

**BEFORE THE COMMISSIONER  
APPOINTED BY ENVIRONMENT SOUTHLAND**

**In the Matter** of applications for resource consent to operate a landfill (APP20202200, APP-205862-01-V2)

**Between** **A B LIME LIMITED**  
**Applicant**

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**BRIEF OF EVIDENCE OF DONOVAN VAN KEKEM**

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## **BRIEF OF EVIDENCE OF DONOVAN VAN KEKEM**

### **Introduction**

1. My name is Donovan Van Kekem. I am the managing director of NZ Air Limited (NZ Air). I have over 17 years' specialist air quality experience. I am responsible for assessing the potential for adverse effects on the ambient air quality surrounding the AB Lime landfill as a result of the proposed new air discharge consents as the expert air quality consultant for AB Lime. I have been providing expert advice to AB Lime since 2019.

### **Qualifications and Experience**

2. I have the following qualifications:
  - (a) a Bachelor's Degree in Biochemistry from the University of Canterbury; and
  - (b) a Post Graduate Diploma in Forensic Science from the University of Auckland.
3. I am also a current member of the Clean Air Society of Australia and New Zealand.
4. Some of my work experience which is relevant to this application is as follows:
  - (a) I have been involved in writing and presenting expert air quality evidence for a number of air discharge consents containing nuisance odour and dust discharges including:
    - (i) Envirofert's application for a replacement air discharge consent for discharges to air from its large composting operation in Tuakau;
    - (ii) The Orini chicken egg layer farm on behalf of Mainland Poultry;
    - (iii) The Lamond free range layer farm on behalf of submitters;

- (iv) The expansion of Fonterra's Studholme and Darfield milk processing plant and wastewater treatment plant on behalf of submitters;
  - (v) The Envirowaste Cass Street waste transfer station;
  - (vi) The reconfiguration of Gelita's Woolston factory on behalf of Annex Developments, and
  - (vii) The SOL Harewood gravel quarry.
- (b) I have also acted as an independent processing officer for the Canterbury Regional Council (CRC) assessing a number of complex air discharge consent applications, a number of which have gone through to hearing at which I have attended as an air quality expert on behalf of CRC.
- (c) I have conducted air quality monitoring and/or assessments at a number of landfills including:
- (i) Burwood Landfill, Christchurch;
  - (ii) Redvale Landfill, Auckland;
  - (iii) Kate Valley Landfill, Canterbury;
  - (iv) Watercare's Mangere Pond 2 biosolids landfill, Auckland;  
and
  - (v) Suntown Landfill, Gold Coast Australia.
5. I have also undertaken technical assessments of combustion emissions from industrial facilities for the purpose of obtaining or amending air discharge consents, including:
- (a) Danone's Clutha Valley milk processing plant, installation of two new biomass boilers;
  - (b) Air New Zealand's Christchurch Airport service centre, conversion of coal to woodchip boilers;
  - (c) AFFCO Morewa, conversion of coal to woodchip boiler;

- (d) University of Canterbury's fire laboratory; and
- (e) Department of Corrections, Christchurch Mens, Christchurch Womens, Rolleston, and Rimutaka prisons.

### **Code of Conduct**

6. Although not necessary in respect of council hearings, I can confirm I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing this evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

### **Scope and Structure of Evidence**

7. In preparing this evidence I have read and familiarised myself with:
- (a) The application for resource consent and assessment of environmental effects – Jacobs New Zealand Limited (dated 29 May 2020);
  - (b) The relevant sections of the Southland Regional Council Planning Documents and Southland District Plan;
  - (c) The Section 42A Report;
  - (d) The submissions received on the limited notified application; and
  - (e) The evidence prepared by Walter Starke, Fiona Smith, Steve Smith, Ryan McCone and Timothy Baker.
8. I was the author of the following technical reports which were submitted with the application:
- (a) NZ Air Ltd report dated 29 May 2020. "AB Lime Limited Landfill Resource Consent Application – Landfill Air Quality Technical Memo". (hereafter referred to as the "NZ Air Report").

- (b) NZ Air Ltd addendum letter report dated 14 July 2020. “AB Lime Landfill Air Discharge Consent Application (APP 20202200, APP 205862-01-V2) – Addendum to Air Dispersion Modelling Assessment”.
  - (c) NZ Air Ltd technical letter dated 28 August 2020. “AB Lime Landfill Air Discharge Consent Application (APP 20202200, APP 205862-01-V2) – Air Quality Section 92 Response”. (hereafter referred to as the “NZ Air s92 response”)
9. I was also a co-author of the AB Lime Limited “AB Lime Landfill Air Quality Management Plan” dated 29 May 2020 (hereafter referred to as the LAQMP).
10. I visited the AB Lime landfill in July 2019 and observed the site layout, landfill activities, and local receiving environment.
11. The scope of my evidence is limited to assessing the potential air discharges associated with the activities proposed by the Applicant and potential effects on neighbouring properties, in particular those of the four opposing submitters:
- (a) Stephen Bruce Johnston & Tracey Kim Cavanagh
  - (b) Ross Brydon & Janice Linda McKerchar
  - (c) Roger Graham Hamilton
  - (d) Lyndal & Murray Sinclair
12. My evidence will address the following matters:
- (a) Assessment criteria;
  - (b) Existing air quality environment;
  - (c) Discharges to air;
  - (d) Proposed mitigation measures to limit these discharges to air and associated off-site concentrations of air pollutants;

- (e) Assessment of potential off-site adverse air quality effects from the existing operation and proposed operation of the landfill;
  - (f) Response to submissions;
  - (g) Comments on the Section 42A Reports; and
  - (h) Conclusion.
13. It is not my intention to repeat all of the information that has been lodged with the application, but to provide a summary of the key aspects and conclusions of my assessments. I will cover specific elements which are relevant to the submitters properties and concerns raised.

### **Assessment Criteria**

#### *Odour*

14. Before discussing my assessment, it is important to understand the air quality criteria relevant to this proposal.
15. The main discharge to air from the proposed AB Lime landfill operations which has the potential for adverse off-site effects is nuisance odour. The odour rules, policies and objectives in the Southland Regional Air Plan (SRAP) refer to the 'offensive or objectionable' threshold for nuisance beyond the boundary of the activity. Therefore, for the purpose of this assessment, the criteria for odour discharges is considered to be the 'offensive or objectionable' threshold.
16. The method for assessing 'offensive or objectionable' odour involves undertaking an assessment using the FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) factors, which is a technique commonly used throughout New Zealand. The use of a FIDOL assessment removes some of the subjectivity associated with undertaking odour assessments and provides a framework to make an objective analysis of an offensive or objectionable effect.

17. The New Zealand Ministry for the Environment (MfE) Good Practice Guide for Assessing and Managing Odour (2016) (MfE GPG Odour) contains a list of recommended assessment tools (in Table A2.2) for preparing an assessment of effects on the environment for modifying discharges of odour to air from an existing facility.
18. I have followed much of the guidance contained within the MfE GPG Odour in the assessments that I have undertaken to determine the potential for nuisance odour effects associated with the existing and proposed operation of the AB Lime landfill. The guidance in the MfE GPG Odour have been developed by industry experts and set out industry best practice methodology for undertaking technical assessments of odour and other air discharges.

#### *Products of Combustion*

19. The assessment criteria for combustion emissions from the landfill gas flare and lime kilns are those contained within Regulation 13 of the National Environmental Standards for Air Quality 2004 (NES-AQ) and the Ministry for the Environment, Ambient Air Quality Guidelines 2002 (AAQG). The pollutants discharged from the site which have regulatory limits in the NES and AAQG are, carbon monoxide (CO), sulphur dioxide (SO<sub>2</sub>), particulate matter less than 10 microns in diameter (PM<sub>10</sub>), and nitrogen dioxide (NO<sub>2</sub>).
20. I have assessed the change in peak off-site concentrations of these pollutants as a result of the proposed changes in on-site operations and proposed new consent conditions using air dispersion modelling (discussed further in paragraphs [120]-[133] below). The model assesses all of the discharges to air from the proposed combustion plant so can be used to assess effects irrespective of whether they are to be compared to the current operation or not.
21. As the current and proposed emissions from the AB Lime combustion plant are not within a polluted airshed the NES-AQ Regulation 17 standard is not applicable for this assessment.

22. I have included a summary of the ambient air quality guidelines and standards used in the assessment of effects of these pollutants in Table 1 below.

