LANDFILL OPERATIONS PTY LTD

EXTENSION OF THE MELBOURNE REGIONAL LANDFILL

EXPERT REPORT - AIR QUALITY

Norton Rose Fullbright

15 September 2016

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1 INTRODUCTION

1. I have been engaged by Landfill Operations Ltd (Landfill Ops), a wholly owned subsidiary of Cleanaway Waste Management Ltd (Cleanaway), the proponent of the extension of the Melbourne Regional Landfill (Project), at the instruction of Norton Rose Fulbright, to examine potential odour impact issues associated with the Project and to prepare a Statement of Evidence.

2. This expert witness report provides a summary of the potential odour impacts that I consider may arise as a result of the Project, as relevant to my expertise. The report also examines potential dust issues at some locations.

3. I have read and agree to abide with the Planning Panels Victoria (PPV) “Guide to Expert Evidence”, and specifically note the Expert’s Duty to the Panel.

4. I am an expert in Air Quality with more than 20 years of experience. I have a bachelor degree in mechanical engineering and 10 years of experience at the New South Wales Environment Protection Authority (EPA), where I worked as the principal technical policy adviser in the Air Branch. My experience includes specific experience in air quality related to odour, including the measurement of odour, development of policy and the modelling and assessment of potential impacts from various projects. I am currently a Director of Todoroski Air Sciences, a specialised air quality consultancy. Our key clients include industrial operations, ranging from small business to top 10 global companies, and various government agencies, from the local to commonwealth level. A copy of my CV is attached at Appendix A.

2 DOCUMENTS CONSULTED

5. In preparing this Statement of Evidence, I reviewed the documents provided to me in the Brief to Expert from Norton Rose Fulbright and also considered the documents listed in Section 10.

6. The key document I have considered is the Air Quality Assessment report by Pacific Environment Limited (PEL) dated 13 May 2016, Job ID. 20496, PEL (2016). The Report forms the first separate attachment to this report.

3 INSTRUCTIONS

7. The key instructions I have received in regard to matters to address in my report include:

   1) Undertake a peer review of the Air Quality Assessment and Addendum to the Air Quality Assessment prepared by Pacific Environment for the Applications and, as part of your peer review, re-run the odour modelling undertaken by Pacific Environment;

   2) Please prepare your model based on the following assumptions:

      (1) 24 hour operations, midnight to midnight, 365 days a year;
      (2) waste volumes as set out in the spreadsheet titled “TPI proposed waste volumes”;
      (3) daily cover material of 0.3 m/day;
      (4) interim cap thickness of 0.5 m - comprising 40 mm NDRC quarry product;
progressive installation of sacrificial horizontal gas collection pipes during waste placement;

installation of permanent vertical gas extraction wells once waste filling is completed in each cell;

active landfill face area of 1800 m²;

surface area of the leachate ponds is 10,000 m² and location of leachate ponds as set out in Golders Figure 13: Leachate Pond Management Plan. Please note that Figure 2.3 in the Pacific Environment report is incorrect;

daily truck movements as set out in GTA’s Traffic Impact Assessment dated 12 December 2016. Please note that Pacific Environment originally relied on an older version of the GTA report, but this was corrected in section 5.2.3; and

unpaved haul roads as per Figure 5.1 in the Pacific Environment report.

Please consider the cumulative impact of any other odour sources in the vicinity which you consider are within the same “quadrant” as MRL.

Please critically review and determine whether you support the:

(1) site specific odour emission rates;

(2) four worst case scenarios;

(3) criteria to compare the modelling results against.

I have also been requested to consider:

(1) The potential air quality impacts at several locations representing the residential boundary of the proposed new Precinct Structure Plan, Planning Scheme Amendment # 162. These potential future sensitive receptors are located to the north west of the site and are numbered R26 to R29 in this report; and,


4 PEER REVIEW

On the basis that the PEL 13 May 2016 report supersedes the previous air quality impact assessment reports, I have limited my peer review to the 13 May 2016 Report (the Report). I also make reference to the addendum report dated 18 February (addendum Report).

The Report provides an assessment of potential odour and dust impacts which may arise due to the Project. Generally, the key aspects which affect the potential impacts from the Project relate to the following;

(1) Emissions from the Project – in this case odour sampling data from the existing landfill operations are used to calculate the Project odour emissions, and emission factors are used to calculate the Project dust emissions;

(2) The metrological conditions that lead to the peak impacts, and whether these are adequately represented in the air dispersion modelling;

(3) The representation of the various stages of the Project in the air dispersion modelling set up, in this case several base case and future operational scenarios are examined;
(4) Whether the predicted results are realistic, in this case some data from field odour observations are provided, along with a field odour assessment and complaints analysis. Both dust and odour impacts are considered;

(5) For odour, a risk assessment of the potential effects that may arise; and,

(6) The likely effectiveness of the management to deal with any potential odour and dust impacts – in this case a management plan is outlined.

10. These key aspects also describe the overall air modelling assessment from start to finish, and are considered in this order, in more detail below.

4.1 Emissions from the Project

4.1.1 Odour sampling data for the Landfill operations

11. The site specific odour sampling results are summarised in Section 5.1.2 of the Report, and the complete data are presented Appendix C6 of the Report. The data comprise reports from Ektimo, a specialist emissions sampling company. The Ektimo reports are generally clear and show that the appropriate methods have been followed for collecting and analysing the odour concentrations sampled.

12. I generally consider that the methods applied are appropriate, however I note that for the final and interim capped areas, the sampled odour includes odour from the soil itself. This is evident when examining the description of the character of the odour that was sampled, and also the hedonic tone (pleasantness or unpleasantness) of the odour for each sample.

13. For the final cap (a 1.6m deep layer of soil over the landfill), the four samples taken have a neutral hedonic tone, and an odour character of dust, dry soil, earth, or dusty. The odour concentration ranges from 53 to 86ou. The soil blank (i.e. an area of soil unaffected by the landfill) shows the same hedonic tone and odour character and an essentially equivalent odour concentration of 70ou. As such, I consider the final cap as having no tangible odour relative to the normal odour of the land, and thus agree with the approach in this regard set out at Appendix C3.1 of the Report.

14. The five intermediate cap (a 0.5m deep layer of soil over the landfill) samples show:

(1) two results (sample ID 98 and 15) with odour concentration, hedonic tone and character essentially equivalent to the soil blank and final cap results;

(2) one result (sample ID 117) with a neutral-mildly unpleasant hedonic tone, an odour character of dust, sweet, rotten, earth, compost, and an odour concentration of 170ou, and,

(3) two results (sample ID 179 and 165) with a mildly unpleasant odour character, with an odour character described as onions, garlic and rotten, and odour concentrations of 320 to 600ou.

15. The Report considers that the highest result (sample ID 179) is atypical and is likely due to inadequate capping or an issue with the integrity of the gas collection. Closer examination reveals that sample ID 15, with the lowest odour concentration of 61ou was sampled in close
proximity, indicating a localised issue at position of sample ID 179. Thus it appears reasonable to attribute the sample ID 179 result to inadequate capping, for example in terms of depth, consistency of material or some form of permeability, or some issue with the local efficiency of the gas collection system.

16. The Report also considers the three daily cap results (the daily spread of a 0.3m layer of soil used to cover that day’s rubbish) as part of the interim cap. The samples for the daily cap are termed tip face samples in the Ektimo report. These three samples show relatively similar results, very unpleasant hedonic tone, an odour character of rubbish, sweet, and odour concentrations from 370 to 460ou.

17. The average of all eight samples taken in the interim capped area (including sample ID 179 considered to be atypical of the future operation) is used in the Report to establish the odour emissions rate for the interim capped area. The average odour emission rate for these eight samples is 0.18ou/m³/s.

18. The Report adjusts this emission rate to account for better management practices in the form of improved consistency of cap quality and sacrificial horizontal gas collection. These practices are assumed to account for a 50-75% improvement in cap performance (and hence odour from the intermediate capped areas). The rate adopted in the report is 0.08ou/m³/s. This is 44% of the average of the eight samples (including the atypical sample ID 179), and represents an expected 56% improvement in performance in future.

19. I have considered whether it is reasonable to assume such a reduction in the emissions due to improved capping and gas collection in two ways;

20. Firstly, on the basis of the collected sample showing likely capping and gas collection issues (sample ID 179), and potentially sample ID 165, I consider that it is reasonable to assume a significant reduction in emissions could be achieved. For example; the average emission rate from the intermediate cap excluding sample ID 179 is 0.088ou/m³/s. This rate of emission is equivalent to a reduction of 75% relative to the sample ID 179 result and is similar to the adopted emission rate. If sample ID 165 is also considered atypical of the future operations, the average emission rate would be 0.057ou/m³/s, a reduction of 59% relative to the sample ID 165 result and 84% relative to sample ID 179. In my view, on this basis, the adopted value of 0.08ou/m³/s is reasonable.

21. Secondly, I have also considered my observations of the existing landfill which I inspected on 26 August 2016. I observed that the daily cap area appeared to be a relatively small part of the total intermediate cap area. The calculations made in the Report give equal weighting to each measurement, whereas it appears that it would be more accurate to assume that the daily cap results account for a smaller area than the intermediate cap results. Also, as the daily cap is relatively thin and has no immediate gas drainage I consider that the improvements due to better gas collection and improved capping would be somewhat less for the daily cap area.

22. Thus an alternative way to calculate the potential emissions from the intermediate capped areas would be to simply exclude the atypical results in the intermediate area. (In effect this assumes
that the remaining results represent the odour emissions that may occur with improvements to capping and gas collection), and to consider that the daily cap area is relatively a smaller part of the intermediate capped areas. For example, the average emission rate excluding samples ID 165 and 179 is 0.057ou/m^3/s and for the daily capped area 0.247ou/m^3/s. My estimate is that the daily capped area was approximately 10% of the total interim capped area; thus 0.9 x 0.057 + 0.1x0.25 = 0.076ou/m^3/s. When considered this way, it also appears that the adopted value of 0.08ou/m^3/s is reasonable.

23. I do not agree that the method used by Ektimo to calculate the rate of odour emission from the active tipping face is accurate in this case. Specifically I do not agree with the calculated results for the average mass rate of odour (ou.m^3/min) presented in the Ektimo report on Page 19 and 20 for samples identified as tip face sampling – test 1 and test 2. In this regard I generally agree with the calculations made in the Report as described in Appendix C.3.3 of the Report.

24. I consider that Appendix C of the Report adequately describes why the Ektimo calculation is inappropriate in this case, and also outlines a more accurate way to calculate the likely odour emission rate from the tip face.

(1) To describe this in plain English: It is generally not possible to accurately sample the odour from the highly irregular surface such as the active tipping face using the standard method, which is to place a flux chamber over the sampled surface. A flux chamber would not reasonably seal against such a surface, leading to error.

(2) In this case Ektimo measured the odour in the ambient air 70m downwind from the active tip face. This was done by collecting odorous air whilst traversing a 56m long path dissecting the downwind plume of odour from the tip face.

(3) To calculate the mass rate of odour that would have been emanating from the tip face whilst sampling, Ektimo make a simple assumption that the downwind plume of odour from the tip face has a uniform concentration through a rectangular area 15m high and 56m wide (70m downwind of the source). Ektimo also assumes that the wind passing through this rectangular area is uniform. The Ektimo simplification would greatly overestimate the actual tip face emission rate as the actual plume would not have a uniform concentration through its cross-section, the vertical wind profile would not be uniform and there would be other adjacent (upwind) landfill sources contributing to the odour.

(4) Appendix C of the Report outlines how the actual emission rate was more accurately calculated for input to the air dispersion modelling.

25. I note that to “back-calculate” the odour mass emission rate from the tip face corresponding with the measured downwind odour concentrations, it may have been better to have used the AERMOD model instead of the AUSPLUME model, but regardless I agree with the statement on Page C-4 of the Report that “any differences in estimates derived from AUSPLUME and AERMOD are small compared to other sources of uncertainty in the estimation process”. Whilst these models differ in many ways, for the critical plume spread functions, over such short distances (70m), the differences would be minor.
26. The Report applies a leachate pond odour emission rate of 0.04ou/m$^2$/s. Based on my experience, the level adopted is reasonable for representing a leachate pond that is operating correctly. The leachate pond in any case would be a small odour source relative to the rest of the site, and I observed during my site visit on 26 August 2016 that the pond is well aerated and had little odour. Whilst problems can occur with leachate ponds if aeriation systems fail when there is a nutrient overload, with reasonable care and contingencies such as having a spare aeriation pump on site on standby there is relatively little risk that the odour rate from the leachate pond would be significantly greater in practice.

