COPY

AIR QUALITY IMPACT ASSESSMENT
BUILDING 34, FOX STUDIOS

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Prepared for
Fox Studios

by
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1. INTRODUCTION

This report has been prepared by Holmes Air Sciences on behalf of Fox Studios Australia (FSA). Its purpose is to assess the air impacts from the proposed spray booths and associated vents at building 34, Fox Studios site at Moore Park. The report comprises the results of computer based modelling of odour from the proposed spray booths. A cumulative assessment has also been undertaken with the impacts of the existing craft shop located at building 36.

2. BACKGROUND TO THE STUDY

Fox Studios are lodging a Development Application for the reconstruction of building 34 at the Moore Park site. The location of this building is shown in **Figure 1**. The building will house four spray booths that will be used for a range of activities. There is the potential for emissions of volatile chemicals with odorous properties to be emitted during operations within the building. At this stage no emissions data are available for these booths and the approach adopted in this assessment has been to use odour measurements which were undertaken for the spray booth in the Craft Shop in building 36 which is now operational (**Holmes Air Sciences, 2003**). The Craft Shop booth is fitted with paper filters, and while these are effective in absorbing aerosolised sticky material generated during spraying, the odour measurements made with and without the filters in place indicated that they are not very effective in reducing the volatile components of the emissions and hence the odour. Notwithstanding this, the odour impacts of the Craft Shop booth are within DEC limits. These filters are proposed for use in building 34; however, as will be discussed later in the report, additional odour controls are likely to be required.

An odour assessment has been carried out in accordance with the NSW Department of Environment and Conservation (formerly Environment Protection Association) "Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW". As discussed, the odour emissions measured from the existing ventilation outlet on building 36 were used as input for the model for all four vents on building 34. The results of this monitoring are provided in **Appendix A**.

Table 1 provides measured emission parameters from the craft shop stack as well as the assumed emissions from vents A – D of building 34. The locations of these vents are shown in **Figure 2**.

Information provided by FSA indicated that while the site is approved to operate 24-hours a day, the most likely operating scenario would be between 7am and 7pm on weekdays. In the modelling presented in this report it has been assumed conservatively that all vents would be operating simultaneously from 6am to 8pm on a daily basis.

Table 1: Emissions from craft shop stack and stack A - D, building 34

	Building 36	Building 34 Vents A – D
Stack height (m)	9	14
Stack diameter (m)	1.03	1.25

Exit temperature (C)	19.2	19.2
Exit velocity (m/s)	14.3	7.4
Actual volumetric flow rate m^3/s	11.9	9.35
Odour emissions ($ou.m^3/s$)	2440	2440

3. RELEVANT AIR QUALITY GOALS

This section discusses air quality goals relating to odour. It should be noted that there is still considerable debate in the scientific community about appropriate odour goals as determined by dispersion modelling.

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 is 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 identify from multiple sniffing ports the one where odour is detected, regardless of whether they are sure they can detect odour. There is also a "yes/no" or "free choice" endpoint where panellists are required to say whether or not they can detect odour from one sniffing port. Forced choice olfactometry generally detects lower odour levels than yes/no olfactometry.

In both cases, odorous air is presented to the panellists in increasing concentrations. For the forced-choice method, where there are multiple ports for each panellist, the concentration is increased until all panellists consistently distinguish the port with the sample from the blanks. For a yes/no olfactometer (which has only one sniffing port) one method used is to increase the concentration of odour in the sample until all panellists respond. The sample is then shut off and once all panellists cease to respond, the sample is introduced again at random dilutions and the panellists are asked whether they can detect the odour.

There are variations in the literature in the terminology for odour thresholds. The NSW DEC has used the definition of the ***detection*** threshold as the lowest concentration which will elicit a response, but where the panellist is essentially guessing correctly. This corresponds to the first end point in the forced-choice olfactometry method. The odour ***recognition*** threshold is, by definition, the minimum concentration at which the panellist is certain they can detect the odour. This is also referred to as the certainty threshold and is the second endpoint in forced-choice olfactometry and similar to the first end point in yes/no olfactometry.

There is a general move in Europe and Australia to adopt the certainty threshold as the odour standard and to reference this to a standard concentration of butanol (40 parts per billion (ppb)). The odour levels referred to in this report are the certainty odour levels OU_{SCR} (Odour detected by 50% of panellists using the recognition threshold).

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. However the DEC has now published a Draft Odour Policy which includes recommendations for odour criteria (**NSW EPA, 2001**). These are discussed below and have been used for this assessment.

3.1 Odour goals

The determination of air quality goals for odour and their use in the assessment of odour impacts, is recognised as a difficult topic in air pollution science. The topic has received considerable attention in the past five years and the procedures for assessing odour impacts using dispersion models have been refined considerably.

The DEC has in recent times attempted to refine odour goals and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour. However as discussed above these procedures are still being developed and odour goals are likely to be revised in the future.

There are two factors that need to be considered:

1. what "level of exposure" to odour is considered acceptable to meet current community standards in NSW and

2. how can dispersion models be used to determine if a source of odour meets the goals which are based on this acceptable level of exposure

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 **F**requency of the exposure
- the **I**ntensity of the odour
- the **D**uration of the odour episodes and
- the **O**ffensiveness 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 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. Odour goals need to take account of these factors.

There is now a new Australian standard for odour measurement which is based on the European standard.

The DEC Draft Odour Policy includes some recommendations for odour criteria. They have been refined by the DEC to take account of population density in the area. **Table 2** lists the odour certainty thresholds, to be exceeded not more than 1% of the time, for different population densities. The odour certainty thresholds presented in **Table 2** have been used for this study.

The difference between odour goals 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.

Table 2: Odour Performance Criteria for the Assessment of Odour (EPA, 2001)

Population of affected community	Odour performance criteria (nose response odour certainty units at the 99th percentile)
Single residence (≤2)	7
10 – 30	6
30 – 125	5
125 – 500	4
500 – 2000	3
Urban	2

It is common practice to use dispersion models to determine compliance with odour goals. This introduces a complication because Gaussian dispersion models are only able to directly predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine more rigorously the ratio between the one-second peak concentrations and three-minute and longer period average concentrations (referred to as the peak to mean ratio) that might be predicted by a Gaussian dispersion model, the NSW DEC commissioned a study by **Katestone Scientific Pty Ltd (1995, 1998)**. This study recommended peak to mean ratios for a range of circumstances. The ratio is also dependent on atmospheric stability and the distance from the source. For emission from surface points (or short stacks), the peak to mean ratio is of the order of 25 in the near field. For building wake affected stacks as applies in this case the peak to-mean ratio is 2.3. A summary of the factors is provided in **Appendix B**.

"But what about Odourless Toxic & Hazardous fumes"

4. APPROACH TO MODELLING ASSESSMENT

4.1 Introduction

Ground level concentrations have been estimated using AUSPLUME (Version 5.4) dispersion model. AUSPLUME is an advanced Gaussian dispersion model. Terrain has been taken to be flat and the landuse is considered to be industrial. The output from the AUSPLUME modelling file is attached in **Appendix C**.

4.2 Meteorological data

Meteorological data collected at the NSW DEC's monitoring site at Randwick for the period July 2001 – June 2002, were used for the modelling.

The Randwick data is 99.2% complete. Annual and seasonal windroses are shown in **Figure 3**. On an annual basis, the winds are predominantly from the west, west northwest, northeast and south. The westerlies dominate in the winter and the southerlies and northwesterlies in summer. What no Autumn or Spring?

