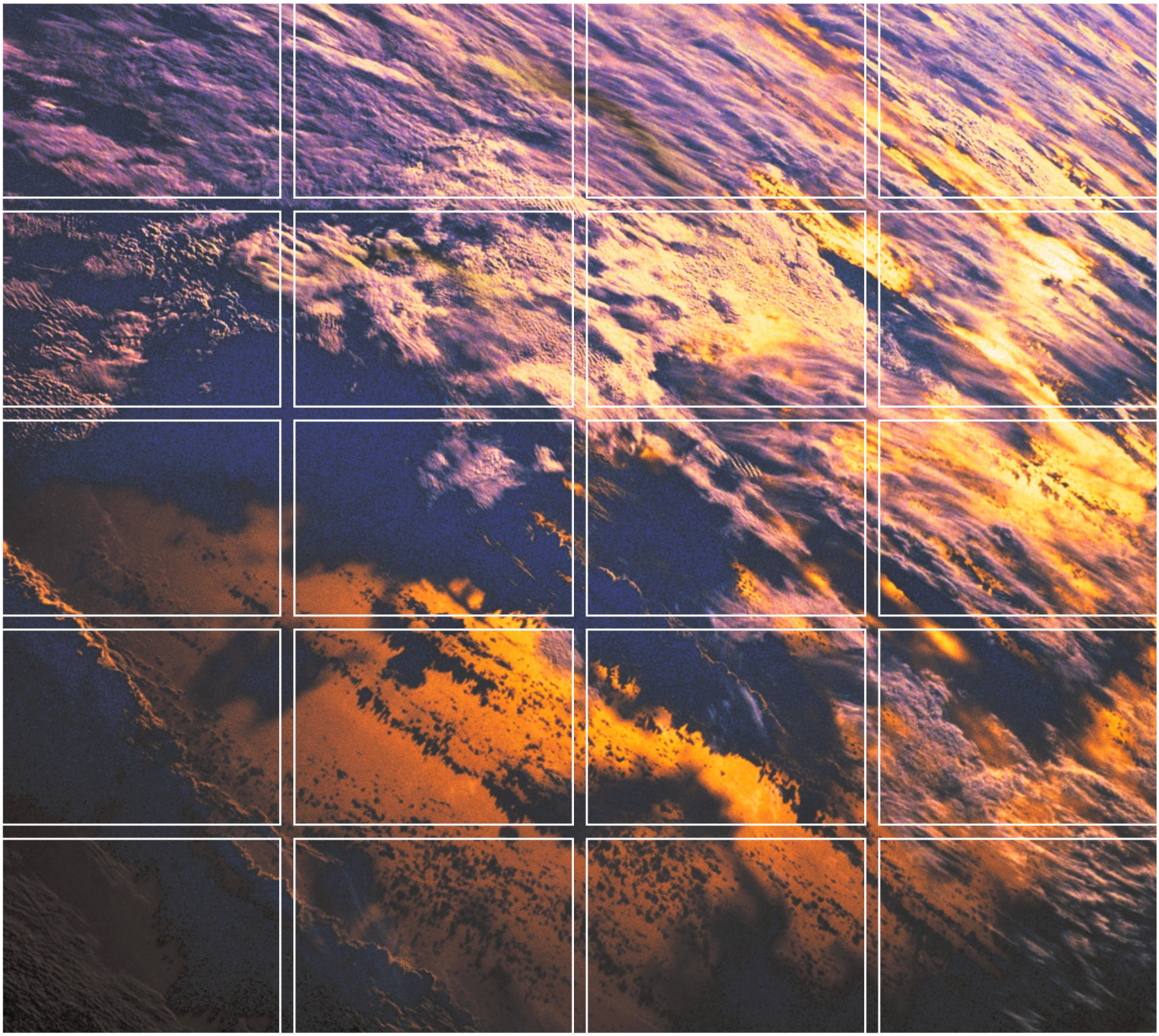


Greenvale Poultry Farm Buffer Study Review

Report

At the request of Gadens Lawyers on behalf of Mr. Sam Sassine

January 2013

0186460

www.erm.com

The world's leading sustainability consultancy

ERM

Final REPORT

At the request of Gadens Lawyers on behalf of Mr. Sam Sassine

Greenvale Poultry Farm Buffer Study Review

January 2013

Reference: 0186460

Environmental Resources Management Australia
Level 3, Tower 3 (WTC)
18-38 Siddeley Street, DOCKLANDS VIC 3005
AUSTRALIA
Telephone +61 3 9696 8011
Facsimile +61 3 9696 8022
www.erm.com

Approved by:	*Iain Cowan*
Position:	Project Manager
Signed:	
Date:	*23 January 2013*
Approved by:	*Warren Pump*
Position:	Partner
Signed:	
Date:	*23 January 2013*

Environmental Resources Management Australia Pty Ltd Quality System

Certified System
Quality
ISO 9001
SAI GLOBAL

Greenvale Poultry Farm Buffer Study Review

Report

At the request of Gadens Lawyers on behalf of Mr. Sam Sassine

January 2013

Reference: 0186460

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was prepared at the request of Gaden's Lawyers on behalf of Mr. Sam Sassine to undertake a third party review of the buffer assessment completed by GHD Australia Pty Ltd for the Growth Areas Authority (GAA) (GHD Pty Ltd, 2012). The review was completed by Dr. Iain Cowan. Dr. Cowan's statement of qualifications and requirements of Planning Panels Victoria is included in Annex A.

The GAA has indicated intention to include the land bounded by Somerton, French, Hillview and Brendan Roads (subject area) as part of the urban growth zone. This area would then be available for rezoning to residential from rural residential as indicated in the Greenvale Central Precinct Structure Plan (PSP 21).

Within the subject area is an egg farm that has been operated by its current owners since 1980. The GHD assessment considered the potential buffer distance that would be required to allow the egg farm to continue operation with surrounding development without resulting in amenity issues.

The GHD assessment assessed two scenarios:

- The continued operation of the farm at 5,000 birds;
- The potential redevelopment of the farm to accommodate 45,000 birds.

The recommendations of GHD's assessment were that:

- For a capacity of 5,000 birds a 33m directional buffer would be required, however the buffer should be increased to 100m due to historical complaints; and
- For a capacity of 45,000 birds a 140m buffer would be required.

1.1 SCOPE OF WORK

The scope of work for the review has been limited to:

- Site visit;
- Review of the approach and methodology of the buffer assessment conducted by GHD; and
- Reporting.

2 SITE VISIT

A site visit of the Greenvale Egg Farm and 690 Somerton Road was undertaken on 15 January 2013.