27. Thus, I do support the adopted odour emission rates.

4.2 Analysis of meteorological conditions

28. The Report presents results for five years of meteorological data, from 2008 to 2012 inclusive. The Victorian Environment Protection Authority (EPA) provided the meteorological model input files used in the modelling for 2008 and 2009. The Report states that the meteorological modelling files for 2010, 2011 and 2012 were developed per the draft EPA guidance (Publication 1550).

29. The way in which air emissions are modelled in Victoria has recently changed, with the AERMOD model superseding the AUSPLUME model. The AERMOD model requires meteorological data to be processed for use in the AERMET component, before the AERMOD (air dispersion) component of the model can be run. The EPA seeks that several meteorological parameters be established differently to the default way in which AERMET would be set up, say in NSW or America. At this time, the EPA guidelines for how to develop the meteorological input files for use in AERMET are in draft form, and are scant on any detail as to exactly how to prepare the meteorological input files to EPA’s satisfaction. Consequently, various consultants have somewhat differing interpretations and approaches to this issue.

30. I also examined the EPA data, and note that the data indicate that the EPA may be applying adjustments in its meteorological files that are not mentioned in its draft guideline, for example the convective mixing heights tend to be capped at height intervals of approx. 250m, (i.e. there is an improbable overabundance of data in bands of height approx. 250m apart).

31. The Report outlines that it was not possible to exactly replicate the approach used by the EPA, and through an iterative process meteorological files were developed such that the results closely mimic those produced using the EPA files.

32. At this point it is important to note that only a very small part of the meteorological data is used to define the predicted impacts per the EPA criteria, which specifies that the predicted impacts relate to the 99.9th percentile value, or in other words the 9th highest hour of the 8,760 hours in year. Thus the weather conditions that cause the worst 9 hours of air dispersion are most relevant, and it is vital that the data used in the modelling adequately represents these limited worst case dispersion hours.

33. There are some clear differences between the meteorological files for 2008-9 (EPA) and the other years. For example, the mixing heights differ in terms of capped heights, but also in the late
afternoon the EPA files show a smoother transition from high daytime mixing height to lower night time mixing height than the 2010-12 files. This can be seen by comparing Figures 3.23 and 3.24 of the Report with Figures 3.25 to 3.27 of the Report. These differences affect the average and upper mixing heights which are generally not associated with the highest off-site impacts. (i.e. the difference are unlikely to matter in regard to maximum predicted impacts).

34. Some of the differences shown in the figures however arise only due to how the figures were plotted, and not due to the actual data. For example, Figures 3.25 to 3.27 of the Report show zero mixing heights. If this was correct, it would lead to excessively high impacts in the modelling. However these plots are simply treating some of the missing data as a zero value, whereas in the EPA data set (2008-9) these missing data are indicated as a -999 value, which is not plotted in Figure 3.23 and 3.24 of the Report. It is normal for there to be some missing data, and this does not detract from the modelling results.

35. The key test I applied in my review of the meteorological data was examination of the differences in the shape of the odour impact contours between each year, when all other inputs to the model are identical. This test provides a direct, logical and robust indication of whether the differences that can be seen in the meteorological input files are affecting the predicted results. Noting that there are, and should be, differences between any two meteorological modelling years, the modelled odour contours show very similar shapes, and in my opinion, this indicates that there is no tangible effect on the predicted odour results due to any inconsistency between the EPA approach and the approach adopted in the Report to develop the meteorological files.

36. It is also relevant to consider whether the raw meteorological files used in the meteorological modelling are representative of the conditions which may occur on the site. In this regard I note that the input data to the files is primarily sourced from the EPA monitoring station in Deer Park.

37. The EPA Deer Park monitoring station was located approximately 5km away from the site. I went to the EPA monitoring station site on 26 August 2016, and whilst the station had been removed, I could see where it had been and inspected the surrounding area. The station had been positioned in an ideal area; flat and unencumbered by tall trees buildings or terrain.

38. I observed that the area is relatively flat for many kilometres around the station and the Project site, and thus the data measured at the EPA station at Deer Park would be reasonably representative of the wider area, including the area around the Project site.

39. EPA monitoring is generally subject to strict quality controls and maintenance. With this in mind and in light of the surrounding lack of topographical features that may affect the meteorology, I consider that the collected data would reliably represent the conditions of the general area around the Project.

4.3 Project stages, scenarios and modelling assumptions

40. The Report considers two base case and four future case scenarios, two of which have a secondary low emissions future case scenario.
41. The base case scenarios are used to ascertain whether the odour model, including the emissions and meteorological assumptions can reasonably replicate the observed levels of odour, as indicated by the field observations (see further discussion in Section 4.5).

42. Base case 2014, includes odour emissions from Pinegro and an active landfill tip face area of 3,600m². The scenario shows that only two of the modelled surrounding receptors would have a low risk of impacts and all others would have a medium risk of impacts (refer to Table 8.1 of the Report).

43. Base case 2015 is for the landfill alone, with a with a tipping face area of 1,800m². The results show a significantly lower level of impact than for base case 2014, however some odour effects still occur for residences to the east which are shown to have a medium risk of odour impact.

44. Scenarios, S1, S2, S3 and S4 represent the progression of the Project west and then northwards. S1 would have the most effect for residences to the east, S2 for residences to the southwest, S3 is centrally located and may affect the nearest receptor, and S4 would have most effect for residences to the north of the site.

45. It is noted that for scenarios S3 and S4, a low impact scenario is added. This aims to represent greater segregation of food wastes from the rubbish in the future. This is considered to be a reasonably likely future scenario, given that such initiatives are in place in Australia. This would reduce the amount of putrescible material being landfilled, and hence the amount of gas and odour that would be generated at the Project. The assumed reduction of 30% in odour appears to be plausible based on a commensurate uptake of waste segregation.

46. In my opinion, these scenarios would reasonably represent all key stages of impact over the life of the Project. Thus I support the adopted scenarios, however I note that there are some technical issues with how these scenarios are represented in the modelling, as outlined below.

47. The location of the odour sources shown in the modelling described in the Report were mapped over the final Project layout. It became apparent that the modelling in the Report would appear to be based on an earlier version of the Project plan. Also the potentially odorous leachate ponds were modelled in the positions of the relatively benign stormwater ponds. It is understood that some adjustments may have been made in the Report to account for this. However the surface areas of the cells and the locations of the modelled sources in the Report are not completely aligned with those of the Project.

48. There would be some degree of uncertainty in the Report due to the modelling assumptions not being entirely consistent with the final proposed Project. For this and other reasons, I have re-modelled the Project to determine what the impacts might be if the correct source areas and positions etc. are used.

49. In the figures below, the modelled source locations used by PEL to obtain the results shown in the Report are shown alongside the positions for the sources in the re-run modelling that I conducted, i.e. Todoroski Air Sciences (TAS).
Figure 1: Modelled odour sources Scenario S1

Figure 2: Modelled odour sources Scenario S2
Figure 3: Modelled odour sources Scenario S3

Figure 4: Modelled odour sources Scenario S4
50. The other aspects of the Report that are corrected in the re-run modelling relate to the surface area of the cells, as shown in Table 1.

Table 1: Surface areas of odorous sources used in the modelling (m²)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Active Face PEL</th>
<th>Interim Covered Cells PEL</th>
<th>Leachate Pond PEL</th>
<th>Total area of odorous sources PEL</th>
<th>Active Face TAS</th>
<th>Interim Covered Cells TAS</th>
<th>Leachate Pond TAS</th>
<th>Total area of odorous sources TAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Case 2014</td>
<td>3,600</td>
<td>176,400</td>
<td>10,000</td>
<td>190,000</td>
<td>3,600</td>
<td>176,400</td>
<td>10,000</td>
<td>190,000</td>
</tr>
<tr>
<td>Base Case 2015</td>
<td>1,800</td>
<td>178,200</td>
<td>10,000</td>
<td>190,000</td>
<td>1,800</td>
<td>178,200</td>
<td>10,000</td>
<td>190,000</td>
</tr>
<tr>
<td>Scenario 1 (Cell 1)</td>
<td>1,800</td>
<td>176,200</td>
<td>10,000</td>
<td>188,000</td>
<td>1,800</td>
<td>177,496</td>
<td>10,000</td>
<td>189,296</td>
</tr>
<tr>
<td>Scenario 2 (Cell 4)</td>
<td>1,800</td>
<td>238,700</td>
<td>10,000</td>
<td>250,500</td>
<td>1,800</td>
<td>160,218</td>
<td>10,000</td>
<td>172,018</td>
</tr>
<tr>
<td>Scenario 3 (Cell 8)</td>
<td>1,800</td>
<td>149,200</td>
<td>10,000</td>
<td>161,000</td>
<td>1,800</td>
<td>116,491</td>
<td>10,000</td>
<td>128,291</td>
</tr>
<tr>
<td>Scenario 4 (Cell 10)</td>
<td>1,800</td>
<td>238,125</td>
<td>10,000</td>
<td>249,925</td>
<td>1,800</td>
<td>218,900</td>
<td>10,000</td>
<td>230,700</td>
</tr>
</tbody>
</table>

51. The change in the surface areas in the TAS re-run modelling, is due to different cell sizes in the actual Project, and results in a proportional change in the amount of odour emitted from each source. (Note that whilst the same total surface area is used to represent the leachate pond, the TAS re-run modelling uses only one leachate pond in the correct location, whilst the PEL modelling represents several leachate ponds placed in the locations of the stormwater ponds).

52. The odour emission rates (per unit area), and meteorological files are not changed in the re-run TAS modelling.

53. The TAS re-run modelling generally uses fewer odour sources more closely placed together within the correct cell location. This acts to increase the rate of odour emission from the modelled sources and the cell area, however counter to this increase in the odour rate, in some cases the smaller cell area means there is less total odour.

54. It is not intuitively clear what effect this may have on the resulting impacts at any receptor, (e.g. impacts may be higher or lower at any one receptor and are likely to be higher and lower at different receptors spatially). This is another reason to re-run the modelling.

4.4 Air dispersion modelling results

4.4.1 EPA odour criterion

55. The applicable criterion for the Project is an odour level of **1ou at the 99.9th percentile, for a 3 minute averaging period**, each hour. Generally speaking the odour concentration level in the criterion is set at a level indicative of no discernible odour.

56. In this regard, I have been instructed to advise whether I “support the criteria to compare the modelling results against”. I note that the correct EPA odour criterion has been applied in the Report for comparison with the modelling results, thus I support this aspect of the Report.

57. It may be useful for me to re-phrase the question as follows; how do you interpret the EPA odour criterion?
58. If this rephrased question is considered, it may be helpful to note that no human is capable of directly detecting any common odour (such as that typically emitted from a landfill) at a level of 1ou in the ambient environment\(^1\); let alone recognising what the nature or character of the odour is. Thus I interpret that the purpose of the criterion is for application in air dispersion modelling assessments (only), and not for the field assessment of odour.

59. I also consider that the EPA odour criterion is a screening level indicator of likely compliance only, but not an indicator of likely non-compliance or odour impact.

60. In other words, when used in an air dispersion modelling assessment conducted per the EPA guidelines, wherever the criterion is met, no further assessment is warranted as there would be no tangible risk of odour impacts arising.

61. However where the criterion is not met in an air dispersion modelling assessment, it does not follow that there would be an odour impact, only that there is a possibility that an impact may occur. In this case, it is thus necessary to conduct an additional odour risk assessment at each receptor, and the EPA has developed guidelines for doing just that.

62. How the risk assessment is interpreted in regard to the acceptability of a project would vary according to the specific case. For example, if all other factors are equal, the risk level that is acceptable for say a landfill project with odour effects over a few years whilst progressing near to the affected receptors would be less than the risk level acceptable for an abattoir in a fixed location having the same odour effect on the same receptors, but for say 20-30 years. (Obviously there are many other factors to consider, such as the overall number of affected receptors, the context of the receiving environment, available contingency measures to minimise the odour etc.)

63. I note that it would not be reasonable to interpret the EPA odour criterion as absolute and incontrovertible; independent of an odour risk assessment; or, applicable to the odour level off-site during actual operation. If this were the case, no typical activity that could be smelt off site would be permissible.

