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BOWRAL BRICKS

NEW BERRIMA BRICKWORKS FACILITY (SSD 10422)

RESPONSE TO EPA ADVICE ON SUBMISSIONS REPORT

DOCUMENT CONTROL

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1. INTRODUCTION

This document prepared by Airlabs Environmental Pty. Ltd. (Airlabs) presents a response to comments issued by the NSW- Environment Protection Authority (EPA) in the *EPA Advice on Submissions Report* for the Revised Air Quality Impact Assessment Report issued for the New Berrima Brickworks Facility (SSD 10422) (Report No: OCT20142.1, issued 19 October 2020).

Hereafter, this document is referred to as the RTS and the Revised Air Quality Impact Assessment Report as AQIA V2.

Specific comments issued by the EPA after undertaking a review of the AQIA V2 are presented in blue italics followed by Airlabs's response.

It is requested that the RTS be read in conjunction with the AQIA V2 report.

2. RESPONSE TO COMMENTS

1. Hydrogen fluoride (HF) impacts on sensitive land.

The EPA previously requested the proponent provide a detailed land use and vegetation assessment to evaluate current and potential future land uses and vegetation that may be sensitive to fluoride.

Airlabs did an aerial survey to identify any wineries or fluoride sensitive vegetation in close proximity to the proposed site. Airlabs also considered information provided to them by Austral Bricks and reviewed information available on the public domain. The information provided by Austral Bricks or supporting documentation has not been included in the revised AQIA V2.

Airlabs did not identify any existing wineries or sensitive vegetation near the proposed facility or within the expected zone of impact. Airlabs have therefore applied the general HF assessment criteria (2.9 µg/m^3).

Dispersion modelling has been undertaken, at a maximum HF emission concentration of 20 mg/m^3. This is consistent with the expected emission performance of the Austral Bricks, Horsley Park Plants 2 and 3.

Incremental and cumulative HF ground level concentration isopleths have been overlaid on the Wingecarribee Local Environmental Plan 2010 to determine the extent of the predicted HF impacts. When the sensitive land use assessment criterion of 1.5 µg/m^3 (24-hour) is applied, the results of the dispersion modelling show predicted impacts above the EPA's impact assessment criteria in the land zoned E3 to the North West of the proposed facility. As such, there is potential that future specialised land use potential in this area may be affected, including vegetation sensitive to fluoride, such as grape vines and stone fruits.

The EPA recommends the proponent be required to provide supporting evidence of the information considered in Airlabs survey of the potential for sensitive lands surrounding the proposed project site.

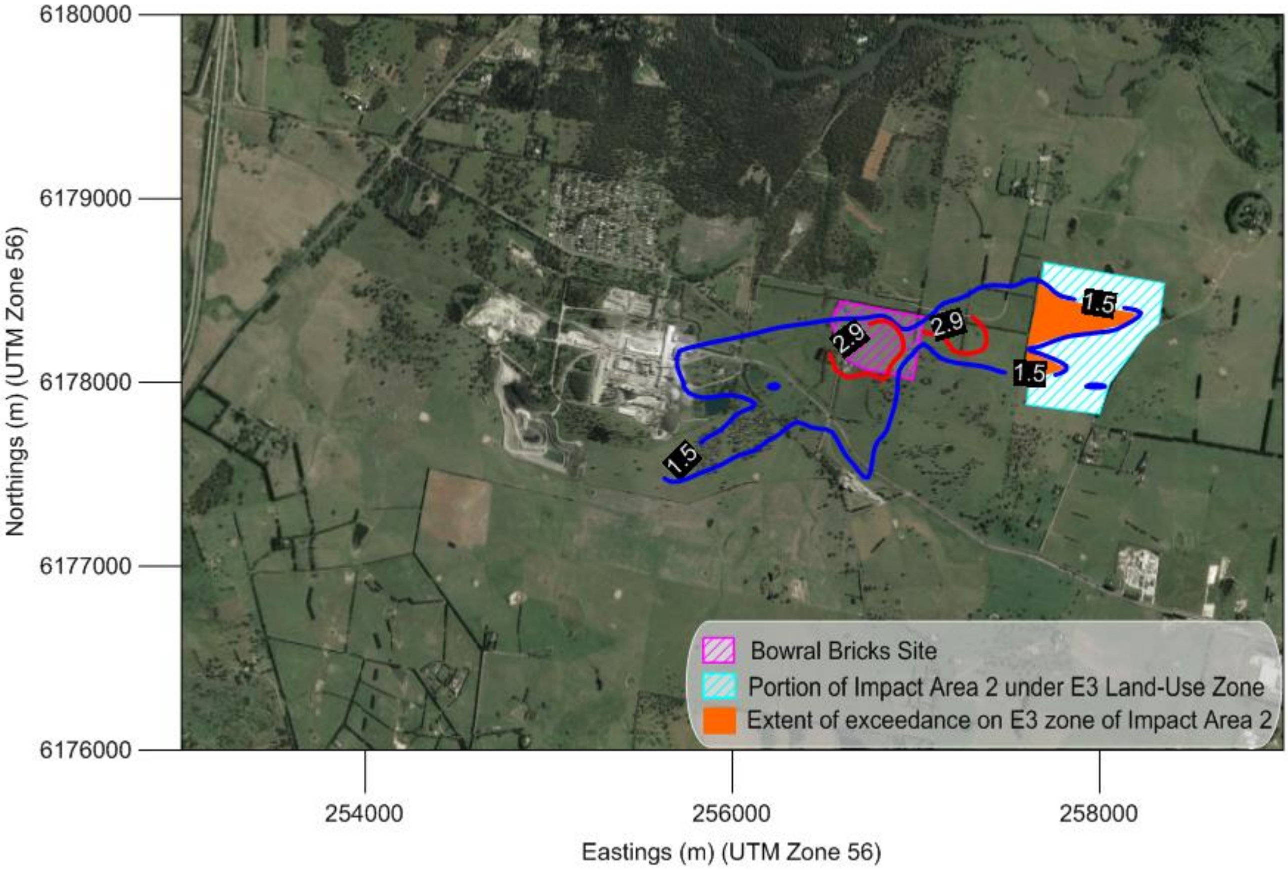
- In the AQIA V2, Airlabs informed that there are no existing wineries and sensitive vegetation within the identified modelling domain and therefore application of the general land-use assessment criteria was considered appropriate for the assessment of HF impacts. Incremental and cumulative HF concentration isopleths for the various time averaging periods (i.e. 24-hour, 7-day, 30-days and 90-days) were presented and assessed against the general land use assessment criteria as well as the sensitive land use assessment criteria in the AQIA V2. The isopleths were overlaid on the Wingecarribee Local Environmental Plan 2010 – Land Zoning Map (Sheet LZN_007C) to assess HF impacts on the existing land uses outside the proposed facility site boundary.

- EPA reviewed the incremental and cumulative HF concentration isopleths and noted that the worst impacts are predicted for the 24-hour averaging periods. EPA in their comments mention that when the sensitive land use assessment criteria (1.5 µg/m^3) is applied for the interpretation of the 24-hour averaging period concentrations, results of the dispersion modelling show predicted concentrations above the impact assessment criteria in the land zoned E3 to the north-west of the proposed facility and further note that there is potential that future specialised land use in this area may be affected including vegetation sensitive to fluoride – such as grape vines and stone fruits.

- Airlabs acknowledge EPA's concerns with regards to potential impacts on sensitive vegetation, however, applying the sensitive land use assessment criteria to land use that is in close proximity to existing heavy industrial sites (which include the proposed facility) is a highly conservative approach, as it is very unlikely that there would be sensitive vegetation areas at a distance of about 1km from the eastern boundary of the proposed facility, where the predicted concentrations have exceeded the sensitive land use assessment criteria.
- Nonetheless, to address EPA's concerns, Airlabs and Austral Bricks have investigated the areas where the predicted concentrations for the 24-hour averaging period exceeded the sensitive land use impact assessment criteria.
- Upon closer examination of the 24-hour average incremental isopleth, it is noted that concentrations exceeding the sensitive land use assessment criteria to the west, south and south-west are predicted on Heavy Industrial (IN3) and General Industrial (IN1) areas. It is highly unlikely that there would be sensitive vegetation land parcels in these zones, therefore, the application of the general land use assessment criteria is more appropriate for the concentrations predicted to the west and south-west of the proposed facility.
- With regards to the concentrations predicted to the east, Airlabs acknowledge that levels exceed the sensitive land use impact assessment criteria on specific land parcels that are currently classified E3 – Environmental Management. 24-hour average concentrations exceed the sensitive land use assessment criteria at the following locations:
    - Lot 1 DP 414246 (hereafter 'Impact Area 1'); and
    - Lot 1 DP 623038 (hereafter 'Impact Area 2').
- The addresses of the impacted areas have been obtained from the NSW – Department of Customer Services – Spatial Information Exchange (SIX Maps).
- Across the rest of the modelling domain (with the exception of the IN1 and IN3 zones) as shown in the AQIA V2, predicted concentrations comply with the general as well as the sensitive land use assessment criteria for the 24-hour averaging period, which is the most critical averaging period for the assessment of fluoride impacts.
- Based on discussions with Brickworks, it is understood that Impact Area 1 is owned by Austral Bricks – which is the site for the Austral Bricks Quarry. Therefore, this area can be excluded as a potential site for sensitive vegetation, and therefore application of the sensitive land use assessment criteria may not be warranted.
- Impact Area 2 has a combination of two (2) land-use categories - E3 and IN1. E3 component of Impact Area 2 is shown as light-blue coloured hatched area in **Figure 1**. Across the E3 component of Impact Area 2, predicted 24-hour average concentrations (shown in **Figure 1** as solid orange colour blocks) exceed the sensitive land use assessment criteria for an area which is limited to a maximum area of approximately 10 ha in size. Across the remaining area E3 component of Impact Area 2, the predicted concentrations comply with the sensitive land use assessment criteria.
- Taking into consideration that Impact Area 2 has a combination of E3 and IN1 zones and it is immediately adjacent to the Austral Bricks Quarry site and in close proximity to heavy industrial sites, which include the Boral Cement Plant, Austral Masonry Plant and the proposed facility, it is very much unlikely that it would be considered an appropriate site for sensitive vegetation.