The current egg laying barn is limited to the south-west corner of the site. The barn is approximately 25m X 10m and is adjacent to a commercial shop. The barn has tunnel ventilation with air drawn in to the barn across cooling pads and expelled at the southern end of the barn. The exhaust fans are located beneath a hood which directs the exhaust air to the ground (*Figure 2.1*)

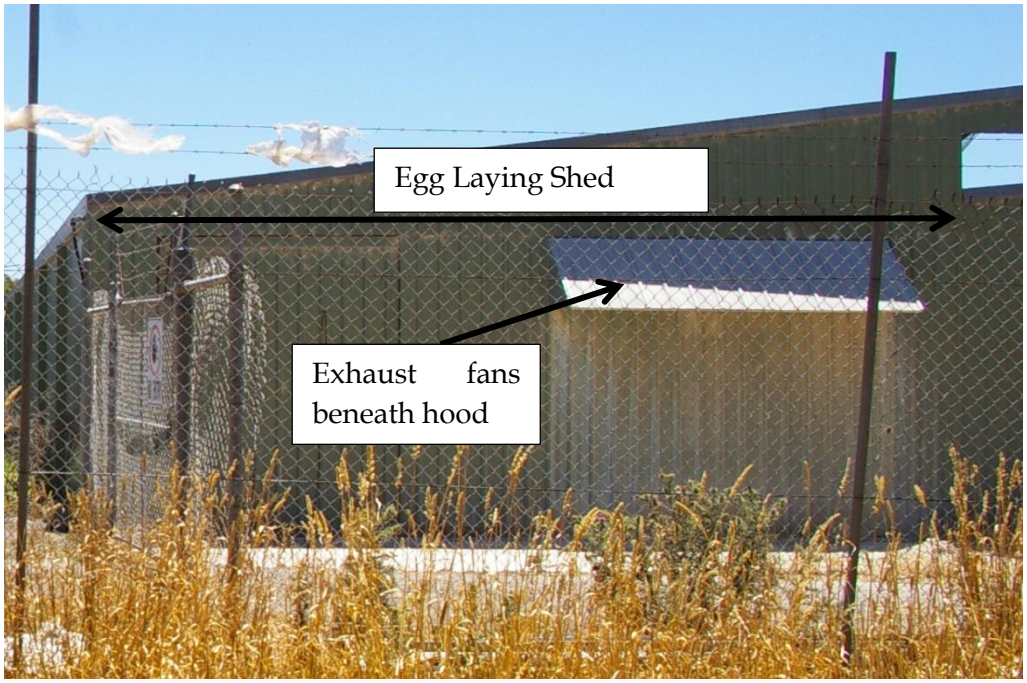


Figure 2.1 Egg laying shed with exhaust fans beneath hood

The remainder of the sheds on the site were considered to be in a poor state of repair (*Figure 2.2*). The inside of the sheds was observed to be equally in a poor state of repair with cracked concrete floors and old manure located beneath rusted cages.

A large pile of used chicken litter was located on the eastern side of the western sheds (*Figure 2.3*). The litter pile was considered to have dimensions of approximately 12m X 5m X 0.75m. The litter pile was located on bare earth below the eaves of the western shed. Saturation of the pile is also likely to result in a large odour impact where the pile becomes anaerobic and is later opened up for sale.

Figure 2.2 Unused western sheds

Figure 2.3 Front and side view of manure pile during site visit on 15 January 2013

3 BUFFER ASSESSMENT REVIEW

The assessment undertaken by GHD to define appropriate buffers for the Greenvale Poultry farm may be separated into three key phases:

- Scenario selection;
- Meteorological assessment; and
- Buffer assessment.

3.1 SCENARIO SELECTION

According to the GHD assessment, prior to 2007, the egg farm operated at a capacity of 45,000 birds housed within five sheds on the site. Subsequent to 2007, the farm reduced significantly in size with between 2,000 and 5,000 hens now located within a 250m^2 shed at the south eastern corner of the farm (Figure 2 of the GHD report).

Consequently, the buffer assessment has considered two scenarios:

- 5,000 hens within existing area (25m X 10m) – Current operation; and
- 45,000 hens in refurbished sheds - expanded operation.

3.1.1 *Current operation*

At the time of the GHD report, the farm was operating at a size of 2,000 birds however GHD's report notes that the farm is capable of operating with 5,000 birds within the current shed arrangements. The number of birds within the shed directly impacts the odour emission, and therefore it is important to understand how many birds the farm currently operates at, and how many it is intended that the farm operate at in the future.

GHD's assessment has assumed that the current barn is capable of housing up to 5,000 birds; with the given area of the barn (250m^2), this equates to 20 birds/m^2. The Primary Industry Standing Committee has published the Model Code of Practice for the Welfare of Domestic Poultry (the code) (CSIRO, 2002). Section A2.1.2 of the code specifies that stocking densities for laying fowls in a barn is 30 kg/m^2. During egg production a hen will generally grow from approximately 1.5kg to 4.5kg with hens at this property estimated to be approximately 2.7 kg (Australian Poultry CRC, 2011) (Kraan, 2013). The code specifies that to define the number of birds permitted within an area, the bird weight at the end of the growth cycle must be used. Using a bird weight of 2.7 kg, as estimated at this property, with a barn area of 250m^2, this would allow a maximum stocking of 2,778 birds; less than the 5,000 birds assumed to be present in the assessment.

3.1.2 Future operations

An increase in bird numbers from current operations has been considered by GHD, with up to 46,000 birds being housed at any one time. This is comprised of:

- 40,000 birds in single cage style production in a refurbished western shed; and
- 6,000 birds in barn style production in a refurbished eastern shed.

This figure is later revised to 45,000 birds by GHD, based on previous bird numbers at the farm.

The code requires a maximum stocking density of 40 kg/m^2 cage floor area, and for the barn style production 30 kg/m^2. Using an average weight of 2.7 kg/bird and the areas provided, the estimates provided by GHD are considered appropriate.

It is understood that currently, the GAA has conservatively adopted the recommended buffer distance of 136m based on the farm operating at 45,000 birds. It is considered inappropriate to apply a buffer calculated for 45,000 birds given that the GHD report states that:

- 'Significant' investment would be required to bring the sheds to the required standards (*Figure 2.2*);
- The current owner does not envisage increasing the farm size;
- Development approval may be required; and
- Following redevelopment of the area, it is likely that the farm will cease to exist.

Consequently, an appropriate buffer assessment should be conducted for current operations only.

This review has therefore only considered the suitability of the buffer for current operations for between 2,000 and 3,750 birds as it is considered that this is the likely operating level following development of the surrounding land.

3.2 METEOROLOGICAL ASSESSMENT

GHD undertook a meteorological assessment for data collected at Melbourne Airport by EPA in 1992. The validity of a 20 year old dataset was not considered by GHD.

To determine the validity of a 20 year old dataset, the last five years of available meteorological data from the Bureau of Meteorology[1] for Melbourne Airport was obtained.

Figure 3.1 shows the wind roses for data collected at Melbourne Airport for 2008 to 2012 inclusive. Comparison of these wind roses to Figure 6 in the GHD report indicates that:

- The pattern of wind directions collected in 1992 is similar to more recent data;
- The northerly component is stronger and the north-north-easterly component is lower. This may be due to a difference in location of the instrumentation; and
- The southerly component is lower in more recent years.