Concentrations have been predicted over a grid 2.5 km x 2.5 km with the workshop at the approximate centre of grid space 50 m x 50 m. Additional discrete receptors were placed along Moore Park Road and Poate Road in order to estimate the concentrations at nearby residences. The locations of these receptors are marked on **Figure 1** and their co-ordinates are summarised in **Table 3**.

Table 3: Discrete receptor location

Receptor ID	Location	
	X (m)	Y (m)
1	336072	6248770
2	336103	6248755
3	336135	6248739
4	336166	6248726
5	336194	6248716
6	336218	6248668
7	336202	6248642
8	336190	6248612
9	336211	6248590
10	336233	6248570
11	336255	6248548

5. RESULTS OF MODELLING

Assessing odour is complex and as discussed in **Section 3.1** it is necessary to incorporate into the modelling some measure of the nose response time. In the case of a stack which is building wake affected, it is necessary to take account of the meteorological conditions under which building wake affects the emissions. Screening modelling was undertaken with synthetic meteorological data files and it was determined that at wind speeds above 1.4 m/s for all stability classes for all wind directions, the emission from the craft shop stack were affected by building wake.

Check our wind Speed Vents on Building are Above the WALL height!!

Therefore building wake peak to mean ratios of 2.3 have been incorporated into emissions for all stability classes at wind speeds greater than 1.4 m/s. For wind speeds less than this, near field peak to mean ratios for surface points of 25 and 12 have been used. This is a conservative approach as the residences on Poate Road would effectively be outside the near field zone. And Moore Park Rd.!! Collateral Damage!!

While the area is urban where the appropriate goal is 2 odour units 99th percentile, the population that would possibly be affected is likely to be less than 125 therefore an odour goal of 4 may be appropriate. It is also important to note that the odour generating activities in the buildings will not be continuous and all vents would not be operating simultaneously and therefore the odour impacts would be less than those predicted. Bad luck for 125

24 Hours 7 days Model 6 AM – 8 pm

Figure 4 presents contour plots of the 99th percentile odour levels at a height of 6 metres above the base of the building for each of the four vents on building 34 individually. **Table 4** presents the predicted 99th percentile odour levels at sensitive receptors on the boundary of the site, along Moore Park Road and Poate Road for building 34 and building 34 and 36 combined. check plan?

Also NOTE NECS Dyeroom is issue – Has little Ventilation No Emission Control

Figure 5 presents the predicted impacts of emissions from all four vents on building 34 and the cumulative impacts with building 36.

What are they to Reveal Chemical – Toxic – Hazardous – etc?

There are predicted exceedances of the 99th percentile 2 odour unit goal outside the site.

As building 34 is not yet developed, it is not possible to make measurements of odour emissions. However on the basis of the modelling presented here, there is a risk of off-site odour impacts. It is recommended that the vents associated with building 34 be further controlled beyond the proposed paper filters. Activated carbon filters would be an option. — Why only an option – NECS State "Must be"

Figure 6 presents the predicted cumulative odour impacts at the 99th percentile for building 34 with 90% control of odour and building 36. It has been assumed that the odour emissions from building 34 would be controlled by 90%, that is the odour emission rate would be 244 ou.m³/s. The predicted odour impacts are below 2 odour units at all sensitive receptors.

only? wow Thanks

While it is possible that there may be some detectable odour from time to time (the DEC odour goal does not preclude this) it would still be less than that predicted by the modelling as the buildings would not be operating on a daily basis throughout the year. Stated 7 days 24 Hrs! Was Model with Large open doors open Adding Venturie principle!

Table 4: Predicted odour levels at sensitive receptors (ou)				
	Building 34 alone without odour controls			
	Height above ground			
	6 m		**9 m**	
Receptor ID	**Maximum**	**99th percentile**	**Maximum**	**99th percentile**
1	83.7	4.6	91.6	5.3

2	59.9	3.9	71.2	4.4
3	95.6	9.4	96.3	10.1
4	93.5	10.3	93.8	10.3
5	95.1	9.6	94.9	9.7
6	77.9	12.1	78.2	12.0
7	74.8	13.7	75.6	13.7
8	89.4	8.4	88.6	8.3
9	89.2	5.7	88.3	5.7
10	86.6	4.3	85.6	4.2
11	85.0	3.2	83.9	3.2
	Building 34 and 36 combined without odour controls			
1	84.7	4.6	93.2	5.5
2	59.9	4.0	71.2	4.7
3	95.6	9.5	96.3	10.5
4	93.5	10.3	93.8	10.5
5	95.7	9.9	95.7	10.1
6	79.5	12.5	80.7	12.8
7	78.9	14.1	82.6	14.4
8	96.5	8.7	101.0	8.7
9	100.0	6.2	105.0	6.2
10	101.0	4.7	104.0	4.8
11	102.0	3.9	105.0	3.9
	Building 34 and 36 combined with odour controls on building 34			
1	24.5	1.0	25.2	1.1
2	11.8	0.7	12.9	0.9
3	9.6	1.2	9.6	1.3
4	9.4	1.2	9.4	1.3
5	10.1	1.3	10.3	1.4
6	11.8	1.7	15.2	1.8
7	12.2	1.7	16.9	1.95
8	16.1	1.4	20.8	1.5
9	20.0	1.3	25.1	1.3
10	22.7	1.2	27.4	1.2
11	25.1	1.0	29.2	1.0

Collateral Damage!

6. CONCLUSIONS

On the basis of conservative modelling of odour emissions from building 34, some impact in the surrounding residential area has been predicted. The modelling assumed continuous and simultaneous emissions from all four vents on building 34 between the hours of 6 am and 8 pm. Cumulative impacts with emissions from building 36 were also considered.

* While this approach is conservative, it would nevertheless be prudent to consider controlling these emissions further to ensure that there are no impacts in the community. Activated carbon filters would be an "option" for control of emissions from building 34. It is considered that no further controls on building 36 are required.

Read Nees Report PAGE 7 +

7. REFERENCES

Holmes Air Sciences (2003)
"Air quality assessment Craft Shop, Building 36 Fox Studios" prepared for Fox Studios
Australia, September 2003

* No Mention of Outside Work Noise - Dust - Demolition of Props?

Katestone Scientific (1998)
"Report from Katestone Scientific to Environment Protection Authority of NSW, Peak to Mean Ratios for Odour Assessments".

NSW EPA (2001)
"Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW". January, 2001

NSW EPA (2000)
"Approved Methods for Sampling and analysis of air pollutants in New South Wales" EPA 2000/9 January 2000

APPENDIX A

AUSTRALIAN WATER TECHNOLOGIES

DRAFT

24 July 2003

Holmes Air Sciences
Suite 2B, 14 Glen Street
EASTWOOD NSW 2122

Attention Dr. K Holmes

RE: Results from the Fox Studios Odour Analysis.

Five odour samples were collected from the Fox Building 36 on 23/7/03. The samples were analysed for odour strength. This produced the result tabulated below in the terminology of the Draft Procedures for Dynamic Olfactometry from the EPA - WB.

DRAFT	Date of Analysis	Odour Strength OU_{SOR}
Building 36 Exhaust Duct With Filter in Place #1	23/7/03	260
Building 36 Exhaust Duct With Filter in Place #2	23/7/03	150
Building 36 Exhaust Duct Without Filter #1	23/7/03	180
Building 36 Exhaust Duct Without Filter #2	23/7/03	120
Building 36 Ambient	23/7/03	35

The analysis was carried out on the AC'SCENT Olfactometer according to the Australian New Zealand standard: Air Quality - Determination of odour concentration by dynamic olfactometry (AS/NZS 4323.3:2001).

The duct diameter at the sampling plane had a diameter of 1030 mm and had an average velocity of 14.3 m/s @ 19.2 °C and 52% RH with the inlet filter in place. Without the filter The average velocity was 15.6 m/s @ 20.1 °C and 51% RH.

