

13 October 2009

Ian Grant
Wagga Wagga City Council
Via email: grant.ian@wagga.nsw.gov.au

Dear Ian

Re: Bomen Industrial Park – odour assessment

Holmes Air Sciences (now PAEHolmes) prepared an air quality impact assessment in January 2008 for Willana Associates (**Holmes Air Sciences, 2008**) to assist Wagga Wagga City Council in their review of future development near the Bomen Industrial Area.

It is understood the Cartwrights Hill Group have challenged the veracity of the study on the basis that it did not include a survey of the opinions of Cartwrights Hill residents.

PAEHolmes understand that there have been ongoing complaints in the area relating to odour emissions from the Bomen Industrial Area. In the order of 440 odour complaints have been lodged since 1997 to now. However, we also note that the Cartwrights Hill Group in its representations to Council suggest there is no longer any odour issue in the area.

The 2008 air quality impact assessment was a qualitative assessment of the odour emissions from Bomen Industrial Estate. This involved the use of a dispersion model (AUSPLUME) in combination with representative meteorological data and odour emissions data to predict the impacts at the residential areas. AUSPLUME is the most widely and commonly used computer model in Australia for dispersion modelling.

The predicted impacts were compared with the relevant assessment criteria to determine if there is potential for a negative impact.

The following paragraphs are provided in way of explaining the nature of odour and the reasoning behind the odour impact assessment criteria.

Science of odour

The detectability of an odour (i.e. whether someone smells it or not) is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. The theoretical minimum concentration is referred to as the "odour threshold" and is the definition of 1 odour unit (ou). Therefore, an odour concentration of less than 1 ou would theoretically mean there is odour.

In practice, the character of a particular odour can only be judged by a person's reaction to it. The level at which an odour is perceived to be a nuisance can range from 2 ou to 10 ou depending on the combination of a number of factors. The most important factors (the so-called FIDOL factors) are:

- the **F**requency of the exposure
- the **I**ntensity of the odour
- the **D**uration of the odour episodes
- the **O**ffensiveness of the odour, and
- the **L**ocation of the source

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In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. The odour criteria defined by the Department of Environment, Climate Change, and Water (DECCW) take account of these factors by defining odour criteria based on population density. This is based on the fact that the higher the population density, the higher the possibility there will be someone within the community that finds a particular odour offensive.

The difference between odour criteria is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

The criteria assume that up to 7 odour units (ou) at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be exposed. The criterion of 2 ou at the 99th percentile is considered to be acceptable for the whole population.

For the estimated population density in the vicinity of Cartwrights Hill, an odour criterion of around 4 to 5 ou would be appropriate. The 99th percentile means that the criteria can be exceeded for 87 hours of the year (0.01*8760 hours per year).

Table 1 lists the odour assessment criteria, to be exceeded not more than 1% of the time, for different population densities.

Table 1 : DECCW odour assessment criteria

Population of affected community	Odour performance criteria (nose response odour certainty units at the 99 th percentile)
Rural single residence (≤ 2)	7
~10	6
~30	5
~125	4
~500	3
Urban (>2000) and/or schools and hospitals	2

Study Assumptions

The 2008 air quality impact assessment modelled odour emissions from the following sources:

- Cargill Foods (existing and upgraded);
- Riverina Woolcombing;
- Livestock Marketing Centre;
- Proposed ANL plant;
- Future food processing plant in the central northern area of the Bomen Industrial Area;
- Two future poultry livestock plant in the central eastern area of the Bomen Industrial Area; and
- Two future poultry livestock plant in the north eastern area of the Bomen Industrial Area.

