BEFORE THE CANTERBURY REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
A N D	
IN THE MATTER	of the Proposed Canterbury Regional Air Plan
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IN THE MATTER	of submissions and further submissions by St George's Hospital Incorporated (Submitter No. 63131).

STATEMENT OF EVIDENCE OF JEFFREY GEORGE BLUETT

1. INTRODUCTION

Qualifications and Experience

1.1 My full name is Jeffrey George Bluett.

1.2 I am employed as the leader of the air quality team by Golder Associates (NZ) Limited (Golder), a ground engineering and environmental consulting firm. I have been employed by Golder since April 2015 and have over 18 years of experience in the field of air quality management.

1.3 I hold the qualifications of a Bachelor of Science (University of Otago) and a Master of Science degree (First Class Honours) in Environmental Science (Lincoln University), specialising in air pollution modelling.

1.4 I am a member of the Clean Air Society of Australia and New Zealand (CASANZ). Within CASANZ, I currently hold or have held the following positions, NZ Branch committee member (1998-present), NZ Branch secretary (2014-present), CASANZ Council (2014-present), Transport Special Interest Group deputy chair (2010-2014), Training Activities Chairperson (2002-2008) and Conference Co-convenor (2002).

1.5 I have authored or co-authored approximately 100 reports and peer reviewed papers in aspects of transport, industrial, domestic and agricultural emissions to air. My research work focused on measuring real-world emissions and comparing those to laboratory measurements. I also have extensive experience in air quality and meteorological monitoring, air quality management plans, dispersion modelling and impact assessment statements. I have been involved in consultancy and advice to local and central government and to industry. My most recent investigations have focused on qualifying the effects of dust and the efficacy of various dust suppressants from roadways, bulk material stockyards and open cast coal mines.

1.6 Previously I have worked as investigating officer for the Canterbury Regional Council processing resource consent applications (1997-2000) and leader of the air quality team and research scientist at the National Institute of Water and Atmospheric Research (2000-2012).

My Role – St George's Hospital Incorporated's Submissions

1.7 As outlined by Ms Carmen Taylor in her evidence, following the notification of the Proposed Canterbury Air Regional Plan (Proposed CARP) in March 2015, St George's Hospital Incorporated (St George's) sought advice from Golder's air quality and planning experts as to whether they considered there were any implications for St George's arising from the Proposed CARP.

1.8 I provided this initial advice and then assisted with the preparation of St George's submission. In providing this advice, I recognised that St George's interest in the Proposed CARP is to ensure that the the boilers and generators it currently operates, and will operate into the future, will be able to provide heating and emergency electricity (and load shedding) at its hospital facilities located in Merivale, Christchurch.

1.9 Given my involvement in this process, I am familiar with the nature of these facilities, how they operate and the resource consents, and associated conditions, they hold for these facilities. Broadly speaking, I am also familiar with it proposed upgrade needs in relation to these facilities and have considered this when preparing my evidence.

Code of Conduct

1.10 Whilst this is a Council Hearing, I acknowledge that I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court updated Practice Note 2014, and agree to comply with it. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

2. EXECUTIVE SUMMARY

2.1 My evidence will show that:

(a) It is not appropriate to apply the Ambient Air Quality Guidelines to individual discharges in the manner proposed in Policy 6.21 and Rule 7.18 of the Proposed CARP.

(b) Condition 3 of Rule 7.19 which specifies that there may be no buildings within 25 m of the stack with a height greater than 5 m above ground level provides no additional protection of ambient air quality to that that provided by the requirements of Condition 5 which sets minimum stack height based on building height. Therefore, I support St George's request for the removal of Condition 3 from Rule 7.19.

3. SCOPE OF EVIDENCE

3.1 My evidence will provide technical information to support the planning evidence written by Ms Carmen Taylor on behalf of St George's. My evidence scope covers the following issues:

(a) Section 4 of my evidence discusses the of the Ambient Air Quality Guidelines 2002 Update[1] and the appropriateness, from a technical perspective, of utilising these guidelines in the manner proposed in Policy 6.21 and Rule 7.18.

(b) In Section 5 I discuss Condition 3 of Rule 7.19 and whether it plays any role in avoiding potential adverse effects on the environment.

3.2 In addition, I note that my comments on the use of the AAQGs are similar in nature with evidence of Mr Roger Cudmore being presented on behalf of other submitters. Mr Cudmore and I worked together in preparing the submissions and further submissions for St George's and other parties. We are generally in agreement on the issues associated with the Proposed CARP and the nature of amendments required to address those issues.