Regards,

R. Andersen, Air Quality Coordinator.

were all units working at time of Test

* It would appear that the filter add very little when added? %?

APPENDIX B
PEAK TO MEAN RATIOS FOR ODOUR MODELLING

Peak-to-mean ratios

The following table shows recommended factors for estimating peak concentrations for different source types, stabilities and distances.

Table A1 – Factors for estimating peak concentration in flat terrain

Source Type	Pasquill-Gifford stability class	Near field i_{max}	Near field x_{max}	Near field P/M60	Far field i	Far field P/M60
Area	D	0.5	500 to 1000	2.5	0.4	2.3
	E,F	0.5	300 to 800	2.3	0.3	1.9
	A,B,C	0.5	500 to 1000	2.5	0.4	2.3
Line	D	1.0	350	6	0.75	6
	E,F	1.0	250	6	0.65	6
	A,B,C	1.0	350	6	0.75	6
Surface point	D	2.5	200	25	1.2	5 to 7
	E,F	2.5	200	25	1.2	5 to 7
	A,B,C	2.0	1000	12	0.6	3 to 4
Tall wake-free point	D	4.5	5 h	35	1.0	6
	E,F	4.5	5 h	35	1.0	6
	A,B,C	2.3	2.5 h	17	0.5	3
Wake-affected point	A - F	0.4	-	2.3	0.4	2.3
Volume	A - F	0.4	-	2.3	0.4	2.3

i_{max} maximum centreline intensity of concentration
x_{max} approximate location of i_{max} in metres
P/M60 P/M ratio for long averaging times (typically 1 hour), at a probability of 10^3
h stack height

APPENDIX C
OUTPUT FROM DISPERSION MODELLING

Fox Studios odour impacts 6 metres near field - Randwick Met

```
Concentration or deposition                              Concentration
Emission rate units                                      OUV/second
Concentration units                                      Odour_Units
Units conversion factor                                  1.00E+00
Constant background concentration                                 0.00E+00
Terrain effects                                          None
Smooth stability class changes?                          No
Other stability class adjustments ("urban modes")        None
Ignore building wake effects?                            No
Decay coefficient (unless overridden by met. file)       0.000
Anemometer height                                        10 m
Roughness height at the wind vane site                   0.300 m

                    DISPERSION CURVES
Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
Horizontal dispersion curves for sources >100m high  Briggs Rural
Vertical  dispersion  curves for sources >100m high  Briggs Rural
Enhance horizontal plume spreads for buoyancy?       Yes
Enhance  vertical  plume spreads for buoyancy?       Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust  vertical  P-G formulae for roughness height? Yes
Roughness height                                     0.800m
Adjustment for wind directional shear                None

                    PLUME RISE OPTIONS
Gradual plume rise?                                  Yes
Stack-tip downwash included?                         Yes
Building downwash algorithm:                        PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions?          No
Disregard temp. gradients in the hourly met. file?   No
```

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.40, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

Fox Studios odour impacts 6 metres near field - Randwick Met

SOURCE CHARACTERISTICS

STACK SOURCE: ST36

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
336122	6248665	0m	9m	1.03m	0C	0.0m/s

Hourly additive factors will be used with the declared exit velocity (m/sec) and temperature (K).

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	67	64	65	24	24	23	87	88	87	83	77	69
Effective building height	8	8	8	10	10	10	14	14	14	14	14	14
Along-flow building length	49	40	40	16	19	21	73	73	71	67	66	64
Along-flow distance from stack	-63	-57	-51	17	18	18	-79	-85	-88	-88	-91	-92
Across-flow distance from stack	-8	-13	-18	-15	-11	-6	44	36	27	17	6	-5

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	64	65	70	73	67	68	67	67	65	24	24	23
Effective building height	14	14	14	14	8	8	8	8	8	10	10	10
Along-flow building length	67	76	83	87	63	57	49	46	40	16	19	20
Along-flow distance from stack	-93	-94	-92	-87	7	10	14	-32	11	-33	-37	-39
Across-flow distance from stack	-17	-29	-36	-43	-4	2	8	22	18	15	10	6

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	87	88	87	84	77	55	65	66	70	73	67	68
Effective building height	14	14	14	14	14	8	14	14	14	14	8	8
Along-flow building length	73	73	71	67	66	69	67	76	83	87	63	57
Along-flow distance from stack	7	12	17	21	25	-54	27	19	10	1	-69	-67
Across-flow distance from stack	-44	-36	-27	-16	-6	-13	17	28	36	43	4	-2

(Constant) emission rate - 2.44E+03 OUV/second

Hourly multiplicative factors will be used with this emission factor.
No gravitational settling or scavenging.

STACK SOURCE: ST34A

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
336061	6248731	0m	14m	1.25m	0C	0.0m/s

Hourly additive factors will be used with the declared exit velocity (m/sec) and temperature (K).

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	67	66	64	67	76	83	87	88	87	83	77	69
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	83	77	69	64	66	70	73	73	71	67	66	64
Along-flow distance from stack	-80	-74	-66	-60	-57	-51	-45	-36	-27	-17	-11	-7
Across-flow distance from stack	-17	-22	-26	-29	-33	-37	-39	-40	-40	-38	-35	-32

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	64	65	70	73	73	71	67	66	64	67	76	83
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	67	76	83	87	88	87	84	77	69	65	66	70
Along-flow distance from stack	-4	-4	-5	-5	-4	-4	-4	-3	-3	-4	-9	-19
Across-flow distance from stack	-28	-24	-16	-8	0	9	17	22	26	29	34	37

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	87	88	87	84	77	68	65	66	70	73	73	71
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	73	73	71	67	66	64	67	76	83	87	88	87
Along-flow distance from stack	-28	-37	-44	-50	-55	-58	-63	-71	-78	-82	-84	-83
Across-flow distance from stack	39	40	40	38	36	32	28	24	17	8	0	-9

(Constant) emission rate - 2.44E+03 OUV/second

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

STACK SOURCE: ST34B

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
336076	6248706	0m	14m	1.25m	0C	0.0m/s

Hourly additive factors will be used with the
declared exit velocity (m/sec) and temperature (K).

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	67	66	64	67	76	83	87	88	87	83	77	69
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	83	77	69	64	66	70	73	73	71	67	66	64
Along-flow distance from stack	-58	-56	-52	-51	-52	-52	-50	-47	-42	-38	-34	-32
Across-flow distance from stack	3	1	0	-2	-5	-7	-10	-13	-15	-16	-17	-18

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	64	65	70	73	73	71	67	66	64	67	76	83
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	67	76	83	87	88	87	84	77	69	65	66	70
Along-flow distance from stack	-32	-33	-34	-33	-32	-29	-26	-22	-17	-14	-14	-18
Across-flow distance from stack	-19	-20	-17	-14	-10	-7	-3	-1	0	2	5	7

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	87	88	87	84	77	68	65	66	70	73	73	71
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	73	73	71	67	66	64	67	76	83	87	88	87
Along-flow distance from stack	-23	-26	-29	-31	-32	-32	-35	-43	-49	-54	-57	-58
Across-flow distance from stack	10	13	15	16	17	18	18	20	17	14	10	7

(Constant) emission rate = 2.44E+03 OUV/second

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

STACK SOURCE: ST34C

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
336073	6248701	0m	14m	1.25m	0C	0.0m/s

Hourly additive factors will be used with the
declared exit velocity (m/sec) and temperature (K).

