts to flush silt or supress emissions on those surfaces also represents best practice emission control. The use of water carts on crushed compacted road surfaces at the project site is shown to be sufficient to ensure that air quality criteria at surrounding residences are achieved. Given the size of the required tipping and sorting shed, the use of a 3-sided and roofed enclosure with water mists is considered to represent best practice. The use of 3-sided enclosures around storage piles, and the application of water is common practice and also represents best practice for materials storage activities.

When compared to other similar operations recently approved by NSW DPIE, the project is proposed to include particulate control measures at, or in excess of those proposed for other operations, even with greater annual throughputs, as summarised in **Table 1**.

The updated dispersion modelling, incorporating a range of conservatism and justification for all emission controls adopted, demonstrates clearly that the project can be operated without resulting in exceedances of air quality criteria at surrounding residences. In addition, the scale-up approvals process, and inclusion of real-time particulate and meteorological measurements to be used in a real-time responsive air quality management process should provide confidence that the project can be operated responsibly and without resulting in exceedances of air quality criteria.

Table 1 – Comparison of particulate mitigation performed at similar sites

Activity	Kariong Sand and Soil Supplies Facility	Kembla Grange Waste Facility	Mayfield West Waste Facility
	SSD 8660 Under assessment	SSD 5300 Approved in 2016	SSD 7698 Approved in 2018
General information			
Throughput	200 000 tpa	230 000 tpa	315 000 tpa
Materials processing	All activities enclosed	Some activities performed external, some internal. Crushing and mulching activities external using mobile equipment. Crushing to be done indoors as part of Mod 2	All crushing and mulching activities external using mobile equipment, co-mingled waste sorting internal (3-sided shed)
Haulage	Majority on paved roads, some on compacted crushed concrete pavement	Compacted crushed concrete pavement	Some paved, some constructed of compacted crushed concrete
Mitigation measures			
Proposed mitigation	Full enclosure of all materials processing activities with water mists	Watering of haul routes	Water sprays used on unsealed surfaces Vehicle movements restricted to designated routes

Activity	Kariong Sand and Soil Supplies Facility	Kembla Grange Waste Facility	Mayfield West Waste Facility
	SSD 8660 Under assessment	SSD 5300 Approved in 2016	SSD 7698 Approved in 2018
	Tipping and spreading building to be 3-sided, with water mists Watering of all haulage routes, minimisation of vehicles speeds Use of 3-sided bays with water sprays for all materials storage		Water sprays will be used at stockpiles, crushing and screening plants and during material handling Wheel wash Existing sheds used to undertake particulate generating activities where possible

3. Updated emissions inventory that includes, where possible, estimated emission rates in g/s

"Additional information and clarification have been provided in the revised AQIA (V2, 2020) to allow replication of emission rate calculations. Annual and Peak 24-hour emissions inventories are included in Appendix C. The peak maximum daily rates have been estimated based on the maximum potential hourly processing rates, which equates to an equivalent 669,000 t/annum. This represents about 3.3 fold increase in processing rates, when compared to the maximum 200,000 t/annum proposed. The EPA considers this approach to be reasonable.

It is noted that high levels of control have been applied to some activities which result has resulted in an overly optimistic reduction in emissions. The estimated total level of control for all activities associated with material processing is about 90% which is considered high, for the types of controls proposed. The EPA would consider such high levels of control are likely more associated with best practice controls such as fully enclosed structures around processing areas.

Despite the high levels of controls, significant incremental dust impacts are still predicted. For example, the maximum incremental (24-hour) PM_{10} concentration at receptor 3 is 13 ug/m^3, representing 26% of the EPA's impact assessment criterion. There is also noted uncertainties associated with the meteorological modelling, as discussed in point 4 below.

The EPA has also identified issues associated with the wind erosion calculations. Controlled emissions estimated during peak 24-hour scenario are approximately half of those predicted for the annual scenario (1,782,7 kg/annum vs 891.4 kg/annum respectively). There is no justification provided for the 50% reduction in predicted emissions between the two scenarios.

Notwithstanding this, it is considered the risk of dust impacts arising from the project can be further mitigated via the implementation of best practice controls such as fully enclosed buildings around processing activities and the adoption of an appropriate proactive and reactive dust management strategy.

***The EPA recommends the AQIA (V2, 2020) be revised to include robust justification for all levels of emission control adopted. Additionally, the emissions inventory must be reviewed to ensure the estimated controlled emission rates are accurate.**"*

The discussion outlined in response to issue 2 provides justification for the level of control associated with materials processing activities. A multiplicative control factor of 85 % is entirely appropriate for the level of control proposed.

The approach to assessment is in accordance with the NSW EPA 'Approved Methods' document. The project impacts plus a background concentration (i.e. a cumulative impact) were compared to the air quality criteria as outlined within the 'Approved Methods' document. No criteria are outlined within that document with which to compare incremental impacts from a project.

The following control measures have been implemented within the dispersion modelling assessment:

<u>Tip and spread waste receival building</u>

The following controls have been applied to unloading of materials within the tip and spread waste receival building:

- Performance of activities within an enclosed building – 70 % control
- Application of water mists – 50 % control
- Minimisation of drop height – 30 % control

With reference to the control of particulate emissions through the inclusion of the 3-sided and roofed tip and spread building, the adopted (multiplicative) control factors are associated with:

- Three-sided and roofed enclosure – 70 % (Table 95 of (Katestone, 2011))
- Application of water – 50 % control (Table 4 of (NPI, 2012))
- Minimisation of drop heights from vehicles from 3 m to 1.5 m -30 % control (Table 90 of (Katestone, 2011))

These factors are all appropriate for inclusion in the modelling assessment. As previously noted, the emission factors adopted are generally associated with the mining and quarrying industry and adjustment through the use of referenced controls is entirely appropriate and routinely performed in similar studies across Australia.

The proposed tip and spread waste receival building will act to minimise the effect of wind shear and contain a proportion of any emitted particulate generated through the action of unloading within the structure. The use of water sprays further acts to 'drop out' any particulate during unloading, and a handheld hose will also be available to water down any particularly dusty loads and/or to supplement the water sprays, as required. The emission factor for material unloading is that adopted for the mining industry, where the height of the truck body is approximately 3 m from ground level (i.e. large dump trucks). Such vehicles would not be present at the project site, and the adjustment of that factor to account for the vehicles delivering materials to site (i.e. with truck bodies 1.5 m above ground level) is entirely appropriate.

The following controls have been applied to the spreading of materials on the floor of the tip and spread waste receival building activities:

- Performance of activities within an enclosed building – 70 % control
- Application of water mists – 50 % control

The justification for the adoption of these control factors is provided above.

The following controls have been applied to the loading of materials to front end loader within the tip and spread waste receival building activities:

- Performance of activities within an enclosed building – 70 % control

The justification for the adoption of this control factor is provided above.

Materials processing activities

The control factors applied during materials processing activities, and full justification for their adoption is provided previously in issue 2.

Secondary sorting warehouse

The secondary sorting warehouse will be fully enclosed and an emission control factor of 70 % has been applied. The justification for this level of control, given the design of the secondary sorting warehouse (i.e. 4 walls, roofed) is considered to have been provided previously in relation to the materials processing activities. Furthermore, a misting system will be present in the secondary sorting warehouse which results in a further 50 % emission control. This factor has also been previously justified.

Vehicle haulage

Emission controls factors have been applied to the movement of vehicles on paved and unpaved roads at the project site. Emissions associated with road haulage are associated with vehicle weights, speeds and road silt content. The emissions controls adopted for unpaved haulage routes includes watering at a rate of >2 $L \cdot m^{-2} \cdot hr^{-1}$ (75 % control), and a reduction in vehicle speed to 30 $km \cdot hr^{-1}$ (75 % control).

The adoption of a 75 % control due to watering of unpaved roads is considered to be conservative. An alternative approach outlined in (US EPA, 1987) takes into account site specific factors including the daytime evaporation rate, traffic volumes, time between application and application intensity.

The Control Efficiency (CE) is given by:

$$CE = 100 - \left(\frac{0.8 \times P \times D \times T}{I}\right)$$

where:

P = potential average daytime evaporation rate ($mm \cdot hr^{-1}$)

D = average hourly daytime traffic data ($veh \cdot hr^{-1}$)

T = time between applications (hours)

I = application intensity (L·m^{-2})

In the absence of data from Gosford AWS, evaporation data was obtained from Peats Ridge (Waratah Road) AWS which recorded a maximum evaporation rate of 4.7 mm·day^{-1} (conservatively 0.39 mm·hr^{-1} over 12 hours of daylight hours) between 1981 and 2012. For the purposes of comparison, the water application intensity and rate were taken to be 2 L·m^{-2}·hr^{-1}, and the hourly vehicle movements were calculated based on the 24-hour maximum emissions inventory (i.e. 14 vehicles per day). The minimum calculated control efficiency afforded by an hourly application of water during operation was calculated to be 99.7 %.

Further calculations were performed to identify the number of vehicles which could travel on unpaved roads at the project site to result in a control efficiency of 75 % through the equation outlined in US EPA (1987) and this number is approximately 150 vehicles·hr^{-1}, significantly in excess of the vehicles anticipated at the project site in any hour or day.

The adopted control factor of 75 % on unpaved haulage routes through the application of water is therefore considered to be conservative.

Vehicles at the project site will be limited to a speed of 5 km·hr^{-1} which would be enforced through traffic control signage, and the design and layout of the site would ensure that those speeds are adhered to. Table 66 of Katestone (2012) outlines the effectiveness of vehicle speed reductions to 30 km·hr^{-1} on unpaved roads as up to 85 %, which is entirely achievable given the proposed speeds proposed at the site. Given that vehicle speeds on site roads would be likely to be significantly lower than 30 km·hr^{-1}, emissions generated through the action of vehicles on unpaved surfaces would be anticipated to be significantly lower than those modelled.

Emissions reductions due to reduction in vehicle speeds on paved roads at the project site have not been included, as there are no defensible emissions reductions available in the literature. The application of water to paved haulage routes would occur at the same rate as for unpaved haulage routes, although an emission reduction of 30 % has been applied to the watering of paved roads as per (USEPA, 2011) which indicates that an hourly water flushing at a rate of 0.48 $gal{\cdot}yd^{-2}$ (equivalent to 2.2 $L{\cdot}m^{-2}{\cdot}hr^{-1}$) would result in emissions reductions of between 30 % and 70 %. For the purposes of this assessment, the lower (conservative) reduction factor of 30 % has been adopted. Paved road surfaces will also be routinely swept to keep surfaces clean and to avoid dust generation through resuspension, although emission reductions associated with this management measure have not been included in emission estimation.