\(^1\) Odour concentration is measured by a panel of trained “noses” (i.e. people) working in a specialised odour free laboratory under controlled conditions. The panel is presented with highly diluted odour from the sample though a device known as an olfactometer. The dilution is progressively reduced until half of the panel believe that there may be an odour present. The level of dilution of the sample at this time is the odour concentration of the sample. Note that the panelists do not attempt to identify the source or nature of the odour, only to indicate when there is a sensation of odour. By definition, 1 ou is the level of odour of an undiluted sample. Hence such a level of odour might be sensed, but not recognised by only half of a panel of trained experts under controlled laboratory conditions.

The testing can be extended by progressively reducing the dilution over a range of concentrations where the sample odour character and hedonic tone are tested.

Field testing procedures, as described in Appendix C.4 of the Report can be used to infer odour concentrations in the field, but the actual concentration is not directly measurable in this manner.
4.4.2 Air dispersion modelling

64. Four new receptor locations to the Northwest, labelled R26 to R29, as shown in Figure 5 were added to the re-run modelling.

![Figure 5: Modelled receptor locations (showing additional receptors 26 to 29)](image)

4.4.3 Odour results

65. The key significant changes due to the re-run modelling occur in scenario S2 and scenario S4. The re-run modelling results for scenarios S2 and S4 are shown in Figure 6 and Figure 7 in blue contours that are overlain on the original yellow PEL model contours from the Report.

66. Figure 6 shows that there is a reduction in impacts for scenario S2, likely due to the smaller cell surface area (and commensurately smaller odour emissions) and to some extent the location of the leachate pond.

67. Figure 7 shows a general increase in impacts for scenario S4, likely due to bunching the sources within the cell and generally having the sources closer to the receptors.
When examined in more detail, the results for scenario S4 in Figure 7 also show less pronounced spikes of odour towards the north (R7 to R15) and south, but more odour to the east and south-east. In my view this is correct and to be expected because the original modelling in the Report placed most of the odour sources along a straight north-south axis, which would not occur in reality, whereas the re-run modelling places the sources more closely bunched together within the actual cell (refer to Figure 4). The source placement in the original modelling would cause odour to be exceptionally concentrated when the wind blew from the south or north, along the alignment of the odour sources. In this case, in the modelling, odour from the first source adds excessively with the next source, and the next and so on, causing exaggerated spikes in odour to the north and south of the source axis. This north-south axis of alignment would also cause the modelled odour to be more diluted (than might actually be the case) when a wind blew across the axis of source alignment, e.g. a westerly or south-easterly wind.

So the changes between the results in the Report and the re-run modelling can be seen easily identified at each receptor, for every year and scenario re-run, the fractional changes are shown in Table 2. The tabled results indicate a general increase in predicted impacts for scenario S4 and a general decrease for scenario S2, but no tangible change for the other scenarios. Where the value is less than one it indicates the re-run result is less than in the Report (i.e. 0.98 means the re-run result is 98% of the result in the Report), and conversely where the number is larger than 1 this indicates an increased level of impact in the re-run results.

The re-run modelling shows that for the various scenarios:

1. S1 - the maximum decrease at any receptor is 21% and the maximum increase is 17%;
2. S2 - the maximum decrease at any receptor is 36% and the minimum decrease is 1%;
3. S3 - the maximum decrease at any receptor is 35% and the maximum increase is 7%;
4. S4 - the maximum decrease at any receptor is 42% and the maximum increase is 63%;

It is important to also note that the actual level of impact in odour units is more relevant to the assessment of impacts than the fraction change due to the re-run modelling. For example, the maximum increase of 63% arising from the re-run modelling occurs at Receptor R14 for scenario S4 in meteorological modelling year 2009. The result arises due to a change in odour impact from 0.9ou to 1.4ou. In practice, this is not a discernible change in the level of odour one may experience, but it may indicate some slightly more frequent presence of odour.

The modelled odour concentrations due to the Project at each receptor for the re-run scenarios S1 to S4 are shown in Table 3. Several additional receptors (R26 to R29) are included to represent the boundary of the proposed new receptor areas in the PSP to the northwest.
Figure 6: Predicted odour levels Scenario S2
Figure 7: Predicted odour levels Scenario S4
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16080594_Expert_Report_Air_Ravenhall_160915
73. The summary of the odour risk assessment for the Project, conducted per the EPA methodology developed for broiler farms is shown in Table 4.

74. The results show that the medium level of risk for receptor R15 changes to a low level of risk, and that the low level risk predicted at R20 and R17 does not arise when the actual Project is represented in the (re-run) modelling.

75. The difference in the predicted odour concentration results that leads to the change in risk assessment is small; a difference of less than 0.10ou for R17; 0.11ou for R20; and, up to 0.5OU for R15. Such a change would not be measurable or perceptible in reality.

Table 4: Summary of odour Risk Assessment per EPA methodology

<table>
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<tr>
<th>Receptor</th>
<th>PEL</th>
<th>S1</th>
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<th>S3</th>
<th>S4</th>
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76. Overall, my evaluation of the situation is that;

(1) Odour impacts would occur at Receptor 1 and to a lesser degree at R2 whilst the Project operates cell 4 (scenario S2). However these impacts would only occur for a limited time. There would be a steady increase in the odour concentration and frequency of odour events, which would then subside.

(2) In regard to the low risk of odour impacts predicted at receptors R12 to R16 in scenario S4, the predicted levels of odour are between 0.7ou and 1.7ou in any one meteorological
modelling year. I consider that there is negligible risk of any serious odour impact at these locations for these reasons:

(i) The predicted odour levels are low by any measure, and considering fractions of odour units is not material to what may be experienced in practice. For example in NSW, the EPA would round the predicted odour concentration to the nearest whole number, and in this case the results would round to 1ou at all of these receptors when averaged across all meteorological modelling years.

(ii) The impacts only occur for a limited period towards the end of the life of the Project.

(iii) The predicted impacts do not factor in any source separation to divert putrescible material out of the rubbish. This is an increasingly growing practice as it is economical, and good for the environment. In this case it would reduce odour by an estimated 20 to 30%, and if it were adopted by some local councils (as likely to be the case in the future), no impacts would arise.

77. My evaluation is also supported by the EPA and operator field observations, discussed below.

4.5 Field odour observations
4.5.1 EPA surveillance

78. Between March 2014 and January 2016, the EPA conducted 760 odour checks over three series’ of odour surveillance monitoring, and 29 investigations of public odour reports. The complete summary of the EPA investigations can be found at http://www.epa.vic.gov.au/our-work/current-issues/landfills/ravenhall-landfill/epas-actions-around-ravenhall-landfill but in summary, the EPA says:

- Overall offensive odour has been detected in residential areas on very few occasions.
- The majority of strong odours detected during odour surveillance were as follows:
  - 2014 – four of the strong odours detected were from composting, three from the landfill
  - 2015 – 10 of the strong odours detected were compost, two were asphalt, two from the landfill
  - 2016 – one of the strong odours detected was from the landfill; the remaining nine were of a random, non-industrial nature, including asphalt, manure (from livestock), moist soil, woodchips and a sewer leak.

79. The number of checks that the EPA conducted in each year is stated as follows:

- In 2014 [Feb-Mar], EPA conducted 149 odour checks. Seven recorded a strong odour, nine recorded a weak odour and 133 recorded no odour.
- In 2015 [Feb-Apr], EPA conducted 111 odour checks. Fourteen recorded a strong odour, nine recorded a weak odour and 88 recorded no odour.
- In 2016 [Jan], EPA conducted 119 odour checks. Ten recorded a strong odour, 23 recorded a weak odour and 86 recorded no odour.
80. The EPA surveillance data is summarised in Figure 8. The data show that the number of strong landfill odour observations has decreased over time, but more odour overall has been observed. The increasing odour observed by EPA was generally traced to sources other than the landfill.

81. It is noted that in the series of odour monitoring surveilances conducted each year, only three strong landfill odour instances were recorded in 2014, two in 2015 and one in 2016. This could simply be interpreted to mean that strong landfill odour is rare. However it is also noticeable that the total number of odour events being detected has increased each year (in each series of odour surveilances). This may be because actual odour in the environment from all sources has increased, or the EPA personnel conducting the surveilances have become better, more attuned to at detecting odour (or other factors). In my view, the two trends (increasing total odour and decreasing strong landfill odour) whilst individually weak, when considered together tend to suggest that there has been an improvement in the emissions of odour from the landfill, and also that in the context of the receiving environment, landfill odour is not significant.

82. It is not clear whether the EPA observations of strong landfill odour relate to observation points along or very near the landfill boundary or residential areas. However it is noted that the EPA states; “While there have been many public reports of odour pollution, ongoing EPA observations have rarely found landfill odours in residential areas.”

83. The EPA plots the received number odour reports stating the Ravenhall landfill as the source since 2013. A copy of the EPA plot from the EPA website is presented below as Figure 9.
Figure 9: Public odour reports to EPA stating Ravenhall landfill as the source

84. The EPA odour surveillance between February and March 2014, coincides with the time of peak public odour reports and the February 2014 announcement of the Project. During this time the EPA surveillance identified the least number of odours in the observations (16 out of 149), however the largest number of strong landfill odours (three out of seven) were identified at this time. The remaining four strong odour were from composting.

85. The February to April 2015 EPA surveillance identified odour in 23 of 111 observations and 14 observations of strong odour, ten of which were attributed to composting facility, two to landfill odour, and two to asphalt odour.

86. The January 2016 EPA surveillance identified odour in 33 of 119 observations and 10 observations of strong odour, nine of which were attributed to various sources but only one of which was attributed to landfill odour. During this time, the number of public odour reports stating the landfill as the source increased significantly.

4.5.2 Operator surveillance

87. At Appendix C4.2 the Report describes in detail field odour observations conducted on a number of occasions. Broadly, I consider that these observations appear to be consistent with the EPA observations. The June 2014 observations indicate that the Pinegro composting facility was the dominant source of odour, even when the landfill was releasing odour from the gas extraction system and operating the active face. The October 2014 observations identified composting, asphalt and two types of landfill odour. The October 2015 observations identified no tangible landfill odour, the November and December 2015 observations were conducted for the most part on site or near the boundary and coincide with the source odour sampling by Ektimo.
4.5.3  Consideration of field odour observations, complaints and modelling results

88. Only the base case modelling scenarios can be compared with the field observations.

89. It is my understanding that the Pinegro composting facility wound back operations near the end of 2015 and completely ceased to operate in December 2015. The composting facility was operating during the 2014 operator observations that identify dominant or significant odour from Pinegro, and also the February to April EPA observations which attribute the majority of strong odours observed to composting. The operator observations in October 2015 identified no tangible odour and by this time Pinegro had significantly reduced activity.

90. The base case 2014 shows a medium risk of odour impact at most receptors, and relative to base case 2015 (without Pinegro and with reduced active tipping face) it is apparent that base case 2014 shows some significant impacts from the Pinegro facility and some level of impact from the landfill. This is consistent with the EPA and operator field observations, which report identifiable landfill odour at significant distances from the landfill, but also stronger compost odours.

91. The modelling results for base case 2014, vs base case 2015 indicate a reduction in odour impacts from the landfill, and whilst perhaps only indicative, the EPA results also show that this is likely to be the case.

92. On the basis of the above, I consider that there is generally good agreement between the modelling results and the field observations in regard to odour impacts from the landfill. This also indicates that the future scenarios would also be a generally good indicator of potential future odour impacts.

4.5.4  Complaints

93. As set out in Section 3.7.4 of the Report, complaints data are not always a good indicator of actual annoyance or odour impact. The EPA observations show that there have rarely been any strong landfill odours in the residential areas, and that the least number of odour observations occurred at the time of the large spike in odour complaints immediately after the announcement of the intended Project illustrate that complaints are generally driven by both emotive and physical causes.

94. The EPA observations confirm that it is unlikely that there was in fact a sudden increase in any physical odours from the landfill commensurate with the increase in complaints, and it is more likely the spike in complaints (odour reports) was driven by emotive factors such as fear of possible and unknown consequences of the intended Project, coupled with passing historical experience with odours in the vicinity (i.e. landfill, Pinegro etc).

95. From direct experience as the principal technical adviser in the Air Branch at NSW EPA where I worked for ten years, year to year, odour is generally the 1st or 2nd highest environmental complaint issue in NSW aside from noise complaints.