Sources that have potential to generate significant, widespread odour that were not included in the 2008 modelling are:

- Pioneer Road Services (Asphalt Plant); and
- Riverina Oils (proposed)

Odour emissions data available for the 2008 assessment included only the source description, the source type, the source location and the odour emission rate so various other parameters required for the dispersion model needed to be assumed. The assumptions were as follows:

- All area sources are at ground-level;
- All volume sources are 2 m above ground-level;
- All stack sources were 20 m high with a diameter of 0.5 m, exhaust velocity of 15 m/s and exhaust temperature 5 degrees above the ambient temperature; and
- Areas of proposed sources were taken to be 100 m by 100 m, in the absence of source dimension information;

The 2008 predicted 99th percentile odour impacts from all these sources are shown on **Figure 1** (existing Cargill Foods) and **Figure 2** (upgraded Cargill Foods).

Whilst both these figures show a worst-case assessment as they assume all the odours from all operations occur concurrently and are of the same character, they clearly show the greatest potential for landuse conflict occurs in the southern part of the Bomen Industrial Area, nearest to Cartwrights Hill.

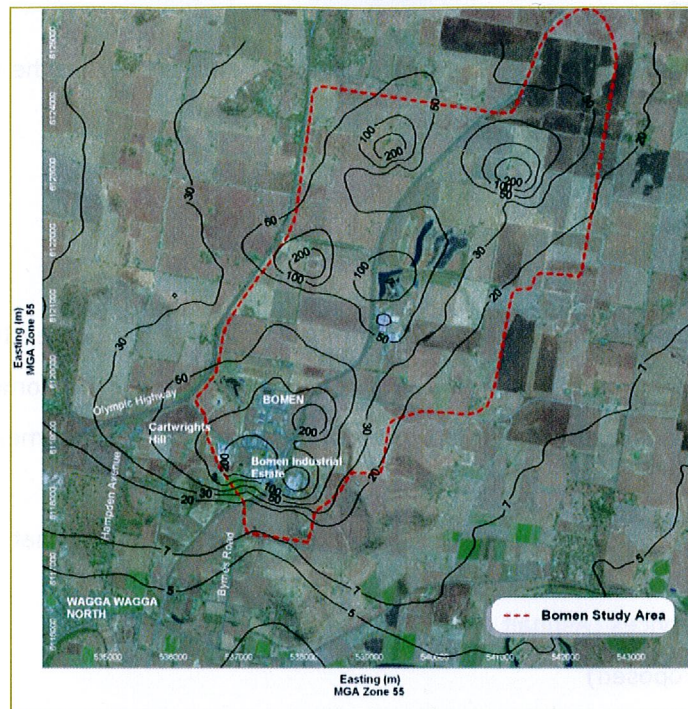


Figure 1: Predicted 99th percentile odour due to all sources (Cargill Foods existing)

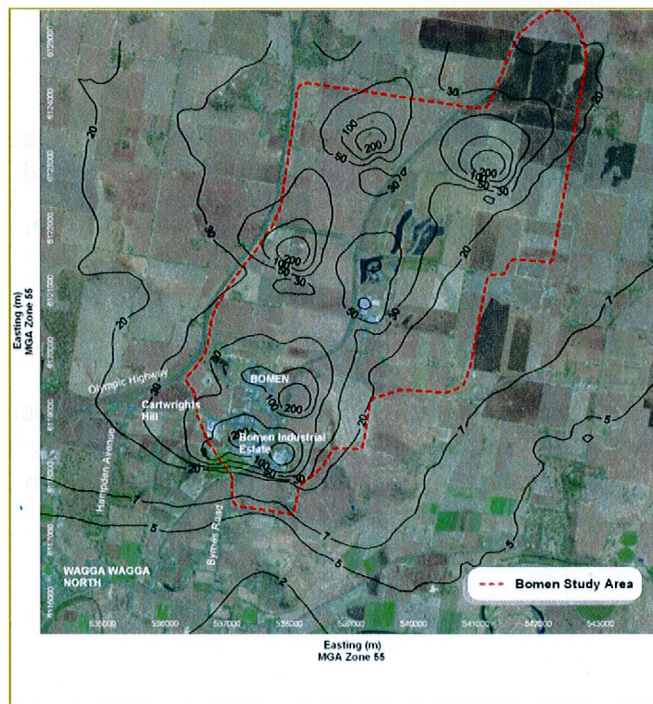


Figure 2: Predicted 99th percentile odour due to all sources (Cargill Foods upgraded)