4. 2002 AMBIENT AIR QUALITY GUIDELINES – POLICY 6.21 AND RULE 7.18

4.1 The 2002 Ambient Air Quality Guidelines (AAQG) published by the Ministry for the Environment (MfE) is referred to in Policy 6.21 and Rule 7.18. The notified wording of this policy and rule seek to avoid/prohibit (respectively) industrial and large scale combustion discharges to air that will likely result in exceedances of the AAQG.

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[1] Ministry for the Environment and Ministry of Health 2002. Ambient Air Quality Guidelines – 2002 Update. Air Quality Report No. 32, prepared by the Ministry for the Environment and Ministry of Health, May 2002.

4.2 In my opinion this use of the AAQG is inconsistent with the defined purpose of the guidelines as stated in the guidelines themselves.

4.3 The AAQG states that these guideline levels were not developed with the intention of being used for assessing discharges from individual sources. Specifically, the wording AAQG guideline[2] states:

> *"As was stated in the 1994 Guidelines, the ambient guideline values are not designed to be used to assess the environmental and health impacts of individual discharges to air as required by the RMA, or a regional or district plan. Individual discharges include point, area or line sources from activities such as industries, roads and sewage-treatment plants."*

4.4 I consider that the use of the AAQG in the way proposed in the Proposed CARP is inconsistent with their intent and results, if applied, is overly onerous criteria for industrial discharges.

4.5 The Section 42A Report recommends that Policy 6.21 to be amended to provide better guidance to the application of BPO and that Rule 7.18 is deleted and replaced with a rule that outlines BPO. It is unclear the extent of reliance these new rules (for which wording has not been proposed) will have on AAQG and therefore it is not possible for me to assess this matter further.

4.6 Irrespective of any amended wording, in my opinion, it is not appropriate to apply the AAQG to individual discharges in the manner proposed in Policy 6.21 and Rule 7.18 of the Proposed CARP. The AAGQ was not developed for this purpose. Ms Taylor discusses this matter further in her planning evidence.

5. RULE 7.19 – PERMITTED ACTIVITY FOR EXTERNAL COMBUSTION OF GAS

5.1 My evidence particularly relates to Condition 3 of Rule 7.19. This specifies that there may be no buildings within 25 m of the stack with a height greater than 5 m above ground level (that is, if the building is in effect on the same site and the building was not anticipated or established at the time the stack was established).

5.2 As outlined in St George's submission, it is considered that this condition is redundant and provides no significant further provisions for the protection of air quality than that provided by Condition 5 of this rule. Condition 5 requires minimum stack height of 1 m above buildings for small gas fired boilers and minimum of 7 m above ground level and at least 3 m higher than buildings within a 35 m radius of any large gas fired boilers.

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[2] Section 3.7, p. 40 of the AAQG.

5.3 To demonstrate that the limit on buildings height of 5 m within a 25 m radius of a stack does not provide any environmental benefit and is therefore unnecessary, the Golder air team have estimated the ground level concentrations of pollutants discharged from a 5 MW gas fired boiler discharging in the centre of a 20 m wide by 20 m long building with various heights. Additional modelling runs were was undertaken to assess the effect of another building within a 25 m radius of the stack.

5.4 Building heights of 4.5 m, 5 m, and 10 m were chosen. For each building height the stack height has been set based on the requirements of Condition 5, i.e., 3 m above the height of the building.

5.5 Normal exhaust gas conditions have been selected with a unit emission rate (1 g/s) to demonstrate the effect of varying building heights. The dispersion model CALPUFF was used to model the discharge and predict 1 hour 99.9th percentile ground level concentrations. Further details of the modelling setup are provided in Attachment A of my evidence.

5.6 The results of the modelling assessment demonstrates that the taller stacks resulted in lower maximum ground level concentrations than the shorter stacks, even when accounting for the effect of nearby buildings. A summary of these modelling results is also provided in Attachment A. The relationship between stack height, nearby buildings and ground level concentrations established by the modelling is expected to be able to be extrapolated beyond a building height of 10 m.

5.7 To look at this issue from another perspective, if Condition 3 was retained, a 5 MW gas fired boiler with a stack height of 13 m that was in the vicinity of a 10 m building would require a resource consent whereas a 5 MW gas fired boiler with a 7.5 m high stack near a 4.5 m high building would not. The maximum ground level concentrations from the gas fired boiler with the 13 m stack is less than half that from the 7.5 m stack. In my opinion this is inconsistent with the intent of a permitted activity rule which as I understand it is to permit activities where the effects are minor or less than minor.