**Table 1** Ambient Air Quality Standards and Guidelines Relevant to the Assessment

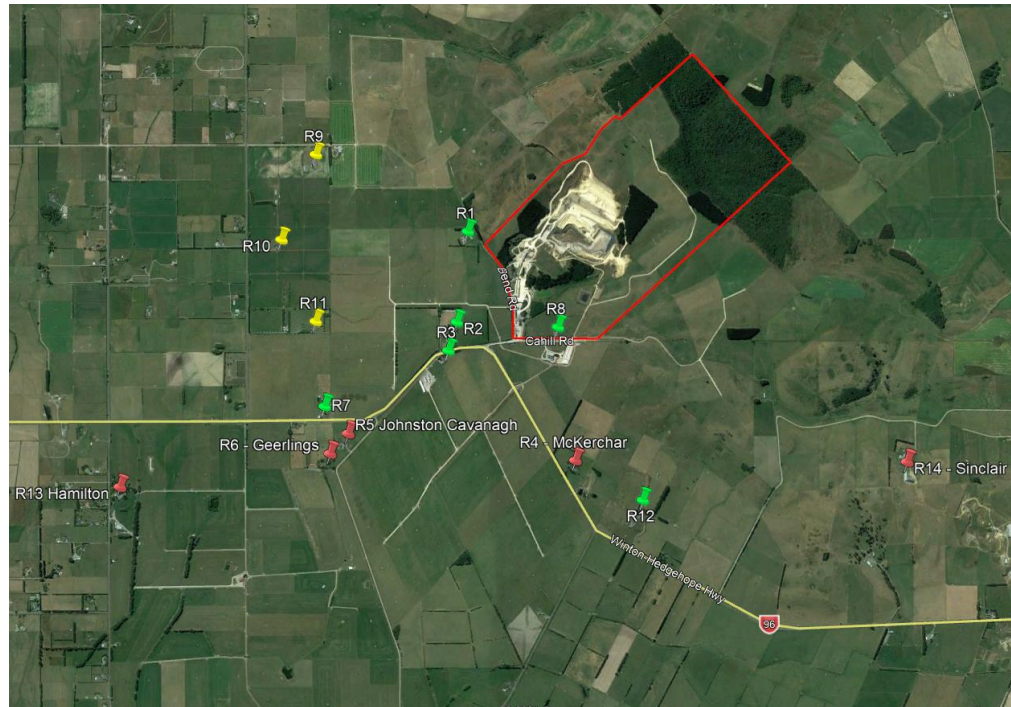
Pollutant	Threshold Concentration ( $\mu\text{g}/\text{m}^3$ )	Averaging Period
NO <sub>2</sub>	200	1 hour
	100	24 hour
SO <sub>2</sub>	350	1 hour
	120	24 hour
CO	30,000	1 hour
	10,000	8 hour
PM <sub>10</sub>	50	24 hour
	20	Annual

### Existing Air Quality Environment

23. To provide context to the emissions from the landfill and potential for adverse air quality effects, I will now outline the surrounding environment within which the discharges to air are occurring.
24. AB Lime's quarry and landfill are well separated from neighbouring properties/off-site dwellings. **Figure 1** illustrates the location of off-site dwellings relative to the site. Green markers indicate dwellings owned by AB Lime, and yellow markers are the nearest dwellings not owned by AB Lime. Red markers annotate the location of submitters. The nearest dwelling not owned by AB Lime (R4) is approximately 1,200 m from the landfill operations. Neighbouring dwellings are primarily situated west – south of the site. The land northwest – south east of the site is sparsely populated. As such, winds blowing from the north, northeast and east have the highest potential to generate off-site air quality effects.



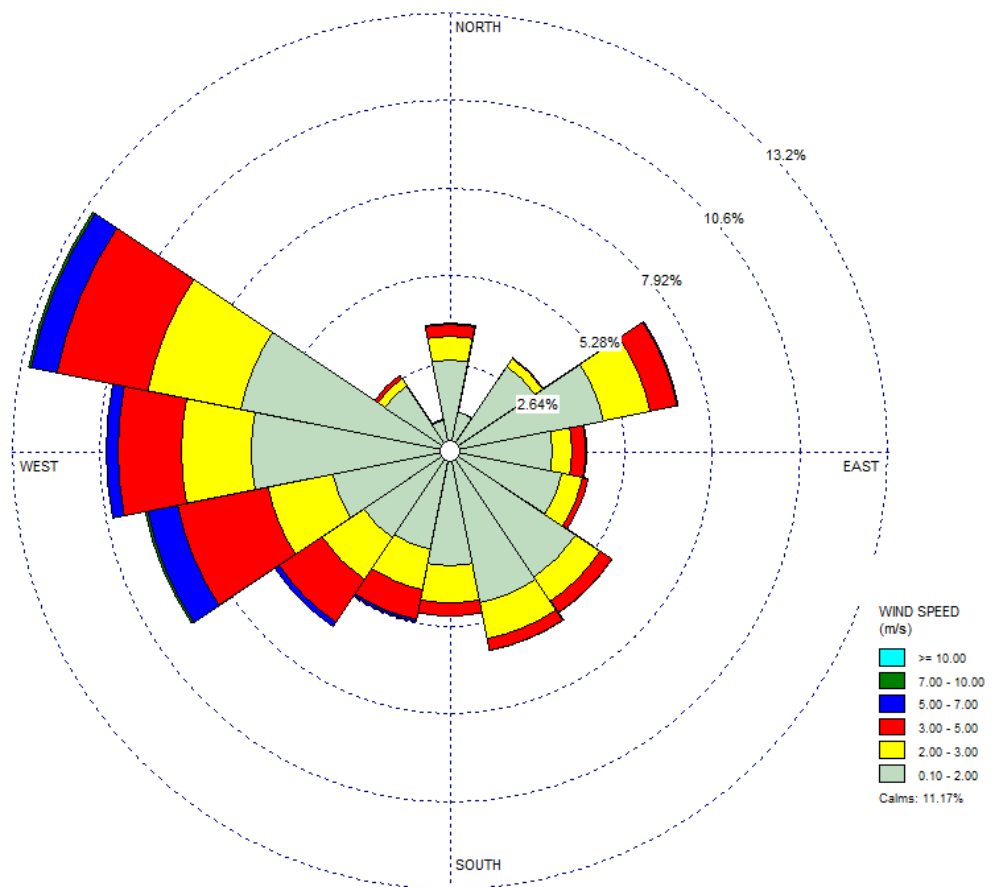
**Figure 1.** Location of sensitive receptors and submitters



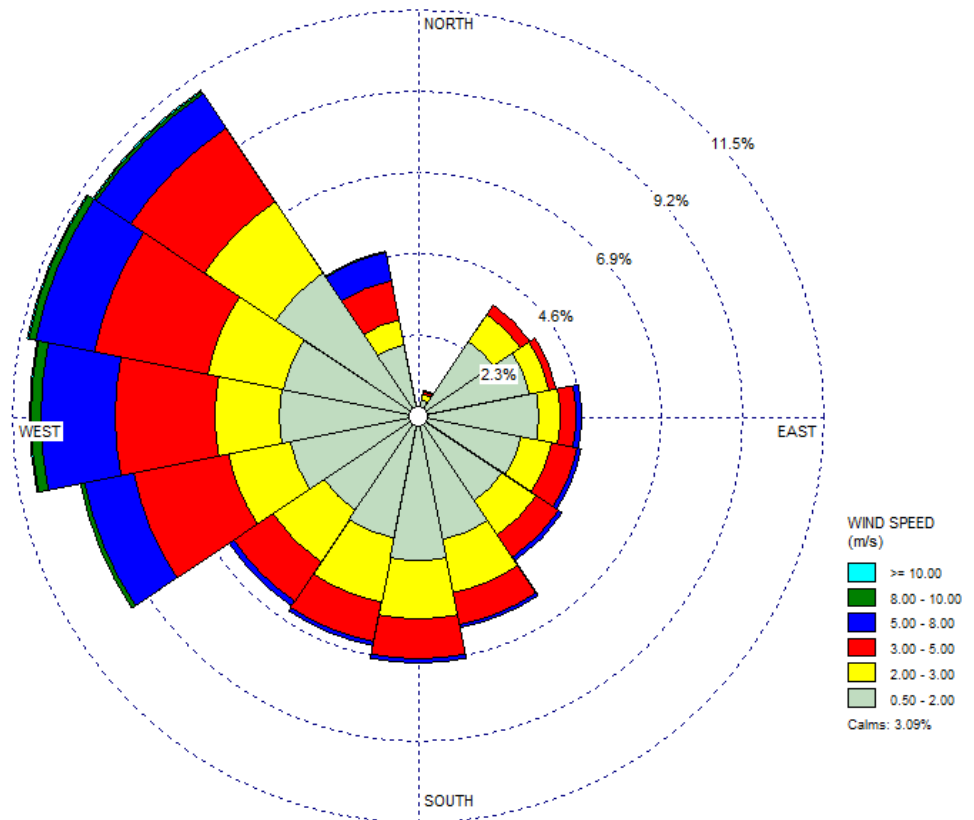
25. It is noted that the listed address of submitter R. G. Hamilton (R13) is approximately 2,900 m from the landfill operations, as such there is a very low potential that adverse air quality effects will occur at this dwelling. However, this submitter owns unoccupied land parcels closer to the AB Lime landfill. The closest of which is approximately 1,400 m southwest of the landfill operations.
26. The rural zoned land adjacent to the site would be considered to have a 'moderate to high' sensitivity (as defined in the MfE GPG Odour and Dust) to odour and dust discharged from the landfill operations. The adjacent public roads and unoccupied land would have a 'low' sensitivity, due to the infrequent and short duration of exposure on these roads/unoccupied land.
27. The local weather data was described in the application documents. Whilst the on-site weather station is not currently sited in accordance with the applicable AS/NZ standard for weather stations, the data does provide an indication of wind conditions closer to ground level and within the landfill 'valley'.

28. A wind rose of the wind data collected from the on-site weather station is included as **Figure 2** below. Predominantly winds measured at the on-site weather station blow from the west and the south. These winds blow air discharges from the site towards predominantly unoccupied land. Winds from the north – east (which would blow emissions from the site towards the nearest off-site dwellings) occur much less frequently.