Overall, however, it is considered that the 1992 wind speed and directions used in the assessment are appropriate for use today.

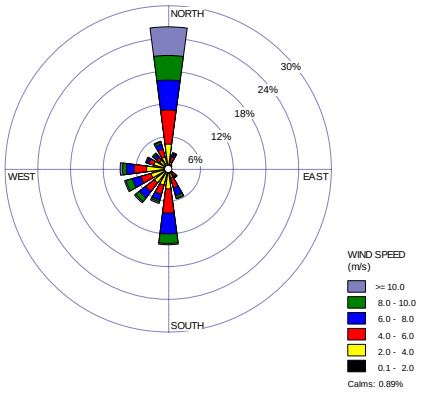
Figure 3.2 shows the frequency of stability classes for 2008 to 2012 inclusive. The stability classes have been calculated taking account of cloud cover and wind speed from the Bureau of Meteorology observations.

It is considered that the frequency of stability categories is similar between the 1992 dataset and the data collected between 2008 and 2012.

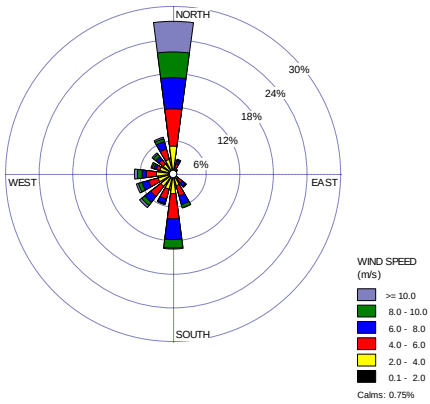
There are no significant terrain features between Melbourne Airport and the egg farm that would alter significantly the wind profile at the site compared to Melbourne Airport.

Overall, therefore, it is considered that the 1992 dataset from Melbourne Airport is representative of current conditions at the site.

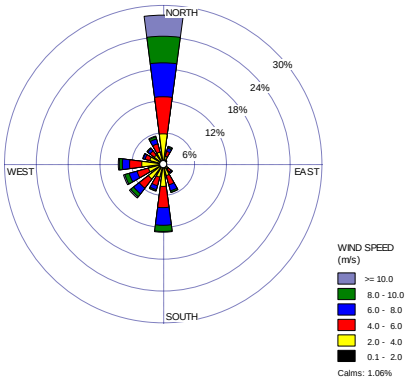
[1] EPA no longer monitor at Melbourne Airport



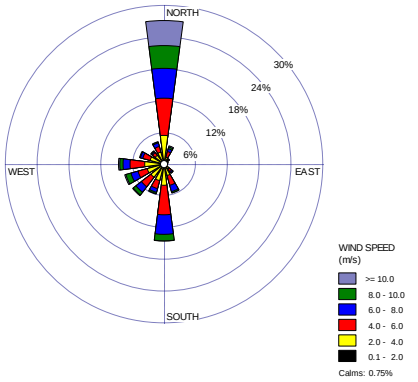
2008



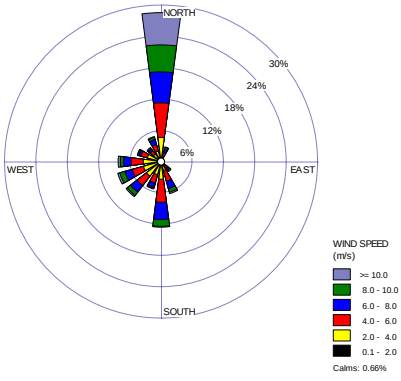
2009



2010



2011



2012

Figure 3.1 Wind roses for Melbourne Airport 2008 to 2012 inclusive

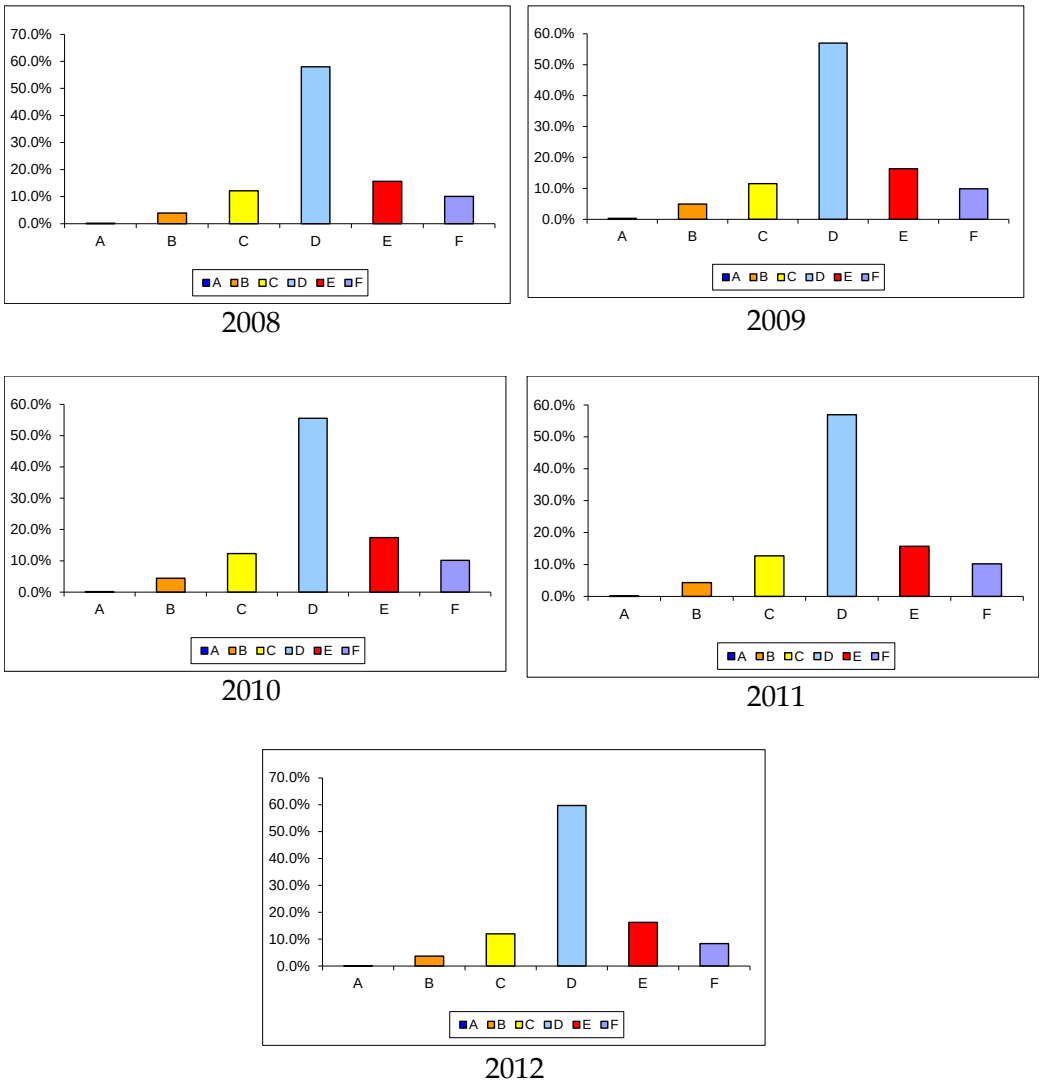


Figure 3.2 ***Frequency of atmospheric stability***

3.3 *BUFFER ASSESSMENT*

During normal operation of industry it is expected that residual emissions are below acceptable criteria beyond the site boundary. In the case of general odour within an urban area, this is considered to be 1 odour unit (OU), which in the ambient environment is not likely to be detected (Environment Protection Authority of Victoria, 2001).