- Based on the above observations, it can be summarised that the 24-hour average fluoride ground level concentrations exceed the sensitive land use assessment criteria only on two (2) lots across land use that is categorised as E3 – Environmental Management by the Wingecarribee Local Environmental Plan 2010, of which one (1) lot belongs to Austral Bricks – where the proposed quarry would be developed and on the other site, concentrations above the sensitive land use assessment criteria are limited to a maximum area of approximately 10 ha in size on the land that is categorised as E3.
- Moreover, taking into context the location of the lot where the elevated concentrations are predicted and it's vicinity to existing and proposed heavy industries, which include the proposed facility, it is very much unlikely that it would be considerable a potential site for developing vegetation sensitive to fluoride impacts and therefore, the application of the sensitive land use assessment criteria to that particular lot may not be appropriate. Outside these two (2) earmarked lots, predicted fluoride concentrations are not expected to have any considerable impacts on the remaining areas identified in the modelling domain.
- Furthermore, it is worth noting that the modelling results are based on a maximum discharge concentration of 20 mg/m^3, which is being achieved through end-of-pipe mitigation measures which include commissioning of a fluorine cascade scrubber. This proposed discharge concentration of 20 mg/m^3, is in-line with most of other Austral Bricks' plants in South Australia and Western Australia that have end-of-pipe HF abatement technologies. This demonstrates that the proposed discharge concentrations are in-line with the best practice measures implemented by Austral Bricks.
- Moreover, from a cumulative assessment point of view, the risk of adverse impacts is low since there are no other sources of fluoride emissions within the identified modelling domain.
- Taking into consideration the maximum discharge concentration of 20 mg/m^3 proposed by Austral Bricks which reflects best practice measures and coupled with elevated concentrations limited to only a certain area of a land parcel (refer **Figure 1**) where the sensitive land use assessment criteria is applied and also noting the unlikelihood of sensitive vegetation being developed on that lot due to proximity to existing heavy industrial facilities clearly demonstrates the low level fluoride impacts predicted from the proposed facility.
- Therefore, based on the above reasons, a detailed vegetation characterisation of the impacted areas may not be considered necessary.

Figure 1: Extent of Exceedance of the 24-hour average HF Concentrations on Impact Area 2 (Represented by the Solid Orange Coloured Area)



2. Assessment of hydrogen chloride

The EPA previously requested that the AQIA be revised to include an assessment of hydrogen chloride (HCl). HCl must be assessed at and beyond the boundary of the facility and consider cumulative sources including the Boral Berrima Cement Works.

A cumulative and incremental assessment of HCl emissions has been conducted which is presented in the revised AQIA V2. Modelling of the HCl emissions is based on a maximum discharge concentration of 100 mg/m^3, which is at the Group 6 concentration standard prescribed in the Clean Air Regulation.

The maximum (reported as 99.9th percentile) 1-hour average incremental HCl concentration predicted at or beyond the facility boundary is 30.4 µg/m^3 (22% of the impact assessment criteria). Airlabs have not proposed any additional options to further reduce HCl emissions based on the results of the modelling.

Austral Bricks proposes to install a fluorine cascade scrubber to control emissions of acid gases, including HCL. The effectiveness of this pollution control option is dependent on the adsorbing material used. For example, unmodified calcium carbonate granules are effective at removing HF and SO_3, whilst only partially effective (50% control) for HCl and largely ineffective (20% control) for SO_2 (CER, 2016)1. Improved HCl removal performance can be achieved with the use of modified adsorption materials or through additional controls.

Airlabs have assumed a HCl discharge concentration of 100 mg/m^3, consistent with the maximum allowable standard prescribed in the Clean Air Regulation. This is inconsistent with best practice and the EPA's expected emission performance, for a newly designed plant. Emission performance well below the POEO Clean Air Regulation should be practicably achievable. Additionally, under Section 45 the Protection of the Environment Operations Act (1997), the EPA must consider, among other matters, the practical measures that could be taken to prevent, control, abate or mitigate pollution.

The EPA requests that further evaluation of emission controls is undertaken.

- Austral Bricks are proposing to install a cascade scrubber to reduce the discharge concentration of acidic pollutants mainly HF along with HCl and SOx. Maximum discharge concentrations for these pollutants as mentioned in the AQIA V2 are as follows:
  - HF: 20 mg/m^3
  - HCl: 100 mg/m^3
  - SO_2: 400 mg/m^3
- EPA in their comments note that the proposed HCl discharge concentration of 100 mg/m^3 is in-line with the maximum allowable standard prescribed in the Clean Air Regulation and that this approach is inconsistent with best practice and the EPA's expected performance for a newly designed plant. EPA also note that at the proposed discharge concentration of 100 mg/m^3, the maximum (reported as 99.9th percentile) 1-hour average incremental HCl concentration predicted at or beyond the facility is 22% of the impact assessment criteria and that no additional options to further reduce HCl emissions have been proposed.
- EPA also cite reference from the Ceramic Manufacturing (CER) Best Available Techniques (BAT) Reference Document (BREF) – European Commission (August 2007), where in, it is stated that modification of the adsorbent material used in the cascade scrubber will result in higher removal performance of HCl. As-such, EPA have requested for a further evaluation of HCl emission controls.
- Austral Bricks have shared their concerns with Airlabs that no weightage is being given to the dispersion modelling results. Modelling demonstrates adequate compliance with the HCl impact assessment criteria where-by the model predictions are substantively lower – less than 25% of the HCl impact assessment criteria, however, EPA deem that the proposed discharge concentration of 100 mg/m^3 , which is in-line with the maximum allowable standard does not reflect best practice measure and is inconsistent with EPA's expected emission performance –

for a newly designed plant. EPA in their comments note that modifying the absorption media will result in improved / lower HCl concentrations. To address EPA's concerns, Austral Bricks have consulted with the kiln manufacturer to further reduce the HCl discharge concentration, even though modelling at 100 mg/m^3 demonstrates adequate compliance. Based on advice from the kiln manufacturer, the revised HCl discharge concentration from the kiln exhaust stack will not exceed 80 mg/m^3. This provides a 20% reduction in the HCl discharge concentration and also addresses EPA's concerns regarding discharge concentrations being in-line with the maximum allowable standard prescribed in the Clean Air Regulation.

- With the revised discharge concentration of 80 mg/m^3, the ground level concentrations will be further lower than what was predicted for a discharge concentration of 100 mg/m^3. Modelling at 100 mg/m^3 showed that the maximum ground level concentration (reported as the 99.9th percentile, 1-hour average incremental) predicted outside the facility site boundary was less than 25% of the impact assessment criteria. As-such, revised dispersion modelling at 80 mg/m^3 is not warranted.

- Therefore, in summation, EPA's concerns with respect to HCl emissions are being addressed by lowering the kiln exhaust stack maximum discharge concentration from 100 mg/m^3 to 80 mg/m^3.

3. Significant incremental impacts are predicted

The EPA previously requested that the proponent identify and evaluate further mitigation measures to minimise emissions of pollutants including sulfur trioxide, nitrogen oxides and sulfur dioxide in a revised AQIA. Additionally, options to improve dispersion, such as increasing the stack height, should also be considered.

The revised AQIA V2 includes additional discussion regarding the expected emission performance of the proposed plant. Airlabs have used the results of the dispersion modelling and the predicted levels of compliance with the EPA's assessment criterion, to determine that further consideration of additional controls was not warranted.

As identified in Point 2 above, the proposed cascade scrubber is not effective at controlling some pollutants associated with the brick manufacturing including NOx. Emission reduction options, such as low NOx burners or catalytic reduction have not been discussed which indicates that no mitigation measures have been proposed for preventing or minimising NOx emissions. This is inconsistent with best practice and the EPA's expected emission performance for a newly designed plant. Emission performance well below the POEO Clean Air Regulation should be practicably achievable.

The cascade scrubber also has limited effectiveness at controlling SO_2, depending on the absorbing material used. However, options for minimising emissions of SO_2, such as the use of appropriate absorbing material, have not been discussed in detail and no emission performance guarantees or engineering specifications have been provided.

The proposed facility will be the dominant source of SO_2 emissions in the local area, with predicted incremental impacts (10 minute, 100% ile) of up to 131 µg/m^3 (18% of the EPA's assessment criterion). All reasonable and feasible options to further reduce SO_2 emissions should be evaluated in a revised assessment.

The EPA requests that the AQIA V2 be revised to include a detailed feasibility assessment of engineering options and control measures to minimise emissions of pollutants including, but not limited to, particles, hydrogen chloride, nitrogen oxides and sulfur dioxide as far as practicably achievable. The results of dispersion modelling must not be used as the sole basis for not proposing emission controls. Where controls are proposed, the estimated level of emission performance must be supported using engineering specifications or performance guarantees.

Although modelling conducted in the AQIA V2 demonstrates adequate compliance with the relevant impact assessment criteria for all of the modelled pollutants, EPA have requested that the assessment be revised to include a detailed feasibility assessment of engineering options and control measures to reduce pollutant concentrations and that the results of the dispersion modelling are not to be used as the sole purpose for not proposing emission controls.