**Figure 2.** On-site weather station wind rose 2012 - 2014

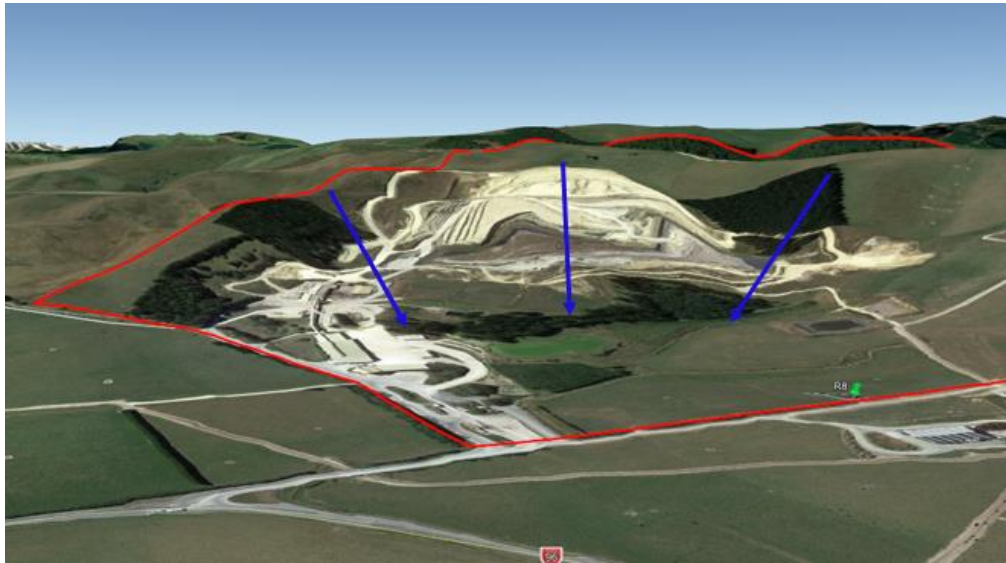


29. Subsequent to undertaking my original assessments, I have been able to obtain weather data from the Environment Southland ambient air quality monitoring station on Essex street in Winton. The wind speed and direction data collected in Winton between 2018 – 2020 is presented in a wind rose in **Figure 3** below. The wind patterns in the Winton data are very similar to that measured on-site.

**Figure 3.** Winton wind rose 2018 - 2020

30. The site is situated in a semi-circular valley on the side of a hill (see **Figure 4**). As the land cools overnight, the cold air drains down this valley towards the closest neighbouring receptors (see blue arrows in **Figure 4**). Due to this local topography and the cold air drainage directionality, during poor air dispersion conditions (low wind speeds, low temperatures, inversion layers, early mornings/late evenings, etc), there is a higher potential for adverse off-site odour effects down valley.

**Figure 4.** Cold air drainage flows



31. The current ambient concentrations of CO, SO<sub>2</sub>, PM<sub>10</sub>, and NO<sub>2</sub> in the immediate environment surrounding the site are likely to be dominated by the current emissions from the on-site flare and lime kilns. However, there will also be contributions from home heating appliances and traffic emissions.
32. To my knowledge, AB Lime is the only emitter of odours consistent with that which occur from a landfill in the surrounding environment.
33. However, in a rural environment such as that surrounding the current landfill, normal rural odours such as those from sheep and beef farming, silage, irrigation of effluent, application of fertiliser and other rural activities are expected and form the accepted existing environment for rural residents. Odour from some of these activities can be similar in character to that which is discharged from the landfill.
34. In the NZ Air Report, I produced an analysis of the 69 complaints received by Environment Southland between November 2004 and March 2020. Table 2 below presents a summary of this investigation.

**Table 2.** Summary of complaint analysis

Investigation Outcome	Count
ES did not visit	51
Investigated by ES - odour detected offsite	9
Investigated by ES - no odour detected off-site	4
Investigated by ES – odour detected which resulted in enforcement action	4
Investigated by AB Lime - odour observed by AB Lime	13
Investigated by AB Lime - no odour observed	43
Investigated by AB Lime – possible odour off-site	8

35. I must make it clear that whilst there is a lot of discussion about the complaint record in the NZ Air reports and this evidence, it is only one tool in the assessment of offensive and objectionable effects.
36. In Section 4.1 of the MfE GPG Odour, it is noted that there are a number of shortcomings associated with evaluating odour complaint records. These include:
- (a) Some people may be reluctant to complain, or simply not know who to complain to;
  - (b) Sometimes complaints are vexatious;
  - (c) Sometimes complaints are made by people who are sensitised or have vested interests. These factors can reduce the overall usefulness of the complaint records because they may skew the complaint frequency data compared to other evidence of adverse effects;
  - (d) People may stop complaining about a continuing problem if they feel no action is being taken;
  - (e) People’s tolerance or intolerance to odours can vary considerably with individual perception; and

- (f) It can sometimes be difficult to identify the cause of specific odour problems, so that one activity may be wrongly blamed for the actions of another.
37. Therefore, whilst odour complaint data can be an indicator of the perceived effect of an odour discharge, it is not necessarily an accurate representation of 'actual effects'. More 'weight' is applied to complaints that are independently verified by Council or the emitter.
38. Overall, only a small number of the complaints in the complaint record have been independently confirmed as resulting in adverse off-site effects.
39. However, I note that many complaints were anonymous (40%), were not able to be investigated immediately due to delays in receiving the complaint, and/or were reported by the complainant as occurring for a brief period of time. Therefore, it is possible that detectable odour has been present off-site more frequently, but was not able to be validated by an external party.
40. Where the location is recorded, complaints were primarily received from three receptors (R3, R4, and R5) which are within 1,700 m of the landfill working area.
41. Complaints were primarily received during the early morning or late evening, this is consistent with poor odour dispersion conditions and the times of day when cold air drainage effects are more likely.
42. Based on my analysis of the complaint record, the Environment Southland investigation reports, Environment Southlands' record of enforcement action, and AB Lime's internal investigation reports it is clear to me, that on occasion, historic operations at AB Lime have resulted in offensive and objectionable odour beyond the boundary of the site. As such the historic environment had degraded odour amenity values.

43. However, based on the more recent records of complaint, Environment Southland investigation, and AB Lime's records, the odour amenity surrounding the AB Lime landfill is much improved.
44. I note the in the Section 42A Report, it considers that the consent application period beyond 2038 (i.e. beyond that which is covered in the current consent) is for a 'new' consent rather than a replacement consent (further detailed in Mr McCone's evidence<sup>1</sup>). As such it appears the Report considers that the receiving environment for these 'new' consents should be considered to be a 'greenfield'.
45. I agree with Mr Starke that even if AB Lime was to cease operations at 2038 that there would still be discharges of landfill gas (LFG) and odour from the landfill for a further 30-50 years or more due to the continued decomposition of the waste mass over time. It won't be a 'greenfield' site for many years to come. I comment further on the Section 42A Report in paragraphs [177]-[193] below.
46. From the information I have reviewed there is no adverse impacts on local amenity vales as a result of dust discharges.

#### **Discharges to Air**

47. The existing and proposed site operations are detailed extensively in the evidence of Mr Starke<sup>2</sup>. As such I have not repeated these here.
48. The landfill currently discharges pollutants to air in accordance with their existing resource consents. Future proposed operations on the site will continue to discharge the same pollutants to air.
49. AB Lime has proposed a detailed and prescriptive set of draft air discharge consent conditions<sup>3</sup>. These outline the performance standards for odour, dust, LFG and combustion emissions to air.

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<sup>1</sup> Evidence of Mr McCone paragraphs [50]-[62]

<sup>2</sup> Evidence of Mr Starke paragraphs [8]-[78]

<sup>3</sup> Refer to the discharge permit to discharge contaminants into air from combustion processes where combustible refuse matter is flared, the discharge permit to discharge contaminants into air from refuse disposal facilities receiving greater than 100,000 m<sup>3</sup>/year of uncompacted solid waste, the discharge permit to use masking agents to disguise odour, and variation to discharge permit AUTH-205861-01-V1.

50. The LAQMP (which will be independently peer reviewed and certified) provides the mechanism for AB Lime to comply with the proposed consent condition performance standards.
51. With appropriate management techniques identified in the NZ Air Report and LAQMP a removal of the current limit for waste acceptance and alterations to the operations of the lime kilns will not result in the discharge of any additional air pollutants.
52. The air pollutants currently discharged and proposed to be discharged are:
  - (a) Odour;
  - (b) Dust;
  - (c) Landfill gas, which consists primarily of methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>) and trace amounts of hydrogen sulphide (H<sub>2</sub>S);  
and
  - (d) Products of combustion including:
    - (i) NO<sub>2</sub>;
    - (ii) CO;
    - (iii) PM<sub>10</sub>; and
    - (iv) SO<sub>2</sub>.
53. The following existing and proposed site activities have the potential to discharge odour:
  - (a) Transport of waste onto the site;
  - (b) Waste deposition, handling, and compaction at the tip face;
  - (c) Special waste handling;
  - (d) Landfill gas emissions;
  - (e) Leachate collection and processing;



- (f) Fugitive emissions from daily cover or final capping; and
  - (g) Hazardous waste handling.
54. The following existing and proposed landfill site activities have the potential to discharge dust:
- (a) Disturbance of surface fines on access roads as a result of traffic movements;
  - (b) Earthworks and material handling activities - such as the placement of cover material during dry periods;
  - (c) Filling and compaction of dusty waste;
  - (d) Fugitive dust emissions from exposed surfaces;
  - (e) Material being tracked off-site onto Cahill Road by vehicle movements; and
  - (f) Dust from material stockpiles.
55. Landfill gas (consisting primarily of CH<sub>4</sub>, CO<sub>2</sub> and minor quantities of other volatile organic compounds (VOCs) including H<sub>2</sub>S) is produced within the landfill mass as the organic material decomposes. This will continue to a more limited degree even after the landfill is no longer accepting waste. Potential discharge points include cracks in the capping, the open working face, and leaks in the landfill gas extraction network.
56. The handling of the landfill leachate also has the potential to discharge H<sub>2</sub>S.
57. Products of combustion (CO, PM<sub>10</sub>, NO<sub>2</sub> and SO<sub>2</sub>) are emitted from the following sources on-site:
- (a) Motor vehicle exhausts;
  - (b) The landfill gas flare; and
  - (c) The lime kilns.