Based on the above discussion, the application of the control factors to haulage routes at the project site is entirely appropriate, and likely to be conservative.

An additional level of conservatism is built into the emission estimation through the adoption of conservative silt contents. The silt content and loading associated with unpaved and paved roads has been taken to be 8.3 % and 8.2 $g{\cdot}m^{-2}$ respectively, as outlined in (US EPA, 2006) and (USEPA, 2011) as being associated with stone quarrying and processing, and quarrying respectively. Given the construction and management of the haul roads, the silt contents and loading of site haulage routes is likely to be lower than those assumed, although this would be subject to testing prior to scale up approval to 150 000 tpa with those site-specific silt loading values used in any updated modelling performed.

Other activities

Water sprays will be present within the waste storage bays, landscape supplies, and aggregate storage areas. A 50 % control has been applied to these sources based on the application of water, taken from the NPI (2012) and Katestone (2012) and is entirely appropriate.

The waste storage bays, landscape supplies, and aggregate storage areas would be three-sided bins constructed of concrete blocks. The purpose of 3-sided bins is to contain materials and reduce the potential of the wind to erode those surfaces. As outlined in Katestone (2012), the erection of 3-sided enclosures around storage piles results in a 75 % reduction in emissions through reduction in wind speeds.

The adoption of these multiplicative factors are entirely appropriate.

As previously noted, in response to submissions, the entire area of the site has been included within the modelling assessment as a source of wind erosion. With the exception of the waste storage bays, landscape supplies, and aggregate storage areas, no emissions controls have been applied over the remaining area of 2.7 ha. Given that many areas of the site would not receive continual replenishment of material which could be eroded by the wind and transported to surrounding receptor locations, this inclusion is considered to represent a highly conservative assumption.

4. Additional meteorological data options such as those generated using CALMET run in various modes (no-observation, hybrid).

"The previous AQIA (V1 2019) included discussion of 2 approaches used for meteorological modelling using TAPM. Neither approach provided an adequate representation of the local meteorology when the output data were compared to observations at the Gosford AWS (data validation).

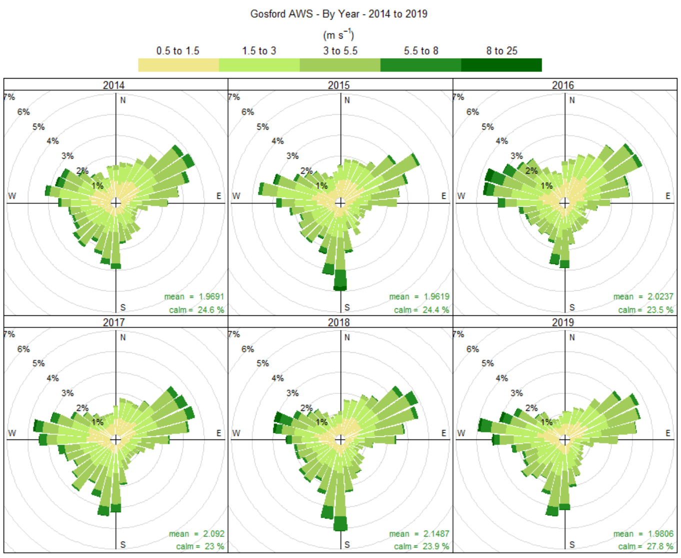
The revised AQIA (V2, 2020) includes results of additional meteorological modelling (approach #3) which was performed using WRF meteorological model output as input to CALMET. This approach again, did not adequately characterise the observed wind conditions.

A fourth approach has been performed using AERMOD. Observational data from Gosford AWS has been adopted as an input to the dispersion model. As such, the predicted wind roses closely resemble those at Gosford Automatic Weather Station.

Furthermore, the meteorological analysis undertaken has only considered 3 consecutive years of data (2014 to 2016), rather than the 5 years recommended in the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2016). No justification for this shorter review period was provided. This further increases the uncertainty associated with the AQIA (V2, 2020).

***The EPA notes there is still uncertainty associated with the meteorological modelling undertaken in the AQIA (V2, 2020). However, the uncertainties could be adequately managed via a commitment to improved engineering controls including fully enclosed structures around processing areas**."*

Meteorological monitoring commenced at Gosford AWS in 2013 and therefore data for full calendar years were available from 2014 to 2016 at the time of the assessment being performed. More recent data has been examined (2017 to 2019) with those wind roses presented below. These indicate that the selection of the modelling year of 2015 is valid and entirely appropriate. There is little inter-annual variability in the meteorological observations and the selection of any of the years 2014 to 2019 would have made little material difference to the results of the assessment.



As previously discussed, the proponent has committed to included full enclosure of materials processing activities.

Dispersion modelling has also been re-performed to include a number of adjustments as previously noted, and compliance with the NSW EPA air quality criteria is still achieved (refer **Appendix B**).

As previously discussed, the proponent will also install a meteorological monitoring station at the site, with site-specific data used in any updated air quality modelling assessment to remove any uncertainty associated with those inputs.

Peer Review of Kariong Sand and Soil Supplies Air Quality Impact Assessment – Todoroski Air Sciences, 22 September 2020

5. Modelling approach is not ideal

> *"AERMOD does not produce especially reliable results when modelling area sources such as wind erosion and it is not a model recommended by the reviewer for modelling ground based sources of dust emissions, as occur in this case."*

AERMOD is a widely used dispersion model in NSW, Australia and globally.

As identified and confirmed by the reviewer, the choice of the AERMOD dispersion model in the AQIA resulted from a number of issues which arose in the generation of appropriate meteorological data. A review of the USEPA AERMOD implementation guide (USEPA, 2019) indicates that:

"..concentration predictions for area sources may be overestimated under very light wind conditions.." and "***..this is not expected to be a problem for meteorological data collected using standard wind instruments since instrument thresholds are generally too high..***" (pp 23).

As discussed in the AQIA, meteorological data adopted in the assessment was from the Gosford AWS, which uses standard instrumentation and therefore, the concern raised by the reviewer is not likely to be an issue. Furthermore, should it be an issue then air pollutant concentrations are likely to have been over-predicted resulting in a conservative approximation of impacts being presented in the AQIA.

AERMOD has been adopted by numerous air quality practitioners in NSW when assessing the potential impacts of ground-based dust sources (e.g. (Ramboll ENVIRON, 2017a), (Ramboll ENVIRON, 2017b), (EMM, 2019)). These studies have been subject to appropriate regulatory review and the modelling approach has been deemed to be acceptable by the NSW regulatory bodies.

6. Meteorological modelling data used in the modelling is not representative of the locality

> *"The meteorological data used are not representative of the site"*
>
> *"The AQIA does not detail why it would be expected and necessary for the weather conditions at the project site to closely match those at Gosford AWS."*
>
> *"The AERMET data used in the dispersion modelling is not representative of the project location."*
>
> *"The weather inputs and model used have potential to lead to invalid or incorrect results."*

As discussed in detail in the AQIA, the meteorological data adopted in the performance of the assessment were a result of numerous meteorological modelling sensitivity exercises, where model outputs could not be adequately validated against the limited observations in the area (i.e. Gosford AWS). It is acknowledged that these data are not representative of the site, and they are not presented as such in the AQIA.

It is noted that the reviewer has provided a 'CALMET extract' of a meteorological model output for the project site and states that these would be '*likely more representative of the project site*'. However, without adequate validation of those modelling results with observations, that statement cannot be supported to any degree and the data presented by the reviewer may be no more reflective of site conditions than that presented in the AQIA. Interestingly, the reviewer's presented annual wind rose for the project site compare well with that modelled in the original AQIA (2018) using no data assimilation and the TAPM model. However, that model did not validate well against observations at Gosford AWS which prompted NSW EPA to request an alternative meteorological modelling approach/method.

As previously indicated, the proponent proposes to install and operate a meteorological monitoring station at the project site, and observations would be able to be used as either input to, or validation for, any subsequent meteorological modelling exercises performed. This would provide confidence that the meteorological inputs to dispersion modelling adequately reflect site conditions, once the proponent seeks modification of the approval to move from 100 000 tpa to throughputs of 150 000 tpa and subsequently 200 000 tpa.

> *"The selected meteorological data are not compared to long term climate data of at least five years. The year 2015 was selected based on a comparison of 2014 to 2016 data (three years)"*

See response 4 above.

7. Modelled sources and emissions appear to be significantly underestimated, and are not best practice

> *"The emissions inventory appears to be far too low for a large number of key emission sources"*
>
> *"The annualised peak values used to develop the emission rates do not appear to reasonably reflect the likely additional activity on a peak day, relative to an average day"*
>
> *"..there may be potential for underestimation of the peak 24-hour average dust impacts."*

Emissions estimation and dispersion modelling have been re-performed. Emissions inventories and dispersion modelling results are presented in **Appendix B**. A comparison of calculated maximum 24-hour and annual average emissions indicates that the emissions during the worst-case day are:

- Haulage - 1.2 times higher than average
- Materials handling – 2.2 times higher than average
- Materials processing – 2.5 times higher than average

The above levels of conservatism have been modelled on each and every day of the assessment year, and are considered to be appropriate. Following approval of the project at a 100 000 tpa throughout, detailed information would be collated by the proponent to allow characterisation of peak activity rates in any updated AQIA.

> *"The adopted emission rate for material hauling is for public roads, not industrial roads, and is especially not appropriate for representing industrial roads made of concrete rubble where heavy trucks and equipment will spill material, track material and grind the surface rubble into a fine silt."*
>
> *"A more suitable silt loading representative of this type of road would be between 8 and 20g/m2 , and this will greatly increase the modelled emissions (as outlined above) and the predicted impacts given that*

this will become a significant site dust source. The impacts are likely to especially increase for the most affected receptors which the site roads are relatively closer to."

"The 30% control factor applied to further reduce the emissions for this type of road cannot be achieved as it is not possible to sweep such a road surface or to use water flushing to remove the silt after sweeping to loosen it."

"The claimed best practice design for the project is not consistent with the type of road proposed."