Austral Bricks have taken EPA's comments on-board and have investigated the options for further reducing the discharge concentrations from the kiln stack.

Based on further consultations with the kiln manufacturer and undertaking a detailed review of historical pollutant concentrations measured across other Austral Bricks' manufacturing facilities, a revised discharge concentration estimate has been provided to Airlabs, which is summarised below in **Table 1**.

The revised discharge concentrations are expected to the maximum concentrations, and as seen from **Table 1**, are considerably lower than what was proposed in AQIA V2. These revised discharge concentrations which are considerably lower than the maximum allowable standard clearly demonstrates Austral Bricks' commitment towards a sustainable mode of operation with respect to air quality.

As the revised discharge concentrations are notably lower than the corresponding concentrations presented in AQIA V2, no further modelling is warranted as the predicted ground level concentrations corresponding to the revised discharge concentrations will be considerably lower than what was presented in AQIA V2.

Table 1: Revised Discharge Concentrations from the Proposed Facility Kiln Exhaust Stack

Pollutant	Units	Corresponding Standard of Concentration – Ceramic Works, Group 6, Schedule 3 POEO Clean Air Regulation 2010,	Revised Maximum Discharge Concentrations proposed by Austral Bricks	Discharge Concentrations presented in AQIA V2	Percentage Reduction in the Revised Discharge Concentrations when compared to Concentrations presented in AQIA V2
TSP	mg/Nm^3 corrected to 273K, dry and 101.325 kPa	50	33	45	27%
PM_{10}		n.d.	30	37 [(a)]	19%
$PM_{2.5}$		n.d.	22.5	22.5 [(b)]	No additional reduction
HF		50	20	20	No additional reduction
SO_2		1,000	120	400	70%
NOx as NO_2		500	250	450	44%
Sulfuric acid mist		100	26	75	65%
HCl		100	80	100	20%

(a) *Design concentrations for PM_{10} were not provided. As-such, PM_{10} concentrations have been estimated based on the PM_{10} / TSP ratio obtained from the design concentrations for the upgraded Plant 2 site at Horsley Park (SSD 9601 Mod 1)*

(b) *Design concentrations for $PM_{2.5}$ were not provided. As-such, $PM_{2.5}$ concentrations have been estimated assuming that they are approximately 50% of the design TSP concentration.*

4. Assessment of nitrogen dioxide impacts

The EPA previously requested that the AQIA be revised to include a refined assessment of nitrogen dioxide, accounting for all nearby emission sources.

The EPA's previous advice dated 21 August 2020 (DOC20/604489-13) identified that NOx emissions from the Boral Cement Plant adopted in the original assessment were considerably lower for the 2017/18 reporting period (2,300 tonnes) when compared to the emissions from the higher for the 2018/19 reporting period (4,000 tonnes).

To address this concern, Airlabs undertook a review of the NOx emissions released from the Boral Cement Plant as reported to the NPI over a 10-year period from 2009 to 2019. Airlabs observed that NOx emissions from the Boral Cement Plant were approximately 1.7 times higher in 2018/19 than the average emissions measured over the 9 preceding years. As-such, the average of the last five years (including the emissions reported for the 2018/19 period), was determined to be 2,880 tonnes and used in the cumulative assessment. Airlabs are unaware of any reason for the increase in NOx emissions at the Boral cement plant.

Given the limited data-set publicly available regarding the NOx emissions, and the unfamiliarity with the change in operating conditions at Boral Cement, the EPA considers that a more conservative approach could have been applied. The EPA considers that there is still potential that cumulative NOx impacts have been slightly underpredicted, further supporting the EPA's request in Point 3 above that additional NOx controls must be considered in the final design stages of the project.

Airlabs have taken on-board EPA's concerns with regards to assessment of nitrogen dioxide (NO_2) impacts, and as a result, a revised assessment of NO2 impacts has been conducted, which is summarised below:

For determination of cumulative NO_2 ground level concentrations, the following sources have been included in the cumulative assessment:

- Incremental (Project only) impacts as a result of NOx emissions discharged from the kiln exhaust stack (refer **Table 1**)
- Emissions released from the Austral Masonry Plant (refer Table 8, page 37 of 114 of the AQIA V2).
- Emissions from the Boral Cement Plant for the 2018-19 reporting period, as requested by the EPA in the above comments. Total NOx emissions from the Boral Cement Plant (point + fugitive) for the 2018-19 reporting period have been estimated to be 4,000,000 kgs.
- 1-hour and annual average ambient NO_2 concentrations recorded at the Bargo air monitoring station for the 2017 calendar year (refer Table 6, page 34 of 114 of the AQIA V2).

Maximum (100th percentile) incremental and cumulative NO_2 ground level concentrations for all the averaging periods predicted across the identified sensitive receptors (refer Table 2, page 24 of 114 of the AQIA V2) from the revised assessment are summarised in **Table 2** and **Table 3** respectively.

Consistent with the previous air quality assessments and in-line with the requirements of the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2017) ('the Approved Methods'), ground-level NO2 concentrations were predicted assuming that all of the NOx would be instantly converted to NO_2 (100% NOx to NO_2 conversion).

Table 2: Model Predicted Maximum (100th Percentile) Incremental Ground-Level NO_2 Concentrations – Based on a Maximum Discharge Concentration of 250 mg/m^3

Receptor I.D.	Maximum 1-Hour Average Incremental Ground Level Concentrations (µg/m^3)	Annual Average Incremental Ground Level Concentrations (µg/m^3)
1	8.2	0.1
2	10.7	0.1
3	14.3	0.1
4	17.0	0.2
5	16.7	0.2
6	14.5	0.2
7	20.1	0.2
8	17.5	0.2
9	17.7	0.2
10	19.6	0.2
11	18.6	0.2
12	24.7	0.3
13	17.9	0.2
14	17.9	0.2
15	16.2	0.2
16	15.2	0.2
17	14.0	0.2
18	10.8	0.1
19	10.7	0.1
20	13.7	0.2
21	21.6	0.3
22	21.7	0.4
23	20.6	0.3
24	17.1	0.3
25	14.1	0.1
26	14.3	0.2
27	15.3	0.1
28	12.9	0.1
29	11.3	0.1
30	6.6	0.1
31	12.8	0.1
32	7.3	0.0
33	8.7	0.0
34	9.2	0.1
35	10.6	0.1
36	9.9	0.1

Receptor I.D.	Maximum 1-Hour Average Incremental Ground Level Concentrations (µg/m³)	Annual Average Incremental Ground Level Concentrations (µg/m³)
37	13.4	0.1
38	12.9	0.1
39	11.4	0.1
40	9.7	0.1
41	16.7	0.1
42	10.5	0.1
43	11.3	0.1
44	9.0	0.1
45	10.9	0.2
46	20.6	0.2
47	24.6	0.2
48	30.9	0.2
49	23.1	0.2
50	16.2	0.2
51	43.6	0.4
52	27.6	0.2
53	20.2	0.3
54	17.2	0.3
55	23.7	0.2
56	28.1	0.2
57	50.9	1.4
58	26.2	0.2
59	21.3	0.2
60	25.8	0.4
61	29.3	0.3
62	25.1	0.2
63	26.9	0.2
64	20.5	0.1
65	21.4	0.1
66	16.5	0.1
67	15.4	0.1
68	17.6	0.1
69	24.9	0.1
70	13.1	0.1
71	14.3	0.1
72	14.1	0.2
73	11.2	0.1

Receptor I.D.	Maximum 1-Hour Average Incremental Ground Level Concentrations (µg/m³)	Annual Average Incremental Ground Level Concentrations (µg/m³)
74	11.4	0.1
75	13.4	0.1
76	15.2	0.1
77	35.0	0.2
78	33.3	0.4
79	21.9	0.5
80	38.0	0.9
81	23.8	0.1
82	18.1	0.1
83	27.8	0.1
84	39.7	0.1
85	26.4	0.1
86	27.5	0.1
87	15.6	0.1
88	28.1	0.4
89	15.8	0.2
90	15.2	0.1
91	32.0	0.3

Table 3: Model Predicted Maximum (100th Percentile) Cumulative Ground-Level NO_2 Concentrations

Receptor I.D.	Maximum 1-Hour Average Cumulative Ground Level Concentrations (µg/m³) Impact Assessment Criteria – 246 µg/m³	Annual Average Cumulative Ground Level Concentrations (µg/m³) Impact Assessment Criteria – 62 µg/m³
1	167	12.3
2	143	12.4
3	136	12.5
4	162	12.6
5	144	12.7
6	167	12.6
7	141	12.8
8	148	12.9
9	146	12.8
10	242	12.9
11	184	13.1
12	139	13.3
13	135	13.2
14	135	13.2
15	161	13.2
16	135	13.1
17	135	13.0
18	135	12.7
19	213	12.7
20	253	12.9
21	172	13.3
22	197	13.6
23	149	13.5
24	170	13.4
25	138	13.1
26	142	13.1
27	166	13.1
28	174	13.0
29	144	13.0
30	135	12.6
31	135	12.5
32	135	12.3
33	135	12.5
34	142	12.7
35	135	12.6
36	180	12.6