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	67	66	64	67	76	83	87	88	87	83	77	69
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	83	77	69	64	66	70	73	73	71	67	66	64
Along-flow distance from stack	-52	-50	-46	-45	-47	-47	-46	-43	-39	-34	-33	-32
Across-flow distance from stack	0	0	0	-1	-3	-5	-7	-8	-10	-11	-11	-12

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	64	65	70	73	73	71	67	66	64	67	76	83
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	67	76	83	87	88	87	84	77	69	65	66	70
Along-flow distance from stack	-33	-35	-37	-37	-36	-34	-31	-27	-23	-20	-19	-23
Across-flow distance from stack	-13	-14	-12	-9	-6	-4	0	0	0	1	3	5

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	87	88	87	84	77	68	65	66	70	73	73	71
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	73	73	71	67	66	64	67	76	83	87	88	87
Along-flow distance from stack	-27	-30	-32	-33	-33	-32	-34	-41	-46	-50	-52	-53
Across-flow distance from stack	7	8	10	11	11	12	13	14	12	9	6	4

(Constant) emission rate = 2.44E+03 OUV/second

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

STACK SOURCE: ST34D

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
336043	6248686	0m	14m	1.25m	0C	0.0m/s

Hourly additive factors will be used with the declared exit velocity (m/sec) and temperature (K).

Effective building dimensions (in metres)

Flow direction	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
Effective building width	67	66	64	67	76	83	87	88	87	83	77	69
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	83	77	69	64	66	70	73	73	71	67	66	64
Along-flow distance from stack	-32	-26	-18	-14	-14	-13	-12	-11	-9	-7	-10	-13
Across-flow distance from stack	-27	-23	-19	-14	-10	-7	-3	2	6	10	13	16

Flow direction	130°	140°	150°	160°	170°	180°	190°	200°	210°	220°	230°	240°
Effective building width	64	65	70	73	73	71	67	66	64	67	76	83
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	67	76	83	87	88	87	84	77	69	65	66	70
Along-flow distance from stack	-19	-27	-35	-41	-46	-49	-51	-52	-51	-50	-52	-57
Across-flow distance from stack	18	19	22	24	26	27	27	23	19	14	11	7

Flow direction	250°	260°	270°	280°	290°	300°	310°	320°	330°	340°	350°	360°
Effective building width	87	88	87	84	77	68	65	66	70	73	73	71
Effective building height	14	14	14	14	14	14	14	14	14	14	14	14
Along-flow building length	73	73	71	67	66	64	67	76	83	87	88	87
Along-flow distance from stack	-60	-62	-62	-60	-56	-51	-47	-49	-48	-46	-43	-38
Across-flow distance from stack	3	-2	-6	-9	-13	-17	-18	-19	-22	-24	-26	-27

(Constant) emission rate = 2.44E+03 OUV/second

Hourly multiplicative factors will be used with this emission factor.

No gravitational settling or scavenging.

1

Fox Studios odour impacts 6 metres near field - Randwick Met

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):

335000.m 335050.m 335100.m 335150.m 335200.m 335250.m 335300.m
335350.m 335400.m 335450.m 335500.m 335550.m 335600.m 335650.m
335700.m 335750.m 335800.m 335850.m 335900.m 335950.m 336000.m
336050.m 336100.m 336150.m 336200.m 336250.m 336300.m 336350.m
336400.m 336450.m 336500.m 336550.m 336600.m 336650.m 336700.m
336750.m 336800.m 336850.m 336900.m 336950.m 337000.m 337050.m
337100.m 337150.m 337200.m 337250.m 337300.m 337350.m 337400.m
337450.m

and these y-values (or northings):

6247500.m 6247550.m 6247600.m 6247650.m 6247700.m 6247750.m 6247800.m
6247850.m 6247900.m 6247950.m 6248000.m 6248050.m 6248100.m 6248150.m
6248200.m 6248250.m 6248300.m 6248350.m 6248400.m 6248450.m 6248500.m
6248550.m 6248600.m 6248650.m 6248700.m 6248750.m 6248800.m 6248850.m
6248900.m 6248950.m 6249000.m 6249050.m 6249100.m 6249150.m 6249200.m
6249250.m 6249300.m 6249350.m 6249400.m 6249450.m 6249500.m 6249550.m
6249600.m 6249650.m 6249700.m 6249750.m 6249800.m 6249850.m 6249900.m
6249950.m

at a height above ground level of 6.0 metres

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	336072	6248770	0.0	6.0	7	336202	6248642	0.0	6.0
2	336103	6248755	0.0	6.0	8	336190	6248612	0.0	6.0
3	336135	6248739	0.0	6.0	9	336211	6248590	0.0	6.0
4	336166	6248726	0.0	6.0	10	336233	6248570	0.0	6.0
5	336194	6248716	0.0	6.0	11	336255	6248548	0.0	6.0
6	336218	6248668	0.0	6.0					

METEOROLOGICAL DATA : AUSPLUME Modelling File (Met MANAGER)

```
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            HOURLY VARIABLE EMISSION FACTOR INFORMATION
            -------------------------------------------

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Fox_studios_2004\MetData\emiss_34_36_nf.src
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Fox studios variable emissions

            HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION
            ---------------------------------------------

Prefix ST36   allocated: ST36
Prefix ST34A  allocated: ST34A
Prefix ST34B  allocated: ST34B
Prefix ST34C  allocated: ST34C
Prefix ST34D  allocated: ST34D
```
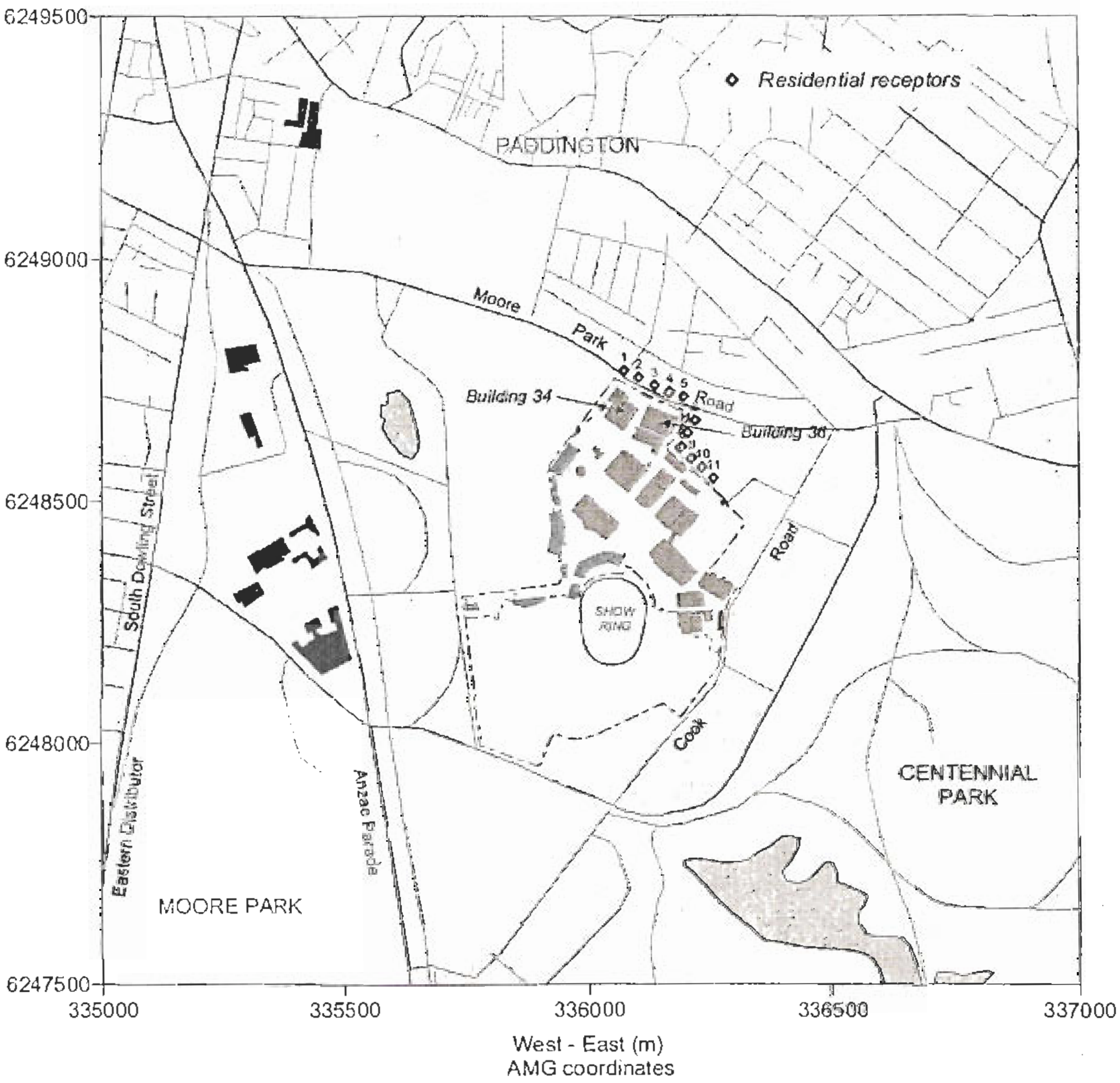

