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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES

COAL SEAM METHANE AND ODOUR

PREPARED ON BEHALF OF SYDNEY GAS LIMITED

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1 EXECUTIVE SUMMARY

Odour assessment of coal seam methane has been conducted by Sydney Gas during gas well venting. Dispersion modelling has predicted worst case odour level at the nearest residence (200 metre away) during drilling is below all NSW EPA criteria for populations ranging from a single residence to an urban population of 2000.

2 INTRODUCTION

This report provides the details of testwork and the background discussion on odour issues. It is provided to the reader as background information so that the way odour is measured and assessed can be understood.

An odour is defined by NSW Environment Protection Authority (NSW EPA) as a sensation resulting from the reception of a stimulus by the olfactory sensory system. The sensory perception of odours has four distinct properties: intensity, detectability, character and hedonic tone. The combined effects of these properties are related to the annoyance that may be caused by an odour.

3 ODOUR MEASUREMENT

The NSW EPA has three documents which are used in measuring and assessing the potential impact of odour:

NSW EPA Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales, Sydney NSW, July 2001.

NSW EPA (2001a) "Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW". January, 2001. NSW Environment Protection Authority, 59-61 Goulburn Street, Sydney, NSW, 2000

NSW EPA (2001b) "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW", August 2001. NSW Environment Protection Authority, 59-61 Goulburn Street, Sydney, NSW, 2000

Odour is measured using panels of people who are presented with samples of odorous gas diluted with decreasing quantities of clean odour-free air. The panellists then note when the smell becomes detectable. Odour in the air is then quantified in terms of odour units which are the number of dilutions required to bring the odour to a level at which 50% of the panellists can just detect the odour. This process is known as olfactometry.

Olfactometry can involve a "forced choice" end point where panellists assess air flows from multiple sniffing ports, only one of which contains the diluted odour, and are "forced" to choose the air flow which contains the diluted odour, regardless of whether they are sure they can detect odour. This forced choice procedure continues at decreasing dilution ratios until the panellists correctly nominate the air flow containing the diluted odour at a concentration where they are certain that the odour is present.

There is also a "yes/no" or "free choice" endpoint where panellists are required to say whether or not they can detect odour in the sniffing port. That is, they can say they do not detect odour. Forced choice olfactometry generally detects lower odour levels than yes/no olfactometry.

As with all sensory methods of identification, there is variability between individuals. Consequently the results of odour measurements depend on the way in which the panel is selected and the way in which the panel responses are interpreted. The process by which these imprecise measurements are translated into regulatory goals is still being refined.

4 AIR QUALITY GOALS

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors, the most important of which are the frequency of the exposure, the intensity of the odour, the duration of the odour episodes and the offensiveness of the odour (the so-called FIDO factor).

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 sulphide, 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 FIDO factors as discussed above. In addition, 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. Odour goals need to take account of these factors.

The most common method of assessing odour impact on a community is by the use of computer based predictive dispersion modelling. Dispersion model predictions are typically valid for time scales equivalent to ten minutes to hour averaging periods. The detection of odour by the human nose typically occurs over a time scale of approximately one second. A series of peak-to-mean ratios have been developed for different source types to take account of this (**Katestone, 1998**). The peak-to-mean ratio (P/M ratio) is applied to the emission rate to give effective source strength.

NSW EPA has defined odour performance criteria allowing for population density, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity. Table 1 presents the odour performance criteria. The 99th percentile level is used to allow for limitations in models which may tend to predict extremes of impact which may not be experienced in real life.

TABLE 1 ODOUR PERFORMANCE CRITERIA

Population of Affected Community	Odour Performance Criterion (odour units)
Urban area (≥ 2000)	2.0
500 – 2000	3.0
125 – 500	4.0
30 – 125	5.0
10 – 30	6.0
Single residence (≤ 2)	7.0

Source: NSW EPA *Approved Methods & Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (2001).*

5 AUSLPUME DISPERSION MODELLING

Odour sampling at the source is reported as an odour concentration in odour units (OU).