Buffers are used in Victoria to protect the surrounding community during upset conditions that may eventuate due to unusual meteorology or something occurring during production. The current buffer distances within Victoria for egg production are set at 400m, with draft guidelines suggesting an increase to 500m (EPA Victoria, 1990) and (EPA Victoria, 2012). It is agreed that the increase is likely due to the increased farm size between 1990 and 2012 when the guidelines were published.

3.3.1 Typical approach to buffer assessments

The typical approach to a buffer assessment is to define upset conditions for the facility and use dispersion model to define the distance to acceptable ambient concentrations. Where it can be demonstrated that the buffer distance is less than the default as a result, for example of a smaller farm size, this may be used as a justification for the reduction of the default buffer distance.

3.3.2 GHD approach to buffer distance

The GHD assessment has used an unusual approach with the determination of appropriate buffers through the consideration of the 500m buffer distance included in the Draft Recommended separation distances for industrial residual air emissions (EPA Victoria, 2012). GHD considers that the buffer distance set within the draft guideline has been determined based on a typical egg farm size of 500,000 birds. It is noted that published data indicates that typically, farms have between three and eight sheds with an average stocking between 30,000 to 50,000 hens, indicating a maximum farm size of 400,000 birds (Australian Poultry CRC, 2011)

GHD then uses the maximum farm size of 5,000 as a factor of the typical farm size (500,000) together the exponential factor included in the separation distance calculation in the Victorian Broiler Code (Department of Primary Industry, 2009). GHD has calculated that this provides a buffer distance of approximately 33m.

Whilst not usual, the approach taken by GHD to 'derate' the buffer distance is considered appropriate as:

- Increase in odour emission rate is directly related to the number of birds (the separation distance calculation in the Victorian Broiler Code is related to the number of birds housed); and
- The exponent used is the same as that used in the separation distance calculation in the Victorian Broiler Code, which was derived from dispersion modelling of broiler farms.

Table 3.1 compares the buffer distances calculated using:

- GHD's method;
- GHD's method with a typical maximum farm size of 400,000 birds; and
- The method prescribed by the Victorian Broiler Code (Department of Primary Industry, 2009).

Table 3.1 ***Calculation of buffer distances in metres using Equation 1 in the GHD assessment and the Victorian Broiler Code.***

Number of Birds	GHD Method	ERM Adopted Values[1]	Victorian Broiler Code
2000[2]	25	29	39
2778[3]	30	34	55
5000[4]	42[6]	47	64
45000[5]	136	156	211

1 – Using maximum farm size of 400,000 birds

2 – Birds currently housed as noted by GHD

3 – Maximum number of birds allowed in 250m^2 based on typical weight of 2.7 kg

4 – Maximum number of birds considered by GHD in 250m^2.

5 – Maximum number of birds that could be housed following redevelopment

6 - The calculation provided by GHD of 33m is incorrect, and use of Equation 1 in the GHD report results in a buffer of 42m

The distances prescribed by the Victorian Broiler Code are presented in *Table 3.1* to demonstrate that the method presented by GHD provides buffer distances in the same order of magnitude. The method proposed by GHD, with the adopted farm size of 400,000 birds is preferred for this facility, as it is based on the buffer distance for egg production, which has lower odour emissions than broiler production and a referenced value for typical farm sizes in Australia.

From *Table 3.1*, it is clear, that the number of birds to be housed at the farm needs to be known, as this forms the recommended buffer distance. It is considered that the appropriate number for this farm should be 2,778 birds, as this is the maximum number of birds permitted in 250m^2, based on a typical hen weight of 2.7 kg, and the likelihood of farm expansion is very low.

GHD considered that the buffer calculated using this approach was not sufficient for the current situation and therefore proposed the default buffer distance of 100m. The use of a 100m buffer was adopted for two reasons:

- The minimum default for buffer distances in the EPA guidelines is 100m; and
- Historically, complaint has been received from 50 French Road and 690 Somerton Road (directly to the north and south of the farm respectively).

EPA Default Buffer

GHD's assessment refers to the minimum default buffer of 100 metres within the EPA guidelines. The existing buffer distance guidelines and draft separation distance guidelines do not specifically refer to a minimum default value of 100m, rather the minimum buffer distance provided in the tables is 100m (EPA Victoria, 1990) and (EPA Victoria, 2012).

It is considered that this does not mean that EPA recommends a minimum of 100m be used for any industry; rather an appropriately sized buffer should be in place for the size of the operation being used.

Further, with the maximum farm size able to be 2,778 birds, based on an average bird mass of 2.7 kg, it is questionable as to whether the site should be classed as industrial, and whether the buffer distances apply to this farm.

Historical Complaint

In assessing a suitable buffer distance for an operation, consideration of historical complaint is an important consideration. Complaint history provides an indication of the distance at which impact may occur during upset conditions and therefore the distance at which the buffer should be placed.

The GHD assessment considers complaints from the properties immediately to the north and south of the egg farm. The cause of the complaints is attributed to:

- North of the site – storage of manure in bags that generates odour in hot weather due to retention of moisture in the polythene bags; and
- South of the site – ventilation exhaust at the southern end of the shed.

Discussion by the author of this report with the owner of southern property has provided further insight to the cause of the complaint than was available to GHD. The owner of the property to the south has indicated that the odour complaints, since conversion to a barn-laid operation, has resulted from the manure storage piles to the east of the main sheds at the southern end of the property.

During the site visit on 15 January 2013, the strongest odour was considered to be generated from the manure pile located behind the western sheds, with a very low odour generated from the exhaust of the egg laying shed.

At the time of the site visit, it was estimated that the manure pile contained approximately 45m^3 of manure (based on estimated dimensions of 12m X 5m X 0.75m high) (*Figure 2.3*). Examination of Figure 4 in the GHD assessment report indicates that the manure pile was significantly longer than observed during the site visit indicating a manure pile of approximately 30m length (150m^3).

In a broiler farm setting litter generation is expected to be 0.5kg per 1kg of live weight over the 7 week growth period, indicating a volume of approximately 8m^3 for 2,000 chickens over 7 weeks (FSA Consulting, Year Unknown), (Poultry Hub, 2013) and (Green Soil Service, 2008). Litter production from barn egg production is expected to be less than for broilers as there is less floor area with litter, and excreta are collected on conveyor belts below the feeding and egg laying area.