1 Peak values for the 100 worst cases (in Odour_Units)
Averaging time = 1 hour

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)		
1	1.63E+02	17,19/04/02	(336050,	6248650,	6.0)
2	1.62E+02	20,28/03/02	(336000,	6248650,	6.0)
3	1.54E+02	07,29/03/02	(336100,	6248700,	6.0)
4	1.53E+02	20,16/03/02	(336050,	6248650,	6.0)
5	1.50E+02	07,10/04/02	(336100,	6248650,	6.0)
6	1.40E+02	07,13/04/02	(336050,	6248650,	6.0)
7	1.39E+02	19,28/02/02	(336100,	6248650,	6.0)
8	1.30E+02	19,28/03/02	(336050,	6248650,	6.0)
9	1.30E+02	20,28/02/02	(336100,	6248650,	6.0)
10	1.26E+02	20,04/09/01	(336050,	6248650,	6.0)
11	1.25E+02	16,25/06/02	(336000,	6248700,	6.0)
12	1.22E+02	18,25/06/02	(336050,	6248650,	6.0)
13	1.20E+02	07,15/04/02	(336100,	6248650,	6.0)
14	1.17E+02	20,15/05/02	(336000,	6248700,	6.0)
15	1.17E+02	20,10/08/01	(336000,	6248650,	6.0)
16	1.17E+02	07,12/04/02	(336000,	6248700,	6.0)
17	1.16E+02	19,13/08/01	(336050,	6248650,	6.0)
18	1.13E+02	19,18/07/01	(336000,	6248700,	6.0)
19	1.12E+02	20,01/09/01	(336100,	6248650,	6.0)
20	1.12E+02	19,16/05/02	(336050,	6248650,	6.0)
21	1.11E+02	19,11/07/01	(336100,	6248650,	6.0)
22	1.08E+02	19,26/07/01	(336100,	6248700,	6.0)
23	1.06E+02	20,18/07/01	(336050,	6248650,	6.0)
24	1.04E+02	17,12/07/01	(336050,	6248650,	6.0)
25	1.03E+02	19,06/06/02	(336000,	6248650,	6.0)
26	1.01E+02	19,08/07/01	(336050,	6248650,	6.0)
27	1.01E+02	07,02/05/02	(336100,	6248650,	6.0)
28	1.00E+02	20,06/05/02	(336000,	6248650,	6.0)
29	9.98E+01	20,20/09/01	(336100,	6248700,	6.0)
30	9.84E+01	07,07/09/01	(336100,	6248650,	6.0)
31	9.76E+01	07,11/09/01	(336100,	6248700,	6.0)
32	9.70E+01	20,25/02/02	(336050,	6248650,	6.0)
33	9.70E+01	07,17/04/02	(336100,	6248700,	6.0)
34	9.69E+01	19,18/05/02	(336100,	6248650,	6.0)
35	9.69E+01	20,29/04/02	(336050,	6248650,	6.0)
36	9.52E+01	07,11/04/02	(335950,	6248600,	6.0)
37	9.44E+01	20,12/07/01	(336050,	6248650,	6.0)
38	9.39E+01	07,16/04/02	(336100,	6248700,	6.0)
39	9.37E+01	17,26/07/01	(336050,	6248650,	6.0)
40	8.97E+01	18,26/07/01	(336100,	6248650,	6.0)
41	8.93E+01	19,25/02/02	(336050,	6248650,	6.0)
42	8.83E+01	20,06/06/02	(336050,	6248650,	6.0)
43	8.78E+01	19,10/08/01	(335950,	6248600,	6.0)
44	8.65E+01	20,16/05/02	(335950,	6248850,	6.0)
45	8.64E+01	07,27/03/02	(336100,	6248700,	6.0)
46	8.54E+01	07,28/05/02	(336100,	6248700,	6.0)
47	8.50E+01	07,30/04/02	(336100,	6248700,	6.0)
48	8.47E+01	20,31/08/01	(336072,	6248770,	6.0)
49	8.36E+01	07,01/08/01	(336100,	6248650,	6.0)
50	8.26E+01	07,07/06/02	(336100,	6248700,	6.0)
51	8.25E+01	07,08/04/02	(336300,	6248600,	6.0)
52	8.15E+01	18,20/09/01	(336050,	6248700,	6.0)
53	8.12E+01	17,11/06/02	(336100,	6248650,	6.0)
54	8.11E+01	20,01/07/01	(336000,	6248650,	6.0)
55	8.11E+01	18,18/05/02	(336100,	6248700,	6.0)
56	8.05E+01	20,16/09/01	(336000,	6248650,	6.0)
57	7.94E+01	19,15/05/02	(335900,	6248850,	6.0)
58	7.90E+01	07,24/04/02	(336300,	6248550,	6.0)
59	7.80E+01	20,30/04/02	(336050,	6248650,	6.0)
60	7.68E+01	19,31/08/01	(336050,	6248750,	6.0)
61	7.59E+01	20,10/07/01	(336072,	6248770,	6.0)
62	7.57E+01	08,20/02/02	(336100,	6248700,	6.0)
63	7.54E+01	07,20/02/02	(336100,	6248700,	6.0)
64	7.52E+01	18,28/02/02	(336050,	6248650,	6.0)
65	7.36E+01	07,11/06/02	(336100,	6248650,	6.0)
66	7.33E+01	07,09/04/02	(336300,	6248850,	6.0)
67	7.32E+01	20,26/10/01	(336100,	6248700,	6.0)
68	7.17E+01	18,09/05/02	(336100,	6248650,	6.0)
69	7.11E+01	16,23/06/02	(336100,	6248700,	6.0)
70	7.10E+01	19,01/07/01	(336000,	6248700,	6.0)
71	7.05E+01	20,05/06/02	(336050,	6248750,	6.0)

