Before the Independent Hearing Commissioners
Appointed by the Taranaki Regional Council

Under	the Resource Management Act 1991
In the matter of	a resource consent for air discharge relating to the poultry farm operation at 58 Airport Drive, New Plymouth (5262-3.0)

Supplementary Evidence of Jason Savelio Karena Pene

25 February 2022

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1 My full name is Jason Savelio Karena Pene.

2 I prepared a statement of evidence dated 28 January 2022 and summary/rebuttal statement dated 14 February 2022 in relation to air quality. My qualifications and experience are set out in my statement of 28 January 2022.

3 I repeat the confirmation given in that statement that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court.

Purpose and scope

4 The purpose of this statement is to provide further air quality assessment information requested by the hearing commissioners: Specifically I discuss the following below:

(a) Updates to the dispersion modelling configuration I have used to predict odour concentrations associated with the proposed operation (as well as the existing operation and permitted activities);

(b) Updated odour concentration predictions for the scenarios discussed in the hearing;

(c) Availability of suitable wind conditions for shed cleanout; and

(d) Reliability of dispersion modelling predictions at nearby receptors.

Updated odour dispersion modelling configuration

5 As requested by the hearing commissioners, I have provided results of odour dispersion modelling comparing the proposed activity with the existing activity and the permitted activity under Rule 51 of the Taranaki Regional Air Plan in **Attachment A** to this statement.

6 Specifically, I have provided 99.5th percentile odour concentration results for the following four scenarios:

(a) the proposed free-range configuration (with a stocking density of 15 birds/m^2 and exhaust via 7 m chimney vents);

(b) the existing broiler configuration stocked at the operational peak stocking density (35 kg/m^2) and with exhaust via horizontal vents;

(c) stocking of Sheds 1 and 2 at the rate allowed under permitted activity Rule 51 of the Taranaki Regional Air Plan (total of 30,000 birds) with exhaust via horizontal vents; and

(d) stocking of Sheds 1 and 2 at permitted activity rate (total of 30,000 birds) with exhaust via vertical 7m high chimney vents (as currently being installed at the site).

7 To address matters raised in the hearing and following discussions with Mr Van Kekem and Mr Backshall regarding model configuration, I have updated the model configuration to include the following:

(a) Increased resolution of contour plots and inclusion of curtilage receptors;

(b) Modelling of exposure of upper storey dwelling receptors; and

(c) Modifications to represent the impact of shelterbelt vegetation surrounding the site.

8 In relation to 7(a), I have provided updated model contour plots encompassing a 500 m x 500 m area, which includes the site and each submitter property. I have also included additional discrete receptors to represent exposure within the curtilage of adjoining properties. Certain regional plans such as the Canterbury Air Regional Plan refer specifically to the area within 20 m of the façade of a dwelling as being included within the definition of a "sensitive activity". However, this is not the case in the Regional Air Quality Plan for Taranaki (RAQPT). The RAQPT definition of dwellinghouse (which is included in the definition of "sensitive area") is as follows and does not include a notional boundary provision:

> Dwellinghouse* means any building, whether permanent or temporary, that is occupied, in whole or in part, as a residence; and includes any structure or outdoor living area that is accessory to, and used wholly or principally for the purposes of, the residence; but does not include the land upon which the residence is sited.

9 I have therefore sited curtilage receptors at the nearest apparent accessible garden or yard areas of properties rather than at any notional boundary. The location of these receptors is illustrated in Attachment A.

10 In relation to 7(b), I have included an elevated (flagpole) receptor at the McDonald dwelling at 62 Airport Drive to represent potential exposure at the upper floor of this dwelling. This receptor has been sited at the location of the nearest upper floor window (based on photographs provided by Mr Van Kekem) and at a height of 6 m above ground level.

11 In relation to 7(c), as I noted in response to commissioners' questions in the hearing, it is not practicable to incorporate shelter belt vegetation in the building downwash algorithms used in the CALPUFF model. As an alternative, I have upgraded the CALMET meteorological model on which the CALPUFF odour

predictions have been based to better reflect the impact of the adjacent tall vegetation on dispersion and propagation of emissions. This has included an increase in resolution of the CALMET model from 100 m to 25 m in the x and y directions (meteorological conditions in each hour are predicted in each 25 m x 25 m cell across the model domain). At the suggestion of Mr Van Kekem, I have modified the land use categorisation of cells occupied by shelterbelt vegetation to Forest Cover. I discuss the modifications to the CALMET model further in **Attachment A**.