Consequently, it is considered that the amount of manure observed during the site visit and evident from the aerial photographs included in the GHD report is large for 2,000 chickens currently present on site and therefore presents a potentially large odour source compared to the size of the farm.

GHD notes, in relation to the odour impact from the bagged manure that relocation can readily be achieved to reduce odour impact. Similarly, ERM considers that relocation of the manure piles, and better management would be expected to significantly reduce potential odour impacts to the south of the site. Correct storage of only litter produced by the farm in the centre of the site, would for example be expected to contain the generated odour within the site boundaries. Best practice guidance for the storage of manure is detailed in the Environmental guidelines for the Australia Egg Industry, and includes:

- Appropriate design of spent litter stockpiles to ensure they can freely drain and not pond water;
- Using of bunding to prevent entry and contamination of stormwater runoff;
- Installation of an impermeable base on spent litter stockpiling areas; and
- Installation of a dam to catch runoff from outdoor stockpile areas (Australian Egg Corporation Limited, 2008).

The remaining odour generated from the barn would be incorporated within the buffers estimated using Equation 1 in the GHD assessment. It is recommended however that a maximum farm size for Australian conditions of 400,000 birds is used as this is based on recently published data. For the current maximum stocking density of 2,778 birds, based on a bird mass of 2.7 kg, this would result in a 34m buffer.

Directional buffer assessment

Rather than use a unidirectional buffer, GHD used local meteorology to define a directional buffer. This was achieved through the use of dispersion modelling together with a nominal emission rate of 10 OUV/m^2/sec and an area source of 100m^2 for the current operation.

This approach was not intended to represent actual emissions from the farm, or provide the anticipated odour concentration from farm operations. Rather, dispersion modelling was used to define a directional contour that approximated the area of the 100m buffer taking in to account ambient weather conditions, where the requirement for the 100m buffer has been pre-determined using the methods discussed above.

For the intended purpose, the approach adopted by GHD for the generation of a direction buffer is appropriate. However, the presentation of the results for the directional buffer pre-supposes that the use of a 100m buffer for current operations is correct. As discussed, the reasons for the selection of the 100m buffer assume that the emissions from the barn are the cause of odour impact to the south, where in reality it is more likely that this was caused by poor management of large manure stock piles.

It is therefore recommended that the results of the modelling be used to adopt a directional buffer at 36m from the source.

4 CONCLUSION

Environmental Resources Management Australia Pty Ltd (ERM) was prepared at the request of Gadens Lawyers on behalf of Mr. Sam Sassine to undertake a third party review of the buffer assessment completed by GHD Australia Pty Ltd for the Growth Areas Authority (GAA) (GHD Pty Ltd, 2012). The review was completed by Dr. Iain Cowan.

The scope of for the review has been limited to:

- Site visit;
- Review of the approach and methodology of the buffer assessment conducted by GHD; and
- Reporting.

The site visit was conducted on 15 January 2013, the main findings from the site visit were:

- The barn currently used for egg production is located on the south-west corner of the western shed area and is approximately 25m X 10m in area;
- The remainder of the sheds on site are in a poor state of repair and would require investment to bring the sheds to a standard where they could be used for egg production;
- A pile of chicken litter is located on the eastern side of the western shed area; and
- The chicken litter pile was considered to be the main source of odour from the site, with minimal odour generated from the operating shed.

Following review of the GHD assessment, it is considered that:

- The approach adopted by GHD, whilst unusual for a buffer study, provides a valid approach;
- The likelihood of future redevelopment of the site to house 45,000 birds is very low due to the 'significant' investment required, the likely requirement of development approval and GAA's opinion that following development of the area the farm would cease to exist;
- The adoption of a 136m buffer is inappropriate as this relates to the use of the site for 45,000 birds which is considered unlikely;
- The adoption of a 100m buffer is inappropriate as this is based on a historical odour complaint that was incorrectly attributed to exhaust emissions from the barn rather than from stored litter / manure; and
- The adoption of a 34m buffer is recommended, this relates to the housing of 2,778 birds in the current laying shed. 2,778 birds is the maximum number of birds that may be housed within this space within current welfare legislation, based on a average bird size of 2.7 kg.

5 REFERENCES

Australian Egg Corporation Limited. (2008, June). *Environmental Guidelines for the Australian Egg Industry.* Retrieved January 17, 2013, from Australian Egg Corporation Limited: http://www.aecl.org/system/attachments/178/original/Environmental_Guidelines_for_the_Australian_Egg_Industry.pdf?1253233923

Australian Poultry CRC. (2011, September 25). *Dust and Odour Emissions from Layer Sheds.* Retrieved January 16, 2013, from Poultry Hub: http://www.poultryhub.org/wp-content/uploads/2012/07/Final-Report-04-45-Layers.pdf

CSIRO. (2002). *Model Code of Practice for the Welfare of Domestic Poultry.* Retrieved January 16, 2013, from CSIRO Publishing: http://www.publish.csiro.au/Books/download.cfm?ID=3451

Department of Primary Industry. (2009). *Victorian Code for Broiler Farms.* Retrieved January 17, 2013, from Department of Primary Industry: http://www.dpi.vic.gov.au/__data/assets/pdf_file/0015/36051/Broiler-Code-Chapters-1-5.pdf

Environment Protection Authority of Victoria. (2001). *State Environment Protection Policy for Air Quality Management.* Melbourne: Victorian Government Printer.

EPA Victoria. (1990, July). *Recommended buffer distances for industrial residual air emissions (AQ 2/86).* Retrieved January 17, 2013, from Environment Protection Authority of Victoria: http://epanote2.epa.vic.gov.au/epa/publications.nsf/2f1c2625731746aa4a256ce90001cbb5/5e4d899b28bcfe404a2565fc0008e3d4/$FILE/Aq286.PDF

EPA Victoria. (2012, October). *Draft Recommended separation distances for industrial residual air emissions.* Retrieved January 17, 2013, from Environment Protection Authority of Victoria: http://www.epa.vic.gov.au/~/media/Publications/1506.pdf

FSA Consulting. (Year Unknown). *Meat Chicken Technical Environmental Note 2 - Manure Production and Spent Litter Composition.* Retrieved January 18, 2013, from FSA Consulting: http://www.fsaconsulting.net/pdfs/Note%202-Manure%20Production%20%20Litter%20Composition%20V2.pdf

GHD Pty Ltd. (2012). *Odour Impact Assessment - Egg Layer Farm Buffer Review.* Melbourne: GHD.