For use in AUSPLUME dispersion modelling, which predicts the impact over a given area, the odour concentration (OU) must be converted in to an Odour Emission Rate (OER). The units of measure for the OER is OU volume per second.

For odour modelling, the P/M ratio is then applied to the OUv/s. It is this OER figure that this used in the AUSPLUME model.

The AUSPLUME model then generates odour concentrations and odour contours in OU at the 99th percentile. **It is these OUs from the modelling output, not the odour strength of the odour itself,** that are compared and assessed against the NSW EPA Odour Criteria.

6 SYDNEY GAS OPERATIONS

The details of test work provided by Sydney Gas (attached) in relation to the odour impact from gas freely vented into the atmosphere states that:

> "An odour assessment was conducted at Sydney Gas' Cawdor operations in 2000 with the purpose of quantifying potential odours emanating from the area of operations. This was carried out by Australian Water Technologies and PCCD[1][1] and entailed sampling a quantity of gas released directly from the release valve of 'Johndilo' Well Site 7A. The sample resulted in an odour reading 4390 odour units. This was then modelled according to potential flow rates, pipe openings and weather conditions. The results indicated that although odour from the hypothetical discharge of unburned gas might be detectable, the maximum ground level odour concentration would still be acceptable in terms of the EPA guidelines. Similar conditions are expected to prevail for this proposed seven well program.
>
> These well sites are located within a typical rural area. The property and the surrounding land are not subject to intensive farming other than for grazing purposes. Any odours that may therefore occur within the general area are linked to typical low-level rural activities.
>
> It is concluded that each site is capable of producing a range of odours which would be difficult to quantify and compare. Furthermore, the imposition of any detectable odours as a result of the proposed drilling operations would merely add to the variety of potential odours already present. The experience to date is that there has been little, if anything, in the way of odour, caused by any of Sydney Gas' drilling activities. "

A review of the modelling report concluded that the AUSPLUME modelling was carried out in accordance with NSW EPA requirements at that point in time. However, the Peak to Mean (P/M) ratios used in the report have subsequently changed. SEMA calculated the impact of revising the P/M ratios and subsequent odour emissions in accordance with current NSW EPA requirements. The calculation showed that the odour contours values would increase by up to 20% (conservative). For example, the 0.8 OU contour would now be in the order of 1 OU, the 1 OU contour would be 1.2 OU, the 3 OU contour would be in the order 3.6 OU and so on.

By using this data, it is possible for Sydney Gas to assess the impact of the operations similar to those modelled in the report. For example, the OU at 200m to the east of the release point the 99th odour concentration would be approximately 2.4 OU, which is below all NSW EPA criteria for populations ranging from a single residence to an urban population of 2000.

Analysing the data in terms of what the 4390 odour value compares to requires comparison to other more recognisable odour sources. Table 2 allows this comparison to occur.

(1) Pollution Control Consultancy and Design, April 2000. Assessment of Odour Emitted from Un-Ignited Flare at Cawdor Gas Field.

TABLE 2 ODOUR CONCENTRATIONS FROM VARIOUS SOURCES

Location (Description)	Odour Concentrations (Odour Units)
Ambient – Outside	30
Ambient – inside storage area	50
Baghouse	61
Landfill cover	994
Cooling Tower	1,449
Mushroom composting operation – exit stack	1,835
Agitation Wastewater Tank	11,092
Offal storage bin	19,555
Effluent storage pond	31,000

The implications of the 4,000 OU concentration at source implies an unpleasant reaction, although it is noticed that during the testwork any odour was barely perceptible (Sydney Gas communications, 2005). The odour concentration rapidly dissipates according to the modelling and is less than NSW EPA requirements at 200 metres from any discharge under worst case conditions. It is noted that the 200 metre point is the nearest Sydney Gas is permitted to perform drilling operations to a residence under the Petroleum (Onshore) Act.