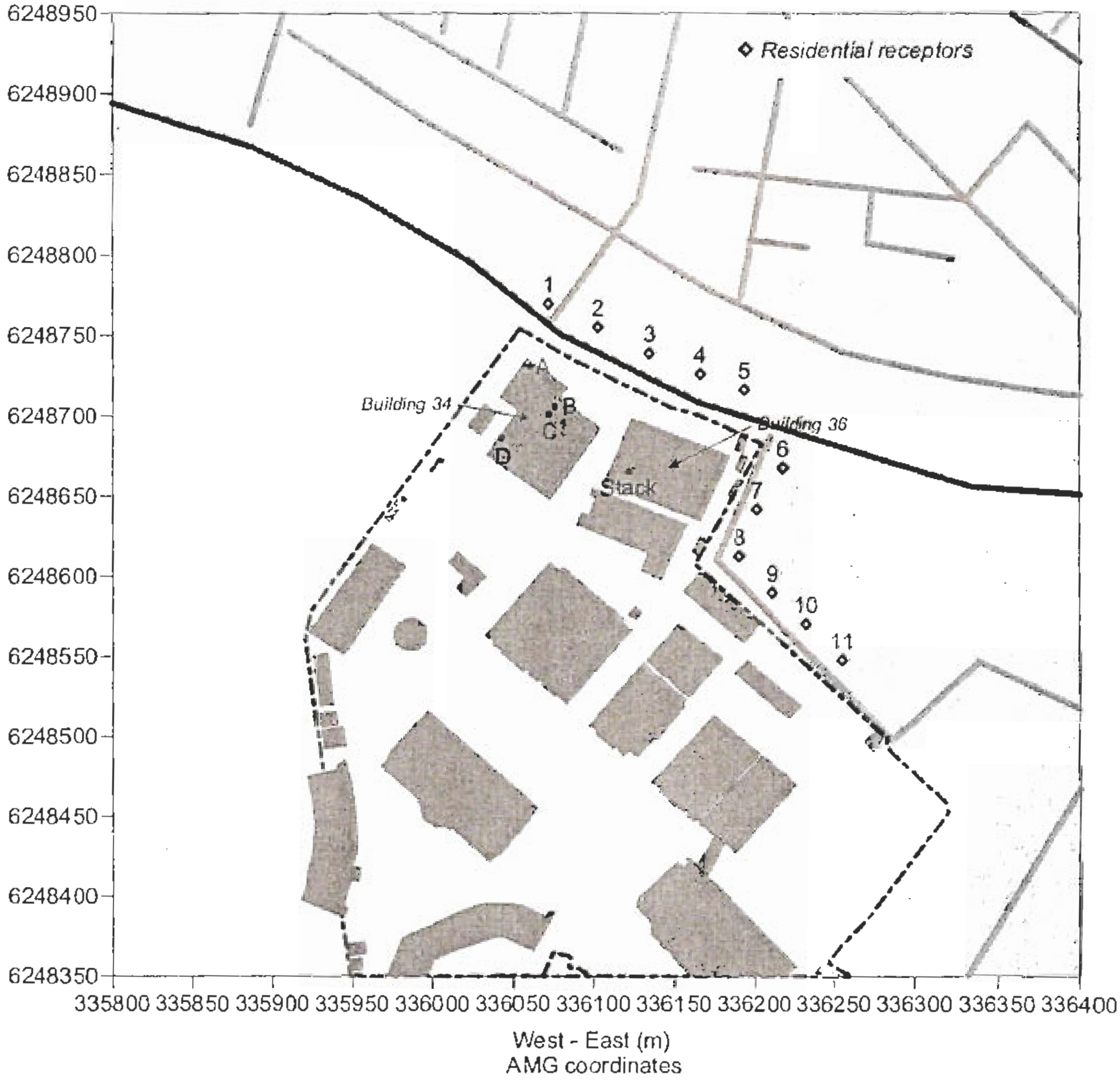
72	7.05E+01	20,11/06/02	(336050,	6248650,	6.0)
73	7.05E+01	18,23/06/02	(336100,	6248700,	6.0)
74	6.90E+01	17,25/06/02	(336000,	6248650,	6.0)
75	6.82E+01	20,23/04/02	(336050,	6248750,	6.0)
76	6.79E+01	07,15/01/02	(336100,	6248700,	6.0)
77	6.79E+01	20,18/05/02	(336100,	6248700,	6.0)
78	6.78E+01	20,25/06/02	(336100,	6248650,	6.0)
79	6.78E+01	20,12/05/02	(336000,	6248700,	6.0)
80	6.78E+01	19,03/06/02	(336050,	6248650,	6.0)
81	6.78E+01	08,29/03/02	(336100,	6248700,	6.0)
82	6.76E+01	18,01/07/01	(335950,	6248800,	6.0)
83	6.74E+01	07,30/07/01	(336100,	6248700,	6.0)
84	6.71E+01	07,03/04/02	(336100,	6248650,	6.0)
85	6.64E+01	08,21/04/02	(336100,	6248700,	6.0)
86	6.61E+01	19,23/06/02	(336300,	6248550,	6.0)
87	6.60E+01	18,06/06/02	(336000,	6248650,	6.0)
88	6.58E+01	20,07/05/02	(336000,	6248650,	6.0)
89	6.53E+01	19,07/05/02	(336000,	6248700,	6.0)
90	6.46E+01	20,03/06/02	(336050,	6248650,	6.0)
91	6.45E+01	20,02/07/01	(336050,	6248750,	6.0)
92	6.44E+01	07,25/08/01	(336100,	6248700,	6.0)
93	6.42E+01	07,17/06/02	(336100,	6248700,	6.0)
94	6.41E+01	07,28/04/02	(336100,	6248700,	6.0)
95	6.34E+01	07,04/06/02	(336100,	6248700,	6.0)
96	6.34E+01	20,02/08/01	(336150,	6248950,	6.0)
97	6.33E+01	07,06/08/01	(336255,	6248548,	6.0)
98	6.30E+01	08,07/06/02	(336300,	6248850,	6.0)
99	6.30E+01	19,05/06/02	(336050,	6248750,	6.0)
100	6.29E+01	07,08/06/02	(336100,	6248700,	6.0)