Green Soil Service. (2008, December 6). *Chicken Manure.* Retrieved January 18, 2013, from Green Soil Services: http://sapropel.ucoz.com/load/6-1-0-12

Kraan, J. (2013). *Statement of Evidence - Greenvale Poultry Farm.*

Poultry Hub. (2013). *Poultry Litter.* Retrieved January 17, 2013, from Poultry Hub: http://www.poultryhub.org/production/husbandry-management/housing-environment/poultry-litter/

Annex A

Planning Panel's Victoria Requirements For Expert Evidence

A.1 Name and address

Dr. Iain Cowan
Environmental Resources Management Australia Pty Ltd
Level 3, Tower 3
18-38 Snidely Street
World Trade Centre
Docklands
VIC 3005

A.2 Qualifications, experience and areas of expertise

Details of my qualifications, experience and areas of expertise are detailed in my curriculum vitae which may be found in Annex B.

A.3 Expertise in preparing this report

I have undertaken numerous studies over more than twelve years in the field of odour investigations and atmospheric dispersion modelling. This has incorporated projects in relation to odorous emissions from broiler farms, compost facilities, landfills and industrial emissions.

A.4 Other significant contributors to the report

The report has been prepared by Dr. Iain Cowan as the sole author of this report. The report was reviewed, prior to submission by Mr. Warren Pump. Mr. Pump is an EPA appointed auditor for contaminated land.

A.5 Instructions that define the report

I was instructed to prepare a report in a letter dated 21 December 2012. The letter provided a general background of the issues and requested completion of the scope identified in Section *1.1* of this report.

A.6 Identity and qualifications of the person who carried out any tests or experiments upon which the expert relied in making the report

No tests or experiments were undertaken specifically for the preparation of this report.

A.7 Facts matters and all assumptions on which the report proceeds

The report has been prepared with reliance placed on the:

- GHD Buffer Assessment for Greenvale Farm; and
- Documents listed in Section *5* of this report.

A.8 Referenced documents

A list of documents referenced in this expert witness report may be found in Section 5 of this report.

A.9 Statement

Having reviewed the buffer assessment it is my opinion the 136 m buffer, adopted by the GAA is not appropriate as:

- 'Significant' investment would be required to bring the sheds to the required standards;
- The current owner does not envisage increasing the farm size;
- Development approval may be required; and
- Following redevelopment of the area, it is likely that the farm will cease to exist.

I consider that the 100 m buffer, suggested by GHD for the current farm size is not appropriate as:

- The current hen housing at the farm can accommodate a maximum of 2,778 hens, based on an average hen size of 2.7 kg, rather than 5,000 assumed by GHD;
- It is questionable as to whether a farm of 2,778 birds should be classed as industrial, and therefore whether the buffer distances apply to this farm; and
- Odour complaint from the southern property was the result of odour generated from manure storage rather than the laying barn as assumed by GHD.

Having considered the GHD assessment it is my opinion that a 34m buffer would be adequate buffer to contain odour impact from surrounding land uses. The use of a 34 m buffer is dependent on:

- The maximum number of hens being housed on the property being 2,778 within the existing arrangement;
- The limitation of manure storage at the facility to the manure produced at the facility;
- The correct storage of the manure to prevent over wetting and anaerobic conditions; and
- The movement of manure storage away from the boundary of the property.

A.10 Relationship between the expert witness and the party for who the report is prepared

I am employed by Environmental Resources Management (ERM) Australia Pty Ltd, who has a commercial relationship for the provision of this expert witness report with Mr. Sam Sassine. The report has been prepared at the request of Gadens Lawyers and independently of Gadens Lawyers and Mr. Sam Sassine, and forms my opinion of the buffer distance assessment.

A.11 Declaration

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

Dr. Iain Cowan
For ERM Australia Pty Ltd.

Annex B

Curriculum Vitae

Dr. Iain Cowan

Principal Consultant, Air Quality
ERM Melbourne Australia

Dr. Iain Cowan is a consultant within ERM based in Melbourne

Iain Cowan provides extensive experience in the modelling and monitoring of air quality and odour within the United Kingdom and Australia. Iain has extensive experience with several advanced dispersion modelling packages including Calpuff, Ausplume, AERMOD, TAPM, ADMS-Urban, EDMS, CHARM, and AusRoads. He has used these packages, incorporating specialised emission inventories, to model atmospheric emissions / odour and emergency releases from a variety of sources including natural gas processing / transportation, power generation, petroleum industry, mining, metals refining, landfills, aircraft, road traffic and trains. This modelling has been undertaken in preparation for expert wintess testimony, environmental statements, environmental impact assessments as part of regulatory compliance and the planning process. Iain has modelled and monitored air quality for many prestigious projects and clients including Chevron, Santos, AGL, Australian Pipeline Association, Origin Energy, Lihir Gold, CSL, Melbourne Airport and Mobil in Australia as well as the London Olympic Bid, the Welsh Development Agency, the Highways Agency and the London Development Agency in the UK.

Dr. Cowan has more than 12 years of experience in the field of air quality assessment.

Memberships

- Member of the Clean Air Socity of Australia and New Zealand

Fields of Competence

- Dispersion modeling using CALPUFF, AERMOD, TAPM, Ausplume, AusRoads, ADMS and Charm.
- Industrial emissions
- Transport related emissions
- Odorous emissions
- Emissions Inventory Generation
- Expert witness testimony

Education

- PhD Environmental Engineering, University of Surrey, UK, 2004
- BSc Honours, Environmental Geology, Royal Holloway College, University of London, UK, 2000

Languages

- English, native speaker
- French, conversational

Key Industry Sectors

- Expert Wintess Testimony
- Oil and gas
- Mining
- Contaminated land
- Power generation
- Waste (landfills, composting and water)
- Chemical production
- Manufacturing
- Transporation

Honors and Awards

- Clean Air Society Young Achiever Award
- EPSRC Stipend for PhD Research

Publications

- Cowan, I.M., Radford, A.L. and Grynberg, H., 2011. Use of Dispersion Models in the Assessment of Impacts from Spray Evaporation. Clean Air Society for Australia and New Zealand Conference, 31 July – 2 August 2011, Auckland, New Zealand
- Radford, A.L., Cowan, I.M., 2011. 'Comparison of Near Field Impacts of Emergency Release Determined by Ausplume and Charm. Clean Air Society for Australia and New Zealand Conference, 31 July – 2 August 2011, Auckland, New Zealand
- Corbet, L.C; Cowan, I.M; Stella, N. and Brooke. A.; 2009, The Integration of two regulatory dispersion models for a holistic approach to air quality assessment; Clean Air Society for Australia and New Zealand Conference, 6th – 10th September 2009; Perth, Australia
- Cowan, I.M.; 2007, Use of GIS as an air quality screening tool for planners and policy makers – Partnerships between local government and academia; International Union of Air Pollution Professionals World Congress, 10th-13th September 2007; Brisbane, Australia
- Cowan, I.M.; 2004; The Development and Application of and Advanced Screening Model to Predict Air Quality Thesis (PhD). University of Surrey

Key Projects

Odour Assessments

- EPA Victoria – Development of an guideline for undertaking a environmental odour risk assessment for proposed broiler farms.
- Anonymous – Industrial odour assessment for a Halal Abattoir within Melbourne. Assessment required the generation of a site odour emissions inventory and modelling using Ausplume.
- Mobil Oil Australia – Works Approval Application for Mobil Oil Australia for odour treatment system for delivery and storage of fuel oil.
- Mobil Oil Australia – Numerous odour dispersion modelling studies for different grades of fuel oil delivered to terminal, to determine potential impact on surrounding community.
- Norfolk Environment Waste Services – Odour assessment for landfill site. Odour emissions inventory for open and capped cells and landfill gas turbines. Modelled and assessed the impacts of odour using Aermod.