96. The case of complaints following project announcements is common in my experience, for example I recently completed an odour assessment for a forensic taphonomy study in Sydney where up to 200 human bodies would progressively, over 20 years be left to decompose in a field
bounded by residential occupancy. The study would assist police conducting forensic investigations. Understandably, this project would be emotive for most local residents, and as might be expected there were many complaints about odour before anything at all had in fact occurred. I note that once the project was carefully explained, along with the odour mitigation measures that would be used, the complaints ceased. The project has now operated for over a year with no complaint or odour issue arising.

97. For these reasons I consider that for the most part, the spikes in odour complaints are not related to any actual significant change in the odour from the landfill (Project), and mainly arise from a potentially misplaced fear of the Project.

4.6 Odour mitigation and management

98. Generally, the management of odour impacts in residential areas due to emissions from putrescible landfills requires a suitable buffer distance and good operational practices to be maintained over the life of the project.

4.6.1 Buffer distance

99. Landfills are a vital public asset and for economic reasons they generally need to be positioned relatively close to the source of the rubbish, i.e. the city or town. This is recognised in most jurisdictions through a policy or guideline that generally stipulates a minimum buffer distance between a landfill and residential areas, or how to derive such a buffer distance on a case by case basis. A review of the Australian guidelines in this regard is set out in the table below.

<table>
<thead>
<tr>
<th>Source</th>
<th>Separation Distance</th>
<th>Guideline</th>
<th>Source</th>
<th>Separation Distance</th>
<th>Guideline</th>
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<td>500m</td>
<td>VIC EPA Siting, design, operation and rehabilitation of landfills</td>
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<td>QLD DEHP Guideline Landfill siting, design, operation and rehabilitation</td>
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<td>SA EPA</td>
<td>500m</td>
<td>SA EPA Environmental management of landfill facilities (municipal solid waste and commercial and industrial general waste)</td>
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<td>NSW EPA</td>
<td>Case by case, 1000m for &gt;50,000tpa</td>
<td>NSW EPA Environmental guidelines solid waste landfills - second edition</td>
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<td>WA EPA Guidance for the assessment of environmental factors</td>
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<td>Case-by-case, but not within 250m</td>
<td>NT EPA Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites</td>
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100. Broadly, the guidelines specify a minimum separation distance of 500m. In NSW no minimum buffer distance is specified as this is set on a case by case basis, however it is recommended that a separation distance of 1,000m is considered for large putrescible landfills.

101. It would appear that the Project would be more than 500m from any residence.
102. Generally, based on the results in the Report and from the re-run modelling, it would be advisable to not allow residential land use within 500m of the nearest odorous sources at the Project, and preferably not within 1,000m where this is feasible.

103. The question thus arises whether any buffer that may be stipulated should be regularly shaped or shaped according to the modelling contours.

104. Due to the prevailing winds, the contour results indicate greater effects would occur to the south east, however in my opinion, the AERMOD modelling approach stipulated in Victoria does not deal well with odour impacts from large odour sources that emit fugitive odours near ground level e.g. landfills, chicken farms, feedlots and composting facilities. Because these sources emit a significant quantum of odour at all times, even when there is little or no wind, high levels of impact can occur under low wind speed conditions. These conditions are most likely to occur outside of daytime hours.

105. Due to its inherent limitations, the AERMOD model is not ideally accurate at predicting the likely impacts under such conditions. The model tends to project emissions further than they can possibly reach, but on the other hand it does not accumulate emissions in any one area over time (as may arise under a period of low wind or near calm conditions for a few hours).

106. For these reasons the shape of the AERMOD contour results at the 99.9th percentile needs to be interpreted with a degree of caution and professional judgement. The key aspects to consider are that the spikes in impact projected well away from the source, and outside of the typical smoothed line through the outer parts of a contour line are unlikely to reliably indicate any actual effect that may occur in practice.

107. Given that the EPA odour risk assessment approach considers the 9th highest result corresponding with the 99.9th percentile, the 44th highest result corresponding with the 99.5th percentile and the 175th result corresponding with the 98th percentile, a possible way to develop a sensible buffer shape is to take the shape of a lower percentile contour e.g. the 99th or 98th percentile contour, and scale it to fit approximately over the more jagged criteria contour line at the 99.9th percentile.

4.6.2 Project design and operational management measures

108. The Project would manage odour amenity impacts using the following mitigation measures:

(1) Participating in projects to encourage source separation of food and diversion of food waste from landfill (i.e. actively participating in Council tenders for food waste diversion). Greater uptake of source separation results in less putrescible waste emplaced at the landfill, and reduces the potential for gas and odour emissions.

(2) Completing daily, intermediate and final capping as per best practise standards. These covers suppress the release of odour from the fresh and emplaced materials.

(3) Installing horizontal sacrificial landfill gas collection pipelines (as well as vertical gas collection). By collecting the gas from within the landfill, far less gas would be released. The
collected gas is consumed in engines which provide power, and excess gas is destroyed in a flare.

(4) The active tipping face for the extension would be maintained to an area of 1,800 m². A relatively small active tipping face area is achieved by more rapidly compacting and covering the material. The amount of odour from the waste at the active tipping face is reduced in proportion to the reduction in the exposed area.

(5) The Project would increase the size and efficiency of the landfill gas collection and control systems and install additional horizontal gas collection wells as an appropriate waste thickness is reached. This would reduce the amount of gas and hence odour that may escape.

(6) Using odour neutralisers in the vicinity of the active face if necessary;

(7) Undertaking daily site inspections which include odour observations;

(8) Undertaking aeration of the leachate ponds. When aerated, leachate pond produce only low levels of odour. To ensure this remains the case, all critical plant would also be carefully maintained per the manufacturer’s specifications to prevent breakdowns.

The primary source of dust emissions at the Project (detailed in Section 6) is the movement of trucks on unsealed roads, and to a lesser degree wind erosion and some material handling. Dust from the site would be managed using the following mitigation measures;

(1) Regular watering of haul roads to maintain the surface in a relatively moist state. Diligent watering can control emissions by more than 90%, but for the purposes of the dust assessment a level of 75% control was used.

(2) A wheel wash would be used for trucks exiting the facility to prevent the track out of mud onto public roads.

(3) Internal roads between the public road and the wheel wash would be sealed, along with some other permanent on-site roads.

(4) Sealed roads would be swept regularly.

(5) Dust from of the soil capping would be managed by using moist materials, and by planting vegetative cover to stabilise the surface of completed capping to prevent wind erosion.
5 ASPECTS OF THE REPORT I ONLY PARTIALLY AGREE WITH

109. There are some parts of the Report that I only partially agree with. These issues do not affect the final outcome of the Report, which I do agree with. Some of the main issues are outlined below.

110. I agree with the discussion at Appendix C.2 describing the factors such as increasing wind speed and turbulent wind passing over an odour source that will strip increasingly more odour from the surface. However, for the reasons listed below, I believe that in this case, these factors would not fully apply as is assumed in the Report.

(1) The 0.3m daily cap is relatively inert soil material. Initially this material will not have any inherent malodour, and so there is no odour in the material for the wind to strip out. The primary odour would originate from gas escaping through fissures and gaps in the material. This gas leakage would be affected by the factors described, but not to the same extent; the primary factors in the initial odour release would be the quality of the cover material and the pressure of the entrained gas.

(2) However, over time the pore spaces in the soil capping material will progressively become infused with odour from the waste material below, and from re-handling of the material, and the surface of the capping material may overtime reach a state where the wind stripping factors would apply as described in the Report. It is not clear how long this would be (if at all), but it would be longer for the intermediate cover (0.5m) than for daily cover (0.3m).

(3) As the measured emissions from the daily cover were found to be greater than those form the interim cover, the question arises as to whether this phenomena of wind stripping the gas from the surface is already factored into the odour measurement data used in the study. As the odour was measured with a flux hood, which does not ‘strip’ odour from the surface the data tend to suggest that the higher daily capping results (measured by Ektimo), are due to gas from the landfilled material escaping directly to the air, and not from the capping so much. Thus I do agree that some factor for wind stripping odour from the caped surface could possibly be applied (i.e. to permit greater escape of gas though the cap to some small degree), but I am not convinced it would be as high as that discussed in Appendix C.2.

(4) The odour impregnated material that is exposed to the elements (and thus potentially affected wind stripping additional odour from it) is the waste at the active tip face. This material will generally have a highly irregular surface and the majority of the material surface would be sheltered from the wind, thus only a relatively small fraction of the surface of the material would be affected relative to say the surface of a pond or cattle feedlot pad.

(5) Changing atmospheric pressure is likely to have a significant effect on odour. It is generally well understood that when the atmospheric pressure is falling, this causes the rate of odour emissions to increase, and conversely when the pressure rises, it reduces the rate of odour emission.

111. The comparison between the modelled and observed results in Table C.5 indicates that the model overestimates the odour levels observed, (possibly because the assumptions used may
overestimating the amount of odour being stripped from the surface by the wind). The accuracy of the model predictions may thus potentially be improved by considering the above.

112. This leads into another point of incomplete agreement with the Report. As outlined previously I interpret that the EPA odour criterion of 1ou is intended for use in air dispersion modelling (only) as a screening criterion that, if exceeded, is supplemented with a risk assessment used to identify the risk of offensive odours from a project impacting on the surrounding community. Thus I do not believe that it is intended for an actual operation to quantify its odour level and to prove that it is less than 1ou off-site, rather that the onus on any operational project is to not cause offensive odour effects in the surrounding community. As such, I do not fully agree with the approach applied in the Report of verifying the model predictions by attempting to quantify odour concentration in the field. I agree that such verification is good, that the approach is generally sound, and that it is useful (even as done in this case) but in my view it would have been more appropriate to have also conducted an evaluation of the offensiveness of the odour. I acknowledge that this may be a marginal issue, as the verification conducted does provide assurance and confidence in the veracity of the predicted results.

113. In support of my view on this I note that when investigating odour in the area the EPA examines offensive odour, not odour concentrations, e.g. refer to http://www.epa.vic.gov.au/our-work/current-issues/landfills/ravenhall-landfill/epas-actions-around-ravenhall-landfill for a description of the investigations specific to the Ravenhall area.

114. Another aspect of the Report that I only partially agree with is the comparative assessment of the predicted impacts with NSW EPA criteria. I am one of the technical authors of the NSW EPA guidelines and criteria and the NSW odour policy, and I can attest to the fact that the NSW policy and criteria were not developed for use with AERMOD, or in consideration of the specific tweaks to the settings that are used in Victoria. Potentially, a valid assessment of odour impacts may not necessarily result if the NSW odour criteria are compared with the results of modelling using AERMOD.

115. In my experience, when I have compared the Victorian and NSW assessment approaches for large odour projects, the two approaches tend to produce results that on the whole are not greatly dissimilar (provided that the model applicable to the state guideline is used, per the model guidelines set out by each state EPA.) The tendency is that the NSW approach is less stringent at more than half the receptors, but more stringent at a significant proportion of receptors. How each approach may affect a specific project will vary, and would need to be tested.

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2 Offensive odour is considered in the context of the receiving environment, the quality of the odour in terms of strength, character and hedonic tone and a range of other factors including the duration, and frequency of the odour and the time and place in which it occurs.
6 CONSIDERATION OF DUST IMPACTS

116. I have reviewed the Report in relation to potential off-site dust effects due to the Project. I found some inconsistencies in the Report relating to the receptors assessed and consider that some of the assumptions used to calculate the quantities of dust emissions may underestimate the level of dust emitted. However when I made the same calculations using the stated assumptions I found much lower dust emissions than those presented in the Report. I also found a few dust sources in incorrect locations, but this is not greatly important to the outcomes.

117. Thus, in regard to its dust assessment there appear to be two key, but somewhat counteracting issues in the Report; i) no assessment of dust at some potentially affected receptors to the southeast of the site; and, ii) an apparently large overestimation in the dust emissions.

118. In order to confirm what the emissions and hence the potential impacts due to the Project may be, I chose to re-do the dust modelling using emission calculations based on less optimistic assumptions (i.e. that would lead to higher dust levels), at all of the receptors, and I also corrected the location of a few errant dust sources. Note that the Report uses a different set of receptors (R1 to R17) for dust compared to the receptors used for odour (R1 to R25) and some of the same numbered receptors are in different locations. Note also that the dust contour plots in the Report show the receptors pertaining to odour impacts and not the dust assessment receptors in the tabled results in the Report.