Receptor I.D.	Maximum 1-Hour Average Cumulative Ground Level Concentrations (µg/m³) Impact Assessment Criteria – 246 µg/m³	Annual Average Cumulative Ground Level Concentrations (µg/m³) Impact Assessment Criteria – 62 µg/m³
37	217	12.8
38	218	12.7
39	201	12.6
40	188	12.7
41	231	12.7
42	188	12.7
43	189	12.7
44	188	12.7
45	166	12.7
46	179	12.8
47	169	13.0
48	135	12.9
49	135	12.8
50	140	13.0
51	194	12.7
52	135	12.5
53	188	13.0
54	153	13.1
55	233	12.6
56	213	12.8
57	135	14.2
58	135	12.9
59	164	13.1
60	135	13.6
61	135	13.4
62	184	12.8
63	170	12.8
64	135	12.5
65	190	12.4
66	147	12.3
67	140	12.4
68	178	12.4
69	146	12.3
70	164	12.2
71	135	12.3
72	135	13.0
73	188	13.1

Receptor I.D.	Maximum 1-Hour Average Cumulative Ground Level Concentrations (µg/m³) Impact Assessment Criteria – 246 µg/m³	Annual Average Cumulative Ground Level Concentrations (µg/m³) Impact Assessment Criteria – 62 µg/m³
74	135	13.0
75	241	13.2
76	247	12.9
77	247	12.8
78	199	13.1
79	220	13.5
80	135	13.5
81	135	12.7
82	144	12.5
83	177	12.8
84	138	12.4
85	143	12.3
86	167	12.3
87	135	12.2
88 – excluded from cumulative assessment – Boral Cement Plant site		
89	140	12.8
90	135	12.6
91	155	12.5

Revised assessment of NO_2 impacts shows that the maximum incremental (Project only) 1-hour average concentration (refer **Table 2**) across all of the sensitive receptors is 50.9 µg/m³, which is approximately 21% of the impact assessment criteria. Maximum annual average concentration is 1.4 µg/m³, which is approximately 2.2% of the impact assessment criteria. These incremental concentrations have been based on a revised maximum discharge concentration of 250 mg/m³.

Cumulative concentrations are presented in **Table 3**. These concentrations are a consequence of the incremental impacts along with contributions from Boral Cement Plant, the Austral Masonry Plant and the ambient concentrations recorded from the Bargo monitoring station.

Results presented in **Table 3**, show that the 1-hour average cumulative NO_2 concentrations exceed the impact assessment criteria of 246 µg/m³ at three (3) of the sensitive receptors. At two (2) out of these three (3) receptors (Receptor I.D. 76 and 77), the cumulative 1-hour average concentration exceeds the impact assessment criteria only by 1 µg/m³.

It is to be noted that no exceedances of the cumulative 1-hour average NO2 concentrations were reported in the previous assessment i.e. AQIA V2. The main changes constituting the revised assessment of NO2 impacts is the increase in Boral Cement Plant NOx emissions from 2,880 tonnes to 4,000 tonnes and reducing the maximum discharge concentration of NOx emissions from the proposed facility from 450 mg/m³ to 250 mg/m³. As-such, it is evident that these marginal exceedances of the impact assessment criteria are attributed to emissions from the Boral Cement Plant.

Section 5.1.3 of the Approved Methods provides guidance on scenarios where there are elevated background concentrations. The Approved Methods states that no additional exceedances of the impact assessment criteria are to occur as a result of emissions from the proposed facility.

To that extent, an investigation has been undertaken at the three (3) receptors to check for any additional exceedances due to the proposed facility's operations.

Findings of the additional exceedance investigation are presented in **Table 4**. It is clearly evident from **Table 4** that no additional exceedances of the 1-hour average NO_2 ground level concentrations are predicted at any of the worst impacted receptors due to the proposed facility's operations.

As-such, it can be summarised from the revised NO_2 assessment that the proposed facility is not expected to significantly contribute to the overall background concentrations.

It is also worth noting that Austral Bricks are implementing all reasonable and feasible measures to reduce NOx emissions from the proposed facility and this evident by their commitment to reduce the maximum discharge concentration from the originally proposed 450 mg/m^3 to 250 mg/m^3.

No exceedances of the annual average cumulative concentrations have been predicted from the revised assessment and therefore do not warrant a detailed discussion.

Table 4: Assessment of Additional Exceedances of the 1-Hour Average NO_2 Cumulative Concentrations

Receptor I.D.	A	B	Number of Additional Exceedances (B-A)
	Existing Environment	**Existing Environment + Contribution from the Proposed Facility**	
	Number of Exceedances of the 1-Hour Average NO_2 Concentrations	**Number of Exceedances of the 1-Hour Average NO_2 Concentrations**	
20	1	1	0
76	1	1	0
77	1	1	0

5. Kiln emissions during reducing conditions

The EPA previously requested that the AQIA be revised to include a discussion on the expected emissions profiles from the kiln stack under oxidised and reduced conditions. All pollutant emissions associated with the proposed two firing techniques, including carbon monoxide, volatile organic compounds and particles must be adequately evaluated and assessed. Justification for all adopted emission rates should be appropriately supported.

The response provided by Airlabs in the revised AQIA V2 is limited to the following 'Modelling of the kiln emissions have been based on a maximum discharge concentration, considering every kiln condition. Therefore, irrespective of whether the kiln is operating in an oxidation or reduction mode, emissions from either condition would never exceed the modelled emission rates'.

There is no further discussion regarding the emissions profile from the kiln when fired under the various conditions. Evidence, such as emissions profiling data, has not been provided by Airlabs to support their response.

The EPA requests that the AQIA V2 be revised to include supporting evidence of emissions profiles under both oxidising and reducing conditions to support the emissions inventory adopted in the assessment.

In order to address EPA's comments with respect to variance in discharge concentrations during oxidation and reduction conditions, reference was drawn to historical emissions monitoring data measured across Austral Bricks' manufacturing plants as there is no available information from the proposed facility with regards to variations in discharge concentrations occurring due to oxidation and reduction conditions.

Table 5 presented below summarises pollutant discharge concentrations for specific products manufactured under these conditions – i.e. oxidation and reduction. Due to commercial-in-confidence, reasons, details of the specific products or the manufacturing site(s) where these concentrations have been measured cannot be presented in this RTS, however, **Table 5** provides sufficient information to compare average discharge concentrations measured over a period of time when the kiln was operating in oxidation and / or reduction conditions.

Table 5: Comparison of Pollutant Discharge Concentrations – Oxidation and Reduction Conditions – Measured Across Austral Bricks' Manufacturing Site(s)

Pollutant	Measurement Units	Average Concentrations Measured Across a Specific Period of Time under Oxidation Conditions	Average Concentrations Measured Across a Specific Period of Time under Reduction Conditions	Average Concentrations Measured Across a Specific Period of Time under Oxidation - Reduction Mix Conditions
Total particulates	mg/Nm^3 corrected to 273K, dry and 101.325 kPa	10	7	13
HF		15	17	9
SO_2		41	72	75
NOx as NO_2		48	45	67
Sulfuric acid mist		5	11	8

From the information presented in **Table 5,** it is noted that there is not a wide variation in the measured pollutant concentrations across oxidation and reduction conditions – especially for key pollutants such as HF and NOx. Moreover, the discharge concentrations proposed by the kiln manufacturer (refer

Table 1) has taken into account the expected variations occurring as a result of the oxidation, reduction and oxidation-reduction mix conditions and that the maximum discharge concentrations proposed in **Table 1** will not be exceeded irrespective of the conditions under which the kiln would operate.

6.Solid particles emissions control performance

The EPA previously requested that additional information is provided to demonstrate that all reasonable and feasible control measures have been considered and evaluated in the AQIA to achieve an emission performance of particles, which is reflective of best practice controls and benchmarked against comparable emission performance standards for newly installed pollution control systems.

The revised AQIA V2 does not consider any additional emission controls to further reduce particle emissions. Airlabs did not consider additional controls because the modelling results suggest that particulate emissions from the facility (both point and fugitive) are not a major concern as the predicted incremental impacts for all the size fractions is less than 7% of the assessment criteria at the worst impacted receptor. This 'pollute up to goal' approach is not supported by the EPA.

As previously advised, the EPA expect that newly designed plant and equipment can achieve an emission performance well below the standards prescribed in the POEO Clean Air Regulation. Dispersion modelling results should not be used as sole justification for not adopting reasonable and feasible emission controls. Additionally, under Section 45 of the Protection of the Environment Operations Act (1997), the EPA must consider, among other matters, the practical measures that could be taken to prevent, control, abate or mitigate pollution. All practicably achievable options to further reduce point source emissions of particulates form the kiln should be evaluated in a revised assessment.

The EPA requests that the AQIA V2 be revised to include the information request in Point 3 above.

As seen from **Table 1**, Austral Bricks have agreed to lower the maximum discharge concentrations of total particles from 45 mg/m^3 to 33 mg/m^3, which corresponds to a 27% reduction.

This revised discharge concentration of 33 mg/m^3 represents a 34% reduction when compared to the maximum allowable standard prescribed in the Clean Air Regulation.

Therefore, based on the above response, it can be demonstrated that Austral Bricks are undertaking necessary measures to limit / reduce the pollutant discharge concentrations from the proposed kiln stack and therefore adhere to EPA's expectations for newly designed plants. This observation is not only just limited to particle emissions only, but also to all other pollutants released from the kiln exhaust stack. The proposed discharge concentration limits of majority of pollutants have been revised (refer **Table 1**) such that they are considerably lower than what was presented in AQIA V2.

7.Fugitive dust emissions from the operational activities

The EPA previously requested that the AQIA be revised to model emissions of fugitive dust from operational activities over a 24-hour period, unless adequate justification can be provided for adopting a 12-hour period.

Airlabs has revised the assessment to model emissions of fugitive dust from operational activities over a 24-hour period. However, there is no change in predicted emissions from the original assessment. For example, annual Fugitive TSP Emission Estimates have remained at 820kg/year.