58. Essentially the same air pollutants which are currently discharged to air will continue to be discharged from the same or similar activities/sources. The only difference is that due to improved management and mitigation measures on-site, less odour will be discharged and more LFG will be captured and burnt in the lime kilns or on-site flare(s). By increasing the efficiency of LFG capture and combustion, less greenhouse gases will be emitted from the landfill. Furthermore, by utilising LFG as a replacement fuel for the coal fired kilns, less SO<sub>2</sub> and other products of combustion will be discharged to air.

**Proposed Mitigation Measures to Meet the Performance Standards Identified in the Proposed Conditions of Consent**

59. The consents require that there be no offensive and objectionable odour at receptors on land not owned by AB Lime. In order to achieve this AB Lime has proposed a staged (Levels 1 – 3) air discharge mitigation approach in the LAQMP<sup>4</sup>. The trigger points which mandate the requirement to increase the mitigation/management practices to a higher level are based on boundary and off-site monitoring results and/or community/council feedback.
60. This staged mitigation approach provides for multiple factors of safety. Mitigation/management procedures are broken down to three levels (Level 1, Level 2, and Level 3). In my opinion, Level 1 mitigation will be sufficient to mitigate the potential for off-site air quality effects during normal operating conditions. However, should Level 1 mitigation be insufficient to control air discharges from the source/activity, then Level 2 mitigation will be applied. If Level 1 and Level 2 controls are still not controlling air discharges from the site, Level 3 mitigation will be applied. Level 3 mitigation is a final resort and, in many instances, involves ceasing the emitting activity.
61. Table 1 in the LAQMP (attached as **Attachment A**) summarises the three levels of mitigation which are proposed for each identified odour

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<sup>4</sup> Section 4.2 of the LAQMP

emission point. Likewise, Table 2 in the LAQMP provides the proposed staged mitigation measures for dust control.

62. The proposed mitigation measures to control odour, dust and landfill gas emissions from the landfill activities are consistent with industry standards and good practice guidelines, such as; NES-AQ Regulations, Waste Management Institute New Zealand Technical Guidelines for Disposal to Land (2018), MfE GPG Odour, Environmental Protection Agency New South Wales Environmental Guidelines: Solid Waste Landfills (2016), etc.
63. The mitigation measures are primarily designed to control emissions at the points of discharge. By reducing or eliminating emissions at the point source, the potential that odour, dust, or landfill gas reaches the boundary is greatly reduced. These point source controls provide a higher level of certainty that the minimum performance standards set out in the draft consent conditions<sup>5</sup> will be achieved.
64. In my experience, such staged mitigation approaches ensure that the air discharges are controlled to a point that the site activities are not causing an adverse effect at dwellings or sensitive locations beyond the boundary of the site.
65. Additional activity specific mitigation measures are proposed for higher risk activities on-site, such as hazardous waste handling and crisis waste acceptance. These additional controls are described in Sections 5 and 6 of the LAQMP.
66. As a part of the existing air discharge consent conditions AB Lime has an independently peer reviewed and approved landfill management, monitoring and contingency plan. This plan contains odour and landfill gas management and mitigation measures. However, the identification of discharge points and associated mitigation in this plan was limited. The LAQMP which has been developed as a part of this application

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<sup>5</sup> Refer to Condition 3 in the discharge permit to discharge contaminants into air from combustion processes where combustible refuse matter is flared and Condition 4 in the discharge permit to discharge contaminants into air from refuse disposal facilities receiving greater than 100,000 m<sup>3</sup>/year of uncompacted solid waste.

has identified every air discharge point and proposes multi-level mitigation and contingency measures. This improved management structure provides AB Lime staff a much clearer and more prescriptive site air quality management structure. The proposed LAQMP is a substantial improvement on the previous management structure.

67. To ensure that the mitigation measures are being effective, AB Lime will undertake weekly boundary odour surveys and continuous real time monitoring H<sub>2</sub>S.
68. Boundary odour surveys are proposed to occur during meteorological conditions under which there is a higher risk of off-site effects (i.e. winds blowing towards the nearest receptors and poor air dispersion conditions) as outlined in Section 10.4 of the LAQMP.
69. Boundary H<sub>2</sub>S monitoring will be undertaken at two locations on the south western boundary. Automatic alarms will notify on-site staff of the presence of H<sub>2</sub>S and trigger on-site investigations and an increase in mitigation levels for the identified source(s).
70. The alarm setpoints for the boundary H<sub>2</sub>S monitors have been revised due to the lack of monitoring equipment with detection thresholds as low as that originally proposed in the LAQMP. An updated LAQMP is attached as **Attachment A**. The lowest detection threshold of available H<sub>2</sub>S monitoring instrumentation is 0.1 ppm, so the revised alarm setpoint is 0.2 ppm (as this will ensure that false alarms are less likely, due interference that often occurs at the limit of detection).
71. The MfE air quality guideline for H<sub>2</sub>S odour nuisance is 0.005 ppm expressed as a one hour average. I note that the proposed monitoring will provide notifications based on one or ten minute averaging periods so the MfE guideline is not directly comparable in this instance, but has been used as for comparative purposes.
72. Whilst the proposed trigger level is much higher than this nuisance odour threshold, I must stress that there will be a high degree of dispersion and dilution of any H<sub>2</sub>S measured at the site boundary and the resultant H<sub>2</sub>S concentrations which will occur at the nearest

sensitive receptors. R4 is approximately 750 m from the nearest proposed monitoring location, and R5 is approximately 1,100 m for the nearest proposed monitoring location to this receptor.

73. The concentration of air pollutants generally decreases exponentially with distance from the emission source due to progressive dispersion of the pollutant plume. Utilising simple unitary air dispersion modelling I have calculated that the concentration of H<sub>2</sub>S would decrease by approximately two orders of magnitude over a distance of 750 m during poor air dispersion conditions. Note that during meteorological conditions which are more conducive to better air dispersion (i.e. more turbulent wind flows), it is likely that there will be an even higher reduction in concentration with distance from the site.
74. The next nearest receptor (R5) is approximately 1,100 m from the site boundary. At this distance the unitary modelling demonstrated a reduction in concentration of three orders of magnitude, i.e. a much lower potential for observable off-site H<sub>2</sub>S odour.
75. As such, the proposed H<sub>2</sub>S trigger point is likely to act as an effective early warning system for AB Lime where H<sub>2</sub>S is present at the site boundary but not resulting in an observable odour at the nearest off-site receptors. This early warning system will enable AB Lime to instigate site investigations and mitigation measures such that site H<sub>2</sub>S emissions are reduced/eliminated prior to odour being observable off-site.
76. The utilisation of continuous gas monitoring such as proposed by AB Lime is much improved from the current monitoring procedures which rely on periodic staff observations, Environment Southland observations, or off-site complaints to determine if an odour is observable beyond the boundary of the site. Continuous monitoring is always on and provides a continuous real time notification of the potential for off-site odour effects. I would also expect this data to allow AB Lime to fine tune their operations to further improve the efficacy of mitigation methods over time.

77. Mitigation measures are also proposed to limit the mass emission rates of combustion emissions from the site. These include maintenance and tuning procedures for all combustion plant and are detailed in Section 7 of the LAQMP.
78. One of the primary mitigation measures for combustion plant emissions is the reduction/elimination of coal combustion coupled with the proposed reduction in consented SO<sub>2</sub> emissions (which is described in detail in the NZ Air Report and subsequent NZ Air s 92(1) response).

**Assessment of Potential Off-Site Adverse Air Quality Effects from the Existing and Proposed Operation of the Landfill**

79. Whilst there is a landfill which is currently in operation and has existing consented discharges to air, the focus of my assessments has been on air quality effects arising from the proposed landfill and lime kiln operations.
80. Whilst AB Lime is proposing to remove the waste acceptance cap in the air discharge consent, there are physical site constraints which limit the waste acceptance rate (as described in Mr Smith's evidence<sup>6</sup>).
81. The proposed substantive increase in mitigation measures to meet or exceed industry good practice will, in my opinion, actually reduce odour discharges from the site and hence substantially reduce off-site effects. For this reason, I consider there is a low potential for adverse air quality effects arising from the proposed operation of the AB Lime landfill irrespective of whether they are compared with the existing operation or not.
82. The potential for odour to be discharged from a landfill is less about the waste acceptance rate and more about the mitigation measures implemented. Even a small landfill with poor odour and dust mitigation measures can result in off-site effects in excess of one kilometre from the site.

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<sup>6</sup> Evidence of Mr Smith at paragraphs [59]-[77].