Updated odour dispersion modelling results

12 Updated 99.5th percentile odour concentration results for each of the odour scenarios I described above are provided in Attachment A. These results are summarised in the following table.

Table 1: Predicted 99.5th percentile 1-hour average odour concentration predicted at sensitive receptor locations as a result of the proposed operation (with conversion to free range configuration and installation of roof vents)

Prediction location	Predicted 99.5th percentile 1-hour average odour concentration (OU/m^3)			
	Proposed	Existing operational peak density	Permitted activity	
			Horizontal vents	Vertical 7m vents
Highest at a submitter dwelling (inc. upper floor) or curtilage	3.3*	6.9*	3.6*	2.6*
Highest at any other dwelling or curtilage	4.1†	7.0†	3.5†	2.9‡

* Predicted to occur at 62 Airport Drive (McDonald)

† Predicted to occur at 69 Airport Drive

‡ Predicted to occur at 52 Airport Drive

13 The main impact of the modifications to the CALMET model to recognise the presence of tall vegetation has been to reduce predicted peak odour concentrations compared to the results I provided in my previous statements. This impact of vegetation is recognised in the Ministry for the Environment (MfE) guidance on atmospheric dispersion modelling[1] as follows:

> Topographic features, buildings or vegetation increase the ground's surface roughness. For all but the unstable categories (where convective turbulence dominates), surface roughness increases the vertical mixing of a

[1] MfE. 2004. "Good Practice Guide for Atmospheric Dispersion Modelling".

plume and changes the wind-speed profile at elevated heights because of the enhanced mechanical turbulence generated as the air moves over the ground.

14 99.5th percentile 1-hour average odour concentrations in the proposed free-range scenario are predicted to be further reduced below the 5 OU/m^3 criterion at local residences, despite the inclusion of closer curtilage receptors and an elevated upper floor receptor at 62 Airport Drive.

15 Peak odour concentrations in the proposed scenario are also predicted to be slightly lower than corresponding predictions associated with the permitted activity scenario (with horizontal ventilation) at key receptor locations including at 62 Airport Drive (peak submitter dwelling) and 69 Airport Drive (peak non-submitter dwelling). This would indicate that with the proposed modifications to ventilation in place there is little difference between the peak odour effects of the proposal and the permitted baseline, if this is taken into account.

16 As I have discussed previously, the predictions of the proposed scenario do not take account of additional measures that are likely to reduce odour emissions, including replacement of direct heating methods that introduce moisture to the sheds and implementation of improved climate control based on more extensive measurement of shed conditions. Were these proposed improvements able to be accounted for in the model, odour concentrations predicted in the proposed scenario would be further reduced from those presented in Table 1 and Attachment A.

Availability of suitable wind conditions for shed cleanout

17 A clause of the management plan consent condition is proposed by AFTL seeking to defer clean out activities during adverse wind conditions (where operational requirements allow). I have analysed the frequency of the wind conditions specified in the proposed condition (wind from directions between 10° and 235° as a 1-hour average or wind speeds of greater than 10 m/s as a 1-hour average) in 2021 based on New Plymouth AWS data.

18 The number of days where conditions would have allowed either a morning or afternoon cleanout to proceed (or both) in the preceding 7-day period is illustrated in the following figure.