In the original AQIA (AQIA V1), fugitive emissions were modelled over a 12-hour period. Under this scenario, the emission rates are effectively half the 24-hour modelled scenario. For example, estimated annual TSP emission rate from crusher operations in AQIA V1 was 114 kg/yr or 7.2 mg/s. In the revised assessment (AQIA V2), the emission rate has halved to 3.6 mg/s. This reduction in emission rates has not been discussed.

It appears that the emission rates calculated in the revised AQIA V2 are based on the average daily throughput, rather than the peak daily maximum throughput. As such, the modelling scenario does not reflect a worst case.

To reflect a worst-case scenario, for a 24-hour period, the peak maximum daily emission rates should be calculated based on the maximum achievable production rates, rather than the average rate.

The EPA requests that the AQIA V2 be revised to include further assessment of worst case fugitive emissions of particles.

Airlabs acknowledge that particulate matter emission rates estimated for the proposed facility's operations have been based on the average daily throughput for both – the short-term (24-hour) and the long-term (annual) averaging period. The rationale for selecting this approach is that there are limited sources of fugitive dust emissions from the operations as the proposed facility would not have any unsealed haulage surfaces and all the raw materials would be unloaded and handled inside the material storage building. Enclosure of the raw material stockpiles considerably diminishes the potential for fugitive dust emissions.

Airlabs have considered EPA's concerns – especially with regards to predicting the 24-hour average PM_{10} and $PM_{2.5}$ concentrations, and therefore, a revised assessment of particulate impacts has been conducted, which is presented below.

At the time of preparing this RTS, there is no information available regarding peak daily throughputs, which would be used to estimate dust emission rates for the 24-hour averaging period pollutants.

As-such, for the assessment of 24-hour average PM_{10} and $PM_{2.5}$ impacts, it has been assumed that the peak daily throughput would be approximately 1.5 times the average daily throughput. This assumption is consistent with other air quality assessments conducted by Airlabs for extractive operations and material handling facilities and is reasonable, especially considering the limited sources of fugitive dust emissions from the operations at the proposed facility.

For the annual averaging pollutants – i.e., annual average TSP, PM_{10}, $PM_{2.5}$ concentrations and deposited dust levels, no scaling has been applied and therefore the emission rates are unchanged.

Particulate emission rates specific to the 24-hour averaging period pollutants are presented in **Table 6** and emission rates for predicting the annual averaging pollutants as reproduced from AQIA V2 are shown in **Table 7**.

Incremental and cumulative particulate concentrations are presented in **Table 8** and **Table 9** respectively. Cumulative impacts presented in **Table 9** are a result of the combined contribution of emissions from the proposed facility, the Boral Cement, the Austral Masonry Plant, the Austral Bricks Quarry and ambient concentrations recorded from the Bargo air monitoring station.

Table 6: Estimated Annual Fugitive Dust Emission Rates from the Proposed Facility for 24-Hour Averaging Pollutants

Activity	Modelled Annual Emission Rates (kg/year)		
	TSP	**PM_{10}**	**$PM_{2.5}$**
Trucks unloading raw materials into the drive-over bin	12.1	5.7	0.9
Conveying raw material to the crusher hopper	12.1	5.7	0.9
Crusher operations	171.0	77.0	14.3
Conveying crushed material into the raw material storage building	12.1	5.7	0.9
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	12.1	5.7	0.9
Loading crushed raw material into the surge bin conveyor	12.1	5.7	0.9
Conveying raw materials to the surge bin	12.1	5.7	0.9
Heavy vehicle haulage – raw material delivery – paved surface	440.6	84.6	20.5
Heavy vehicle haulage – product dispatch – paved surface	546.1	104.8	25.4
Total	**1,230**	**301**	**65**

Table 7: Estimated Annual Fugitive Dust Emission Rates from the Proposed Facility for Annual Averaging Pollutants

Activity	Modelled Annual Emission Rates (kg/year)		
	TSP	**PM_{10}**	**$PM_{2.5}$**
Trucks unloading raw materials into the drive-over bin	8.1	3.8	0.6
Conveying raw material to the crusher hopper	8.1	3.8	0.6
Crusher operations	114.0	51.3	9.5
Conveying crushed material into the raw material storage building	8.1	3.8	0.6
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	8.1	3.8	0.6
Loading crushed raw material into the surge bin conveyor	8.1	3.8	0.6
Conveying raw materials to the surge bin	8.1	3.8	0.6
Heavy vehicle haulage – raw material delivery – paved surface	293.7	56.4	13.6
Heavy vehicle haulage – product dispatch – paved surface	364.1	69.9	16.9
Total	**820**	**200**	**44**

Table 8: Summary of Predicted Incremental (Proposed Facility Only) Impacts for Particulates

Pollutant	Averaging Period	Assessment Criteria (µg/m³)	Reporting Requirements	Maximum Predicted Incremental Concentration (µg/m³) at the Worst Impacted Receptor	Worst Impacted Receptor Identification (I.D.)	% of Assessment Criteria - Maximum Predicted Incremental at the Worst Impacted Receptor
TSP	Annual	90	100th percentile (maximum) at sensitive receptor	0.16	No. 80	0.2%
PM_{10}	24-hour	50	100th percentile (maximum) at sensitive receptor	2.30	No. 80	4.6%
	Annual	25	100th percentile (maximum) at sensitive receptor	0.14	No. 80	0.6%
$PM_{2.5}$	24-hour	25	100th percentile (maximum) at sensitive receptor	1.70	No. 80	6.8%
	Annual	8	100th percentile (maximum) at sensitive receptor	0.09	No. 80	1.1%
Deposited Dust	Annual	2 g/m²/month (max increase in deposited dust levels)	100th percentile (maximum) at sensitive receptor	0.008	No. 78	0.4%

Table 9: Summary of Predicted Cumulative Impacts for Particulates

Pollutant	Averaging Period	Assessment Criteria (µg/m³)	Reporting Requirements	Maximum Predicted Cumuative Concentration (µg/m³) at the Worst Impacted Receptor	Worst Impacted Receptor Identification (I.D.)	% of Assessment Criteria - Maximum Predicted Cumulative at the Worst Impacted Receptor
TSP	Annual	90	100th percentile (maximum) at sensitive receptor	38.5	No. 77	43%
PM_{10}	24-hour	50	100th percentile (maximum) at sensitive receptor	59.2	No. 80	118%
	Annual	25	100th percentile (maximum) at sensitive receptor	19.1	No. 77	76%
$PM_{2.5}$	24-hour	25	100th percentile (maximum) at sensitive receptor	22.8	No. 79	91%
	Annual	8	100th percentile (maximum) at sensitive receptor	6.8	No. 77	85%
Deposited Dust	Annual	4 g/m²/month	100th percentile (maximum) at sensitive receptor	2.35	No. 77	59%

From the incremental and cumulative particulate concentrations presented in **Table 8** and **Table 9** respectively, it is observed that the incremental particulate concentrations for both the 24-hour averaging period and the annual averaging period are well below the respective impact assessment criteria.

With regards to cumulative concentrations, with the exception of the 24-hour average PM_{10} impacts, remaining pollutants are below their respective impact assessment criteria.

The 24-hour average PM_{10} impacts – which reflect peak daily throughputs as requested by the EPA, at the worst impacted receptor (Receptor No. 80) is approximately 118% of the impact assessment criteria. Correspondingly, the 24-hour average incremental PM_{10} concentration at the worst impacted receptor, which also is No. 80 is 2.3 $\mu g/m^3$, which is approximately 4.6% of the assessment criteria

It is also worth noting that the ambient 24-hour average PM_{10} concentration measured at the Bargo NEPM monitoring station exceeded the assessment criteria of 50 $\mu g/m^3$ on one (1) occasion – 24 September 2017 (refer Table 4 AQIA V2, page 33 of 114). As this exceedance in the background concentration was included in the cumulative assessment, the maximum 24-hour average cumulative PM_{10} concentrations at each sensitive receptor would all have at least one (1) exceedance of the assessment criteria of 50 $\mu g/m^3$.

To further understand the impacts from the proposed facility, possibility of additional exceedances resulting from the proposed facility's operations were investigated and the findings are presented below.

An investigation has been undertaken at all of the identified sensitive receptors to check for any additional exceedance due to the proposed facility's operations.

As seen from **Table 10**, there are two (2) key columns, labelled A and B. Column A in **Table 10** presents the number of exceedances of the 24-hour average PM_{10} concentrations at the identified sensitive receptors as a consequence of the existing environment only – i.e. impacts from Austral Bricks Quarry, Austral Masonry Plant, Boral Cement Plant and the ambient concentrations from the Bargo monitoring station. Column B in **Table 10** presents the number of exceedances of the 24-hour average PM_{10} concentrations at each of the identified sensitive receptors arising due to the contributions from the proposed facility in addition to the existing environment.

If there is no increase in the number of exceedances reported in column B (i.e. additional exceedances), it means that no additional exceedances are reported due to the proposed facility's operations.

As seen from **Table 10**, no additional exceedances (Column B – Column A) are reported at any of the identified discrete sensitive receptors, therefore indicating that the proposed facility's operations are not expected to have an adverse impact on the overall 24-hour average PM_{10} concentrations.

Therefore, based on the above discussion, it is evident that the proposed facility's operations are not expected to have an adverse impact on the overall particulate concentrations in the surrounding environment.