FIGURES



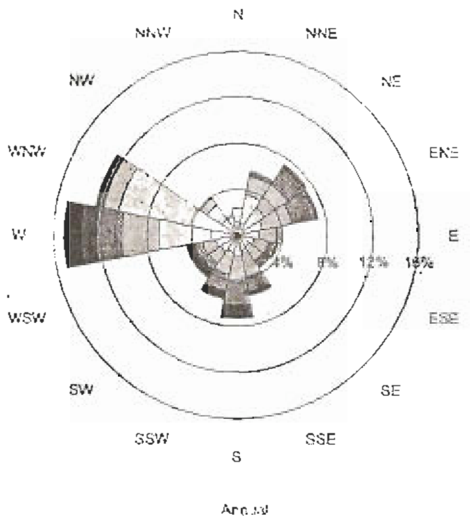
Location of study area

FIGURE 1

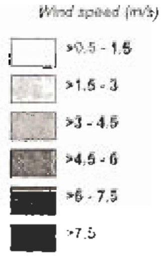


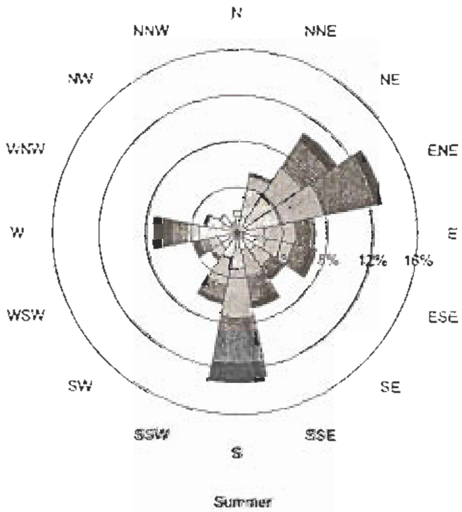
Location of vents

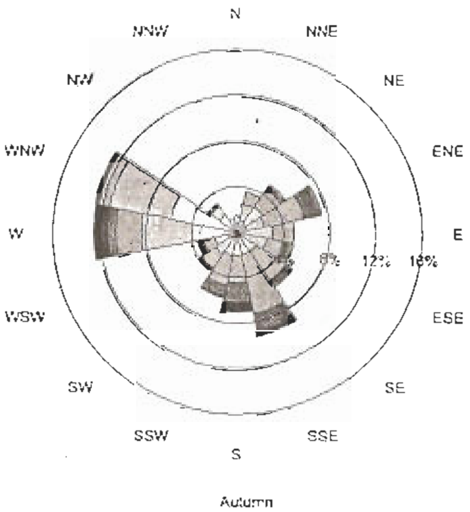
Figure 2

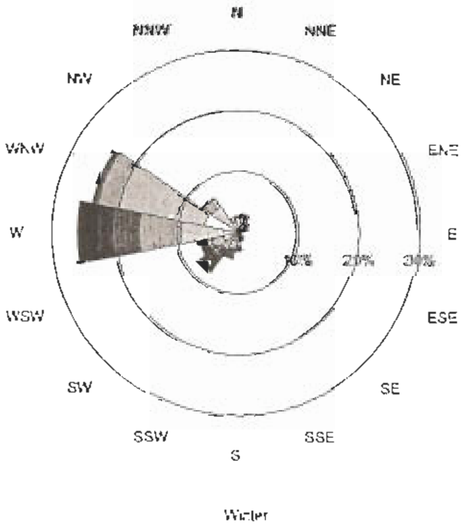


Annual and Seasonal Windroses for Randwick (July 2001 - June 2002)









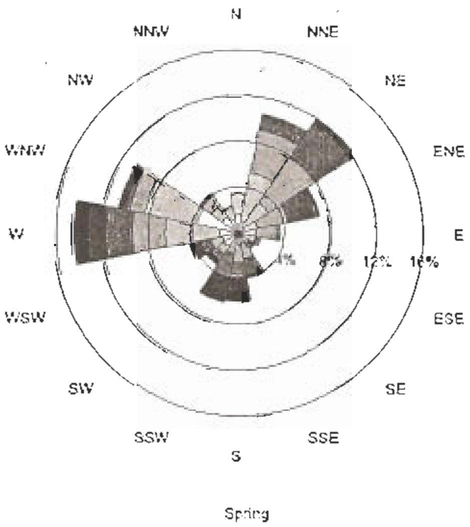
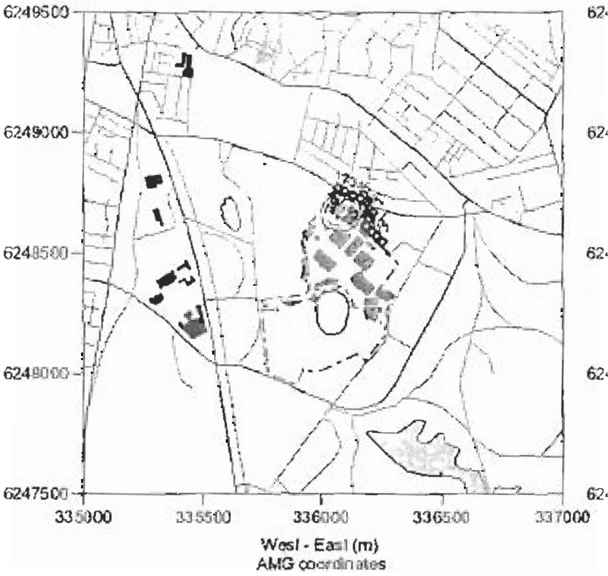
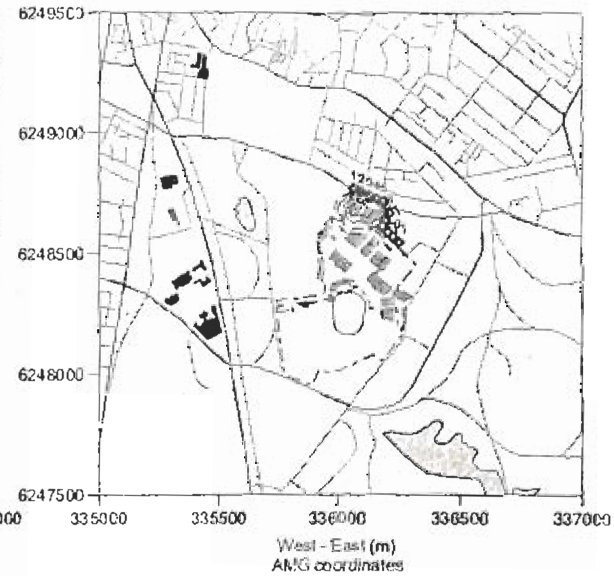


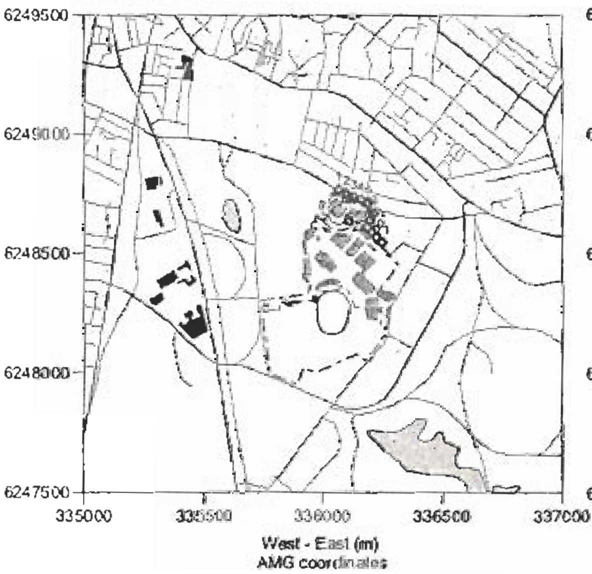
FIGURE 3



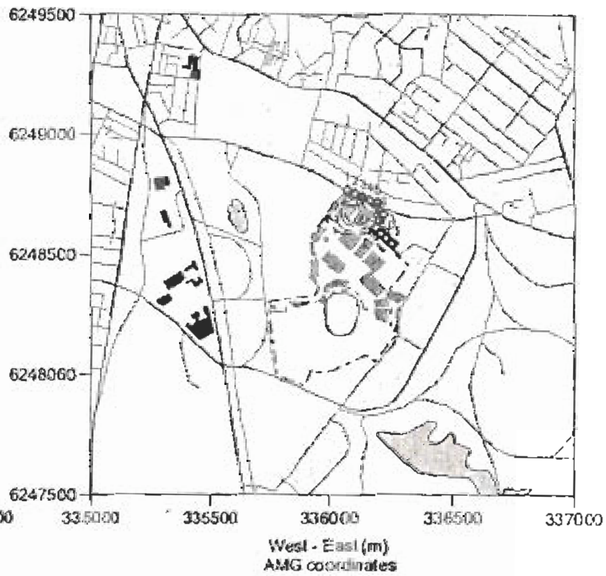
Predicted 99th percentile odour (OU)
6 metres above ground level
Building 34 Stack A



Predicted 99th percentile odour (OU)
6 metres above ground level
Building 34 Stack B



Predicted 99th percentile odour (OU)
6 metres above ground level
Building 34 Stack C



Predicted 99th percentile odour (OU)
6 metres above ground level
Building 34 Stack D