Additional dispersion modelling was completed in the 2008 study to assess the likely impacts of emissions from Cargill Foods only (after upgrade). As **Figure 3** shows, the predicted impacts on Cartwrights Hill due to emissions Cargill Foods are above the DECCW assessment criteria of approximately 4 to 5 ou for the present receptor population.



Figure 3: Predicted 99th percentile odour due Cargill Foods only (after upgrade)

As Cargill Foods did not supply odour source emissions data, and as there is likely to be some thermal buoyancy associated with the emissions (i.e. odour emissions from the sources would rise into the air which assists dispersion), the 2008 study assessed the impacts of emissions for three scenarios based on the assumption that area all sources are dispersed at heights of:

- 10m above ground;
- 20m above ground; and
- 30m above ground.

Figure 4 to Figure 6 show that increased effective source release height will increase dispersion, resulting in lower potential impact. However, without accurate source information from Cargill Foods it is not known which of these modelling scenarios may best represent the actual situation.

What is evident is that even with good buoyancy and dispersion, impacts that exceed the DECCW criteria are likely at Cartwrights Hill.

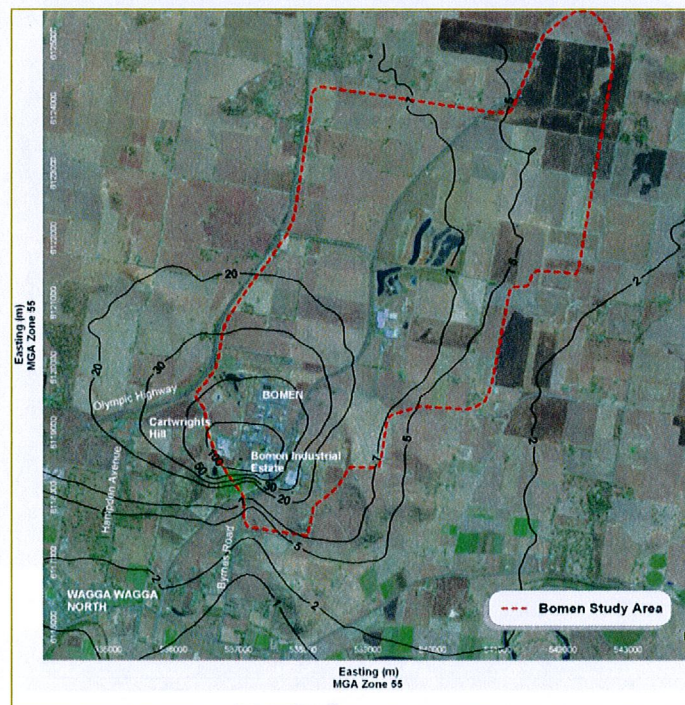


Figure 4: Predicted 99th percentile odour due Cargill Foods only (after upgrade) – area sources 10m above ground



Figure 5: Predicted 99th percentile odour due Cargill Foods only (after upgrade) – area sources 20m above ground