119. Table 6 presents the emission factors, and Table 7 presents the corresponding assumptions I applied to calculate the emissions of dust from the Project and the surrounding sources. I used higher silt values and lower moisture values, which leads to higher calculated levels of dust.

120. Table 8 presents an example of the emission inventory for TSP and PM$_{10}$ for scenario S2, one of the most impacting scenarios for dust. On the basis of generally conservative assumptions for silt, moisture, vehicle kilometres travelled, watering control efficiency, etc., minor sources such as exhaust particulate emissions were ignored.

121. The criteria for dust that has been adopted is per the Protocol for Environmental Management in the Mining and Extractive Industries of a cumulative 24 hour average PM$_{10}$ concentration of 60µg/m$^3$. On the basis of no tangible effects shown in the Report for deposited dust, and the consideration that there would be no risk of any effects arising due to the re-modelling, deposited dust was not examined further.

122. The adopted background level is taken from the Report, which derived a 24 hour average background PM$_{10}$ level of 20µg/m$^3$ on the basis of the EPA monitoring data from Deer Park. In addition, the nearby industrial sources were also included in the modelling, and added with the background level and the predicted dust levels from the Project to calculate the maximum cumulative 24 hour average PM$_{10}$ the results.

123. Figure 10 and Figure 11 present contour plots of the predicted maximum cumulative 24-hour average PM$_{10}$ concentration for the 2008 and 2009 meteorological modelling years for scenarios 2 and 4, respectively, the most impacting scenarios for dust. The figures show the 60µg/m$^3$ contour does not impinge on any receptor.
124. Table 9 summarises the predicted maximum cumulative 24-hour average PM$_{10}$ results for all scenarios at the sensitive receptors. All of the dust results at every receptor are below the criteria in every scenario, and it is thus concluded that no dust impacts would arise due to the Project.

**Table 6: Emission factors applied for the Project**

<table>
<thead>
<tr>
<th>Activity/Materials</th>
<th>Emission factor equation</th>
<th>Variables</th>
<th>Control</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumping daily/interim cover materials</td>
<td>$EF_{TSP} = k \times 0.0016 \times \left( \frac{U^{1.3}}{2.2} \frac{M^{1.4}}{2} \right) \text{kg/tonne}$</td>
<td>$k_{TSP} = 0.74$</td>
<td></td>
<td>NPI, 2012</td>
</tr>
<tr>
<td></td>
<td>$EF_{PM10} = 0.47 \times EF_{TSP}$</td>
<td>$U = \text{wind speed (m/s)}$ $M = \text{moisture content (%)}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hauling on unsealed surfaces</td>
<td>$EF_{TSP} = \frac{0.4536}{1.6093} \times \frac{k_{TSP}}{U^{0.5}} \times \frac{S/(s/12)^{0.7}}{(1.1023 \times M/3)^{0.45}} \frac{kg}{VKT}$</td>
<td>$k_{TSP} = 4.9$ $k_{PM10} = 1.5$ $S = \text{silt content (%) M = average vehicle gross mass (tonnes)}$</td>
<td>75% - watering of trafficked areas</td>
<td>US EPA, 1985</td>
</tr>
<tr>
<td></td>
<td>$EF_{PM10} = \frac{0.4536}{1.6093} \times \frac{k_{PM10}}{U^{0.5}} \times \frac{S/(s/12)^{0.9}}{(1.1023 \times M/3)^{0.45}} \frac{kg}{VKT}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spreading of cover materials</td>
<td>$EF_{TSP} = 2.6 \times \frac{S^{1.2}}{M^{1.3}} \frac{kg}{hour}$</td>
<td>$S = \text{silt content (%) M = moisture content (%)}$</td>
<td></td>
<td>US EPA, 1985</td>
</tr>
<tr>
<td></td>
<td>$EF_{PM10} = 0.34 \times \frac{S^{1.5}}{M^{1.3}} \frac{kg}{hour}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind erosion on exposed areas</td>
<td>$EF_{TSP} = 850 \frac{kg}{ha/year}$ $EF_{PM10} = 0.5 \times EF_{TSP}$</td>
<td></td>
<td></td>
<td>US EPA, 1985 for TSP, NPI 2012 for PM$_{10}$</td>
</tr>
<tr>
<td>Wind erosion of unsealed roads</td>
<td>$EF_{TSP} = 850 \frac{kg}{ha/year}$ $EF_{PM10} = 0.5 \times EF_{TSP}$</td>
<td></td>
<td></td>
<td>75% - watering of unsealed roads</td>
</tr>
</tbody>
</table>

**Table 7: Assumptions made in the emissions inventory**

<table>
<thead>
<tr>
<th>Activity/Materials</th>
<th>Assumed parameters</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily/interim cover materials</td>
<td>10% silt content 7% moisture content</td>
<td>Assumed typical</td>
</tr>
<tr>
<td>Unsealed roads</td>
<td>3.5% silt content</td>
<td>Assumed as typical for unpaved roads managed by watering</td>
</tr>
<tr>
<td>Exposed areas</td>
<td>Total cell areas for all years divided by the number of years, i.e. 2,096,100 m$^2$ / (35-17) = 116,450 m$^2$ ave. p.a.</td>
<td>Calculation as shown based on Project cell areas</td>
</tr>
<tr>
<td>Haul truck for cover materials</td>
<td>38.2 tonnes payload 50 tonnes average gross mass of vehicle (GMV)</td>
<td>Estimated from CAT770G specification as specified in Table H.9 (PEL, 2016)</td>
</tr>
<tr>
<td>Haul truck for waste (existing MRL activities)</td>
<td>7 tonnes payload 17 tonnes average GMV</td>
<td>Table H.9 (PEL, 2016)</td>
</tr>
</tbody>
</table>
| Haul truck for waste (SEMTS to MRL)       | 37 tonnes payload 50 tonnes average GMV | Payload from traffic assessment report (GTA, 2016) 
Average GMV was estimated |
| Light vehicles                            | 20,000 km/annum trip 1.5 tonnes average GMV             |                                            |
### Table 8: Example of emissions inventory calculations, Scenario S2

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>TSP emission (kg/yr)</th>
<th>PM10 emission (kg/yr)</th>
<th>Intensity</th>
<th>Units</th>
<th>Variable 1</th>
<th>Units</th>
<th>Variable 2</th>
<th>Units</th>
<th>Variable 3</th>
<th>Units</th>
<th>Variable 4</th>
<th>Units</th>
<th>Variable 5</th>
<th>Units</th>
<th>Variable 6</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauling of cover materials</td>
<td>31,911</td>
<td>3,040</td>
<td>407,080</td>
<td>t/yr</td>
<td>0.210</td>
<td>kg/t</td>
<td>38.2</td>
<td>tonnes/load</td>
<td>5.5</td>
<td>2.2</td>
<td>kg/VKT</td>
<td>3.5</td>
<td>% silt content</td>
<td>50</td>
<td>Ave GMV (tonnes)</td>
<td>75</td>
</tr>
<tr>
<td>Trucks dumping daily cover material at active face</td>
<td>129</td>
<td>60</td>
<td>315,360</td>
<td>t/yr</td>
<td>0.00041</td>
<td>kg/t</td>
<td>1.992</td>
<td>average of (wind speed/2.2)^1.3 in m/s</td>
<td>7</td>
<td>moisture content in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spreading daily cover material</td>
<td>601</td>
<td>157</td>
<td>183</td>
<td>h/yr</td>
<td>3.3</td>
<td>kg/h</td>
<td>10</td>
<td>silt content in %</td>
<td>7</td>
<td>moisture content in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehandle of daily cover material</td>
<td>601</td>
<td>157</td>
<td>183</td>
<td>h/yr</td>
<td>3.3</td>
<td>kg/h</td>
<td>10</td>
<td>silt content in %</td>
<td>7</td>
<td>moisture content in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trucks dumping interim cover material</td>
<td>37</td>
<td>18</td>
<td>91,720</td>
<td>t/yr</td>
<td>0.00041</td>
<td>kg/t</td>
<td>1.992</td>
<td>average of (wind speed/2.2)^1.3 in m/s</td>
<td>7</td>
<td>moisture content in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spreading interim cover material</td>
<td>601</td>
<td>157</td>
<td>183</td>
<td>h/yr</td>
<td>3.3</td>
<td>kg/h</td>
<td>10</td>
<td>silt content in %</td>
<td>7</td>
<td>moisture content in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind erosion - exposed cell area</td>
<td>9,898</td>
<td>4,949</td>
<td>11.6</td>
<td>ha</td>
<td>850</td>
<td>kg/ha/yr</td>
<td>5.5</td>
<td>km/return trip</td>
<td>1.3</td>
<td>kg/VKT</td>
<td>3.5</td>
<td>% silt content</td>
<td>17</td>
<td>Ave GMV (tonnes)</td>
<td>75</td>
<td>% Control</td>
</tr>
<tr>
<td>Wind erosion - haul road</td>
<td>574</td>
<td>287</td>
<td>2.7</td>
<td>ha</td>
<td>850</td>
<td>kg/ha/yr</td>
<td>75</td>
<td>% Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hauling of waste (existing MRL activities)</td>
<td>211,507</td>
<td>20,146</td>
<td>803,392</td>
<td>t/yr</td>
<td>0.706</td>
<td>kg/t</td>
<td>7</td>
<td>tonnes/load</td>
<td>5.5</td>
<td>1.3</td>
<td>kg/VKT</td>
<td>3.5</td>
<td>% silt content</td>
<td>17</td>
<td>Ave GMV (tonnes)</td>
<td>75</td>
</tr>
<tr>
<td>Wheel-generated dust from light vehicles</td>
<td>2,229</td>
<td>212</td>
<td>20,000.0</td>
<td>km/yr</td>
<td>0.4</td>
<td>kg/VKT</td>
<td>3.5</td>
<td>% silt content</td>
<td>2</td>
<td>Ave GMV (tonnes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hauling of waste (SEMTS to MRL)</td>
<td>49,774</td>
<td>4,741</td>
<td>615,000</td>
<td>t/yr</td>
<td>0.217</td>
<td>kg/t</td>
<td>37</td>
<td>tonnes/load</td>
<td>5.5</td>
<td>2.2</td>
<td>kg/VKT</td>
<td>3.5</td>
<td>% silt content</td>
<td>50</td>
<td>Ave GMV (tonnes)</td>
<td>75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>307,863</strong></td>
<td><strong>33,924</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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16080594_ Expert_Report_Air_Ravenhall_160915
Figure 10: Model-predicted maximum cumulative 24-hour average PM$_{10}$ concentration (µg/m$^3$) for 2008 calendar year (left) and 2009 calendar year (right) for Scenario 2
Figure 11: Model-predicted maximum cumulative 24-hour average PM$_{10}$ concentration (µg/m$^3$) for 2008 calendar year (left) and 2009 calendar year (right) for Scenario 4
7 ADDENDUM REPORT

125. The addendum Report qualitatively considers the potential dust and odour amenity impacts in the event that the Project were to extend beyond the works approval area (e.g. outlined in Figure 5) into the Planning Approval area. The planning approval area is shown in green cross hatching in Figure 12, and is an area further north and east of the northern works approval area.

126. The addendum Report is based on modelling results that are superseded by the results in the Report. I have considered this, but have placed most weight on considering my odour modelling results for scenario 4 (cell 10) which are generally slightly higher than the results in the Report (except at a location immediately north or south of the modelled sources, for the reasons outlined at Paragraph 68, which are not relevant to the potential shape of the sources of odour that may exist in the planning approval area closest to the north and northeast.)
127. The addendum Report indicates that it would be vital to control odour emissions from any landfill in the planning approval area, but that it would be possible to operate a landfill in the planning approval area without unreasonable amenity effects.

128. I agree with this, however the rationale used in the addendum Report to arrive at this conclusion is not completely clear to me. In reaching my view I have considered the situation as follows:

129. The planning approval area, if used for landfilling would clearly carry most risk of impact at the receptors that are closest, i.e. to the northeast of the northern most parts of the planning approval area (Caroline Springs).

130. Relative to my modelling results for scenario S4 (cell 10) landfilling in any potential future cell to the north or north east of cell 10 would be approximately 500m closer to the nearest residential areas. By considering the odour impact contour plot at Figure 7, the following observations can be made:

131. As the area is relatively flat, the prevailing winds would not greatly alter the shape of the contour, however there would be some variation year to year due to the normal variations in the meteorological conditions.