5.8 The Section 42A Report has provided no real explanation or reference to the reason for not accepting the relief sought by St George's to remove Condition 3 of Rule 7.19. Rather, the Section 42A Report states the conditions were drafted with advice from air quality experts and they work as a package and therefore the Section 42A Report recommend that Rules 7.19 to7.27, including all associated conditions, are retained as proposed. As I have demonstrated through the modelling exercise that I have outlined above, I do not consider this to be the case for Condition 3 of Rule 7.19.

5.9 I consider that Condition 3 provides no additional protection of ambient air quality to that that provided by the requirements of Condition 5 which sets minimum stack height based on building height. Therefore, I support St George's request for the removal of Condition 3 from Rule 7.19.

JEFFREY GEORGE BLUETT
18 September 2015

ATTACHMENT A – SUMMARY OF MODELLING

Introduction

A CALPUFF[3] dispersion model (Version 6.42) has been used to predict contaminant ground level concentrations (GLCs) arising from the discharges of a gas fired 5 megawatt (MW) boiler, for various stack and building heights. The objectives were to investigate the building downwash effects on the dispersion of the plume discharged from the boiler stack and to demonstrate whether or not a limit on buildings height of 5 m within a 25 m radius of a stack provides any environmental benefit.

This exercise was carried out using a dispersion model that had been previously set up for another assessment, so that only the discharge parameters and stack and building configuration had to be changed. This allowed for the model set up and run to be done very quickly compared to a regular assessment using CALPUFF.

This modelling exercise also took advantage of an existing three dimensional meteorological CALMET dataset developed for Christchurch City. The dataset is the same as that used for a number of other air quality assessments carried out by Golder in the Christchurch region, which have previously been accepted by the Canterbury Regional Council (CRC), and include those for the Ravensdown Hornby[4] and Alliance Sockburn[5] sites. The dataset covers the two years 2001 and 2002. Additional CALMET configuration information can be provided upon request.

CALPUFF input parameters

The boiler discharge stack was set up in the centre of a 20 m wide by 20 m long building, and the stack and building heights were varied in three separate model runs. In all runs the height of the stack was chosen so that it was 3 m above the roof of the building. The PRIME building downwash algorithm has been used, which is the recommended model option for taking account of building downwash effects[6]. A unit emission rate was applied in order to provide relative results.

A summary of the modelled discharge parameters and stack and building configuration for the boiler is provided in Table 1. Additional CALPUFF configuration information can be provided upon request.

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[3] A non-steady-state puff dispersion model which can simulate the effects of time- and space-varying meteorological conditions on pollutant transport, transformation and removal (definition from Earth Tech, Inc.).

[4] GKM 2007. Assessment of Air Discharges Ravensdown Fertiliser Hornby Works, Christchurch. Report prepared for Ravensdown Fertiliser Co-operative Limited by Golder Kingett Mitchell. September 2007. Golder reference RAVFE-CHC-004.

[5] Golder 2009. Alliance Group Ltd, Sockburn Plan Assessment of Air Discharges. Report prepared for Alliance Group Limited by Golder Associates (NZ) Limited. Golder reference 087813842.

[6] MfE 2004. Good Practice Guide for Atmospheric Dispersion Modelling. Ministry for the Environment. ME Number 522. Wellington

Table 1: Modelled discharge parameters.

Model run	Building height	Stack height	Stack diameter*	Exhaust temperature	Exhaust velocity	Emission rate
1	4.5 m	7.5 m	0.61 m	150 °C	15 m/s	1 g/s
2	5 m	8 m				
3	10 m	13 m				

Notes: * Stoichiometric combustion calculations were undertaken in order to determine a realistic discharge diameter based on 80 % combustion efficiency, 20 % excess air and a 15 m/s efflux velocity.

In order to further investigate the building downwash effects, three additional model runs (numbers 4, 5 and 6) were carried out with the same scenarios detailed above, but with the addition of a second 20 m wide by 20 m long building located at 5 m from the building on which the stack is located. This configuration is shown in Figure 1. In these additional model runs, the height of the second building was varied to match the height of the first building, so that the stack was always 3 m above both buildings.