To address this issue, emissions estimation and dispersion modelling have been re-performed. Dispersion modelling results and emissions inventories are presented in **Appendix B** and **Appendix C**, respectively. Emissions associated with paved and unpaved road surfaces have been calculated, with silt contents as outlined in issue 3 above.

The 30 % control factor has been applied to the paved haulage routes and is associated with water flushing/use of water carts for dust suppression which has been justified previously.

Parts of the project site would be constructed of a sealed asphalt surface, with other parts being recycled crushed concrete with a geotextile membrane. The recycled crushed concrete would comply with the *Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage* (IPWEA, 2010) Class R1 material. The roads would not be made of concrete rubble, but of processed 26.5 mm recycled concrete.

Following approval of the project at a 100 000 tpa throughput, detailed review of the emissions controls would be performed in conjunction with air quality monitoring data and visual observations. Should additional treatment/management be required to ensure that off-site air quality meets required guidelines, this would be investigated and applied.

"A 30% control factor (30% reduction) in emissions for material moved from the supplies bunker for sale by end loader (FEL) is applied. This is incorrect."

Table 4 of the National Pollutant Inventory EETM for Mining (NPI, 2012) indicates that an emission reduction factor of 30 % is applicable to all activities in table 2 of (NPI, 2012) when associated with wind breaks.

However, these control factors have been removed in the updated modelling assessment.

"It appears that wind erosion is only modelled to arise from 1.59 ha, whereas the approximate operational area is 3.9ha. This is an approximate 2.5 fold underestimation of the most significant source of emissions at the site."

The estimation of wind erosion has been performed in the updated dispersion modelling to reflect the entire 3.9 ha site.

"Noting that the weather data used also appears to underestimate the westerly winds which blow towards the most impacted receptors (and the wind erosion occurs under such conditions), this can mean that there may be a large underestimation of the predicted dust impact at receptors."

The issue associated with anticipated wind conditions at the project site has been dealt with above. The reviewer comments regarding the likely wind regime at the project site are based on unvalidated and unsighted modelled data.

"There is a doubling up of control factors in many cases, and this makes the emission implausibly low."

This is incorrect. Emission controls factors are multiplicative, and the application of multiple (but different) controls on one source is appropriate and standard practice and has been adopted. Full discussion is provided in response to issues 2 and 3 above.

"An example is the tipping of every load in the 3-sided enclosure. Closer examination shows that this level of control (70%) is not realistic for this "enclosure", and that there would be quite limited shielding offered in this case given there are three short walled adjacent tipping bays, and the frontal opening spans all three and is very wide."

"Yet, the entire purpose of the receivals bay in this case is to take the entire pile and spread it thinly on the ground, greatly increasing the dust emissions relative to any normal pile. This will result in more emissions overall than a normal uncontrolled pile (not a total 85% reduction as has been assumed)."

Full justification of the multiplicative emissions controls adopted can be viewed in response to issues 2 and 3 above.

"A further example is the application of a 77.7% watering control factor for water sprays on the crusher, and an additional 70% control factor for an enclosure, resulting in a total of 93.3% control. Closer examination shows that the enclosure is like a tunnel as it is open at each end and has what appear to be material conveyors protruding out of the sides. Thus, the key dust generating parts of the crusher are not in the enclosure, and the proposed enclosure provides limited shielding benefit, or no such benefit when winds along the axis of the crusher. Overall, it appears this source may be underestimated by up to approximately three-fold, relative to normal, controlled crusher emissions."

Emission controls associated with materials processing are presented in response to issue 2 above. A 50 % control factor has been applied relating to the use of water sprays during processing which is entirely appropriate (NPI, 2012).

Full details of the proposed enclosure around processing activities, and the level of emissions control is presented in response to issue 2.

"The entire design of this facility represents relatively poor practice and falls well short of best practice in terms of current design and emissions performance practices applied for new facilities."

"The road surfaces, the tipping bay and crusher issues outlined above, are notable examples. Other examples are the site design and layout featuring crossing travel paths of materials and trucks which cause additional silt track out, the many open bays of material, the numerous double handling steps, excessively long transport distance of material with heavy plant due to the poor shape and layout, and a range of other relatively poor practice aspects of the proposal. "

The AQIA has been performed on the facility design and layout presented in the EIS and demonstrates that predicted impacts do not exceed the relevant criteria. Furthermore, the reviewer has not taken into consideration the purpose and functions of the facility, and has made broad and generalised observations in relation to the design of the facility with respect to potential impacts on air quality. We believe these statements are unsubstantiated and misleading.

We wish to highlight that the purpose of the development is to provide an integrated recycling facility for sand, soil and building materials. Comments in relation to how the site is designed to protect air quality is given as follows:

a) **Landscape materials supply area**: The front section of the site is designed to function as a discreet landscape supplies and storage area, where vehicles enter via the weighbridge over an asphalt pavement, then manoeuvre to be loaded with landscape supplies. This area is located in close proximity to the site entrance to minimise vehicle travel distances. Storage bunkers are three sided to contain all materials, have bay mounted sprinklers to keep the surfaces of piles moist and to minimise dust at all times. Further mitigation measures of using water to be applied to the recycled concrete pavement is proposed as an operational control to further minimise dust generation. The positioning of the landscape materials supply area in this location also prevents vehicles from accessing the waste management and recycling operations, which is important to minimise traffic generation, movement on the recycled concrete pavement areas, and improve site safety.

b) **Waste tipping and spreading building**: All waste delivered to the site is via vehicles accessing the site and travelling over a fully sealed asphalt pavement through to the tip and spread building. No vehicle access is required over the recycled concrete pavement (which may generate dust). This building has three fully enclosed sides, and is supported by a full ceiling mounted dust suppression system. This process will enable the detection and removal of non-compliant waste materials, that could otherwise impact on recycling operations and product quality.

c) **Waste storage area**: The waste storage area is located at the southern side of the site, at maximum distance from residential receptors. Waste is storage on a fully sealed asphalt pavement, to minimise dust generation from vehicle movements, with concrete block bays on three sides for effective containment of all materials to minimise wind erosion. Bays are further supported by a bay mounted sprinkler system, which will keep the surfaces of piles moist to prevent wind erosion.

d) **Secondary sorting warehouse**: A fully enclosed building is proposed to receive, sort and separate building waste through a semi-automated processing plant. Dust suppression within the building is enhanced through the use of a ceiling mounted misting system.

e) **Processing area**: A now fully enclosed building around the concrete crushing building is proposed, with internal misting, enclosed conveyors and enclosed bunkers for containment of aggregate material. A rubber drop curtain is proposed for the front face of the bunkers, to further minimise erosion and dust impacts, whilst still allowing plant access for moving bulk materials to storage bays. Note that limited operational plant and equipment will operated in this area, which will be conducted on a recycled crushed concrete pavement. The mulcher building now is fully enclosed, with internal misting, enclosed conveyors and an enclosed bunker for containment of mulch material. A rubber drop curtain is proposed for the front face of the bunker, to further minimise erosion and dust impacts, whilst still allowing plant access for moving bulk materials to storage bays.

f) **Blending area**: Mobile plant and equipment will be used in this area to blend materials for transport to storage bays for sale. All equipment to be fitted with water sprays for dust suppression.

The AQIA further highlights the best practice air quality mitigation measures to ensure that the operation is managed in a manner to protect air quality at all times. Continuous monitoring through an on-site air quality monitoring and weather station will further assist the operator to measure, monitor and control operations to ensure that air quality criteria are met at all times.

> *"The many sources of dust are shown to operate for limited hours per day, and these limited hours result in less total emissions (relative to the same rate of activity occurring in every hour of the day). However, while it is known that the modelling is conducted for every hour of the day, it is unclear if the modelled emissions are released over only the operating hours of the day for each source, or in every hour of the day. There is potential to further underestimate the dust impacts by approximately a factor of two if these limited emissions were spread over all hours. It would be reasonable for this to be clarified or corrected if necessary.'*

Modelling of all emissions sources, other than wind erosion sources (which have been assumed to occur 24 hours per day), have been modelled based on the operational hours of the project (i.e. 7 am to 6 pm for delivery of waste materials and product sales, and 8 am to 5 pm for processing of waste). The updated emissions inventories presented in **Appendix C** provide this information.

8. Modelled Receptors

> *"It is noted that not all of the existing and likely future receptors have been modelled."*
>
> *"Notably, the proposed dwelling at Lot 3 239 Debenham Rd East, Somersby is not considered, nor is the juvenile corrections centre, where there may be many young persons present at any time. The corrections centre may warrant some additional consideration, given that inmates may be present for long periods and may be unable to leave for any respite."*

Two receptors represent potential impacts at the correction centre (Receptor I6 and I9) as indicated in Table 6 of the AQIA. Debenham Road East could not be identified on any maps, and the reviewer was contacted to confirm the location referenced in the peer review, although no reply was received.

Impacts have been predicted at receptor R1 (242 Debenham Rd South) which is adjacent to (and closer to the project site than) 239 Debenham Road South and can be used as a reasonable proxy for those potential impacts.

Impacts have also been predicted at receptor I1 (244 Debenham Rd North) which is adjacent to 239 Debenham Rd North, and can be used as a reasonable proxy for those potential impacts given that it is located nearby.

Incremental impacts at all locations surrounding the project site can be determined from review of the contour plots presented in **Appendix B**.

> *"Based on previous experience with many such activities, the reviewer considers there may be an approximate three-fold underestimation in the AQIA in this case, relative to the likely emissions from this*

site. This would lead to an approximately similar scale of underestimation in the maximum level of predicted dust impact at receptors."

"If this underestimation, and the other potential issues in the AQIA approach were to be corrected it is very likely that unacceptable dust impacts would be predicted, as might be expected in this case when considering the large scale of the development in relatively close proximity of many residential receptors, and the overall generally poor design of the facility which does not reflect industry standards or best practice."

Without additional information to support and justify these unqualified statements, we cannot provide any meaningful comment. Every site and operation is different, and comparison of total emissions from one site with another should be made with care.

9. Background Dust Monitoring Data

"Whilst the nearest available background data from Wyong are used, it is noted that the project site is quite different to the Wyong monitoring location, and this may cause some potential for bias."