Figure 4

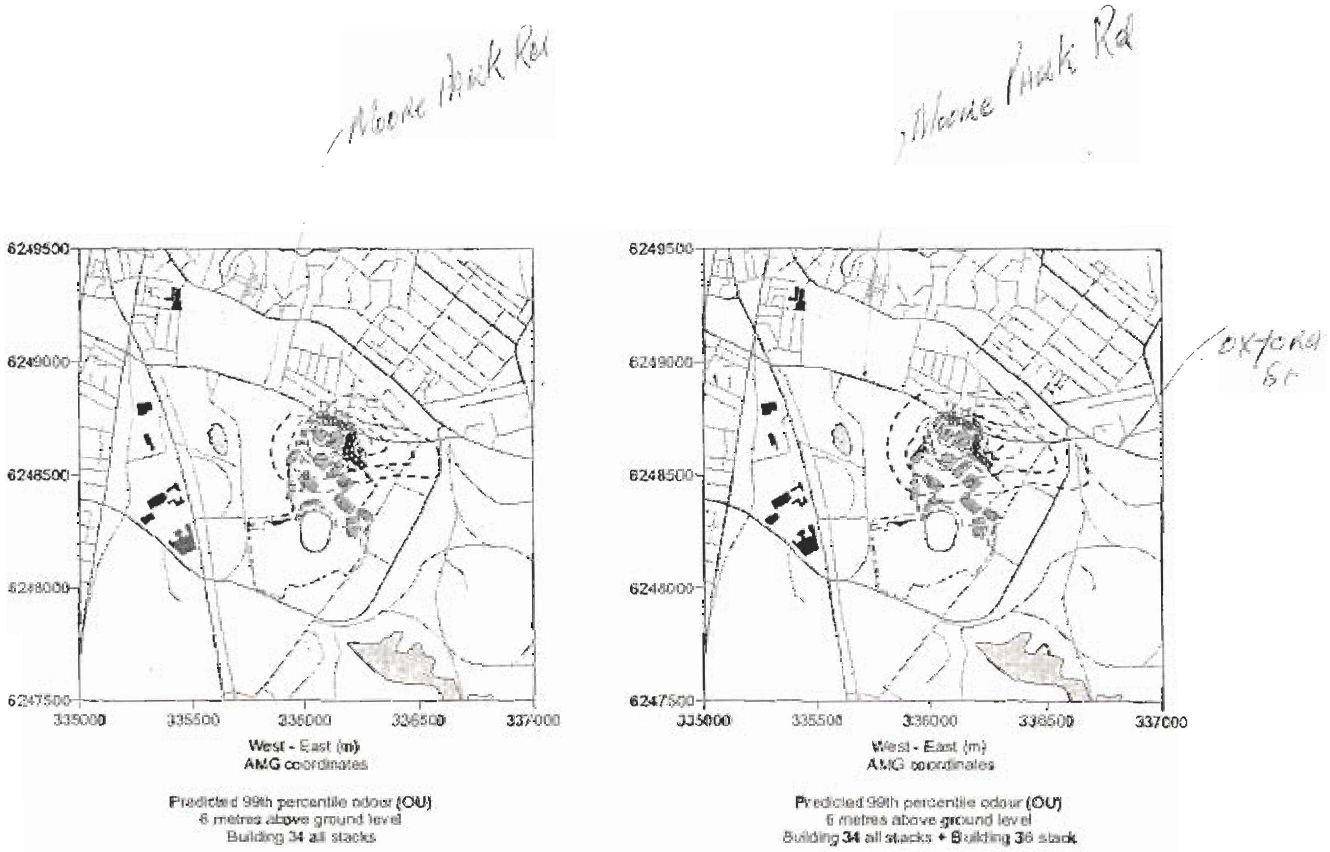
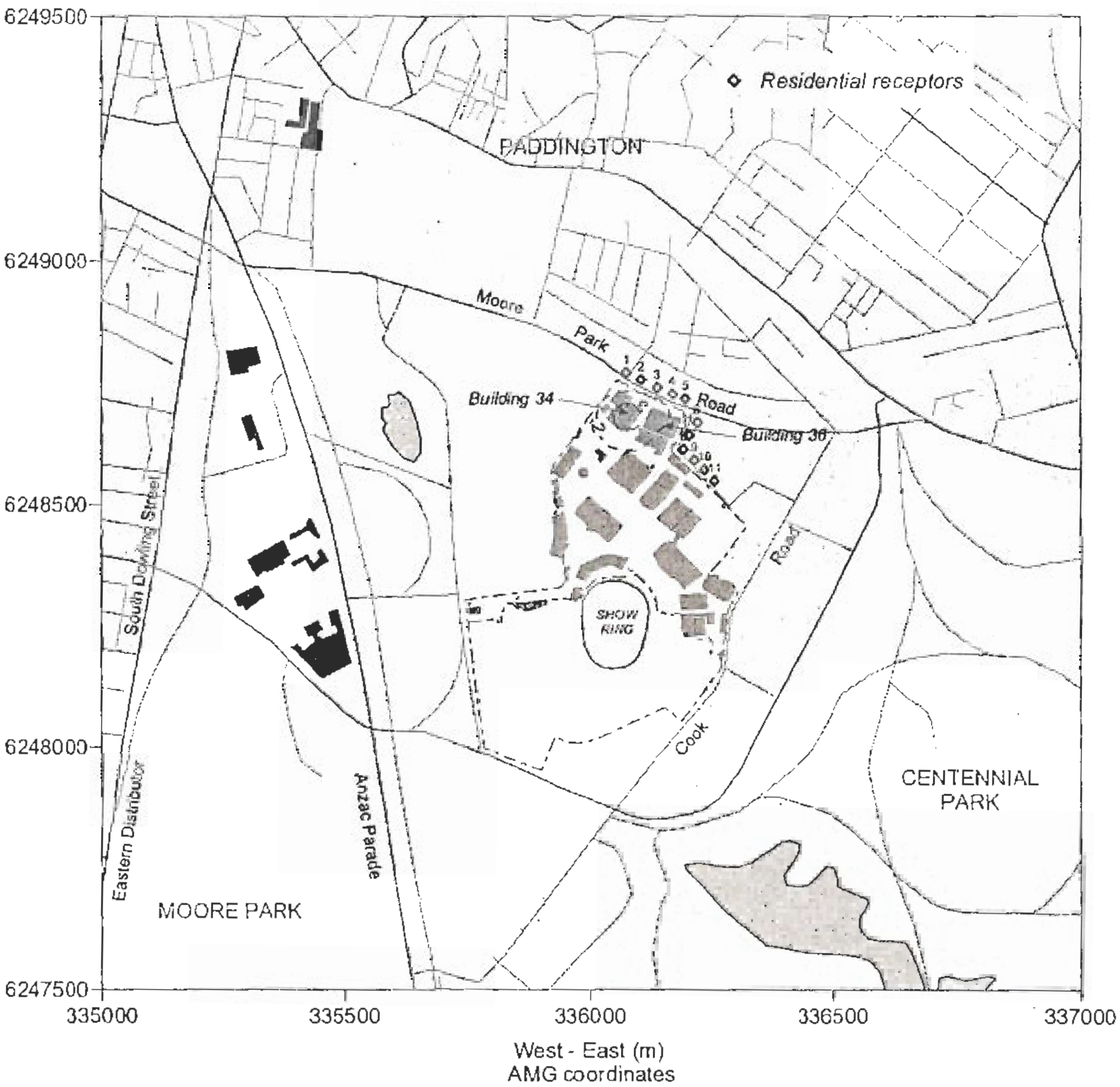


Figure 5

Note: There Are No examples of A N/NE Wind (Summer) Heading over over Aussie Stadium or Cricket ground And Bent St. Why?



Predicted 99th percentile odour levels at 6 metres above ground level
Cumulative impact of building 34 with 90% odour control and building 36

Figure 6