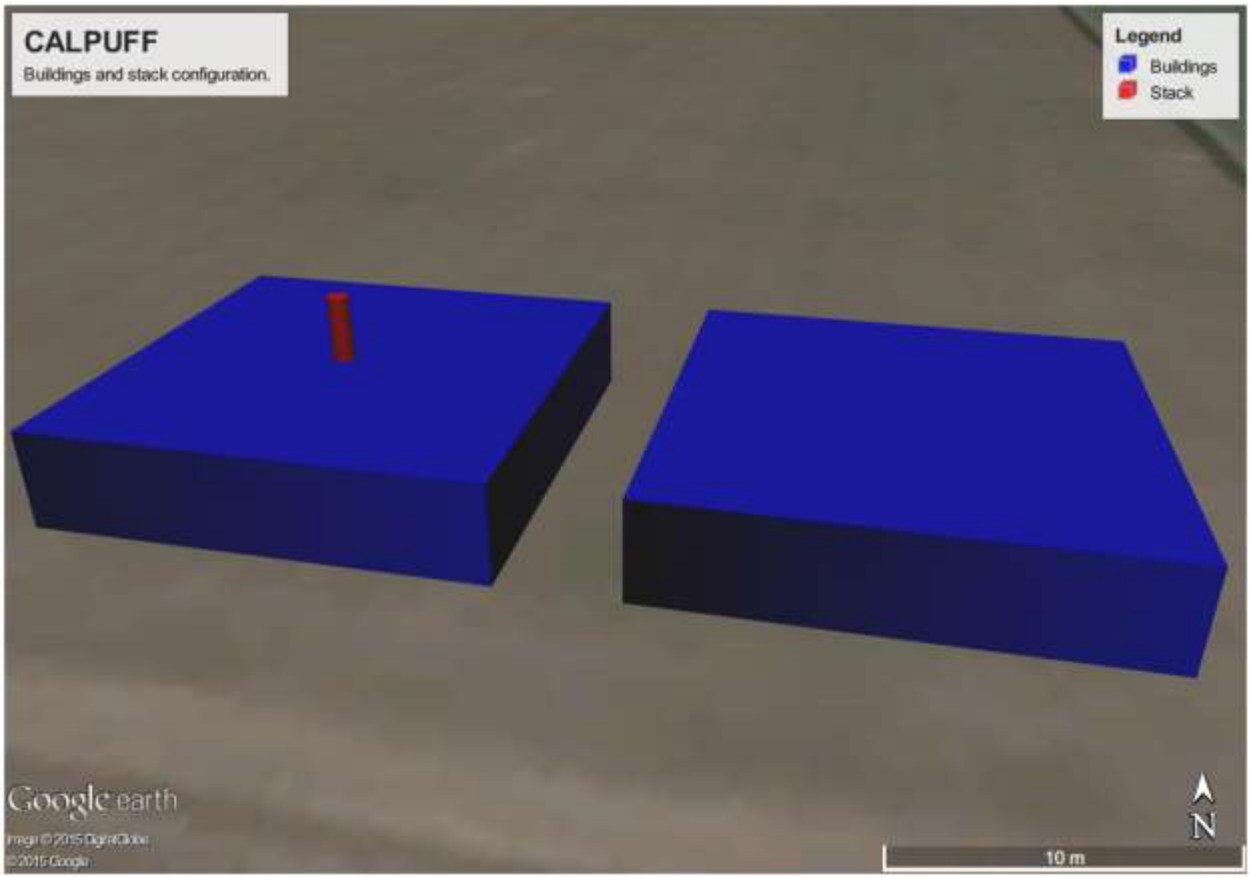

Figure 1: Buildings and stack configuration for additional CALPUFF model runs.

Results

A summary of the modelling results is provided in Table 2. In accordance with accepted modelling practice[7], maximum GLCs have been calculated for 24-hour average predictions and 99.9th percentile GLCs have been calculated to represent the predicted maximum 1-hour average. Note that the results are based on unit emission rate (1 g/s), so the predicted GLCs are only useful as relative results for comparison between the three scenarios modelled in this instance.

Table 2 shows that the taller stack, modelled in runs number 3 and number 6, resulted in lower maximum GLCs than the shorter stacks modelled in runs number 1, 2, 4 and 5, even when accounting for the significantly taller buildings.

Table 2: Model results.

Model run	Building(s) height	Stack height	Averaging period	Predicted Maximum GLC (µg/m³)
1	4.5 m	7.5 m	1-hour	713*
			24-hour	558
2	5 m	8 m	1-hour	657*
			24-hour	503
3	10 m	13 m	1-hour	278*
			24-hour	224
4 (2 buildings)	4.5 m	7.5 m	1-hour	659*
			24-hour	418
5 (2 buildings)	5 m	8 m	1-hour	583*
			24-hour	385
6 (2 buildings)	10 m	13 m	1-hour	273*
			24-hour	202

Notes: * Predicted maximum 1 hour average is based on the 99.9th percentile GLCs.

[7] MfE 2004. Good Practice Guide for Atmospheric Dispersion Modelling. Ministry for the Environment. MfE Number 522. Wellington