"The Wyong monitoring station is located north of a horse track, but south and southeast of low-lying wetlands/ well vegetated land and a golf course. Due to this, it is reasonable to expect the station will record some of the lowest dust levels when winds are from the north to north west, i.e. blowing over the golf course and wetland/ vegetated area. These wind directions are towards some of the nearest and most affected receptors to the project site. There is bare land and industrial activity north and north-northwest of the Project site. Whilst there is uncertainty regarding the exact background dust levels at the site, on balance, using the best available information and considering the above, it is reasonable to assume that the Wyong monitoring data would underestimate the likely background dust levels at this site, and even more so when winds blow towards the nearest, most impacted receptors."

As outlined in Appendix A of the AQIA, a review of air quality monitoring locations within 50 km of the project site is provided. Three air quality monitoring stations (AQMS) were identified, with one being Wyong (approximately 20 km away), and the other two being located in the Sydney Metropolitan region, both over 40 km away.

In the performance of AQIA in NSW, the adoption of air quality monitoring data from a location which directly mirrors the conditions as outlined in the reviewer comments at the site under assessment is extremely rare. NSW DPIE currently operates 79 AQMS which measure PM_{10} continuously, which represents an average of one AQMS per approximately 10 000 square kilometres (km^2), with the majority of those AQMS being located in the most populated areas of the State.

The adoption of air quality monitoring data, often collected at significant distances from proposed projects, to represent conditions at those locations is a routinely adopted approach in NSW. The use of data from a site as close as 20 km away would be considered to be an unusual and a preferable situation for projects outside of the Sydney Metropolitan region.

As previously indicated, the proponent has committed to performing air quality monitoring following approval of the project at 100 000 tpa throughput. These site-specific data would be used in any subsequent AQIA when seeking scale up approval to operate at 150 000 tpa and 200 000 tpa.

10. Cumulative Impacts

"Whilst two similar nearby facilities are identified to have potential to add to cumulative impacts, only one is considered, and not by direct modelling."

"The proposed Bingo Facility across the road from the proposed site is noted in the AQIA to be fully enclosed, to represent best practice, and thus have minimal scope for any cumulative impacts. However, this highlights that the proposed development is not fully enclosed and is therefore not consistent with current industry best practice (as claimed throughout the AQIA). If it is the case as stated in the AQIA that an additional best practice facility across the road does not add any significant level of dust, it follows that the proposal must have much higher impacts than a best practice facility"

"The emissions from the proposed Bingo Facility are not calculated or factored into the assessment as they are not available in the public domain. This will lead to underestimated cumulative impacts, especially at Receptor 1 and also the unassessed likely future receptor at Lot 3 239 Debenham Rd East."

SSD-9265 (the proposed Resource Recovery Facility at 83 Gindurra Road) has been withdrawn and no cumulative impacts would be anticipated. It is understood that a development application for a 'warehouse and distribution facility' is now proposed at that location, and cumulative impacts associated with a development of this time would likely be minimal and do not warrant a quantitative cumulative assessment.

"The emissions from the nearby (not adjacent as claimed) Gosford Quarry are included on the basis of an assumed 26% addition to the site impacts only. However, because the emissions from this quarry are not directly modelled it means that the predicted cumulative impacts at the nearest most impacted receptors which are located between the two sites may not be adequately represented."

"The most impacted receptors cannot experience impacts from both sites at the same time, but may experience impacts from either site more often, i.e. from the proposal when winds have westerly components, and from the quarry when winds have easterly components. This can lead to significantly different, and possibly higher impacts than presented, especially when one also considers the likely bias in the background data".

Impacts associated with the Quarry operation have been modelled as discussed in response to issue 1.

"It is considered that the cumulative impacts are likely to be underestimated when considering the background data and the approach taken."

Based upon the above discussion and considering the withdrawal of the application for SSD-9265, the assessment of potential cumulative impacts is considered to be appropriate given the information available at the current time.

"Overall, the proposal does not provide a realistic assessment of the likely impacts or propose a suitable design consistent with good or best practice. Given the key shortcomings identified in this report, and the relatively close proximity of receptors, it is concluded that unacceptable impacts are likely to occur at the nearby receptors if this proposal is approved."

The reviewer's comments provide a strong case for site specific monitoring of both air quality and meteorology at the project site, which is what has been proposed by the proponent. In addition, the staged approach to approvals (100 000 tpa, 150 000 tpa and 200 000 tpa) provides ample opportunity for the impacts of the project to be clearly characterised, assessed and managed (if required) prior to scale up of the project to accept and process additional materials.

The key changes in project design include the full enclosure of all materials processing activities as requested by NSW EPA. An AQMP would be provided for the project prior to operation which would include a Trigger Action Response Plan to ensure that any off-site impacts are appropriately managed through the pro-active implementation of controls, or modification or cessation of activities. The use of site-specific air quality and meteorological monitoring to inform such a pro-active response is considered to represent best practice for operations of this nature.

Updated dispersion modelling has been performed which confirms that the project can be operated to not result in exceedances of the air quality criteria at all surrounding receptor locations.

Submission by Brad Worthington

> *"My principal concerns regarding the operational phase of SSD-8660 relate to dust generation and its potential to damage the paint surface of high value prestige vehicles and impose additional costs to my business associated with the increased frequency and care in cleaning both vehicles and business premises; and the potential for increased heavy vehicle movements between the proposed facility and Central Coast Highway via Kangoo Road, increasing road safety risks for both my staff and customers."*
>
> *"It is noted that air quality assessment of the proposed amended development is provided in Chapter 9 of the accompanying Environmental Impact Statement (EIS), with dispersion modelling indicating that 'the proposed project will meet all NSW EPA air quality standards and goals, even under worst case scenario conditions'. Notwithstanding the above statement, the analysis of 'Receptor 8' presented in EIS Tables 9.12 and 9.13 and the Incremental 24-hour PM_{10} concentrations presented in EIS Figure 9.4, shows that there will be increased dust deposition at my premises. The EIS presents no analysis of the potential adverse economic impact of increased dust deposition on the operation on my prestige vehicle sales business."*
>
> *"Proposed air quality mitigation measures for the operational phase of the project are summarised in EIS Table 9.4 and include enclosures on crushing and grinding/shredding operations with accompanying water sprays for dust suppression; Construction and use of a three-sided shed in which all materials would be tipped and sorted, incorporating the use of misting sprays; and ceasing crushing, screening and grinding activities when wind speeds exceed 25kph. These mitigation measures will not however avoid the proposed amended development increasing background dust levels and having an adverse financial impact on my businesses, as previously described."*
>
> *"It is not reasonable for development to be approved in the absence of full and proper consideration being given to its environmental and financial impact on existing businesses in the locality. This is a requirement of Section 4.15 (1) (b) of the Environmental Planning and Assessment Act 1979."*

The updated air quality impact assessment (AQIA) has considered the impacts of dust deposition on amenity, with appropriate criteria adopted from NSW EPA guidelines. The AQIA predicts incremental increases in dust deposition at any identified receptors (many of which are located in close proximity to the project) of < 0.1 g $\cdot m^{-2} \cdot month^{-1}$ (as an annual average) which is < 5 % of the NSW EPA amenity criterion. Based on review of modelling results, at the location of the respondents businesses (Kangoo Road, Somersby, which is approximately 1.2 km from any proposed activities at the project site), impacts would also be likely to be < 0.1 $g \cdot m^{-2} \cdot month^{-1}$ (as an annual average) which again represents less than 5 % of the NSW EPA amenity criterion.

Extant dust deposition levels in the area could not be determined for the purposes of the AQIA, given a lack of monitoring data in the area. The proponent does propose to measure the rate of deposited dust at the project boundary and these data would be presented to the community on a regular basis. In any case, it is unlikely that the project would result in any measurable change in dust deposition at the location of the respondent's businesses.

Submission by Central Coast Local Health District, 24 September 2020

"The EIS indicates that particulate matter attributable to the project will contribute up to 26% of the PM_{10} hour criterion and up to 12% of the $PM_{2.5}$ 24 hour criterion at the most affected receptors. Table 9.14 indicates that the impact expected at location I6 (Kariong Correctional Facility) is almost as high."

"The AQIA indicates that, measured at the nearest sensitive receptor, respirable crystalline silica will be increased up to 10% of relevant criteria by the project but this is considered insignificant (section 1.2.3)"

"Construction phase activities have potential to generate 'short term emissions of particulates', which ' may typically be experienced by neighbours as amenity impacts rather than health related impacts'"

"While the anticipated increases may fall under the relevant assessment criteria, we suggest that they could present an increased risk to the health of the community. We reiterate our previous advice that 'Epidemiological studies have been unable to identify a threshold below which exposure to particulate matter air pollution (PM) is not associated with health effects. Therefore, any increase in exposure must be assumed to have an adverse impact, even at levels below assessment criteria.'"

The AQIA has been performed with reference to NSW EPA air quality criteria, with impacts assessed in accordance with NSW EPA guidelines. Current NSW EPA guidance does not require proponents to demonstrate a net-zero impact, but to ensure that the incremental impact associated with any development, plus a background concentration, does not exceed the relevant air quality criteria. A requirement of the POEO (Clean Air) Regulation is to minimise the emissions, which has been demonstrated through the adoption of a wide range of dust control measures (see responses to issues 2 and 3, and **Appendix C**) and supported by a commitment for staged operation and review.

"The expected impact at the Riding Disabled facility is not obvious in the EIS (table 9.17) and we request that the assessment clearly identify the potential impact at this location."

Receptor I7 was specifically included in the AQIA to represent potential impacts at the Riding for the Disabled premises.

"The use of mist sprays for dust suppression is relied throughout the site. We seek confirmation that ceiling mounted spray misters will be effective in managing air quality impacts, especially in relation to the 11m high open face to the tip and spread building (AQIA fig 3)"

Similar misting sprays have been adopted by Bingo Industries at their materials recycling facility at Greenacre, NSW. These misting sprays operate on the open face of a 3-sided building and act to ensure that suspended particulate matter generated through the action of vehicle unloading does not exit the building in any significant quantity. The height of the misting sprays will be carefully designed so that during higher winds, that mist is not blown away from the building.

"The complete closure of doors and openings on the processing building is a dust control measure and the AQIA (p66) notes doors will be closed 'whenever possible', reflecting the realistic situation that openings cannot be closed at all times. We suggest if necessary, to ensure that air quality goals are met, processing operations should cease while doors and other openings are open."

All processing operations would cease when any of the doors on the secondary sorting warehouse (or any materials processing activities) are opened.