Expert Witness Testimony

- Lynn White – Expert witness at VCAT regarding the expansion of a free range broiler farm in Bayles, Victoria. Review of the planning application for expansion of the broiler farm indicated that exisiting and future odour impact from the broiler farm had not been considered in the application. Evidence was given to the panel regarding the potential for odour impact from the exisiting and proposed activities.
- Innova Pty Ltd – Expert witness at VCAT hearing for a proposed permanent soil remediation facility in Altona. Evidence was provided to the Tribunal regarding the efficacy of the emission reduction

technology included as part of the soil remediation technology, and whether this complies with environmental legislation and requirements.

- EPA – Expert witness at VCAT hearing for two proposed broiler farms adjacent to four existing broiler farms near to Nagambie, Victoria. Dispersion modelling of odour from the existing and proposed broiler farms was undertaken to demonstrate existing and future impact with the proposed farms. Dispersion modelling of odour from the broiler farms was undertaken using the CALPUFF modelling system to take advantage of the lower thresholds for wind speed that can result in high odour impact. Modelling using five years of meteorology was undertaken to assess the impact from highly variable broiler growth cycles.
- AGL Pty Ltd – Expert witness at Planning Panels Victoria for a proposed peak loading gas fired power station in the west of Victoria. Advanced dispersion modelling used the CALPUFF modelling system, and incorporated observed ground level and upper air observed meteorological conditions. The assessment has considered start-up conditions on a sub-hourly basis and base load operations on an hourly basis, in addition to taking account of a further proposed base load power station by another operator in the vicinity. Following submission of the Works Approval Application to EPA, a presentation of the potential impacts was made to the Victorian Planning Panel.
- Yarra Ranges Shire Council – Expert witness at VCAT hearing for compost odour impacting a local community. Dispersion modelling of odour from the compost facility was undertaken using the CALPUFF modelling system due to local terrain and meteorology resulting in cool air drainage from surrounding hills and air flow through a valley system.
- Otway Shire Council – Expert witness at VCAT hearing for proposed broiler farm with potential to impact on local community. Review of dispersion modelling undertaken by the proponent and dispersion modelling to show impact using alternative modelling methodologies.
- Grinders Coffee – Expert witness at VCAT hearing for proposed expansion of operation at a coffee roasting facility. Preparation of expert witness testimony included dispersion modelling of proposed emissions from the facility, and assessment of impacts on the surrounding community.

Mining

- Weda Bay Nickel – Dispersion modelling study as part of ESIA to determine impact from mining and process plant activities. Dispersion modelling considered multiple scenarios for variation throughout the mining schedule and included deposition of metals associated with particulate matter within the ore on the surrounding land area.
- Rio Tinto –Review of potential climate and meteorological impacts determined by the UK Meteorological office as a result of the proposed mine adjacent to the Simandou Ridge in Guinea, West Africa.
- Cedar Point –Assessment of impact from dust for a proposed quarry in New South Wales. Dispersion modelling used the CALPUFF modelling system and required development of a meteorological model for the local area followed by emission estimation and dispersion modelling.

- Xstrata Zinc – Internal technical peer review and guidance for an impact assessment for a five million tonne per annum zinc-lead and silver deposit.
- Lihir Gold Limited – Comprehensive impact assessment as part of an EIA for expansion of the mine processing area. The project included emissions inventory generation and modelling for power generation, process plant, unmade road dust generation, tailpipe emissions. Complex dispersion modelling was undertaken using the CALPUFF modelling system to account for steep terrain surrounding the site on three sides and the ocean on the fourth side.
- Bendigo Mining Limited – Revised operational procedures required the modelling of particulate and hydrogen cyanide emissions using Ausplume from operations at a proposed mine for comparison with the approved program.
- BHPB – Dispersion modelling of dust generation for a proposed mine expansion in Queensland. Dispersion modelling included development of a meteorological model for the local area, emissions estimation for a number of sources and dispersion modelling using Calpuff.

Emissions Estimation

- Qantas Airways Ltd –NPI reporting for Qantas Airways for sites across Australia since 2009. Annual reviews product usage at all Qantas facilities across Australia to determine the reporting requirements. Emission estimation of NPI species to air, land, water and transfers are then reported to NPI on behalf of Qantas.
- Shell Australia Pty –NPI reporting for Shell's distribution and airport terminals for the 2008/2009 reporting year. Review of product usage at all Shell facilities across Australia to determine the reporting requirements. Emission estimation of NPI species to air, land, water and transfers are then reported to NPI on behalf of Shell.
- Ford Motor Company of Australia –NPI reporting for Ford's Geelong facility. Review of product usage to determine reporting requirements and estimates emission of NPI species to air, land, water and transfers. The emission estimates are then reported to NPI on behalf of Ford.
- South-East Water –NPI reporting for South-East Water. Reviews of processes at all of South-East Water's treatment plants and estimates emissions to air, land and water for reporting to NPI.

Contaminated Land Management

- Jemena – Evaluation of emissions from contaminated sediments during remediation activities to evaluate potential for odour impacts during remediation activities. Project included measurement of odorous emissions from the contaminated sediments and dispersion modelling using CALPUFF.
- Anonymous – Evaluation of emissions from land contaminated with TCE during renewal of a concrete slab within an industrial facility. Assessment of impact undertaken using dispersion modeling to determine impact on surrounding sensitive receptors.
- Exxon Mobil – Evaluation of emissions from an air stripper and thermal oxidiser for the remediation of contaminated ground water in Melbourne. Evaluation included the use of Ausplume to demonstrate potential for impacts to surrounding land use.

- Shell – Evaluation of emissions from a mobile thermal oxidiser used to treat contaminated ground water in rural New South Wales.
- Anonymous – Evaluation of emissions from contaminated land during remediation activities for the construction of a new hardware store. Assessment included fluxhood mornitoring of emissions from the contaminated soil, dispersion modelling and recommendation for minimisation of impact during remediation.