83. As there has been adverse off-site odour effects associated with the historic operation of the landfill, an improvement in the level of nuisance odour effect is required.
84. These historic adverse odour effects were primarily related to the acceptance of cattle carcasses and oysters/mussels following the Ministry of Primary Industries (MPI) programmes to deal with *Mycoplasma Bovis* and *Bonamia Ostreae* (described in detail in the evidence of Mr Smith<sup>7</sup>). Whilst AB Lime had little control over the receipt of these waste streams, it is aware that better controls over management during such events is necessary to reduce the potential for odour discharges during any future requirement to receive waste streams in such circumstances.
85. The proposed draft consent conditions<sup>8</sup> provide a much more prescriptive methodology for such emergency response scenarios. The performance criteria within the emergency response consent conditions are supported through specific odour and air quality control procedures detailed in the LQAMP. This proposed framework has been designed to better protect the receiving environment from adverse effects, including nuisance odour effects.
86. The activity specific mitigation and monitoring procedures for these crisis waste streams are detailed in Section 6 of the LAQMP. The draft consent conditions and provisions within the LAQMP help AB Lime to respond to the event and provide a clear process for Environment Southland's engagement should another emergency response event arise in the future.
87. In the NZ Air Report, I undertook an extensive analysis of the complaint record between 2004 and 2020. Whilst there had been 65 odour complaints over that period a relatively small percentage of the complaints were verified by either or both of AB Lime and Environment Southland. Whilst the absence of independent verification of the complaint does not preclude the fact that odour was/was not present at

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<sup>7</sup> Evidence of Mr Smith at paragraphs [39]-[58].

<sup>8</sup> Refer to **Attachment A** of Mr McCone's evidence

the time of the complaint, it does provide evidence that some of the complaints may have been vexatious. As mentioned in Mr Smith's evidence<sup>9</sup>, there have been occasions when complaints were received about operations which were not occurring on the site at the time of the complaint.

88. Nonetheless, AB Lime has been implementing progressive improvements to its odour and dust mitigation in accordance with the proposed mitigation measures presented in the LAQMP. As a result, the number of complaints has reduced. To date (14/4/21) there have only been five complaints since the last complaint in my original complaint analysis (which occurred in March 2020), i.e. five complaints over the last year.
89. A brief summary of these five complaints is as follows:
- (a) 21/6/2020 – complaint originated from approximately 1.5 km west of the landfill, relating to odour observed on a Sunday evening. The landfill is closed on Sundays and therefore there was no activity occurring on-site at the time. A retrospective (as notification of the complaint was received two days later) complaint investigation undertaken by AB Lime. There was nothing to suggest that there were any abnormal discharges of odour from the site. In response to this complaint, AB Lime brought forward a number of planned improvements to the landfill and management measures.
  - (b) 15/7/2020 – Odour complaint from Egerton Rd. Investigated by Environment Southland, no odour detected at the complainant's property, weak odour detected at Hodges Rd, no odour at Devereux Rd. During AB Lime's investigation contacts on Egerton Rd made mention that "stock feed" like odour had been detected in the mornings. Due to the investigation by Environment Southland which appears to show that there was some odour source in the vicinity of the complaint but not

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<sup>9</sup> Mr Smith's evidence at paragraph [44]



necessarily the landfill (due to the plume not being able to be tracked back to AB Lime), and the observations of other residents of 'stock feed' like odours (which can be similar to that discharged from the landfill), there is a reasonably high likelihood that odour present during this complaint was not a result of discharges from the AB Lime landfill.

- (c) 5/1/2021 – Ms Cavanagh complained of a bad smell on the evening of the 5<sup>th</sup> and then again on the morning of the 6<sup>th</sup> January. An investigation by AB Lime determined that the landfill gas flare was not operational over this period of time due to a faulty part as discussed in the evidence of Mrs Smith<sup>10</sup>. This was the likely cause of the odour. AB Lime has trialled utilising the lime kiln burners as a backup landfill gas combustion option. This trial was successful, so on top of the proposed back up flare, there will be a third backup in the future. The availability of three independent LFG combustion sources will ensure that LFG is always incinerated.
- (d) 23/2/2021 – Ms Cavanagh left a message on Mr Smith's answerphone regarding odour observed at her property. Unfortunately this message was not picked up until two days after the complaint. A retrospective investigation determined that the likely cause of the complaint was the delivery of offal by Hilton Haulage. This client was given a formal warning and informed that should it happen again the load will be turned away. AB Lime has subsequently informed the complainant to contact the site office for a prompter investigation and response. AB Lime also is developing an 'odorous waste' form and provided further training to site staff.
- (e) 22/3/2021 – Anonymous complaint via text message to Mrs Smith at 8:54 am, about odour from "Browns Rd all the way through to Winton". The follow up investigation by AB Lime determined that there was no abnormal activities on-site at the

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<sup>10</sup> Evidence of Mrs Smith at paragraphs [105]-[107]

time of the complaint and climatic conditions were not conducive to poor air dispersion. Without further information it is difficult to determine if this was a valid complaint or not. However, I consider that under the meteorological conditions at the time of the complaint, that it would be very unlikely that odour from the AB Lime landfill would be observable all the way into Winton.

90. Of the five complaints that have occurred over the last year, only two have been verified by AB Lime as potentially having been caused by activities on its site. In response to both events (flare breakdown and receipt of highly odorous/banned waste), AB Lime has implemented further controls/backup measures to prevent any re-occurrence of off-site nuisance odour effects.
91. Mid last year, I provided AB Lime with an extensive list of industry standard odour and dust mitigation tools for its current and proposed landfill operations. This advice included elevated controls for high risk waste. In conjunction with AB Lime and its' expert team, we have developed a comprehensive and much-improved site design, air quality management, and monitoring program, which in my professional opinion will greatly reduce the potential for off-site nuisance odour effects.
92. Improvements in the site odour mitigation include:
  - (a) Revised air discharge consent conditions which provide more prescriptive limits for on-site activities and discharges;
  - (b) The development of a comprehensive LAQMP to provide site staff with a prescriptive framework for odour mitigation measures and implementation methodologies;
  - (c) A large reduction in the open working face from approximately 3,600 m<sup>2</sup> to 1,000 m<sup>2</sup><sup>11</sup>. Among other things, this greatly reduces the potential for water ingress (leachate quantity), landfill gas egress, and area where waste is exposed to air;

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<sup>11</sup> Evidence of Mr Starke at paragraph [55].

- (d) Improved leachate collection, treatment and transport procedures;
  - (e) Improved landfill gas collection and combustion efficiencies;
  - (f) New landfill capping material/design to be trialled shortly;
  - (g) Lower landfill gas emission limits through the capping (to comply with the NES-AQ);
  - (h) Improved special/emergency waste receipt measures, handling and placement procedures;
  - (i) Siting the on-site weather station in accordance with AS 3580.14 – 2011 and introducing real time alarms for elevated risk weather conditions;
  - (j) Real time H<sub>2</sub>S boundary monitoring;
  - (k) More stringent waste acceptance criteria; and
  - (l) The removal of over steep and uncapped faces.
93. Of the above list a) – g) and k) have already been implemented, and the remaining items are in the process of being implemented and are expected to be implemented in the near future.
94. The landfill capping design described by Mr Starke in his evidence<sup>12</sup> will result in a lower potential for fugitive emissions of LFG and odour from the surface of the landfill. It will also reduce the quantity of leachate production and therefore reduce the potential odour emissions from leachate handling and disposal.
95. In addition to the proposed improvements in capping, Mr Starke also describes proposed improvements which will reduce leachate levels and increase LFG capture and destruction. All of these will reduce fugitive discharges of odour from the landfill.

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<sup>12</sup> Evidence of Mr Starke at paragraphs [58]-[69].

96. As described in Mrs Smith's evidence<sup>13</sup> AB Lime has been utilising new technology to measure and map LFG emissions through the cap of the landfill. This new technology provides for more accurate detection of leaks in the cap and enables AB Lime to repair leaks faster and more effectively.
97. Another benefit of more efficient LFG capture is that there will be LFG available to fuel the lime kilns further reducing the site's reliance of coal. Using LFG to fuel the lime kilns results in cleaner combustion emissions from this process and therefore lower impacts on the ambient air quality surrounding the AB Lime landfill.
98. AB Lime is removing the consent condition which allows for 26 m<sup>3</sup>/day of leakage of leachate within the landfill footprint<sup>14</sup>. This practice has a high risk for off-site odour discharges, therefore by committing to remove this contingency measure for leachate, AB Lime is removing another potential source of odour production from the site.
99. As a result of the implementation of the increased mitigation measures I consider that the instance of odour being observable off-site will be very low or eliminated.
100. Complaint analysis is only one of the recommended assessment tools in the MfE GPGs for odour and dust. In the assessments I have conducted, I used a number of other recommended tools including a review of published recommended separation distances; a review of discharges and mitigation measures against industry good practice; comparisons with other landfill operations; an analysis of the meteorology and terrain effects; and the development of an extensive LAQMP including contingency measures in accordance with best practice.
101. The nearest sensitive receptor, not owned by AB Lime (R4), is approximately 1,100 m from the landfill footprint. This is outside the most conservative published separation distance reviewed (1,000 m in

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<sup>13</sup> Evidence of Mrs Smith at paragraphs [76]-[78].

<sup>14</sup> Evidence of Mr McCone at paragraphs [34]-[39]

the Auckland Unitary Plan). As such there is a low potential for nuisance odour or dust effects to occur if appropriate mitigation measures are implemented at the landfill.

102. I then incorporated the results of the above assessments into a FIDOL assessment to determine the potential for off-site offensive or objectionable odour or dust effects.