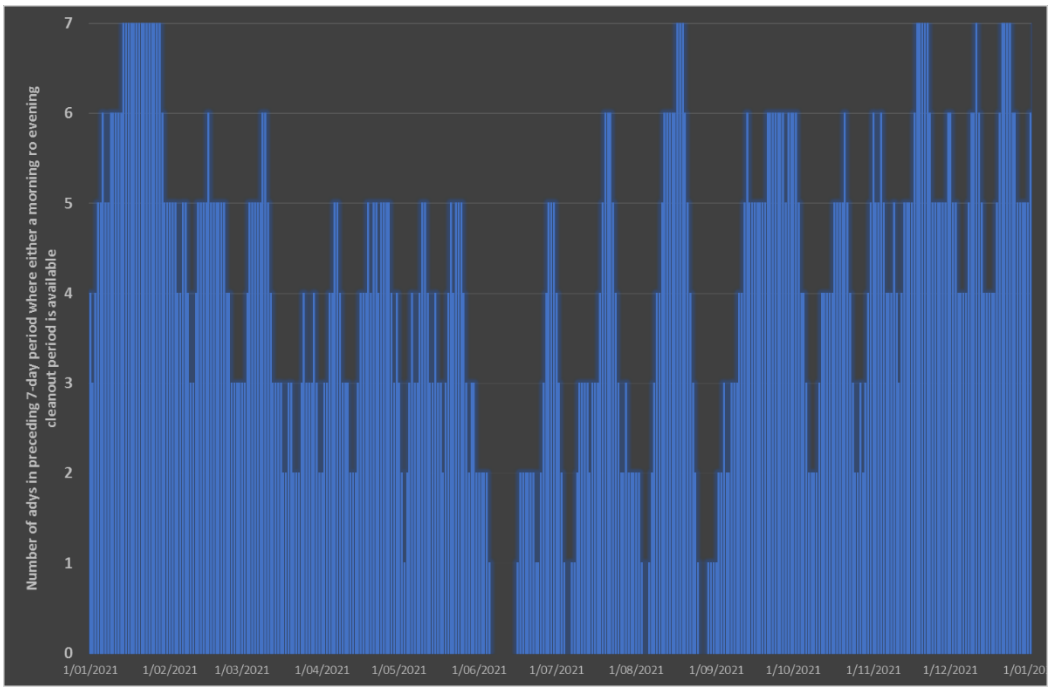

Figure 1: Number of days in preceding 7-day period where wind conditions would have allowed a cleanout to occur throughout 2021

19 The analysis indicates that at most times, clean out would have been able to have been carried out over a seven-day period without adverse wind conditions being encountered. In winter it is possible that persistent adverse wind conditions could occur. In 2021 the longest period without either a morning or evening period meeting the specified requirements was 17 days (in June 2021).

Reliability of dispersion modelling predictions at nearby receptors

20 Mr Van Kekem has questioned the accuracy or reliability of CALPUFF dispersion modelling predictions within a distance of 50 m.

21 A technical peer review conducted for the US EPA in 1998 prior to its adoption of CALPUFF as Guideline Model[2] notes the following:

> "The CALMET/CALPUFF modeling system can simulate atmospheric dispersion on transport scales of from tens of meters to tens of kilometers (near-field) and from tens of kilometers to hundreds of kilometers (far-field)."

[2] KJ Allwine et al. 1998. "*Peer Review of the Calmet/Calpuff Modeling System*".

22 Predictions at a distance of 50 m are therefore towards the lower end of the range of predictions for which the model was developed but the model is capable of prediction of impacts on ambient contaminant concentrations within this type of distance.

23 The US EPA subsequently identified potential areas for concern in relation to the CALPUFF predictions in the near field (defined by the US EPA as predictions within 50 km) in complex wind conditions[3]. However, these concerns are able to be addressed in this instance through the inclusion of nearby surface weather observational data (from New Plymouth AWS), accurate land use categorisations based on the Landcare Research LCDB (modified to reflect local observed conditions around the site) and the very fine resolution of the CALMET grid now used.

24 I therefore consider that the CALPUFF modelling has been conducted in accordance with good practice and that predictions at the McDonald dwelling (located 100 m from the nearest proposed vent) and curtilage receptors located slightly closer are equally representative of actual odour concentrations as predictions further afield.

25 While I agree with Mr Van Kekem that it is not common in New Zealand for poultry odour dispersion modelling to be conducted with receptors within 100 m, I consider that this is more a result of the uncommon nature of odour modelling of farms of the relatively small scale of the proposed operation. In my experience, dispersion modelling is typically employed to assess odour from new or modified operations of a much larger scale. I also note that CALPUFF dispersion modelling is frequently conducted in New Zealand with receptors in similarly close (or closer) proximity to modelled discharges within urban settings for a full range of activities discharging to air.

Jason Pene
25 February 2022

[3] R Brode, B Anderson. 2008 “Technical Issues Related to CALPUFF Near-field Applications”. US EPA Memorandum.

Attachment A: Dispersion modelling update and predictions