"To remove potential subjectivity, formal processes should be developed to guide the ceasing of work on ' windy days' and the visual assessment of, and response to dust lift off during material handling. These processes should be included in the Air Quality Management and Monitoring Plan, or otherwise documented."

An Air Quality Management and Monitoring Plan (AQMMP) would be provided prior to operation the project. Within the AQMMP, a range of information relating to the air quality management and mitigation measures will be provided, which will also provide quantitative triggers which would prompt management responses (i.e. a Trigger Action Response Plan).

"The AQIA states (p50) that no assessment of cumulative impact has been conducted, and we seek confirmation that this is reasonable, given that SEARS have been issued for similar project at 75 Piles Rd Somersby, 83 Gindurra Rd Somersby and that Gosford Quarries operates 250m to the east of the project site. We believe there is an imperative to ensure that the health and amenity of the local area is not negatively affected by the cumulative impact of individual projects especially when the timing of projects means the risk of cumulative impact may be less obvious."

SSD-9265 (the proposed Resource Recovery Facility at 83 Gindurra Road) has been withdrawn and no cumulative impacts would be anticipated. It is understood that a development application for a 'warehouse and distribution facility' is now proposed at that location, and cumulative impacts associated with a development of this time would likely be minimal and do not warrant a quantitative cumulative assessment.

See response to issue 1 which provides discussion regarding the operation of the Quarry.

In their submission, NSW DPIE requested:

"Please include a table of 24-hour concentrations of $PM_{2.5}$ and PM_{10} (background, incremental, and cumulative) at all receivers in the Air Quality Impact Assessment (AQIA) which is similar to Table 21 of the AQIA."

and

"The AQIA only provides a brief silica dust impact assessment as follows:

> *adjustment of the annual average $PM_{2.5}$ modelling results to account for the potential worst-case silica content of processed materials (67%) results in a predicted incremental RCS concentration at the worst affected receptor of 0.28 µg/m^3 which represents >10 % of the criterion. Even with the addition of a background concentration of 0.7 µg/m^3, the maximum RCS concentration is less than one third of the Victorian EPA and the California EPA Office for Environmental Health Hazard Assessment annual average criterion of 3 µg/m^3.*

please provide a table of incremental and cumulative concentrations of respirable crystalline silica at all receivers to justify the project will not negatively impact on the health of the community, even at the closet residential receptor."

The requested tables are provided in **Appendix B**, associated with the updated dispersion modelling assessment, based on emissions as outlined in **Appendix C**.

References

EMM. (2019). *Air Quality Impact Assessment, Girrawen Waste Recycling Transfer Facility.*

Katestone. (2011). *Katestone Environmental Pty Ltd, NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining. June 2011.*

NPI. (2012). *National Pollutant Inventory Emission Estimation Technique Manual for Mining, Version 3.1.*

Ramboll ENVIRON. (2017a). *Air Quality Impact Assessment, St Marys Resource Recovery Facility.*

Ramboll ENVIRON. (2017b). *Air Quality Impact Assessment, Penrith Waste Recycling and Transfer Facility.*

US EPA. (1987). *User's Guide – Emission Control Technologies and Emission Factors for Unpaved Road Fugitive Emissions, Centre for Environmental Research Information, Office of Research and Development, USEPA, September 1987.*

US EPA. (2006). *AP-42 Emission Factors Section 13.2.2 Unpaved Roads.*

USEPA. (2011). *AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.1 Paved Roads.*

USEPA. (2019). *AERMOD Implementation Guide, EPA-454/B-19-035.*

APPENDIX A

Details of the proposed enclosures around the materials processing activities are provided overleaf.

Appendix B – updated dispersion modelling results

The following provide the results of the updated dispersion modelling exercise which has adopted the emissions as outlined in **Appendix C**.

Annual average particulate matter impacts are presented in **Table B1** associated with the project operation, plus the impact of the quarry as discussed in response to issue 1. Impacts associated with the quarry operation alone are also presented in **Table B2**, which indicate impacts <0.1 $\mu g \cdot m^{-3}$ at all surrounding receptors. The results in **Table B1** can therefore also be viewed as impacts associated with the operation of the project alone.

Dispersion modelling results for deposited dust indicate incremental impacts < 0.1 $g \cdot m^{-2} \cdot month^{-1}$ at all surrounding receptors. An error in unit conversion resulted in erroneous reporting of dust deposition rates in the previous AQIA.

All annual average particulate results indicate compliance with the relevant criteria at all surrounding receptor locations.

Table B3 presents the maximum incremental PM_{10} and $PM_{2.5}$ contribution from the project, with the addition of the background air quality measured on that day, at all receptors. **Table B4** presents the maximum cumulative PM_{10} and $PM_{2.5}$ impacts at all receptors, not including the already exceeding background concentration. The results indicate that the project can be operated to not result in additional exceedances of the relevant air quality criteria.

Table B5 presents the calculated respirable crystalline silica (RCS) concentrations predicted at the surrounding receptors. All cumulative RCS concentrations are predicted to be easily achieved, with a minimal contribution from the project.

Contour plots of the maximum incremental PM_{10} and $PM_{2.5}$ predicted through the performance of the updated dispersion modelling assessment are presented overleaf.

Maximum incremental 24 hour PM_{10} concentrations at the most impacted receptor (R3) have been analysed to determine the frequency at which concentrations are predicted to be within various concentration ranges. The analysis indicates that on 300 days out of 365 (i.e. 82.2 % of the year) 24-hour PM_{10} concentrations are predicted to be <2.5 $\mu g \cdot m^{-3}$, on 40 days (11 % of the year) concentrations were predicted to be >2.5 $\mu g \cdot m^{-3}$ and <5 $\mu g \cdot m^{-3}$. On only three occasions are incremental PM_{10} concentrations predicted to be above 10 $\mu g\ m^{-3}$ (i.e < 1 % of the year).

Table B1 - Predicted annual average TSP, PM_{10} and $PM_{2.5}$ concentrations – project plus quarry

Receptor	Annual Average Concentration (µg·m^{-3})								
	TSP			PM_{10}			$PM_{2.5}$		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
R1	7.0	32.8	39.8	1.5	14.4	15.9	0.3	5.2	5.5
R2	9.0	32.8	41.8	2.0	14.4	16.4	0.4	5.2	5.6
R3	2.8	32.8	35.6	0.8	14.4	15.2	0.1	5.2	5.3
R4	2.6	32.8	35.4	0.7	14.4	15.1	0.1	5.2	5.3
R5	4.4	32.8	37.2	1.0	14.4	15.4	0.2	5.2	5.4
R6	0.3	32.8	33.1	<0.1	14.4	14.5	<0.1	5.2	5.3
R7	0.3	32.8	33.1	<0.1	14.4	14.5	<0.1	5.2	5.3
R8	0.3	32.8	33.1	<0.1	14.4	14.5	<0.1	5.2	5.3
I1	0.7	32.8	33.5	0.2	14.4	14.6	<0.1	5.2	5.3
I2	2.4	32.8	35.2	0.6	14.4	15.0	0.1	5.2	5.3
I3	2.3	32.8	35.1	0.6	14.4	15.0	0.1	5.2	5.3
I4	3.2	32.8	36.0	0.8	14.4	15.2	0.2	5.2	5.4
I5	2.2	32.8	35.0	0.6	14.4	15.0	0.1	5.2	5.3
I6	1.6	32.8	34.4	0.4	14.4	14.8	<0.1	5.2	5.3
I7	1.4	32.8	34.2	0.4	14.4	14.8	<0.1	5.2	5.3
I8	1.1	32.8	33.9	0.3	14.4	14.7	<0.1	5.2	5.3
I9	0.5	32.8	33.3	0.1	14.4	14.5	<0.1	5.2	5.3
I10	0.6	32.8	33.4	0.1	14.4	14.5	<0.1	5.2	5.3
I11	0.5	32.8	33.3	0.1	14.4	14.5	<0.1	5.2	5.3
I12	0.4	32.8	33.2	<0.1	14.4	14.5	<0.1	5.2	5.3
I13	0.6	32.8	33.4	0.1	14.4	14.5	<0.1	5.2	5.3
Criterion	-	90		-	25		-	8	

Table B2 - Predicted annual average TSP, PM_{10} and $PM_{2.5}$ concentrations – quarry only

Receptor	Annual Average Concentration (µg·m^{-3})								
	TSP			PM_{10}			$PM_{2.5}$		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
R1	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R2	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R3	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R4	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R5	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R6	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R7	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
R8	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I1	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I2	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I3	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I4	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I5	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I6	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I7	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I8	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I9	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I10	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I11	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I12	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
I13	<0.1	32.8	32.9	<0.1	14.4	14.5	<0.1	5.2	5.3
Criterion	-	90		-	25		-	8	

Table B3 - Predicted 24-hour average PM_{10} and $PM_{2.5}$ concentrations – Maximum incremental impact

Receptor	24-hour average concentration ($\mu g \cdot m^{-3}$)					
	PM_{10}			$PM_{2.5}$		
	Maximum incremental Impact	Background	Cumulative Impact	Maximum incremental Impact	Background	Cumulative Impact
R1	15.5	8.5	24.0	2.9	6.6	9.5
R2	17.4	10.2	27.6	3.5	3.5	7.0
R3	22.6	8.1	30.7	3.5	4.1	7.6
R4	6.9	10.5	17.4	1.2	4.4	5.6
R5	9.2	10.9	20.1	1.9	4.4	6.3
R6	2.1	5.7	7.8	0.3	4.3	4.6
R7	5.7	15.1	20.8	1.0	4	5.0
R8	3.0	8.9	11.9	0.5	4.3	4.8
I1	3.4	12.7	16.1	0.6	5.4	6.0
I2	8.4	14.0	22.4	1.3	<0.1	1.3
I3	8.6	<0.1	8.6	1.5	<0.1	1.5
I4	20.7	9.8	30.5	3.1	<0.1	3.1
I5	12.0	8.4	20.4	2.1	3.8	5.9
I6	13.0	5.7	18.7	2.0	1.6	3.6
I7	9.5	6.3	15.8	1.6	2.7	4.3
I8	6.8	14.0	20.8	1.1	2.7	3.8
I9	3.6	7.4	11.0	0.6	5.3	5.9
I10	7.0	15.7	22.7	1.2	5.7	6.9
I11	5.4	9.8	15.2	0.8	4.5	5.3
I12	5.1	15.7	20.8	0.9	5.7	6.6
I13	5.5	8.4	13.9	1.0	3.8	4.8
Criterion	-	50		-	25	