132. The shape and size of any potential future landfill cells in the planning approval area would be somewhat smaller and more compact than the Project cells, especially relative to scenario S4 (cell 10) which is comparatively large and elongated. A smaller cell (i.e. like those in the planning
approval area) would emit less odour, as it is capped with a 1.6m deep layer of soil sooner, and has a smaller intermediate cap area (the dominant emission source).

133. If the modelled sources in scenario S4 (cell 10) were moved 500m closer to receptors in the northeast, the impacts would be greater by some margin due to the closer physical position. The increase can be reasonably estimated by examining the odour concentrations 500m closer in from 1ou odour criteria contour line, which I consider indicates the bound of acceptable odour impact, and sits near the edge of the receptor areas. If the sources were moved a distance of 500m closer to the landfill, the contour lines indicate there would be approximately 0.5ou more odour concentration at the edge of the nearest receptor locations. Thus the impact due only to a positional change would be 1ou + 0.5ou = 1.5ou.

134. However, it is important to note that my modelling results for scenario S4 do not consider the 30% reduction in odour generation likely to be achieved through a reduction in the fraction of putrescible waste and improved gas management. When this is considered, odour level at the edge of the residential areas, and the change in the odour level at these locations due to a cell being closer might be approximately 30% less, (i.e. 0.7 x 1.5 = 1.05ou at the edge of the residential areas (the approximate location of the current 1ou contour in my scenario 4 modelling). If factoring in a reduction in odour emissions due to a smaller cell, the level would be less than 1.05ou.

135. This level is not significantly different to the modelled scenario, and I would thus consider that it indicates that the planning approval area, with the advent of an approximate 30% reduction in odour emissions from the landfill, would be amenable to landfilling activities.

8  RESPONSE TO SUBMISSIONS

I have reviewed extracts of the public and agency submissions that relate to air quality, have categorised the submissions into the key issues that were raised and provide a response in the tables at Appendix B.

9  CONCLUSIONS

136. My review indicates that despite some technical issues, the odour and dust assessment set out in the Report PEL (2016) overall presents reliable findings.

137. I have re-run the modelling to more accurately reflect the actual proposed Project, and found only a minor difference in the odour risk assessment at the surrounding receptors. The re-run modelling showed some lower and some higher odour effects at specific receptors, but overall a generally lower level of odour risk. In regard to dust, I also generally found in slightly lower impacts.

138. The assessments presented in the Report and based on my re-run modelling results are consistent and arrive at essentially the same conclusions for both dust and odour.

139. The assessment of the base case scenarios (i.e. for the 2014, 2015 landfill operations) are commensurate with the EPA surveillance of 760 odour observations conducted over the same period.
140. I have re-run the modelling using the same odour emissions, but placed the sources in the future locations, and in the context of the base case scenario modelling being reliable, consider that the re-run modelling also provides a reliable assessment of the potential future impacts.

141. The assessment shows that there would be nil or low risk of offensive odour impact other than at one or two isolated dwellings to the south west (R1 and R2) where there may be a moderate risk of odour impacts for a limited period.

142. The assessment also indicates the scale of the zone of potential odour impact that may arise from the Project. (I note that I have some reservations regarding the specific (spikey) shape of the modelled impact area, common to any such project in Victoria, and provide comments on how to best interpret the general shape of the modelling contours).

143. I have inspected the site and observe that the landfill has and in future would continue to have a large separation distance to the existing residential areas, but that there are a few isolated dwellings to the south west in relatively close proximity.

144. The Project would move west, away from the nearest existing residential areas and also the corrective services facilities. This would decrease landfill odour at receptors to the east and south east of the Project, but will for a period increase odour effects at the few isolated receptors to the southwest. The Project would then move generally north, and odour impacts at the isolated receptors would cease.

145. In regard to the residential areas indicated in the Precinct Structure Plan to the northwest, the results indicate no tangible dust or odour impacts would arise.

146. In regard to potential future landfilling activities outside of the works areas and within the planning approval area, provided that a 30% decrease in the emissions as modelled in scenario S4 (e.g. due to better waste segregation in future) is achieved, which is considered likely, the general indication is that such activities would be feasible without undue adverse amenity impact.

147. If no waste segregation occurs in future (as modelled in scenario S4) the odour may at times be observable at residential locations to the north, but the indication is that that this would be a low infrequent level of odour, and as such is unlikely to be offensive.

148. If greater source segregation of waste is implemented by local government in the future, which I believe is likely on the basis that it occurs in various areas, this will result in less putrescible material in the rubbish, less odour from the Project and hence no tangible risk of any unacceptable odours due to the Project in the future.

149. Apart from one or two nearby isolated dwellings, the landfill is favourably located and has a significant buffer between it and sensitive receptors. Based on my observations of the local topography, existing main roads and urban areas, in my opinion there may not be a better location, or at least it would be very hard to find a better location, for disposing of Melbourne's rubbish without unacceptable odour effects.
150. I have made all of the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.
10 REFERENCES

GTA (2016)
“408-546 Hopkins Road, Truganina & 1154-1198 Christies Road, Ravenhall Transport Impact Assessment”, prepared by GTA Consultants for Landfill Operations Pty Ltd, 12 February 2016.

NPI (2012)

PEL (2016)

PEL (2016a)

US EPA (1985 and updates)
Appendix A

Expert Curriculum Vitae
Curriculum Vitae - Aleks Todoroski

Director, Todoroski Air Sciences Pty Ltd

- Email: atodoroski@airsciences.com.au

AREAS OF EXPERTISE

- Air Dispersion Modelling
- Odour Assessment
- Air Quality Management and Impact Assessment
- Environmental Noise
- Meteorology

QUALIFICATIONS & PROFESSIONAL AFFILIATIONS

- Bachelor of Engineering (Mech) (Newcastle University)
- Clean Air Society of Australia & New Zealand
- Australian Acoustical Society
- Air & Waste Management Association

PROFESSIONAL EXPERIENCE

Aleks has a bachelor degree in mechanical engineering and 25 years of experience in air quality and environmental noise both in consulting and in government. He recently worked as general manager at PAEHolmes for three years, where he was responsible for managing the business and the technical work of specialist air quality consultants.

Aleks worked for ten years at NSW EPA, in the role of principal technical policy adviser in the air policy section and as the assessments manager in the noise and air policy sections. He also assisted the NSW RTA on secondment as their noise specialist. Prior to this he was Australian principal in an international environmental consultancy for over 6 years.

Throughout his employment, Aleks has been directly involved in developing significant air and noise policy and in the approval process for many major projects. He has been responsible for the impact assessments for many hundreds of significant projects in the private sector and in government, including many major mining, industrial and land development projects.

In government Aleks implemented the load based licensing scheme in Sydney which involved negotiating emission load limits with the state’s largest industries. He was the EPA’s expert witness in a major odour prosecution (the highest penalty for an environmental offence in Australia at the time).

Aleks has experience in air dispersion modelling, noise modelling, impact assessment and regulatory approval and policy work for various projects in Australia and overseas. He has represented clients and
government in significant legal proceedings, commissions of inquiry and many public processes.

He is also industry representative on the National Environment Protection Council’s (NEPC) Peer Review Committee (PRC). In this role Aleks reviews the work of the State and Territory EPA’s regarding compliance with the National Environment Protection Measures (NEPM) air quality standards.

**PROJECT EXPERIENCE (SELECTED PROJECTS)**

**Environmental Impact Assessments**

**Odour**

- Rutherford Industrial Estate – Investigation of Odour and Ambient Air Quality for NSW Minister for the Environment;
- Murray Goulburn Corporation milk facility, Eastern Creek NSW air, noise and odour impact assessment;
- Landcom Stage IV precinct (The Ponds) draft odour impact assessment
- Bomen Industrial Sewage Treatment facility – odour study for City of Wagga Wagga Council;
- Riverstone – proposed Woolworths distribution centre;
- Cooranbong – assessment of existing landscape supply operations for Lake Macquarie City Council;
- Menai - Sand, glass and inert waste recycling facility;
- Albury – assessment of existing composting facility;
- Louth Park – turf farm operation;
- Poultry and Piggery Farms - for various clients in NSW and Victoria;
- NSW EPA operated Waste Transfer Station –Perisher Valley assessment and audit;
- Various other waste transfer stations;
- Bomen Industrial Estate – preparation of odour study in response to community concerns.

**Industry**

- NSW power generators, modelling all power stations in NSW for mercury investigations;
- Blue Circle Southern Cement, Berrima and Maldon works –waste to energy proposals;
- Cement Australia - Kandos;
- Orica HCB project –contaminated waste;
- Rhodes peninsula – several contaminated land remediation and construction projects;
- Amcor - Paper Mill redevelopment, Botany;
- Shoalhaven Starches – major upgrades and ethanol plant, Bomaderry;
- Hyne and Son Timber – saw mill, Tumbarumba;
- BHPBilliton – various mines and processing plant, South Arm remediation project Newcastle,
Coal seam methane plant Appin;
- Boral – numerous hard rock and gravel quarries, cement plants, asphalt plants and material processing operations;
- Graincorp – grain handling capacity expansion Carrington;
- Trugan - waste oil reprocessing, Rutherford;
- Trans Pacific Industries – oil refining, Rutherford;
- Bluescope Steel – Colourbond plant Erskine Park, Metserv, Kembla, various upgrades to Kembla works;
- Caltex, Shell – expansions of oil refinery, low sulphur fuel projects;
- Numerous odour assessments - Moira, Kiacatoo and Rangers Valley cattle feedlots; numerous large chicken farms, e.g. 5 million birds, piggeries, abattoirs, rendering plants, tanneries; and,
- Boral, Austral, National Ceramics and other brick and tile works.

Roads and infrastructure
- Badgeries Creek Airport;
- Sydney Airport;
- M5 East Motorway and Tunnel;
- Cross city Tunnel;
- Lane Cove Tunnel;
- Numerous upgrades, duplication and by-pass projects for Pacific and Hume Highways;
- Albury-Wodonga National Highway;
- Northern Distributor;
- Eastern Distributor;
- RTA, Newcastle Council, Lake Macquarie Council and Port Stephens Council – various road construction projects, noise monitoring and modelling, e.g. Industrial Drive Mayfield, Carrington Heavy Vehicle Bypass, Pacific Highway Hexham, Nelson Bay Road, various roundabouts and road realignments in the Hunter Valley;
- Extensive noise barrier/ mitigation design for various freeway and highway projects in QLD;
- State Rail Authority – St Mary’s intermodal terminal;
- CRT Yennora – distribution centre
- Sydney Ports – Port Botany expansion, Enfield intermodal terminal, White Bay expansion;
- Newcastle Port Corp - Carrington Basin expansion;
- Very High Speed Train proposal;
- Mt Arthur North Antiene Rail Loop, Wambo Rail Loop;
- Golden Gate Bridge (USA) – earthquake fortification, construction impact assessment.
Mining

- Many NSW coal mines including: Hunter Valley Operations, Mt Pleasant, Muswellbrook Coal, Carrington, Bengalla, Mangoola, Boggabri, Mauls Creek, Stratford, Gloucester, Mt Owen, Glendell, Ashton South East Open Cut, Ashton North, Mt Thorley Warkworth, Abby Green, Wambo, Bulga, Beltana/ Blakefield, Integra, Drayton, United, Ravensworth North, Ravensworth East, Ravensworth Underground, Ulan, Moolarben, Wilpinjong, Coalpac Invincible and Cullen Valley;
- Many QLD coal mines including, Kestrel, Elphinstone, Hail Creek, Blair Athol, Clermont, Valeria, Gregory Crinium;
- Peer review of Drayton South, Dartbrook, Centennial, Bulga, Clermont, Cameby Downs and others;
- Cadia, Peak Hill, RASP, Cowal, Martabe (Sumatra), Lihiy and other gold and metalliferrous mines;
- Snapper, Ginko and Ouyen and other sand and mineral sands projects;
- Argyle diamond mine;
- Tottenham Iron nodule mine;
- Mt Arthur North coal mine – first significant project per NSW Industrial Noise Policy, results in “world best practice” for noise in mining; and,
- Dixon Sands, PF Formation, and other sand quarries, Maroota.