LNG Facilities

- Anonymous – An initial screening assessment of a proposed LNG facility in northern WA was undertaken to determine the potential impact from operation on surrounding facilities using Ausplume.
- Anonymous – Air Quality assessment as part of EIS for new LNG plant in Queensland. TAPM and CALMET used to generate local meteorological conditions with CALPUFF used for dispersion modelling.
- PNG LNG – Air quality dispersion modelling using CALPUFF for two potential suppliers to the PNG LNG facility to the west of Port Moresby in Papua New Guinea. The assessment comprised sourcing local meteorology and land use information. Developing appropriate meteorological files for the site through the use of TAPM and CALMET, and dispersion modelling of all sources using CALPUFF.
- Anonymous –Air quality impact assessment of a proposed LNG facility in northern Tasmania as part of an effect statement. TAPM was used with locally measured meteorological data to generate inputs to Ausplume and Ausroads. Assessments of emissions from industry were undertaken using Ausplume, whilst emissions from vehicles using the local road network were modelled using AusRoads. The combination of results from Ausplume and AusRoads, for a small local network, enabled the provision of a cumulative impact assessment for sources with changed emissions.

Domestic Gas Facilities

- Anonymous – An initial screening assessment for a proposed domestic gas facility in northern WA was undertaken to determine the potential impact from operation on surrounding facilities using Ausplume.

Industrial

- BPFL – Impact assessment of acid deposition resulting from emissions from a proposed ammonium nitrate plant on the Burrup Peninsula, WA. The study included consideration of atmospheric chemistry, dry and wet deposition in addition to atmospheric formation of particulate matter.
- Holcim Cement – Impact assessment of emissions from a concrete batching plant in Margaret River, WA. Emissions estimation of particulate matter arising from material deliveries, movement and loading of concrete to the mixture trucks was undertaken and dispersion modelling completed using CALPUFF.
- Orica Mining Services – Impact assessment of emissions from a proposed Ammonium Nitrate Emulsion plant near to Port Hedland, WA. Emission estimation was completed using manufacturer guarantees and dispersion modelling completed using CALPUFF.
- Brimbank City Council – Expert witness at VCAT for a proposed solid inert waste landfill adjacent to an existing concrete batching / crushing plant in north-

east Melbourne. In preparation for the VCAT hearing. Three months of dust deposition monitoring were undertaken, and dispersion modelling of the existing concrete crushing / batching plant and proposed development of a solid inert waste landfill.

- Sun Metals Limited – Impact assessment of spray drift on surrounding land use from the use of spray evaporators within tailings ponds to reduce pond levels. Dispersion modelling was conducted using the CALPUFF modelling system on a sub-hourly basis using local ground level and upper air meteorological observations as a basis for dispersion modelling.
- Holcim Cement – Impact assessment of emissions from a cement manufacture plant in New Zealand. Local terrain with a bluff adjacent to the stack meant that complex dispersion modelling using the CALPUFF modelling system was required. Local surface and upper air meteorological observations were used with terrain and land use to develop a CALPUFF compatible meteorological file that was able to account for the local geography.
- CSL Limited – Generation of emissions inventory and completion of dispersion modelling using Ausplume in the assessment of formaldehyde release to atmosphere following the sterilisation of laboratories at two facilities.

Power Generation

- SCB PTES – Assessment of a proposed expansion to a based load and peak load power generation facility in Sulawesi Selatan.
- AGL Limited – Assessment of proposed peak loading gas fired power station in the west of Victoria. Advanced dispersion modelling used the CALPUFF modelling system, and has incorporated observed ground level and upper air observed meteorological conditions. The assessment has considered start-up conditions on a sub-hourly basis and base load operations on an hourly basis, in addition to taking account of a further proposed base load power station by another operator in the vicinity. Following submission of the Works Approval Application to EPA, a presentation of the potential impacts was made to the Victorian Planning Panel.
- AGL Limited– Assessment of proposed change in operating hours from peak loading to base load capacity for a gas fired power station in northern Melbourne.
- Origin Energy – Impact assessment of a proposed change in fuel use and construction of a new turbine at a facility in northern Queensland. The assessment incorporated the generation of a meteorological dataset, dispersion modelling and assessment and the use of a regulatory airshed model for the local city.
- Origin Energy – Determination of minimum stack height for the redevelopment of a gas fired power station in central Queensland. The assessment incorporated the development of a meteorological dataset and the modelling of emissions from a variety of stack heights, taking in to account building downwash to finalise the redevelopment design.

Emergency Release Modelling

- Orica – Emergency release assessment of emissions from the nitric acid stack and consideration of potential of impact on other site buildings through the use of near field dispersion modelling at an ammonium nitrate plant.
- Anonymous – Emergency release modelling of CO_2 storage facility to determine potential impact from the

puncture of CO_2 tanks on surrounding housing, roads, stock, fauna and flora.

- Gasnet Pty Ltd – Emergency release modelling of natural gas from a gas compression station on a second by second basis to define the development of the plume area over the period of the release and classify the extent of the hazardous area.
- Australian Pipeline Association – Emergency release modelling of natural gas at a gas compression station from within a building. The study was used to determine the time taken for gas to exit the building during an accidental release, and to determine whether concentrations would be elevated in locations where sensors had been placed as part of the emergency shut-down mechanism.

Transport

- Cikampek-Palimanan Toll Road – Assessment of a proposed toll road in Indonesia. Modelling included determination of diurnal emission rates followed by dispersion modelling using CALQ3HCR.
- Hoddle Street Study – High level qualitative option review and detailed dispersion modelling of options for the redevelopment of Hoddle Street in Melbourne. Qualitative review of multiple options based on vehicle numbers / traffic mix and expected relative emissions from the options. Detailed modelling undertaken using AusRoads and AusVeh emission factors for anticipated traffic volumes for three potential route options.
- Melbourne Airport Limited – Undertook complete modelling exercise of airport pollution sources including the aircraft, roads, parking facilities, jet engine testing and training fires to develop a concentration map of pollution using US FAA dispersion model EDMS. Modelling incorporated all aircraft movements from the terminals to the runway, take-off and landing and use of runway / taxiways varying with wind direction.
- Bankstown Airport - Assessment of the impact on local air quality of moving the engine run-up bay from the current position to a new location at the north-eastern end of Bankstown airport. The assessment has used the regulatory dispersion model AUSPLUME to model concentrations of oxides of nitrogen (NO_X), carbon monoxide (CO) and oxides of sulphur (SO_X).
- London Development Agency – Assessment of the impacts of traffic generation, construction and on site sources of the London Olympic Bid to the surrounding population. Modelling undertaken using ADMS-Roads.
- Highways Agency – Design Manual for Roads and Bridges (DMRB) Impact assessment of the extension of the M6 to the Scottish border.
- Welsh Development Agency – Guidance on Multi-Modal Assessment (GOMMS) Impact assessment for the construction of a bypass
- Wiltshire County Council – Development of a specialised emissions inventory for modelling of transport emissions in a town with roads at high gradient. Modelling was undertaken using ADMS-Roads and used to assess options for reducing ground level concentrations by changing traffic flows on the road network.
- Highways Agency – Secondment to the Highways Agency (major road regulator within England) to assist with the implementation and development of

policy with regard to the assessment of the impacts of road projects on local air quality.

- Bristol NHS Trust – Impact assessment using ADMS-Roads of the redevelopment of two hospitals on local air quality incorporating the increase in vehicle numbers and the use of emissions control technologies for new generators.