Table B4 - Predicted 24-hour average PM_{10} and $PM_{2.5}$ concentrations – Maximum cumulative impact (excluding already exceeding background PM_{10})

Receptor	24-hour average concentration ($\mu g \cdot m^{-3}$)					
	PM_{10}			$PM_{2.5}$		
	Incremental Impact	Background	Maximum cumulative Impact	Incremental Impact	Background	Maximum cumulative Impact
R1	0.7	41.7	42.4	0.8	13.2	14.0
R2	1.2	41.7	42.9	0.4	13.2	13.6
R3	0.5	41.7	42.2	<0.1	13.2	13.3
R4	0.2	41.7	41.9	<0.1	13.2	13.3
R5	0.5	41.7	42.2	0.2	13.2	13.4
R6	<0.1	41.7	41.8	<0.1	13.2	13.3
R7	<0.1	41.7	41.8	<0.1	13.2	13.3
R8	<0.1	41.7	41.8	<0.1	13.2	13.3
I1	0.2	41.7	41.9	<0.1	13.2	13.3
I2	0.1	41.7	41.8	0.1	13.2	13.3
I3	0.2	41.7	41.9	0.2	13.2	13.4
I4	0.5	41.7	42.2	0.4	13.2	13.6
I5	0.4	41.7	42.1	0.1	13.2	13.3
I6	0.1	41.7	41.8	<0.1	13.2	13.3
I7	1.1	41.7	42.8	<0.1	13.2	13.3
I8	0.6	41.7	42.3	<0.1	13.2	13.3
I9	<0.1	41.7	41.8	<0.1	13.2	13.3
I10	0.4	41.7	42.1	<0.1	13.2	13.3
I11	<0.1	41.7	41.8	<0.1	13.2	13.3
I12	0.2	41.7	41.9	<0.1	13.2	13.3
I13	0.2	41.7	41.9	<0.1	13.2	13.3
Criterion	-	50		-	25	

Table B5 - Predicted annual average concentrations of respirable crystalline silica

Receptor	Annual Average Silica (as $PM_{2.5}$) concentrations (µg·m^{-3})		
	Incremental Impact	Background	Cumulative Impact
R1	0.2	0.7	0.9
R2	0.3	0.7	1.0
R3	0.1	0.7	0.8
R4	0.1	0.7	0.8
R5	0.1	0.7	0.8
R6	0.1	0.7	0.8
R7	0.1	0.7	0.8
R8	0.1	0.7	0.8
I1	0.1	0.7	0.8
I2	0.1	0.7	0.8
I3	0.1	0.7	0.8
I4	0.1	0.7	0.8
I5	0.1	0.7	0.8
I6	0.1	0.7	0.8
I7	0.1	0.7	0.8
I8	0.1	0.7	0.8
I9	0.1	0.7	0.8
I10	0.1	0.7	0.8
I11	0.1	0.7	0.8
I12	0.1	0.7	0.8
I13	0.1	0.7	0.8
Criterion	-	3.0	

Figure B1 - Predicted incremental maximum 24-hour PM_{10} concentrations

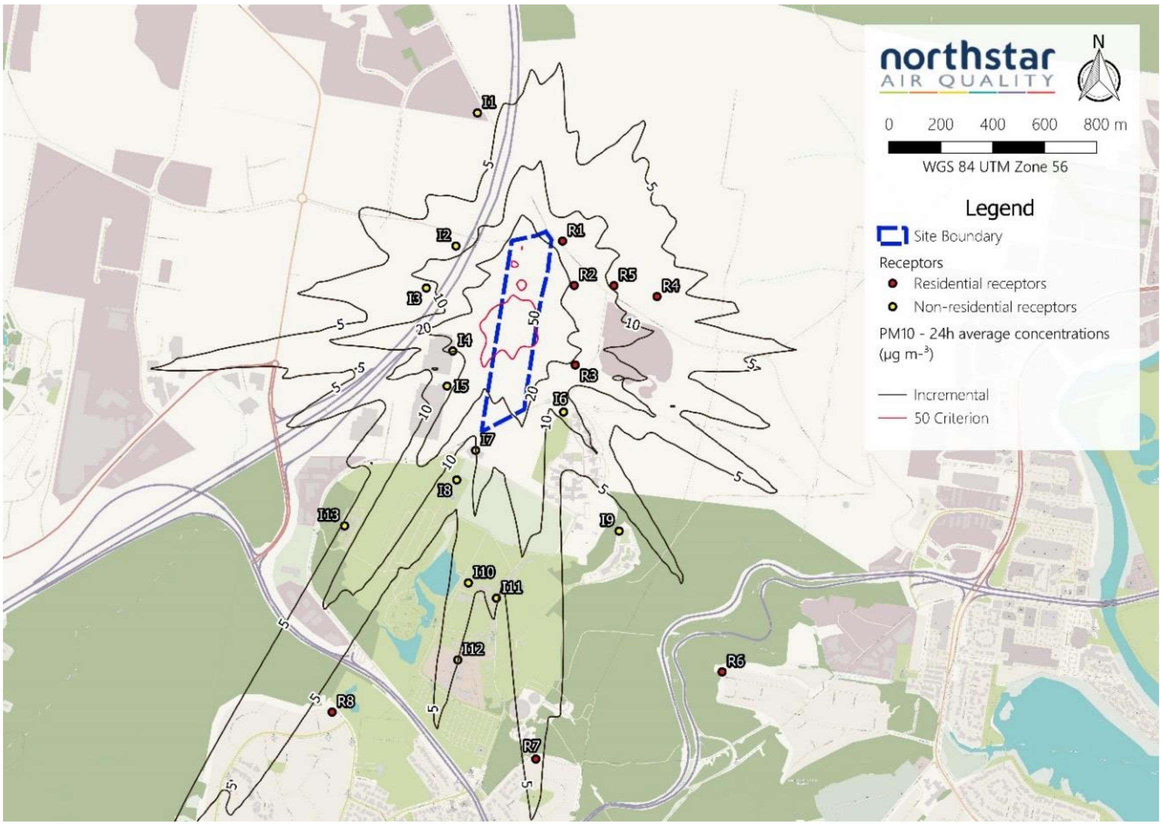
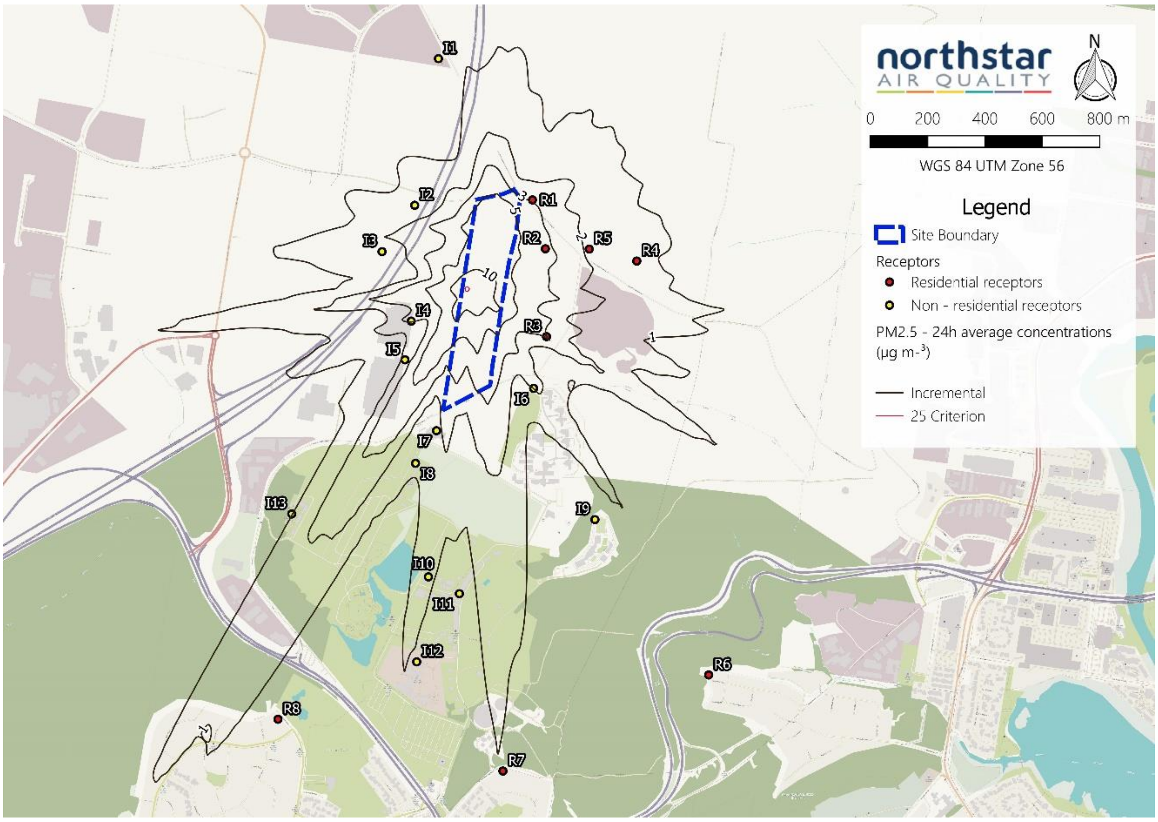