Power/Energy

- Macquarie Generation – Rail Spur and Power Station upgrade;
- Delta Electricity – Munmorah and Bamarang gas fired power stations, Munmorah 4,000MW upgrade;
- Eraring Energy – 42 MW Gas turbine, and Eraring Power Station 4,000MW upgrade;
- Sydney Gas/AGL, various coal seam methane projects, 600MW gas turbine;
- Infratil Energy – 32 MW reciprocating engine “super peak” power plant.
- International Power, several 300 to 600MW peak power stations;
- Tallawarra A and B – combined cycle and peak 2 x 600MW gas turbine plants.
- Northpower – DirectLink project (linking NSW and QLD electricity grids);

Land development

- Rygate West – 4000 acre development between rail line and highway;
- NSW Department of Housing – retirement village on Northern freight line;
- Chapman Real estate – large residential subdivision adjacent to M2 freeway;
- Johnson partners – residential subdivision F2 Freeway;
- Energy Australia – rezoning of land between rail and highway at Artarmon;
- Atlas Halls – design community centre to meet aircraft noise intrusion criteria.

**On-site environmental management projects**
- Abigroup - environmental supervisor for 18km duplication of Pacific Highway project;
- John Holland Construction and Engineering - Bridge over Hunter River;
- Daracon Engineering - 5km multi-lane section of New England Highway;
- Abigroup- infrastructure for Bengalla coal mine;
- Pacific Power - long-term study of fluoride concentrations in Hunter Valley vegetation;
- Telstra – sensitive asbestos removal management during refurbishment of entire, occupied shopping mall owned by Telstra.

**Policy development projects**
- NSW EPA NO₂ impact assessment methodology, 2015
- NSW Policies for NOₓ emissions from stationary engines, turbines, cogeneration plant and large power stations, 2007, 2008;
- NSW Policy on non-standard fuels, waste-to-energy policy;
- NSW Odour Policy, also technical notes on application of odour criteria;
- EPA guidance notes for NSW odour policy, and air dispersion modelling;
- NSW guidelines on Planning and Development alongside transport corridors;
- Revision of Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, 2005;
- EPA Clean Fuels Policy;
- Guidance for assessing non-standard fuel use, internal policy and external guidance;
- Significant technical input to POEO Clean Air Act , POEO General Regulation and POEO Clean Air Regulation;
- Control strategy for non-road engines;
- Meat and Livestock Australia, Australian Lot Feeders association, Australian Pork – odour prediction and management procedures;
- Technical aspects of Industrial Noise Policy (INP), Environmental Criteria for Road Traffic Noise (ECRTN);
- INP and ECRT training manual, internal guidance and application notes;
- Provide RTA’s input to NSW Construction Noise Policy;
- Develop project plan and implement consultation to revise RTA’s Environmental Management Manual (ENMM);
- Baulderstone Hornibrook – develop operational policy/ procedures to manage occupation noise
exposure and construction noise impacts;

- A large range of LBL policy; LBL protocol, LBL resource folder, LBL training manual, FAQ’s, Measurement and monitoring policy, reporting, fees and penalties, legislation, interaction with National Pollutant Inventory, and more.
- Noise policy and guidelines for private sector: industrial premises, coal mines and resorts;

**Engineering noise control projects**

- Forgacs/Australian Navy – Extensive modifications to HMAS Manoora to reduce noise transmission between partitions;
- Sanatarium Health foods/ RTA – optimise factory and freeway noise mitigation design to best reduce overall impact on Cooranbong;
- Johnson Matthey - reduction of plant noise levels including two 25m ovens;
- Celtite Australia - conceptual design consultancy and acoustic evaluation for prototype materials handling equipment;
- Wambo Mining Corporation – amelioration of open cut operations and washery to meet EPA licence and Planning consent conditions;
- NJC Bowling Club - design of compressor enclosure;
- Cardiff RSL Club – major extensions and air conditioner noise;
- Royal Crown Hotel – acoustic treatment to permit live entertainment. Private – various small acoustic enclosures and modifications to ameliorate noise emission;
- Killen+Doran Architects – specification of acoustic control measures for a large luxury apartment building, including Rail, traffic and services noise.

**Environmental Monitoring**

- DirectLink Power project – linking NSW and QLD electricity grids.
- Barina Quarry, Dunmore Quarry;
- M5 East construction;
- Bengalla mine – construction and operation;
- Wambo Mining Corporation – coal washery, open cut mine;
- BHP Mount Owen Mine, Camberwell Coal Company; United Colliery, Nardell Coal Corporation;
- John Holland Construction and Engineering – bridge construction;
- Daracon Engineering – New England Highway construction;
- Abigroup – Pacific Highway duplication;
- Coffs Harbour Council – STP network and Plants upgrading;
- RSPCA – Animal noise;
- Muswellbrook Council – Landfill;
- Waste services – resource recovery centre;
- Weston Aluminium – plant noise;
- Comalco – smelter noise;
- Cargill – compliance monitoring;

**Occupational and work place assessments**
- Goninan and Co.;
- Celtite Australia;
- Daracon Engineering;
- Boulderstone Hornibrook;
- Johnson Matthey;
- Weston Aluminium;
- Wambo opencut and underground mines;
- Cargill Australia QLD and NSW.

**Ambient air quality monitoring**
- Envirosciences - Manage 40 Hi-Vol and PM10 samplers, develop calibration procedures – near 100% deployment of ambient monitoring equipment at many varied sites across Australia;
- Numerous Hunter Valley mines - Hi-Vol, DDG, Coal dust and metals;
- PWCS Kooragang – operate air quality monitoring network, Hi-Vol, PM10, Depositional Dust Gauges and directional ambient air quality sampling;
- BHP Steel Mayfield – various ambient air quality monitoring surveys for dust, metals, speciated VOC, asbestos;
- BHP Shipping – explosive aerosols;
- Koppers, Beresfield, fugitive air emissions from timber treatment including odour, speciated VOC, Copper, Arsenic;
- Numerous small industrial plants and materials handing operations;
- Abigroup/Hunter water - odour and taste of Newcastle's water supply.

**Stack emissions testing and odour sampling**
- Incitec, Kooragang Island - trials for new ammonium process.
- RTA - Sydney Harbour Tunnel;
- Australian Paper Mills, Botany;
- Koppers Coal and Tar Products, Mayfield;
Boral Timbers, Dungog;
Gonnans, Broadmeadow;
BTR Engineering;
Austral Clay and Pipe, Padstow;
Boral Roofing, Wyee;
Exxon/ Mobil, Botany;
Cargil Australia, Kooragang.

Sampling and analysis of air pollutants
- Many varied clients around Australia;
- Experienced in sampling and analysis of air pollutants including: TSP, PM10, Metals, VOC, PAH, Speciated organics, Fluoride in vegetation and in air, O₂, CO, CO₂, NOₓ, SOₓ, Sulfuric acid mists and Asbestos.

Contaminated site assessment/remediation projects
- Thiess - remediation projects Rhodes, Orica, Villawood, Platupus and other sites;
- Sydney Harbour Federation Trust - former gas works and naval site at Milson's Point
- BHPBilliton - former Newcastle BHP steel works, gas works, harbour and associated projects
- Monier/CSR, Cardiff - Remediation of former roof tile manufacturing site;
- Ampol, Hamilton - on site remediation of former service station, noise and air quality considerations in designing treatment system;
- Pacific Power, Cessnock - remediation of former power station/gasworks site;
- Lake Macquarie City Council/ Pasminco, Cockle Creek – lead contamination of residential areas – Land & Environment court reports;
- Newcastle Metal Recyclers - site sampling and validation.

Facilitation - Community consultative committees, workshops and working groups
- Australian Underground Construction and Tunnelling Association – present and chair discussions around “Managing environmental issues for underground projects”;
- Australian Planning Institute – present a talk and host workshop on “Planning considerations to manage cumulative noise”;
- Many dozens of community consultative meetings related to EIS projects;
- NSW Minerals Council – Community/industry presentation on mining issues;
- Member of international working group on recreational noise;
- Input to Harmonoise and Imagine noise mapping projects in EU;
- Member/ DECC representative on various national and cross-state working groups – waste-to-
energy, odour criteria, metropolitan NO\textsubscript{x} policy;

- Rio-Tinto/ Comalco – provide intensive “live-in” staff training courses on noise management and community liaison.

**Management of politically sensitive matters**

- Ethylene oxide/ propylene oxide emissions at Unomedical, Steritech and others – represent DECC at high level, make appropriate on-the-spot decisions, provide sound advice and guidance under pressure;
- Resolve excessive dioxin emission issues at Orica;
- Advise several state, territory and federal Ministers on air quality matters, e.g. Minister Garrett on coal mine dust, NO\textsubscript{x} pollution control and other matters – Advice to NT government on establishing air quality monitoring networks, policy and evaluating large energy projects;
- Waste-to-energy, Greenpeace/ community concern at Blue Circle Southern cement;
- Various matters related to road tunnel air emissions in Sydney;
- Resolving issues between Treasury/ DECC related to NSW Energy Generators;
- The NW and SW development of Sydney – resolve air quality issues with developers, Growth Centres Commission, Landcom, Sydney Water and others.
- Advice to NSW Department of Premier and Cabinet on a major greenhouse/ air quality initiatives.

**PROFESSIONAL DEVELOPMENT AND TRAINING**

- EPA Manager Development Program -. Harvard Business School – intensive internal EPA training over 5 months. Planning and managing service delivery, leading teams and facilitating change and learning, effective communication, self management. Additional mentor meetings and workshops;
- IPAA Expanding Leadership Capability - two days, leadership in the public sector;
- Workshop Facilitator Training - five day intensive training. Practical ability to design and conduct workshops and facilitate group processes for a variety of reasons using varied techniques
- Managing underperformance - in public sector teams;
- Staff Selection Techniques - two days, public sector recruitment;
- EPA Environmental Economics Program - 16 day intensive program. Introduction to environmental economics, overview of environmental legislation, environmental cost-benefit analysis and valuation techniques, applied environmental economics, market based instruments;
- Presentation skills – three days, written presentation skills;
- Project Management;
- The Government Policy Process – two day course and workshops;
- Giving and Receiving Feedback;
- Communications Skills;
- Dealing with Aggressive and Threatening Behaviour;
- EPA Authorised Officer Training;
- EPA Smokey Vehicle Observation Course - authorised to issue infringement penalty notices;
- Hazardous Materials Incident Management Training;
- Noise Measurement Training - received and courses conducted;
- The Air Pollution Model (TAPM) - air dispersion and meteorological model training course;
- CALPUFF and CALMET - three day training in advanced air and meteorological modelling;
- Ausplume - air dispersion modelling course;
- Water sampling procedures;
- Training in various computer applications – advanced MS Excel, MS Word, MS Access.
- Internoise conferences – of the International Institute of Noise Control Engineering (I-INCE) and Australian Acoustical Society.
- International Symposium on Recreational Noise – member of international working group.
- Enviro 04, 05, 06 Conferences – presented papers and discussions on behalf of OEH.
- Most CASANZ Conferences
Appendix B

Response to Submissions
Table 10: Response to submissions -individuals and community groups