Table 10: Assessment of Additional Exceedances of the 24-Hour Average PM_{10} Cumulative Concentrations

Receptor I.D.	A	B	Number of Additional Exceedances (B-A)
	Existing Environment	Existing Environment + Contributions from the Proposed Facility	
	Number of Days of Exceedance of the 24-Hour PM_{10} Concentrations	Number of Days of Exceedance of the 24-Hour PM_{10} Concentrations	
1	1	1	0
2	1	1	0
3	1	1	0
4	1	1	0
5	1	1	0
6	1	1	0
7	1	1	0
8	1	1	0
9	1	1	0
10	1	1	0
11	1	1	0
12	1	1	0
13	1	1	0
14	1	1	0
15	1	1	0
16	1	1	0
17	1	1	0
18	1	1	0
19	1	1	0
20	1	1	0
21	1	1	0
22	1	1	0
23	1	1	0
24	1	1	0
25	1	1	0
26	1	1	0
27	1	1	0
28	1	1	0
29	1	1	0
30	1	1	0
31	1	1	0
32	1	1	0
33	1	1	0
34	1	1	0
35	1	1	0
36	1	1	0
37	1	1	0
38	1	1	0
39	1	1	0
40	1	1	0
41	1	1	0

Receptor I.D.	A	B	Number of Additional Exceedances (B-A)
	Existing Environment	Existing Environment + Contributions from the Proposed Facility	
	Number of Days of Exceedance of the 24-Hour PM_{10} Concentrations	Number of Days of Exceedance of the 24-Hour PM_{10} Concentrations	
42	1	1	0
43	1	1	0
44	1	1	0
45	1	1	0
46	1	1	0
47	1	1	0
48	1	1	0
49	1	1	0
50	1	1	0
51	1	1	0
52	1	1	0
53 – excluded from cumulative assessment – Austral Bricks Quarry site			
54	1	1	0
55	1	1	0
56	1	1	0
58	1	1	0
59	1	1	0
60	1	1	0
61	1	1	0
62	1	1	0
63	1	1	0
64	1	1	0
65	1	1	0
66	1	1	0
67	1	1	0
68	1	1	0
69	1	1	0
70	1	1	0
71	1	1	0
72	1	1	0
73	1	1	0
74	1	1	0
75	1	1	0
76	1	1	0
77	2	2	0
78	1	1	0
79	1	1	0
80	1	1	0
81	1	1	0
82	1	1	0
83	1	1	0
84	1	1	0
85	1	1	0
86	1	1	0

Receptor I.D.	A	B	Number of Additional Exceedances (B-A)
	Existing Environment	Existing Environment + Contributions from the Proposed Facility	
	Number of Days of Exceedance of the 24-Hour PM_{10} Concentrations	Number of Days of Exceedance of the 24-Hour PM_{10} Concentrations	
87	1	1	0
88– excluded from cumulative assessment – Boral Cement Plant site			
89	1	1	0
90	1	1	0
91	1	1	0

3. CLOSURE

This concludes the response prepared by Airlabs for the comments issued by the EPA in the *EPA Advice on Submissions Report* relating to the New Berrima Brickworks Facility – SSD 10422.

If the EPA has any questions / concerns regarding the information presented in the RTS, please do not hesitate to contact the authors of this document and necessary response / clarification will be provided.

APPENDIX A

Revised Fugitive Dust Emission Estimates –

Daily Peak for the 24-hour Averaging Period &

Average Daily for the Annual Averaging Period

Figure A.1: Annual Fugitive TSP Emission Estimates – Proposed Facility

Activity	TSP Emissions (kg/year)	Intensity	Units	TSP Emission Factor	Units	Variable 1	Units	Variable 2	Units	Control Efficiency	Units	Operational Hours
Haul trucks unloading raw material - driver-over bin	8.1	190,000	tonnes per annum	0.00014	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw material to crusher hopper	8.1	190,000	tonnes per annum	0.00014	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Crusher operations	114.0	190,000	tonnes per annum	0.0006	kg/t							Continuous
Conveying crushed raw materials to the raw material storage building	8.1	190,000	tonnes per annum	0.00014	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	8.1	190,000	tonnes per annum	0.00014	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading crushed raw material into the surge bin conveyor	8.1	190,000	tonnes per annum	0.00014	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw materials to the surge bin	8.1	190,000	tonnes per annum	0.00014	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Heavy vehicle haulage - raw material delivery - paved surface	293.7	4,013	vkt/annum	0.073	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Heavy vehicle haulage - product dispatch - paved surface	364.1	4,974	vkt/annum	0.073	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Total TSP Emissions (kg/year)	**820.2**											

Figure A.2: Annual Fugitive PM_{10} Emission Estimates – Proposed Facility

Activity	PM10 Emissions (kg/year)	Intensity	Units	PM10 Emission Factor	Units	Variable 1	Units	Variable 2	Units	Control Efficiency	Units	Operational Hours
Haul trucks unloading raw material - driver-over bin	3.8	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw material to crusher hopper	3.8	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Crusher operations	51.3	190,000	tonnes per annum	0.00027	kg/t							Continuous
Conveying crushed raw materials to the raw material storage building	3.8	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	3.8	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading crushed raw material into the surge bin conveyor	3.8	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw materials to the surge bin	3.8	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Heavy vehicle haulage - raw material delivery - paved surface	56.4	4,013	vkt/annum	0.014	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Heavy vehicle haulage - product dispatch - paved surface	69.9	4,974	vkt/annum	0.014	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Total PM10 Emissions (kg/year)	**200**											

Figure A.3: Annual Fugitive PM_{10} Emission Estimates – Proposed Facility – Representing Peak-Daily Throughputs

Activity	PM10 Emissions (kg/year)	Intensity	Units	PM10 Emission Factor	Units	Variable 1	Units	Variable 2	Units	Control Efficiency	Units	Operational Hours
Haul trucks unloading raw material - driver-over bin	5.7	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw material to crusher hopper	5.7	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Crusher operations	77.0	190,000	tonnes per annum	0.00027	kg/t							Continuous
Conveying crushed raw materials to the raw material storage building	5.7	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	5.7	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading crushed raw material into the surge bin conveyor	5.7	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw materials to the surge bin	5.7	190,000	tonnes per annum	0.00007	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Heavy vehicle haulage - raw material delivery - paved surface	84.6	4,013	vkt/annum	0.014	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Heavy vehicle haulage - product dispatch - paved surface	104.8	4,974	vkt/annum	0.014	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Total PM10 Emissions (kg/year)	**301**											

Figure A.4: Annual Fugitive $PM_{2.5}$ Emission Estimates – Proposed Facility

Activity	PM2.5 Emissions (kg/year)	Intensity	Units	PM2.5 Emission Factor	Units	Variable 1	Units	Variable 2	Units	Control Efficiency	Units	Operational Hours
Haul trucks unloading raw material - driver-over bin	0.6	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw material to crusher hopper	0.6	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Crusher operations	9.5	190,000	tonnes per annum	0.00005	kg/t							Continuous
Conveying crushed raw materials to the raw material storage building	0.6	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	0.6	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading crushed raw material into the surge bin conveyor	0.6	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw materials to the surge bin	0.6	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Heavy vehicle haulage - raw material delivery - paved surface	13.6	4,013	vkt/annum	0.003	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Heavy vehicle haulage - product dispatch - paved surface	16.9	4,974	vkt/annum	0.003	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Total PM2.5 Emissions (kg/year)	**44**											

Figure A.5: Annual Fugitive $PM_{2.5}$ Emission Estimates – Proposed Facility – Representing Peak-Daily Throughputs

Activity	PM2.5 Emissions (kg/year)	Intensity	Units	PM2.5 Emission Factor	Units	Variable 1	Units	Variable 2	Units	Control Efficiency	Units	Operational Hours
Haul trucks unloading raw material - driver-over bin	0.9	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw material to crusher hopper	0.9	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Crusher operations	14.3	190,000	tonnes per annum	0.00005	kg/t							Continuous
Conveying crushed raw materials to the raw material storage building	0.9	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading of crushed raw materials into temporary stockpiles in the raw materials storage building	0.9	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Loading crushed raw material into the surge bin conveyor	0.9	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Conveying raw materials to the surge bin	0.9	190,000	tonnes per annum	0.00001	kg/t	1.64	average (wind speed /2.2)^1.3 in (m/sec)	13.74	(moisture content /2)^1.4	70	% Control	Continuous
Heavy vehicle haulage - raw material delivery - paved surface	20.5	4,013	vkt/annum	0.003	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Heavy vehicle haulage - product dispatch - paved surface	25.4	4,974	vkt/annum	0.003	kg/vkt	0.60	silt loading (g/m2)	34	tons (avg wt of vehicle travelling)			Continuous
Total PM2.5 Emissions (kg/year)	**65**											

APPENDIX B

Incremental Concentration Isopleths

Figure B.1: Incremental 1-hour average maximum NO_2 concentrations ($\mu g/m^3$) (Assessment criteria: 246 $\mu g/m^3$ – red contour)