Figure B2 - Predicted incremental maximum 24-hour $PM_{2.5}$ concentrations



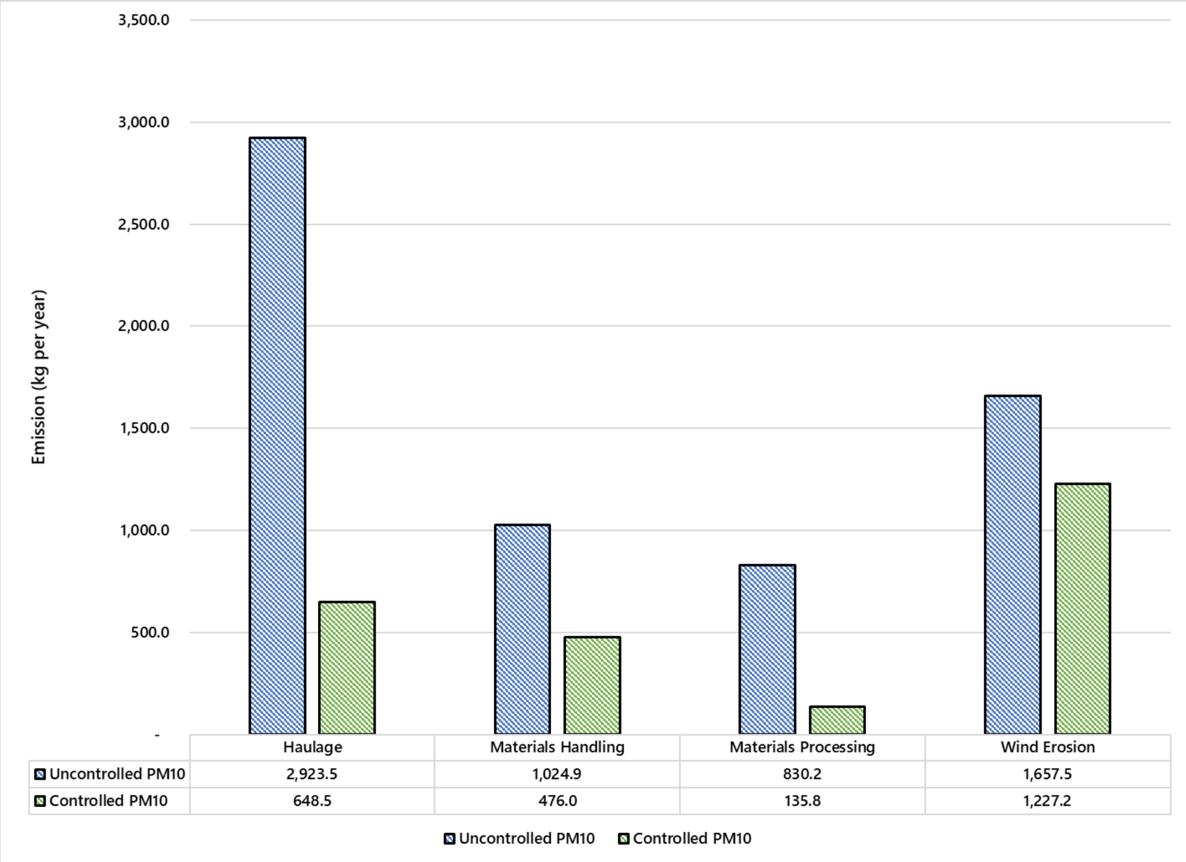
Appendix C – emissions inventory

The following provide the emissions inventories associated with annual average and 24-hr maximum operation of the project. The operational hours of each activity, and the emission rate in grams per second ($g \cdot s^{-1}$) is also provided.

Annual emissions inventory

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·year⁻¹)					g/s (over operational hours)		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$	Hour start	Hour end	TSP	PM_{10}	$PM_{2.5}$
Unloading material in tip and spread waste receival building	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	200,000	t	3 sided building (70%) Water mist (50%) Minimise drop height (30%)	29.4	13.9	2.1	7	18	2.03E-03	9.58E-04	1.45E-04
Spreading material with FEL	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	200,000	t	3 sided building (70%) Water mist (50%)	41.9	19.8	3.0	7	18	2.89E-03	1.37E-03	2.07E-04
Loading FEL at tip and spread waste receival building	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	200,000	t	Water mist (50%)	139.8	66.1	10.0	7	18	9.65E-03	4.56E-03	6.91E-04
Unloading FEL at concrete bay in waste storage area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	200,000	t	Water sprays (50%) Minimise drop height (30%)	97.9	46.3	7.0	7	18	6.75E-03	3.19E-03	4.84E-04
Loading FEL with material at waste storage bays	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	186,000	t	Water sprays (50%)	130.0	61.5	9.3	7	18	8.97E-03	4.24E-03	6.43E-04
Unloading material at processing area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	186,000	t		260.0	123.0	18.6	7	18	1.79E-02	8.49E-03	1.29E-03
Loading crusher with concrete and masonry and asphalt	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	66,000	t		92.3	43.6	6.6	8	17	7.78E-03	3.68E-03	5.57E-04
Crushing	AP-42 - Primary crushing - Table 11.19.2.1	2.7E-03	1.2E-03	2.2E-04	kg/tonne	66,000	tonnes	Application of water (50%) Enclosed building (70%)	26.7	11.9	2.1	8	17	2.25E-03	1.00E-03	1.80E-04
Screening	AP-42 - Screening - Table 11.19.2.1	1.3E-02	4.3E-03	3.0E-04	kg/tonne	166,000	tonnes	Application of water (50%) Enclosed building (70%)	311.3	107.1	7.5	8	17	2.62E-02	9.03E-03	6.32E-04
Unloading of crushed and screened products	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	166,000	t	Wet material (50%) Enclosed building (70%)	34.8	16.5	2.5	8	17	2.94E-03	1.39E-03	2.10E-04
Loading FEL with wood and timber at waste storage area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	20,000	t		28.0	13.2	2.0	7	18	1.93E-03	9.12E-04	1.38E-04
Wood and timber unloaded in processing area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	20,000	t		28.0	13.2	2.0	7	18	1.93E-03	9.12E-04	1.38E-04
Wood and timber loaded to shredder	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	20,000	t		28.0	13.2	2.0	8	17	2.36E-03	1.12E-03	1.69E-04
Shredding	AP-42 - Primary crushing - Table 11.19.2.1	2.7E-03	1.2E-03	2.2E-04	kg/tonne	20,000	tonnes	Enclosed building (70%) Water sprays (50%)	8.1	3.6	0.6	8	17	6.83E-04	3.04E-04	5.46E-05
Unloading of shredded products	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	20,000	t	Enclosed building (70%) Water sprays (50%)	4.2	2.0	0.3	8	17	3.54E-04	1.67E-04	2.53E-05
Loading of FEL with crushed and screened concrete and asphalt	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	66,000	t		92.3	43.6	6.6	7	18	6.37E-03	3.01E-03	4.56E-04
Loading of FEL with shredded material	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	20,000	t		28.0	13.2	2.0	7	18	1.93E-03	9.12E-04	1.38E-04
Unloading of crushed material at Product Storage Area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	66,000	t		92.3	43.6	6.6	7	18	6.37E-03	3.01E-03	4.56E-04
Unloading of shredded material at Product Storage Area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	20,000	t		28.0	13.2	2.0	7	18	1.93E-03	9.12E-04	1.38E-04
Loading FEL with mixed building waste	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	10,000	t		14.0	6.6	1.0	7	18	9.65E-04	4.56E-04	6.91E-05
Unloading of FEL with mixed building waste at Secondary Sorting	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	10,000	t	Enclosed hopper (70%) Misting system (50%)	2.1	1.0	0.2	7	18	1.45E-04	6.84E-05	1.04E-05
Loading of hopper in Secondary Sorting Warehouse	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	10,000	t	Enclosed hopper (70%) Misting system (50%)	2.1	1.0	0.2	8	17	1.77E-04	8.36E-05	1.27E-05
Screening of material in Secondary Sorting Warehouse	AP-42 - Screening - Table 11.19.2.1	1.3E-02	4.3E-03	3.0E-04	kg/tonne	10,000	tonnes	Enclosed hopper (70%) Misting system (50%)	18.8	6.5	0.5	8	17	1.58E-03	5.44E-04	3.81E-05
Soil blending in Product Blending Area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	100,000	t		139.8	66.1	10.0	8	17	1.18E-02	5.58E-03	8.44E-04
Loading FEL with blended product	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	100,000	t		139.8	66.1	10.0	7	18	9.65E-03	4.56E-03	6.91E-04
Unloading FEL with blended product at Product Storage Area	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	100,000	t		139.8	66.1	10.0	7	18	9.65E-03	4.56E-03	6.91E-04
Loading vehicles with product and waste	AP-42 - Batch drop - Section 13.2.4.3	1.4E-03	6.6E-04	1.0E-04	kg/t	200,000	t		279.6	132.2	20.0	7	18	1.93E-02	9.12E-03	1.38E-03
Material hauled on unpaved roads - receivals	AP-42 Unpaved roads - Section 13.2.2	2.7E+00	7.6E-01	7.6E-02	kg/VKT	381	VKT	L2 Watering (75%) Speed reduction to 30 km/hr (75%)	63.9	18.2	1.8	7	18	4.41E-03	1.25E-03	1.25E-04
Material hauled on paved roads - receivals	AP-42 Paved roads - Section 13.2.1	4.9E-01	9.4E-02	2.3E-02	kg/VKT	5,706	VKT	Watering (30%)	1,963.2	376.8	91.2	7	18	1.35E-01	2.60E-02	6.29E-03
Material hauled on unpaved roads - sales	AP-42 Unpaved roads - Section 13.2.2	2.7E+00	7.6E-01	7.6E-02	kg/VKT	2,494	VKT	L2 Watering (75%) Speed reduction to 30 km/hr (75%)	418.0	118.9	11.9	7	18	2.88E-02	8.20E-03	8.20E-04
Material hauled on paved roads - sales	AP-42 Paved roads - Section 13.2.1	4.9E-01	9.4E-02	2.3E-02	kg/VKT	2,039	VKT	Watering (30%)	701.5	134.6	32.6	7	18	4.84E-02	9.29E-03	2.25E-03
Whole site (less below)	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850	425	63.75	kg/ha/yr	2.7	ha		2,331.6	1,165.8	174.9	0	24	2.65E-01	1.33E-01	1.99E-02
Waste storage area	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850	425	63.75	kg/ha/yr	0.5	ha	3 sided bins (75%) water sprays (50%)	55.0	27.5	4.1	0	24	6.27E-03	3.13E-03	4.70E-04
Product storage area	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850	425	63.75	kg/ha/yr	0.6	ha	3 sided bins (75%) water sprays (50%)	67.9	33.9	5.1	0	24	7.73E-03	3.86E-03	5.80E-04

Summary of annual PM_{10} emissions (kg per year)