<table>
<thead>
<tr>
<th>Response No.</th>
<th>Submission Reference</th>
<th>Issue raised</th>
<th>Response to issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MRL00002-8, MRL00010-15, MRL00017, MRL00024-25, MRL00029, MRL00032-33, MRL00035, MRL00038-43, MRL00045, MRL00052, MRL00055, MRL00058, MRL00060, MRL00062, MRL00064-65, MRL00083, MRL00098-99, MRL00101, MRL00103.</td>
<td>Already experience adverse effects of odour from existing landfill operations.</td>
<td>The Environment Protection Authority (EPA) has been monitoring odour in the area of MRL since 2013 and has also conducted specific odour surveillance investigations since 2014. A surge in complaints related to odour from the landfill occurred in February and March 2014 and coincides with the announcement of the proposed future operations at the site. EPA odour surveillance in February and March 2014 found three instances of strong landfill odour off site out of 149 observations (2%), however the EPA surveillance also identified strong composting facility odour more frequently than landfill odour. It is noted that composting odour can smell somewhat similar to odours from a landfill, and unless one traces the odour back to the source it can be hard to tell the two odours apart from a long way away. The EPA surveillance indicates strong odour from the landfill for; • three instances (2.0% of the 149 observations) in 2014; • two instances (1.6% of the 111 observations) in 2015; and, • one instance (0.8% of the 119 observations) in 2016. Air dispersion modelling of the odorous activities occurring in the area during 2014 and 2015 was conducted to see if the model could represent the actual situation. The modelling included consideration of odour sources arising from the Pinegro green waste composting operation in 2014 prior to its closure in late 2015. The results of the modelling show that the contribution of the Pinegro facility to odour levels in the surrounding area to be significant in 2014, and without the Pinegro facility operating in 2015 the results indicate little scope of odour impact from the landfill. The modelling results reflect the EPA surveillance results, which show mostly that the observed odour is due to composting odour, but also that whilst there has been landfill odour in the past it is rare and is decreasing over time.</td>
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<td>2</td>
<td>MRL00002-8, 8, MRL00012, MRL00014-15, MRL00018, MRL00030-32, MRL00038-39, MRL00041-43, MRL00062, MRL00074.</td>
<td>Any future increase will compound the effect of odour</td>
<td>The landfilling operations would increase at a rate of approximately 1% each year on average, however the quantity of odour emitted (and hence the off-site odour effects) are governed by the size of the active face and the size of the interim covered areas. The active face is one of the key sources of odour and will be constant over the life of the Project. The size of the cells will vary year to year as the project progresses form one cell to the other. The modelling predictions only consider the maximum cell area, whereas in reality the odours released will be lower most of the time and only at the maxim rate of emissions near the end of life of the cell, as per the actual cell area at the time. The Project proposes changes to the design and management of the landfill and due to these changes the maximum future odour emissions from the site are expected to be lower than the past rates of odour emission. The Air Quality Assessment includes an investigation of the existing situation of the Melbourne Regional Landfill (MRL). The assessment shows that the past operational and management practices can be improved by the proposed changes to the design and management of the landfill that are part of the landfill Project. Since the acquisition of the site by Cleanaway, a range of new practices have been implemented to better manage odour emissions. The air assessment found that for the future scenarios, generally low or negligible odour risk is predicted to occur, except at two isolated receptors southwest of the landfill where a medium risk of odour is expected for a period of time.</td>
</tr>
<tr>
<td>3</td>
<td>MRL00009, MRL00034, MRL00046-47.</td>
<td>Odour not considered along transport route</td>
<td>The majority of vehicles that would utilise the landfill are council style garbage collection trucks that have sealed bodies containing compressed rubbish. When travelling to the landfill, the truck body will be sealed and would not generate significant odour from the rubbish it carries.</td>
</tr>
<tr>
<td>4</td>
<td>MRL00013, MRL00016-18, MRL00024-25, MRL00036, MRL00045, MRL00062, MRL00098, MRL00103.</td>
<td>Odour effect increases during summer (i.e. warm conditions)</td>
<td>Warmer weather can increase the amount of odour generated by many activities, including landfilling. However, there is no such trend apparent in odour complaints data or in the EPA odour investigations pertaining to the operation of this landfill.</td>
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<td>5</td>
<td>MRL00006-8, MRL00012, MRL00016, MRL00030, MRL00045, MRL00049, MRL00064.</td>
<td>Odour effect increases when winds blow from the MRL</td>
<td>Odour from any source will be transported downwind. The concentration at which the odour arrives will be governed by the prevailing air dispersion conditions, which are a function of the wind conditions. The EPA investigations and the Project assessments both indicate very low levels of odour in the residential areas, and rarely any strong landfill odours occurring off site. The EPA investigations identified composting odour as the dominant source of strong odours in 2014 and 2015. It is noted that the Pinegro composting facility was located close to the Landfill until it ceased to operate in late 2015. Composting odour can smell similar to odours from a landfill, and unless one traces the odour back to the source it can be hard to tell the two odours apart from a long way away. The operational changes proposed to the landfill will reduce odour relative to historical levels. Thus whilst there will be some persons that may be able to on occasion detect the odour, it is unlikely that this odour will be at generally unacceptable levels for prolonged periods of time in residential areas.</td>
</tr>
<tr>
<td>6</td>
<td>MRL00049, MRL00099.</td>
<td>Buffer zones are insufficient</td>
<td>The buffer distances separating the Project and residential areas are larger that set out in the EPA guidelines, and the EPA odour surveillance, of more than 760 odour observations indicates no significant odour impacts arise due to the existing landfill in the residential areas.</td>
</tr>
<tr>
<td>7</td>
<td>MRL00016, MRL00030, MRL00035, MRL00038-39, MRL00041-42, MRL00068, MRL00074, MRL00062, MRL00080-81, MRL00084, MRL00103.</td>
<td>General concern with dust and odour</td>
<td>The assessment uses the AERMOD air dispersion model to simulate the dispersion of odour and dust emissions from the Project. AERMOD is an EPA approved regulatory air dispersion model suitable for making impact assessments in Victoria (e.g. per Publication 1551). Meteorological data obtained from the nearby EPA Deer Park monitoring station for 2008 to 2012 were used in the assessment, and for 2008 and 2009 the EPA provided the meteorological modelling files that were used to model impacts off-site. The predicted 2010, 2011 and 2012 impacts closely match those obtained using the EPA files. The assessment predicts dust levels associated with the operations would be within the relevant guidelines. The haul roads at MRL are a significant source of dust emissions for the site and would be managed using a dedicated on-site watercart. The assessment indicates that per the EPA risk assessment methodology, there is no tangible risk of odour impacts at the great majority of receptors and only a low risk of any potential odour effects at a few locations for a limited period. The assessment shows a potential medium risk of impacts at two isolated receptors located close to the southwest of the site.</td>
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<td>8</td>
<td>MRL00009, MRL00020, MRL00025, MRL00030, MRL00040, MRL00101</td>
<td>Concerned with amenity and property value</td>
<td>The findings of the AQA show the proposed future operations of the MRL are not predicted to have any significantly adverse effect in the surrounding residential areas in regard to dust and odour emissions. Based on this the proposed future operations of the MRL are unlikely to have any significantly adverse effect on the amenity and property value of the surrounding area.</td>
</tr>
<tr>
<td>9</td>
<td>MRL000033</td>
<td>Current dust monitoring does not cover all sides</td>
<td>Potential dust effects have been considered in the assessment which found no tangible impacts that would warrant extensive monitoring and testing. The site dust emissions would however be managed at all times through the operational management plan, which includes a specific mud tracking and dust management component.</td>
</tr>
<tr>
<td>10</td>
<td>MRL00035, MRL00065, MRL00068, MRL00074</td>
<td>Concerned with methane gas and potential unspecified harmful emissions</td>
<td>Current and proposed operations at MRL are in line with current best practice methods and would ensure that emissions of methane gas and toxics emissions are effectively managed. The great majority of the emissions form the landfill are comprised of methane and there may be some level of carbon monoxide. The great majority of the landfill gasses are captures and consumed in gas engines or flares operated continuously at the site. Some fraction of the gasses will be released via through the intermediate cap, however the quantities released are small. As such the levels at which these gasses occur in the ambient air will not be harmful and pose no risk of harm off-site.</td>
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<tr>
<td>11</td>
<td>MRL00102</td>
<td>Odour complaints not associated with Pinegro</td>
<td>The complaints available for examination are those which specify the Landfill as the source of odour, however the EPA surveillance operations conducted in 2014 and 2015, respectively found only 7 and 13 instances of strong odour out of 149 and 111 observations, and that the majority of the strong odours detected were attributable to composting odour. It is noted that composting odour can smell somewhat similar to odours from a landfill, and unless one traces the odour back to the source it can be hard to tell the two odours apart from a long way away.</td>
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### Table 11: Response to submissions – public agencies

<table>
<thead>
<tr>
<th>Response No.</th>
<th>Submission Ref</th>
<th>Issue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Brimbank City Council</td>
<td>A requirement to seal internal haul roads</td>
<td>The AQA does indicate that roads are the largest source of dust emissions from the operation by far. All permanent roads between the public road and the wheel wash would be sealed, and other permanent roads on site also. However sealing all of the internal roads is not feasible as they rapidly change position as the landfill progresses.</td>
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<td>The AQA indicates that haul roads are the greatest source of dust and indicated that odour was consistent with a landfill use.</td>
<td>It is noted that sealing a road may not always reduce dust emissions, especially in places where a lot of mud and dust can be tracked onto the sealed surface. For example, if the semi-permanent roads that access onto the landfill face were sealed, the surface would dry more quickly than a dirt surface which can retain moisture for longer when watered. Thus a sealed road can make it harder to maintain the surface in a moist (and thus dust free) condition when dust and mud is expected to be tracked onto it. For this reason it is better to have a transitional length of dirt road between the landfill face and the sealed permanent roads.</td>
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<td>...the air quality assessment Report indicates a distance of 5km to Deer Park.</td>
<td>The air quality assessment would be referring to the EPA Deer Park monitoring station which was located approximately 5km from the landfill.</td>
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<td>The testing does not include an assessment of large nuisance dust particles which are not contained in the National Environment Protection Measure for Ambient Air Quality (NEPM) as being a risk to human health but nevertheless is a potential sources of amenity impact.</td>
<td>Deposited dust effects can affect amenity, and were modelled and considered in the assessment, which shows no tangible impacts that would warrant extensive monitoring and testing of dust. The site dust emissions would however be managed through the operational management plan, which includes a specific mud tracking and dust management component. This would use direct visual assessment of the dustiness of the haul roads to ensure sufficiently frequent watering intervals are being maintained by the on-site watercart. It is noted that the roads with most risk of dust lift off would be transient and will change location frequently. Due to this, and the fact that reliable dust monitoring equipment requires mains power, it is not feasible to position reliable monitoring equipment near enough and down wind of the road for it to be useful for dust management purposes.</td>
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<td>13</td>
<td>Corrections Victoria</td>
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<td>Offensive odour is the most prominent issue for the existing prisons (MRC and DPFC). MRC have estimated that staff experience offensive odour 40-60 days per annum, while DPFC experience odour approximately 20 days per annum. The report states that practices at the landfill have changed since the Landfill Operation’s acquisition of the landfill and that odours have reduced. The experience of staff at both operating prisons does not reflect this finding.</td>
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<td>The EPA has conducted odour surveillance encompassing 760 odour observations and found very few strong odours that could be attributed to the landfill. The majority of the strong odours found were attributable to the Pinegro composting facility that would have been generally upwind of the corrections centre when the wind generally blows from the landfill towards the corrections centres. It is noted that composting odour can smell somewhat similar to odours from a landfill, and unless one traces the odour back to the source it can be hard to tell the two odours apart from a long way away.</td>
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<th>14</th>
<th>Melton City Council</th>
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<td>Do not clearly demonstrate how the operator will manage roads surrounding the proposed expansion on an ongoing basis. Dust and mud... will increase as landfill traffic increases. On-going odour issues and the ongoing community concerns about the detrimental and negative health effects on the community. The operator to adhere to all condition on the Works Approval issued by the EPA The landfill operator to use best endeavours to rectify any amenity impacts as soon as practicable. Any matters presenting a safety risk to be rectified immediately. Provide maintenance plan which outlines the proactive management of windblown litter, mud on roads, dust, emissions etc. Appropriate measures need to be implemented to control odour emissions from the site so that they don’t adversely impact surrounding communities.</td>
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<td>The Project would increase at approximately 1% per year, and all trucks leaving the site will be required to pass through the wheel wash as necessary to control mud tracking onto the public roads. Whilst the community concerns about odour form the landfill are clear from the complaints data, it is evident from the EPA surveillances, encompassing 760 odour observations that strong odours are rarely associated with the landfill, but most commonly from an unrelated and now closed composting facility and various other sources. The Project proposes design and operational changes that would reduce odour emissions from the site to levels less than have occurred in the past. An odour and dust management plan will be used to manage amenity effects of the Project.</td>
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The odour modelling usually assumes that the landfill is managed according to “best practice” at all times. Modelling should be verified by “ground truthing”. The assessment uses relatively conservative assumptions in deriving the emissions for the scenarios modelled, and whilst in the event of an incident or accident, there may well be higher emissions, it does not follow that this would be a significant issue, especially as incidents can be rectified quickly and may only affect amenity of a brief time.

The community complaints clearly reflect a large degree of concern regarding potential landfill odour, however the EPA surveillance, encompassing 760 odour observations, and tracking of odours to the source found only rare occurrences of strong odours from the landfill off-site (e.g. 2.0% to 0.8%) and that other activities caused the majority of strong odours observed by the EPA in 2014, 2015 and 2016.

The modelling results and “ground truthing” of the modelling results are in agreement with the EPA observations.