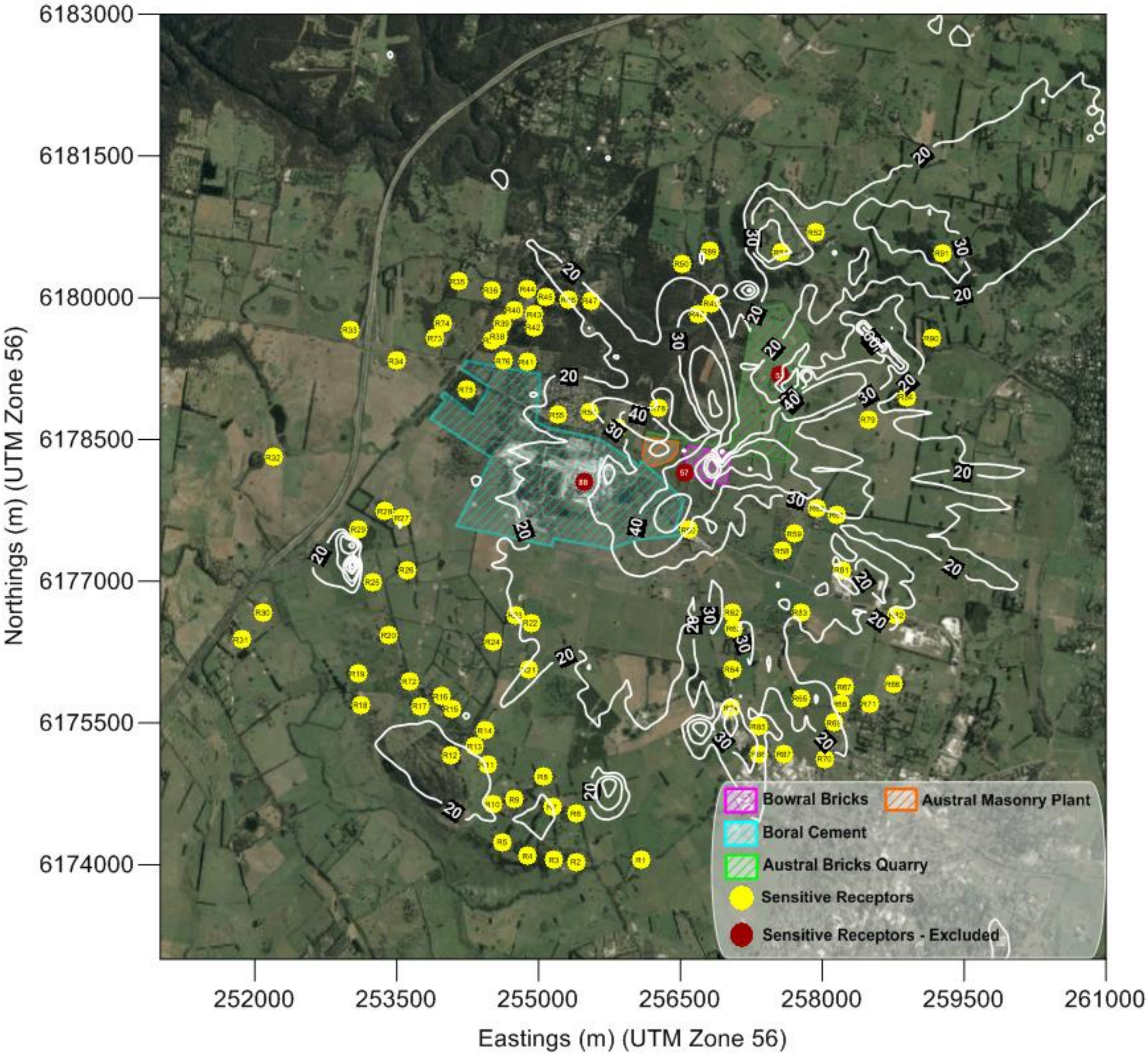


Figure B.2: Incremental annual average NO_2 concentrations ($\mu g/m^3$) (Assessment criteria: 62 $\mu g/m^3$ – red contour)

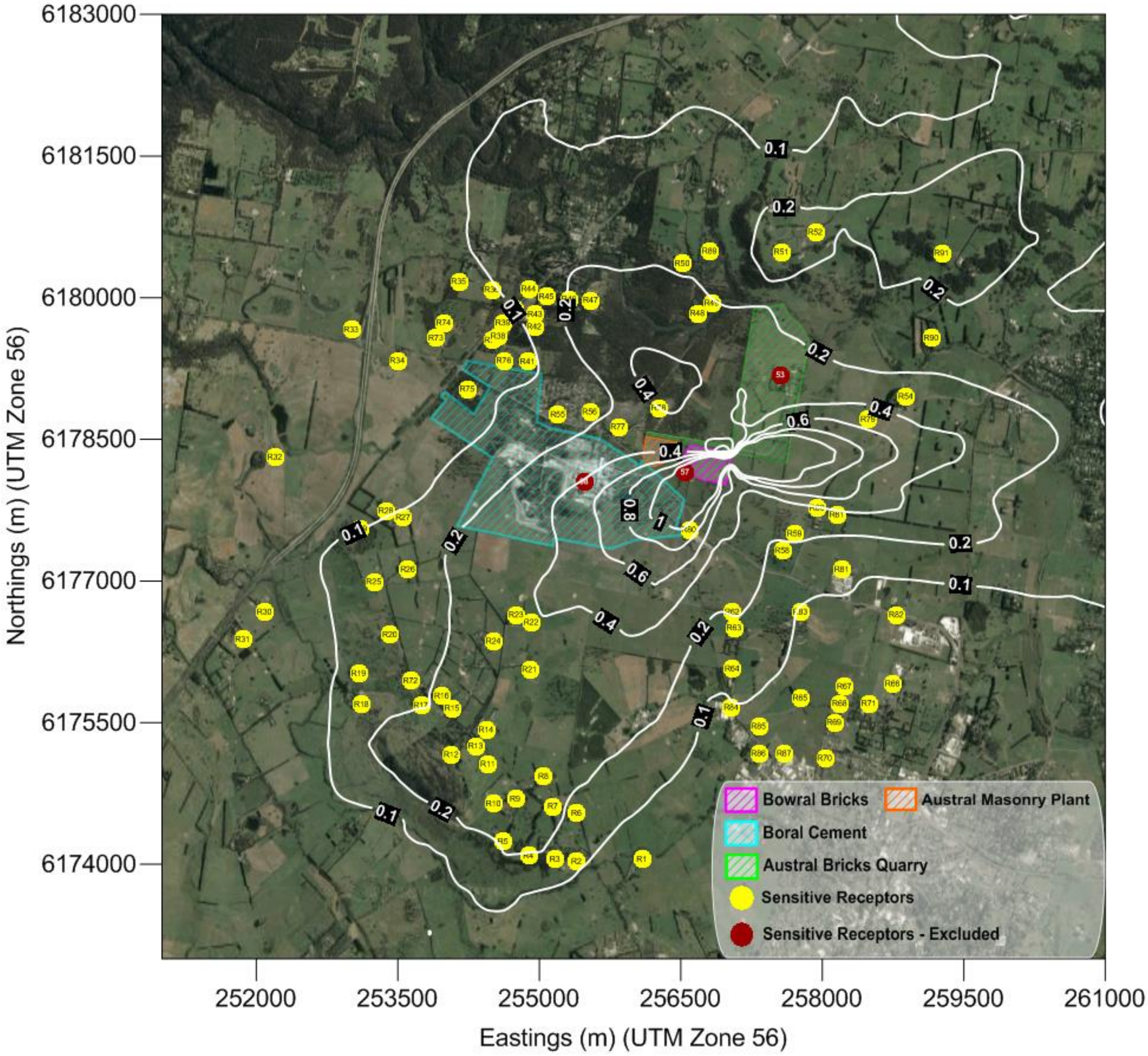


Figure B.3: Incremental 24-hour average maximum PM_{10} concentrations (µg/m³) (Assessment criteria: 50 µg/m³ – red contour)