#### *Frequency*

103. There is a low percentage of time that winds blow towards any one receptor (no more than 11% of the time) and an even lower percentage of these winds which are below 2 m/s. Therefore, the frequency when there is the potential for odour to be observed at any one receptor is low. 53% of the time wind blows away from neighbouring dwellings and towards uninhabited land.
104. Whilst it is likely that some level of odour will be discharged from the landfill at all times, the mitigation measures proposed are designed to limit the number of sources discharging at any one time, the volume of and intensity of odour discharged from the site. With the substantial separation distances that AB Lime has between its landfill footprint and the nearest dwellings not owned by AB Lime, it is expected that the frequency of observable odour beyond the boundary of the site will be low.
105. Furthermore, I consider that the frequency that Level 1, Level 2, and Level 3 controls fail to contain odour emissions beyond the boundary of the site and the meteorological conditions are such that odour could carry from the site to one of the nearest sensitive receptors is very low.

#### *Intensity*

106. The perceived intensity of odour is directly related to the concentration of the odour in the air. Due to dispersion and mixing of an odour plume the higher the separation distance between the emission point and the receptor, the lower the odour concentration, and therefore the lower the intensity. Odour concentrations generally decrease exponentially

with distance from the source. As the nearest sensitive receptor not owned by AB Lime is over 1 km away from the landfill footprint, which is outside the conservative separation/buffer distance guidance discussed in paragraph [101] above, it is likely that the intensity of any odour observed at this location will be low. The intensity at receptors further from the site will be even lower.

107. As discussed earlier, AB Lime is proposing significant improvements to its on-site management of the site, including the odour management procedures. Despite the proposed removal of the waste volume control, the open working face is proposed to be less than 1/3 of historic operations. These improvements will reduce the concentration and volume/amount of odour emissions at the source of the emission. This will consequently result in a substantive decrease in off-site odour concentrations and hence a decrease in the perceived odour intensity.
108. Overall, I consider that the intensity of any odour off-site will be low to indiscernible.

#### *Duration*

109. Historic complaint records and investigations have indicated that observable off-site odour from historic operations has been short. Often by the time either AB Lime, or, Environment Southland representatives reach the location of the complaint, the odour was no longer present. This suggests that the duration of odour events in the past has been short.
110. AB Lime is proposing to use wind condition triggers, odour scout boundary observations, and real time H<sub>2</sub>S monitoring to trigger increased levels of on-site odour and dust mitigation measures. This monitoring and response program is designed to limit the potential duration of any one discharge event.
111. As such, I anticipate that any odour detected beyond the boundary of the site will be for a short duration.

#### *Offensiveness*

112. Odour from the landfill generally falls into one of two character descriptions; 'fresh waste' or the 'rotten egg' like smell of H<sub>2</sub>S in the landfill gas. The hedonic tone of these odour characters can be very unpleasant at a residential dwelling.
113. However, for 'offensive' odour to be detectable at any given receptor it needs to be at an intensity that this character is definable, and needs to be present for a duration long enough for any one receptor to be able to notice it. Based on the assessment I have conducted it is unlikely that this will occur.

*Location*

114. The location of the existing landfill is considered appropriate. It is well separated from neighbouring sensitive receptors and AB Lime own much of the surrounding land. This limits the potential for off-site adverse odour effects.
115. To increase the waste volumes accepted at the existing landfill is considered a much better solution than building another landfill at a greenfield site.
116. Dust emissions from the site have not historically resulted in off-site effects. Current dust mitigation measures on the site are effective at limiting dust emission beyond the boundary of the site. Nonetheless, AB Lime has proposed dust mitigation measures in accordance with industry good practice.
117. In my experience, with good practice mitigation measures dust emissions from vehicle movements and materials handling activities as proposed at the AB Lime facility do not result in adverse effects beyond 100 m of the discharge point. Given the very large separation distances between the dust emission points and the nearest receptors, I consider that dust emissions from the site will not result in adverse off-site effects.

118. Overall, each of the FIDOL factors presented the proposed dust and odour emissions to have a low potential for adverse off-site effects despite the proposed removal of the waste volume limit.
119. I also confirm that this conclusion is reached regardless of whether there is a current landfill or not. In effect what is proposed is consistent with what would be recommended if this were a greenfield site. Nevertheless, as compared with the current operations, it is my view that there will be significant improvements secured as a result of this proposal.

*Emissions from combustion plant*

120. In the NZ Air Report and subsequent s 92(1) response I utilised conservative quantitative air dispersion modelling to assess the potential worst case ambient air quality impacts beyond the boundary of the site. The proposed landfill gas combustion emissions, combined with the operation of the on-site lime kilns, were modelled. The results of the modelling were compared against the relevant ambient air quality standards (discussed above).
121. I used the air dispersion model CALPUFF and developed a site specific one year meteorological data set to assess peak off-site pollutant concentrations.
122. The modelling inputs were extensively reviewed by Environment Southland's technical air quality expert peer reviewers (Beca New Zealand Limited). I supplied additional information and answers to all of the peer reviewer's comments and queries. As identified in the s 42A Report "*By that point the request, response, review of response and applicant's comments resulted in general agreement between technical report authors and technical reviewers that matters had been addressed to each other's satisfaction*"<sup>15</sup>.
123. AB lime is proposing to progressively replace current coal combustion with LFG combustion in the lime kilns. This will result in substantially

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<sup>15</sup> Section 42A Officer's Report: Hearing of resource consent application by AB Lime, Report of Michael Durand at 2.7.1



lower off-site concentrations of SO<sub>2</sub> primarily due to the lower percentage of sulphur in the LFG relative to that in coal.

124. On my advice, AB Lime commissioned a stack testing company to measure current emissions from the on-site landfill gas flare and the lime kilns. Emissions from the lime drying kilns were measured during three fuel burning scenarios:
- Testing Scenario 1 – Coal only
  - Testing Scenario 2 – Combination of coal and LFG; and
  - Testing Scenario 3 – LFG only
125. As a part of this re-consenting process AB Lime is proposing to vary the air discharge consent for the lime kilns. Based on the stack testing results, AB Lime is proposing to reduce the consented mass emission rate of SO<sub>2</sub> from 10 kg/hr to 2 kg/hr. Note that the proposed consent limit of 2 kg/hr is conservative as actual measured emissions from the kilns were lower.
126. There were four modelling scenarios presented across the various reports. These were:
- (a) The current consented landfill with a waste acceptance rate of 100,000 t/yr occurring until 2055: 606 m<sup>3</sup>/hr
  - (b) The landfill operated with a waste acceptance rate of 200,000 t/yr occurring until 2055: 1,202 m<sup>3</sup>/hr
  - (c) The landfill operated with a waste acceptance rate of 300,000 t/yr occurring until 2055: 1,798 m<sup>3</sup>/hr
  - (d) The landfill operated with a waste acceptance rate of 300,000 t/yr occurring until 2055: 1,798 m<sup>3</sup>/hr and a reduced maximum SO<sub>2</sub> mass emission rate of 2 kg/hr.

127. The landfill gas peak production rates for each of the waste receipt rates assessed were modelled by the Jacobs landfill gas engineers<sup>16</sup>.
128. The modelling results for PM<sub>10</sub>, CO and NO<sub>2</sub> were well below the relevant criteria for all modelling scenarios, so the focus was on the SO<sub>2</sub> discharges. A summary of the Scenario 1 and Scenario 4 modelling results is included as Tables 3 and 4 below.

**Table 3. Scenario 1 Modelling Results**

Averaging period	PM <sub>10</sub> µg/m <sup>3</sup>		NO <sub>2</sub> µg/m <sup>3</sup>		SO <sub>2</sub> µg/m <sup>3</sup> *		CO µg/m <sup>3</sup>	
	24 hour	Annual	1 hour 99.9%ile	24 hour	1 hour 99.9%ile	24 hour	1 hour 99.9%ile	8 hour
Max beyond site boundary	8.0	0.46	128	91	370	182	350	289
R9	0.43	0.01	97	76	23	11	14	8
R1	2.70	0.04	106	81	129	72	76	55
R2	0.10	0.00	96	75	14	3	5	2
R5	0.21	0.00	96	75	14	5	10	4
R4	0.35	0.05	98	76	33	8	24	17
Background	21	10	95	75	-	-	5000	2000
Max plus background	29	10	128	91	370	182	5350	2289
Criteria	50	20	200	100	350	120	30000	10000

**Table 4. Scenario 4 Modelling Results**

Averaging period	SO <sub>2</sub> µg/m <sup>3</sup>	
	1 hour 99.9%ile	24 hour
Max beyond site boundary	74	36
R9	5	2
R1	26	14
R2	3	1

<sup>16</sup> AB Lime Limited Landfill Resource Consent Application, Appendix J Landfill Gas Technical Memo, (29 May 2020).