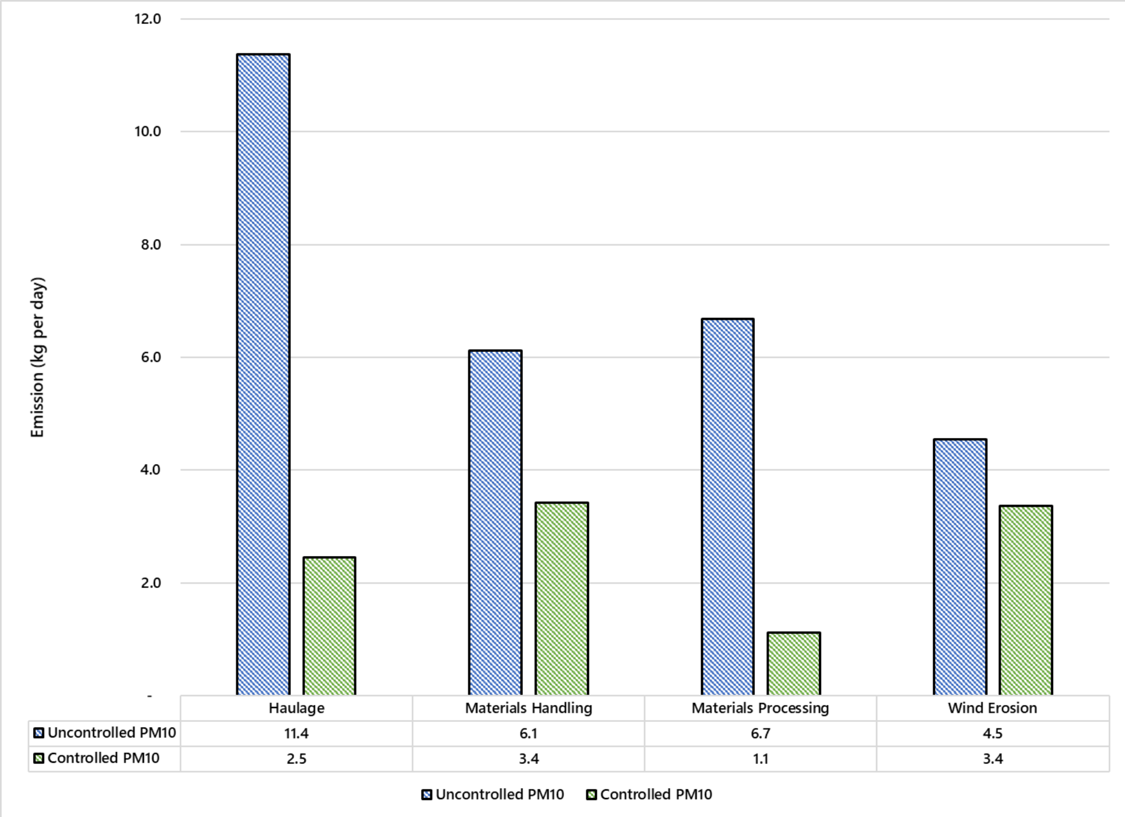


	Haulage	Materials Handling	Materials Processing	Wind Erosion
Uncontrolled PM10	2,923.5	1,024.9	830.2	1,657.5
Controlled PM10	648.5	476.0	135.8	1,227.2

24-hour emissions inventory

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls	Controlled Emissions ($kg \cdot year^{-1}$)			Hour start	Hour end	g/s (over operational hours)		
		TSP	PM_{10}	$PM_{2.5}$				(% efficiency)	TSP	PM_{10}	$PM_{2.5}$			TSP	PM_{10}	$PM_{2.5}$
Unloading material in tip and spread waste receival building	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	933	t	3 sided building (70%) Water mist (50%) Minimise drop height (30%)	0.1	0.1	0.0	7	18	3.28E-03	1.55E-03	2.35E-04
Spreading material with FEL	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	933	t	3 sided building (70%) Water mist (50%)	0.2	0.1	0.0	7	18	4.69E-03	2.22E-03	3.36E-04
Loading to FEL at tip and spread waste receival building	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	933	t	Water mist (50%)	0.6	0.3	0.0	7	18	1.56E-02	7.39E-03	1.12E-03
Unloading FEL at concrete bay in waste storage area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	933	t	Water sprays (50%) Minimise drop height (30%)	0.4	0.2	0.0	7	18	1.09E-02	5.17E-03	7.83E-04
Loading FEL with material at waste storage bays	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	640	t	Water sprays (50%)	0.4	0.2	0.0	7	18	1.07E-02	5.07E-03	7.67E-04
Unloading material at processing area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	640	t		0.8	0.4	0.1	7	18	2.14E-02	1.01E-02	1.53E-03
Loading crusher with concrete and masonry and asphalt	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	640	t		0.8	0.4	0.1	8	17	2.62E-02	1.24E-02	1.88E-03
Crushing	AP-42 - Primary crushing - Table 11.19.2.1	2.7E-03	1.2E-03	2.2E-04	kg/tonne	640	tonnes	Application of water (50%) Enclosed building (70%)	0.3	0.1	0.0	8	17	8.00E-03	3.56E-03	6.40E-04
Screening	AP-42 - Screening - Table 11.19.2.1	1.3E-02	4.3E-03	3.0E-04	kg/tonne	1,280	tonnes	Application of water (50%) Enclosed building (70%)	2.4	0.8	0.1	8	17	7.41E-02	2.55E-02	1.78E-03
Unloading of crushed and screened products	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	1,280	t	Wet material (50%) Enclosed building (70%)	0.3	0.1	0.0	8	17	7.86E-03	3.72E-03	5.63E-04
Loading FEL with wood and timber at waste storage area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	224	t		0.3	0.1	0.0	7	18	7.50E-03	3.55E-03	5.37E-04
Wood and timber unloaded in processing area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	224	t		0.3	0.1	0.0	7	18	7.50E-03	3.55E-03	5.37E-04
Wood and timber loaded to shredder	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	224	t		0.3	0.1	0.0	8	17	9.17E-03	4.34E-03	6.56E-04
Shredding	AP-42 - Primary crushing - Table 11.19.2.1	2.7E-03	1.2E-03	2.2E-04	kg/tonne	224	tonnes	Enclosed building (70%) Water sprays (50%)	0.1	0.0	0.0	8	17	2.80E-03	1.24E-03	2.24E-04
Unloading of shredded products	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	224	t	Enclosed building (70%) Water sprays (50%)	0.0	0.0	0.0	8	17	1.37E-03	6.50E-04	9.85E-05
Loading of FEL with crushed and screened conceret and asphalt	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	1,920	t		2.5	1.2	0.2	7	18	6.43E-02	3.04E-02	4.60E-03
Loading of FEL with shredded material	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	224	t		0.3	0.1	0.0	7	18	7.50E-03	3.55E-03	5.37E-04
Unloading of crushed material at Product Storage Area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	640	t		0.8	0.4	0.1	7	18	2.14E-02	1.01E-02	1.53E-03
Unloading of shredded material at Product Storage Area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	224	t		0.3	0.1	0.0	7	18	7.50E-03	3.55E-03	5.37E-04
Loading of FEL with mixed building waste	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	35	t		0.0	0.0	0.0	7	18	1.17E-03	5.54E-04	8.39E-05
Unloading of FEL with mixed building waste at Secondary Sorting	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	35	t	Enclosed hopper (70%) Misting system (50%)	0.0	0.0	0.0	7	18	1.76E-04	8.31E-05	1.26E-05
Loading of hopper in Secondary Sorting Warehouse	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	35	t	Enclosed hopper (70%) Misting system (50%)	0.0	0.0	0.0	8	17	2.15E-04	1.02E-04	1.54E-05
Screening of material in Secondary Sorting Warehouse	AP-42 - Screening - Table 11.19.2.1	1.3E-02	4.3E-03	3.0E-04	kg/tonne	35	tonnes	Enclosed hopper (70%) Misting system (50%)	0.1	0.0	0.0	8	17	2.03E-03	6.97E-04	4.88E-05
Soil blending in Product Blending Area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	335	t		0.4	0.2	0.0	8	17	1.37E-02	6.48E-03	9.82E-04
Loading FEL with blended product	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	335	t		0.4	0.2	0.0	7	18	1.12E-02	5.30E-03	8.03E-04
Unloading FEL with blended product at Product Storage Area	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	335	t		0.4	0.2	0.0	7	18	1.12E-02	5.30E-03	8.03E-04
Loading vehicles with product and waste	AP-42 - Batch drop - Section 13.2.4.3	1.3E-03	6.3E-04	9.5E-05	kg/t	933	t		1.2	0.6	0.1	7	18	3.12E-02	1.48E-02	2.24E-03
Material hauled on unpaved roads - receivals	AP-42 Unpaved roads - Section 13.2.2	2.7E+00	7.6E-01	7.6E-02	kg/VKT	3	VKT	L2 Watering (75%) Speed reduction to 30 km/hr (75%)	0.4	0.1	0.0	7	18	1.08E-02	3.06E-03	3.06E-04
Material hauled on paved roads - reecival	AP-42 Paved roads - Section 13.2.1	4.9E-01	9.4E-02	2.3E-02	kg/VKT	22	VKT	Watering (30%)	7.5	1.4	0.3	7	18	1.89E-01	3.63E-02	8.78E-03
Material hauled on unpaved roads - sales	AP-42 Unpaved roads - Section 13.2.2	2.7E+00	7.6E-01	7.6E-02	kg/VKT	9	VKT	L2 Watering (75%) Speed reduction to 30 km/hr (75%)	1.5	0.4	0.0	7	18	3.72E-02	1.06E-02	1.06E-03
Material hauled on paved roads - sales	AP-42 Paved roads - Section 13.2.1	4.9E-01	9.4E-02	2.3E-02	kg/VKT	7	VKT	Watering (30%)	2.5	0.5	0.1	7	18	6.24E-02	1.20E-02	2.90E-03
Whole site (less below)	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850	425	63.75	kg/ha/yr	2.743	ha		6.4	3.2	0.5	0	24	2.66E-01	1.33E-01	2.00E-02
Waste storage area	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850	425	63.75	kg/ha/yr	0.518	ha	3 sided bins (75%) water sprays (50%)	0.2	0.1	0.0	0	24	6.28E-03	3.14E-03	4.71E-04
Product storage area	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	850	425	63.75	kg/ha/yr	0.639	ha	3 sided bins (75%) water sprays (50%)	0.2	0.1	0.0	0	24	7.75E-03	3.88E-03	5.81E-04

Summary of maximum 24 hour PM_{10} emissions (kg per day)



	Haulage	Materials Handling	Materials Processing	Wind Erosion
Uncontrolled PM10	11.4	6.1	6.7	4.5
Controlled PM10	2.5	3.4	1.1	3.4