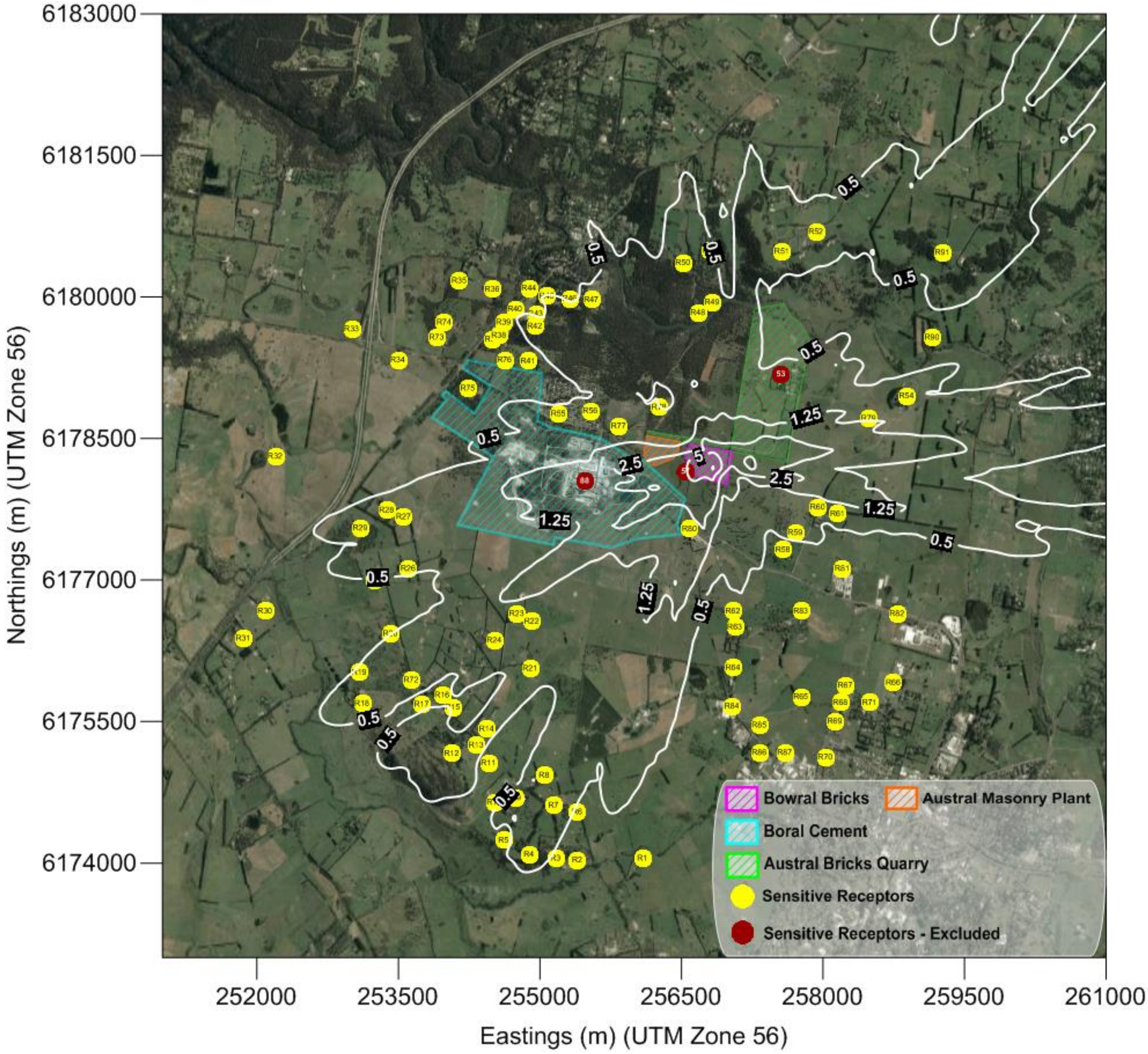


Figure B.4: Incremental annual average PM_{10} concentrations ($\mu g/m^3$) (Assessment criteria: 25 $\mu g/m^3$ – red contour)

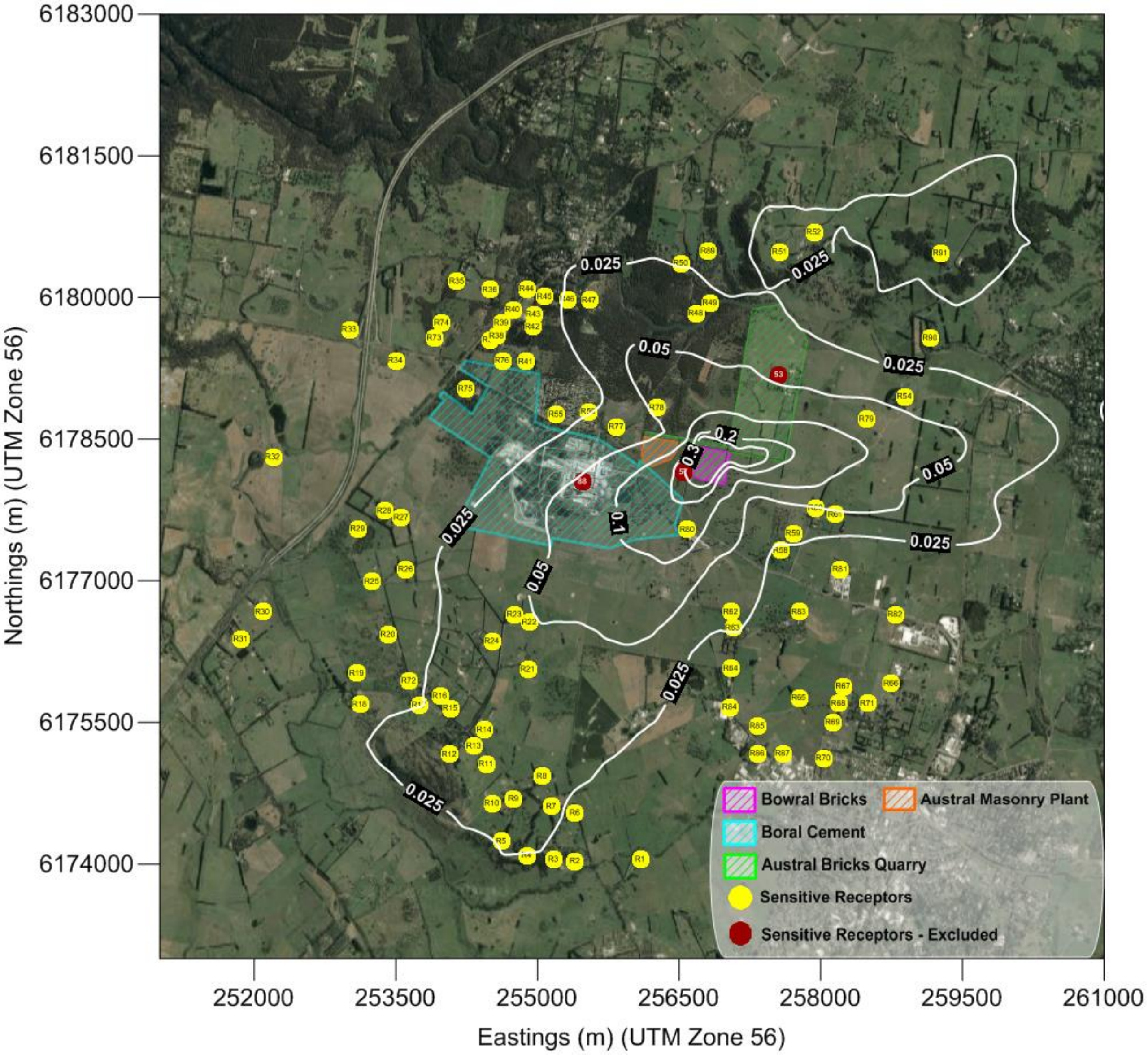


Figure B.5: Incremental 24-hour average maximum $PM_{2.5}$ concentrations ($\mu g/m^3$) (Assessment criteria: 25 $\mu g/m^3$ – red contour)

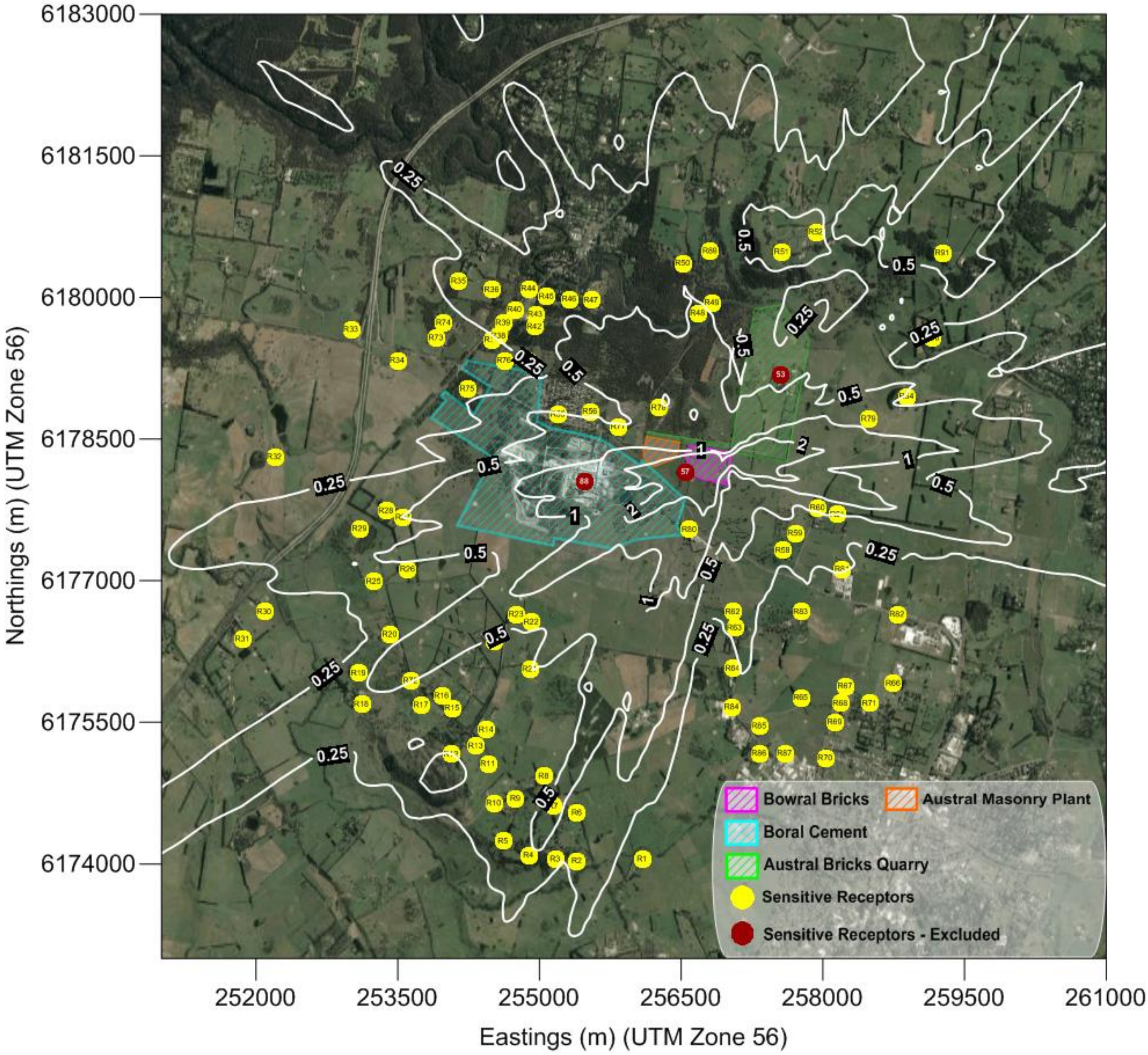


Figure B.6: Incremental annual $PM_{2.5}$ concentrations ($\mu g/m^3$) (Assessment criteria: 25 $\mu g/m^3$ – red contour)