R5	3	1
R4	7	2
Background		
Max plus background	74	36
Criteria	350	120

129. The proposed reduction in the maximum consented SO<sub>2</sub> mass emission rate results in a much lower off-site effect and reduces the current theoretical peak off-site SO<sub>2</sub> concentrations to below the relevant regulatory criteria (the currently consented peak emissions would exceed the NES-AQ and AAQG).
130. The predicted peak off-site concentrations of SO<sub>2</sub> from the current consented operation burning coal only were an hourly average of 370 µg/m<sup>3</sup> and a 24 hour average of 182 µg/m<sup>3</sup>. These exceed the regulatory criteria which are 350 and 120 µg/m<sup>3</sup> respectively.
131. Under the proposed Scenario 4 operating conditions the peak offsite concentrations were hourly average of 74 µg/m<sup>3</sup> and a 24 hour average of 36 µg/m<sup>3</sup>.
132. This is a large reduction in peak off-site SO<sub>2</sub> concentrations and the peak off-site concentrations are now only 20 – 30% of the relevant regulatory criteria, down from 105% and 150% (respectively).
133. The air dispersion modelling demonstrated that despite the fact that the landfill will produce more landfill gas as a result of the proposed increased waste acceptance rates, the use of this landfill gas as a fuel in the on-site kilns and proposed reduction in the consented mass emission rates will result in a net improvement of air quality surrounding the site (including at the nearest receptors).
134. AB Lime's proposed utilisation of LFG to fuel the lime kilns is much more energy efficient than the current operation (currently all of the LFG is flared resulting in a large waste of potential energy), and is

consistent with the New Zealand government's directive to eliminate coal combustion in New Zealand.

135. In the NZ Air Report and s 92(1) response I also assessed the potential for off-site adverse health effects from the discharge of toxic fumes and dust from the receipt and disposal of hazardous waste streams such as aluminium dross contaminated waste, asbestos, medical waste, etc which can be accepted by a Class 1 landfill and authorised by the current consent.
136. However, I note that the disposal of aluminium dross waste (ADW) has now been removed from the proposal<sup>17</sup>. Therefore, the potential effects on air quality from the disposal of this waste are not considered further.
137. The LAQMP contains very prescriptive methodologies for how this waste is to be labelled and packaged in sealed containers prior to delivery to the site, handled during placement into the dedicated special waste pit, and then covered/capped after placement. These controls are designed to essentially eliminate the potential for discharge of air pollutants at the source. This in conjunction with the very large separation distances means that the potential for off-site concentrations of hazardous air pollutants to exceed health based ambient air quality criteria is negligible.
138. I also addressed the use of odour neutralising sprays on-site and the potential for adverse off-site health effects from this activity. This was addressed primarily in the response to Question 1.7 in the s 92(1) response (dated 2 September 2020).
139. As I outlined in the s 92(1) response, AB Lime currently operates an odour neutralising spray system that consists of lengths of polythene pipe strung along the top of ~6 foot high posts with regularly spaced odour neutralising spray misting nozzles approximately 2.5 m apart.
140. Currently odour neutralising spray fence lines are situated between the active areas of the landfill and down valley sensitive receptors. A map

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<sup>17</sup> Evidence of Mr McCone at paragraph [82]

of the current and proposed odour neutralising spray fence lines is included as **Figure 5** below.

**Figure 5.** Odour neutralising fence line map



141. There is also a mobile odour neutralising fog cannon which runs 24 hours a day. It is moved downwind of where daily waste is being placed and has its own independent supply of odour neutralising spray
142. Currently biOx PLUS40 is the deodorising agent used in the spray lines. Whilst the concentrated biOx PLUS40 solution contains substances that are toxic if inhaled (chlorine dioxide), the solution is diluted at a ratio of ~1:500 prior to being used in the misting lines. The dilute solution is then dispersed in the air through the misters/fogging cannon, further reducing the concentration of chlorine dioxide.

143. As I described in the s 92(1) response, an air monitoring program was undertaken by Air Matters to assess the concentration of chlorine dioxide downwind of an odour misting system using biOx PLUS40. The system which was monitored was using a higher dosing rate to that used at AB Lime. Measured peak concentrations of chlorine dioxide were below 0.04 ppm within 10 m of the misting operation. The time weighted average (TWA) for worker exposure for chlorine dioxide is 0.1 ppm. At the very low concentrations measured within 10 m of the source, and the substantial distance of the AB Lime misting lines from the site boundary (mostly greater than 300 m from the boundary), these odour neutralising sprays do not pose a risk to off-site ambient air quality.
144. The use of odour neutralising sprays is a recognised odour mitigation measure which is widely used across a number of odour emitting industries. I have observed the use of similar odour neutralising sprays at a number of industrial facilities with sensitive receptors much closer than that at AB Lime's landfill. To my knowledge there have been no reported adverse health effects associated with the operation of these odour neutralising sprays, both to on-site workers and off-site receptors.

### **Response to Submissions**

145. I have reviewed submissions received from the following parties:

- (i) Stephen Bruce Johnston & Tracey Kim Cavanagh
- (ii) Ross Brydon & Janice Linda McKerchar
- (iii) Roger Graham Hamilton
- (iv) Lyndal & Murray Sinclair
- (v) Jack C M Geerlings
- (vi) Hokonui Rūnanga; and
- (vii) Te Rūnanga o Awarua and Waihōpai Rūnaka

*Mr and Ms McKerchar*

146. Mr and Ms McKerchar submissions raised concerns around odour emissions, landfill gas emissions, and the use of odour masking agents.
147. Mr and Ms McKerchar correctly identified that their dwelling is the closest receptor to the landfill (R4) and that they are in a more predominant downwind location and as such more likely to experience adverse air quality effects if discharges to air from the landfill are not appropriately controlled.
148. Mr and Ms McKerchar also identified certain weather conditions which lead to cold air drainage effects and a more consolidated odour plume drifting towards their dwelling. The orientation and topography of the landfill lead to this effect. The complaint record and AB Lime's experience confirms that this occurs. As such the proposed boundary odour surveys are proposed to occur during these conditions. Should odour be detected at the boundary by AB Lime staff during these boundary surveys the staged mitigation plan can be enacted to prevent odour being observable at the McKerchar residence.
149. In addition, AB Lime propose to install a weather station with real time alarms which will notify on-site staff and management of wind conditions which are blowing towards the McKerchar residence. Once again, these wind triggers will be used as a prompt for site staff to assess the effectiveness of the odour mitigation measures and where required proactively implement higher level controls (Level 2 or Level 3 controls as described in the LAQMP).
150. Finally, the real time boundary H<sub>2</sub>S monitoring will also provide instantaneous alerts as to when landfill gas is detected at the site boundary. Once again triggering an increase in site odour and landfill gas mitigation measures. One of these H<sub>2</sub>S monitors is proposed to be installed in a direct line between the landfill boundary and the McKerchar residence.
151. All of the above monitoring is an improvement on that undertaken historically at the site and consistent with what is now considered good practise.

152. I note from the complaint record that that there have been no recorded complaints from Mr and Ms McKerchar since February 2019 (i.e. no complaints for over two years)<sup>18</sup>. As discussed in paragraphs [92]-[93] progressive improvements have been made to the site which has reduced the number and frequency of complaints. As further recommended changes are made it is expected that the incidence of complaints will be further reduced/eliminated.
153. Mr and Ms McKerchar also mention the “cow/oyster” event, which I have addressed in my reports and evidence. Whilst I agree that these events resulted in unacceptable odour emissions in the past, specific additional controls have been put in place to better control/eliminate odour emissions from the receipt and deposition of special waste in the future. These are described extensively in the LAQMP<sup>19</sup>.
154. I also note that Mr and Ms McKerchar are supportive of the replacement of coal combustion with landfill gas, a number of the proposed site management improvements, and the proposed compliance with the NES.

*Mr Hamilton*

155. Mr Hamilton has raised concerns with the discharge of contaminants to air above industry levels, effects on air quality at neighbouring receptors, and the use of odour masking agents.
156. In my reports and this evidence I have discussed at length the potential effects on air quality at neighbouring dwellings. AB Lime is proposing industry good practice controls to minimise and control odour emissions from its site. In my professional opinion, with these controls in place the proposed operation of the AB Lime landfill and lime kilns will not result adverse air quality effects which exceed the relevant air quality criteria at neighbouring receptors.
157. I have also discussed the use of odour masking agents in paragraphs [141]-[144] above and described how the use of these masking agents

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<sup>18</sup> Although this could be for one of the reasons set out in paragraph 35 above.

<sup>19</sup> Section 6 of the LAQMP.



is an industry standard odour mitigation tool and will not result in adverse health effects off-site.

158. I also note that Mr Hamilton's residence at 202 Egerton Road (R13) is approximately 2.9 km from the working area of the landfill. This is well in excess of that of other receptors assessed in my technical reports and this evidence. As such there is a much lower potential for adverse effects at Mr Hamilton's residence than that of other closer dwellings (at which I have concluded there is a low potential for adverse air quality effects).

*Mr Geerling*

159. The Geerling residence (R6) is approximately 170 m from the Johnston/Cavanagh residence (R5). Mr Geerling is supportive of the application and considers that AB Lime is doing its very best for the environment.

*Mr Johnston and Ms Cavanagh*

160. The residence of Mr Johnston and Ms Cavanagh residence (R5) is approximately 1.8 km from the current landfill operations.
161. Mr Johnston and Ms Cavanagh expressed concerns that the removal of the 100,000 tonnage cap would result in an increased problem with odour. As I have discussed in my reports and this evidence, the amount of odour discharged from a landfill is less about the tonnage received and more about the odour mitigation measures employed at the site. This is supported by the fact that the site design and management improvements to date have resulted in a decrease in observable off-site odour and complaints.
162. Once the additional controls proposed are implemented it is expected that the observable off-site odour at the Johnston/Cavanagh dwelling will further reduce/be eliminated.
163. Mr Johnston and Ms Cavanagh express concerns around historic crisis waste acceptance events (the *Mycoplasma Bovis* and *Bonamia Ostreae* events) and the response time of Environment Southland staff

to attend the site in response to a complaint. As described in the LAQMP it is proposed that during crisis waste acceptance events a special procedure will be instigated which may involve having an Environment Southland member present during the acceptance and placement of this high risk waste.