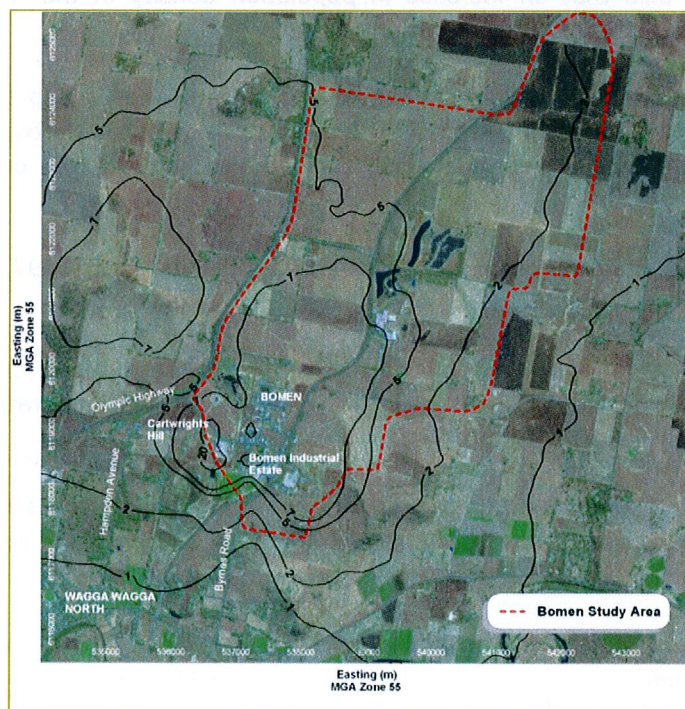


Figure 6: Predicted 99th percentile odour due Cargill Foods only (after upgrade) – area sources 30m above ground

Discussion

The conclusions of the 2008 study were that:

"This study has used computer-based dispersion modelling to quantify odour impacts around the Bomen Industrial Estate, to the north of Wagga Wagga. Particular attention has been on Cartwrights Hill located west of Bomen since Council is in the process of reviewing the zoning of land in this area. To assess the extent of odour impacts, the dispersion model predictions have been compared with odour criteria noted by the DECC.

The dispersion modelling has used local meteorological information and estimates of odour emissions from various industries around Bomen to predict odour levels in the study area. It is recognised that there are some uncertainties in the emission estimates. Nevertheless, the dispersion model results have indicated the following:

- *Predicted odour levels at Cartwrights Hill due to existing and proposed odour sources in the Bomen area are above the DECC's criteria. The magnitude of model predictions suggest that odour complaints are very likely to occur on occasions;*
- *Odour controls on some processes are likely to have reduced off-site odour impacts slightly but not to the point where compliance with odour criteria can be demonstrated; and*
- *Cargill Foods is likely to be the most significant source of odour at Cartwrights Hill;*

It should be noted also that an increase in population density in the Cartwrights Hill area may increase the likelihood of odour complaints."

The 2008 dispersion modelling shows there is a significant and widespread odour impact due to emissions from Bomen Industrial Area. The best case impacts at Cartwrights Hill are above the DECCW criteria of 2 ou for a residential area, and are also above 4 to 5 ou that might apply to the existing population.

The complaints data, understood to be some 440 complaints since 1997, are consistent with the findings of the study.

Since the 2008 study, we are aware of two further plants that operate or have planning approval (Pioneer Road Services Asphalt Plant and Riverina Oils). Either operation has the potential to individually impact on residents in the area on occasions.

Bomen Industrial Area contains a number of large and potentially odorous sources, any one of which could cause an odour issue individually. Overall, there is significant potential risk of an odour problem occurring at any time due to one or more sources.

Should the population density in the area increase, this would further increase the risk of odour complaints in the area.

The nature of the industry in the area also means there would be a complex cocktail of odours present at any time, and this would make regulation and enforcement of odour from any individual premises a difficult task.

In this situation, given the above, an adequate buffer distance is a typically applied planning strategy to manage land-use conflict.

Conclusions

This review confirms that with the currently available information, the original 2008 study conclusions remain valid.

Please feel free to contact me on 02 9874 8644 if you would like any clarification or if I can assist in any way.

Yours sincerely

Aleks Todoroski
PAEHolmes

References:

Holmes Air Sciences (2008)

"DRAFT: Odour Modelling and Impact Assessment: Bomen Industrial Estate. Wagga Wagga"
prepared for Willana Associates, 31 January 2008.