164. Mr Johnston and Ms Cavanagh also mention that weather conditions (including inversion layers) during autumn/winter have resulted in a higher incidence of observable odour at their dwelling.
165. As discussed in paragraphs [23]-[46] above, these meteorological and topographic conditions have been identified and do exacerbate the potential for poor odour dispersion and off-site effects. However, AB Lime is proposing to utilise real time alerts from its on-site weather station to trigger additional mitigation measures during these higher risk meteorological conditions.
166. As for the McKerchar dwelling, it is proposed that a real time H<sub>2</sub>S sensor will be situated in line between the landfill and the Johnston/Cavanagh dwelling.
167. Mr Johnston and Ms Cavanagh have also provided a record of complaints that they have made relating to odour emissions from the AB Lime landfill. I note that only one complaint has been made between June 2019 and the date of the submission (February 2021). At the time of this complaint (5/1/2021) AB Lime's flare had broken down and as such the landfill gas could not be collected and disposed of<sup>20</sup>. The future operations will involve having a secondary flare present (required by the NES-AQ for any new consent) on-site which will be used in the instance when the primary flare and/or the lime kilns are not operational. This will prevent future events of this nature.
168. I also note that AB Lime is now utilising landfill gas as a fuel in the lime kilns and that this provides a third redundancy to burn the landfill gas in the instance that the primary flare or secondary flare is not operational.

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<sup>20</sup> Evidence of Mrs Smith at paragraphs [105]-[106]

169. In my opinion, the reduction in complaints from Mr Johnston and Ms Cavanagh between June 2019 and the present date is testimony to the effectiveness of the on-site improvements that AB Lime has progressively implemented (and will continue to implement) to control discharges from the site.

*Mr and Mrs Sinclair*

170. The submission made by Mr and Mrs Sinclair raises their concerns that odour and gas emissions are affecting their air quality all year round.

171. The Sinclair dwelling is approximately 2.3 km from the current landfill working area. As such there is a low potential for adverse air quality effects.

172. Based on the complaints record that I have reviewed, there is no record of complaints originating from their dwelling. However, it may be possible that they have lodged anonymous complaints. AB Lime is also not aware of any adverse effects which have been reported from this dwelling.

173. Mr and Mrs Sinclair also appear to relate allergies to emissions from the landfill. To my knowledge the gases which are discharged from the landfill are not associated with allergic reactions.

174. Also raised in this submission was a query as to why the methane gas emissions have not been reduced from 5% to the proposed 0.5% already. From a technical perspective I want to highlight that the methane emission rate through the cap is not directly related to the size of the working face (as indicated in Mr and Mrs Sinclair's submission). The methane emissions through the landfill cap are more related to the quality of the capping and the effectiveness of the landfill gas extraction network.

175. As mentioned earlier and discussed in the evidence of other experts, AB Lime has made improvements both to the landfill capping and the landfill gas extraction network. This has resulted in a reduction of measured methane levels on the surface of the landfill.

176. The submissions by Hokonui Rūnanga and Te Rūnanga o Awarua and Waihōpai Rūnaka do not appear to have any air quality related concerns which require my input.

### **Comments on the Section 42A Reports**

177. I have read the Section 42A Report dated 15 April 2021 and have the following comments.
178. The s 42A Report states concerns that the air quality assessment utilises the current odour discharges from the AB Lime landfill as a 'consented baseline' which "*also presumes to account for future effects of the operation*".
179. My assessments have discussed the historic odour discharges from the site and historic amenity values in the surrounding environment. I have also outlined how the proposed improved site mitigation and management procedures are consistent with industry best practice and will improve the surrounding amenity values.
180. Regardless of whether there is an existing landfill present, or the proposal was for a greenfield site, the odour management and mitigation procedures that I have recommended, clearly set out in the LAQMP, and then stipulated within the proposed consent conditions would still be appropriate. As such my conclusions with regards to the potential for off-site effects remain the same between now and 2038 and beyond 2038 - 2046.
181. The offensive or objectionable odour effect criteria within the RMA and Environment Southland planning framework, which must be met, are applicable to all activities, existing or new. No existing or proposed activity can contravene this overarching regulatory limit. My assessment has assessed whether or not the proposed activity will meet the odour requirements of the RMA and the Environment Southland planning framework irrespective of the existing landfill.
182. Reference to the existing landfill and its effects on the environment have been made such that the effectiveness of existing/historic controls and extent of historic effect which has occurred can be

defined. The scale of the increase in mitigation measures is directly proportional to the likely reduction in off-site odour effects.

183. Whilst this reference point has been helpful in determining a starting point, my assessment has focused on utilising the assessment tools recommended with the MfE GPG odour which is the industry standard for assessing the potential for offensive or objectionable odour effects beyond the boundary of any given emitter.
184. The use of many of the tools I have used are applicable to the assessment of both an existing activity and a new activity.
185. The s 42A Report is also concerned that the application expands the types of waste that can be received and therefore the potential for adverse off-site odour and health effects associated with discharges from these additional waste streams.
186. As has been discussed at length in Mr McCone and Mr Smiths' evidence<sup>21</sup>, the application for a new air discharge consent does not allow for any new waste streams to that which is currently consented or allowed under the Class 1 landfill criteria. In fact, as detailed above and in Mr McCone's evidence, AB Lime is now proposing to exclude ADW from the proposed acceptable waste streams.
187. Notwithstanding the above, the proposed air discharge mitigation and monitoring methodology is extensive. It has been designed to be effective for the receipt of a wide variety of waste streams, including hazardous waste and special and crisis waste streams (which include waste with a higher odour discharge potential). These controls will remain effective for all of the waste streams which are acceptable under the Class 1 landfill criteria, including wastes with a higher potential for odour or toxic air discharges. The focus on pre-treatment, containment, and contingency measures for the control of air discharges from all waste streams is the key to achieving compliance

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<sup>21</sup> Evidence of Mr McCone at paragraphs [63]-[74]; Evidence of Mrs Smith at paragraphs [110]-[112].

with the relevant ambient air quality criteria beyond the boundary of the site, regardless of the waste stream received.

188. The s 42A Report lists the following waste streams which it considers to be: *“notable types of waste whose effects have not been assessed or where management plans will not address their effects”*
- 1) Discharges of odour from new waste streams or emergency waste streams;
  - 2) Discharges of remedial waste from other landfill sites; and
  - 3) Discharges of aluminium dross waste originating at NZAS’s smelter at Tiwai Point
189. As discussed earlier, there will not be any new waste streams accepted under this proposal.
190. Whilst remedial waste from another landfill could present an elevated odour risk, it will be treated with the same management and mitigation measures as all of the existing waste streams. Should it be in a highly odorous state when extracted from the landfill of origin it will be up to the client who is seeking to dispose of the waste at AB Lime to pre-treat the waste to the acceptance standard required for all waste to be deposited at the AB Lime landfill<sup>22</sup>. If it does not meet the criteria, it will not be accepted.
191. As discussed earlier, ADW has been removed from the application, so this concern of the s 42A Report is no longer valid.
192. I also note that there appears to be little or no reference in the s 42A Report to the independent expert air quality peer review of the NZ Air assessments. Prue Harwood of Beca (Council’s air quality technical peer reviewer) reviewed all of the NZ Air assessments and associated further information responses. Ms Harwood and myself both came to the conclusion that the technical assessments were appropriate and as far as I am aware Ms Harwood agrees with my conclusions.

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<sup>22</sup> See LOMP Section 4 found in Attachment A of the evidence of Mr Starke

193. On this basis I disagree with the s 42A Report that the potential odour effects associated with the proposed AB Lime landfill have not been sufficiently assessed. In my expert opinion I have assessed all of the potential odour discharges from the proposed operations and consider that the proposed LAQMP and consent conditions are sufficiently detailed such that the adverse nuisance odour effects will be appropriately mitigated and as such there is a low potential for offensive or objectionable odour beyond the boundary of the site.

### **Conclusion**

194. In conjunction with AB Lime and its team of experts I have used my professional experience to help develop a robust set of draft consent conditions which provide the minimum air discharge performance criteria for the proposed site operations. We have developed an extensive LAQMP to provide the practicable methodology to enable AB Lime to meet these performance standards.

195. The performance standards within the draft consent conditions are designed to meet the RMA, NES-AQ, AAQG, and Environment Southland ambient air quality criteria. This includes the requirement to ensure that there is no offensive or objectionable odour observed beyond the boundary of the site.

196. The AB Lime landfill is well separated from neighbouring receptors. The closest sensitive receptor is 1,200 m from the landfill operations, which is in excess of the most appropriate published separation/buffer distance for a landfill of this nature.

197. Nonetheless, I have assessed the proposed discharges of odour from the proposed AB Lime landfill operations. In my expert opinion the proposed odour mitigation measures, monitoring feedback loops, and multi-tier mitigation response will ensure that there is a low potential for observable off-site odour effects.

198. In addition, I have assessed the potential discharges of combustion emissions from the site. AB Lime is proposing to utilise LFG to replace coal combustion in its lime kilns. Stack testing and my assessment has

demonstrated that this will reduce emissions of SO<sub>2</sub> and other pollutants to air. As a consequence, AB Lime is proposing to reduce the consented peak discharges of SO<sub>2</sub> from its lime kilns.

199. In my expert opinion the proposed changes to the site operations and associated air discharge consent conditions will result in a net benefit to air quality in the receiving environment.

Date: 28 April 2021

Donovan Van Kekem