Appendix F Air Quality Impact Assessment

GTS-590-RP-EV-001

AIR IMPACT ASSESSMENT
FOR
JEMENA
PROPOSED GAS FIRED BOILER
HORSLEY PARK, NSW

Prepared for: Jemena, Horsley Park NSW

Prepared by: L Zanotto, Senior Environmental Engineer
Daniele Albanese, Senior Environmental Engineer
R T Benbow, Principal Consultant

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Benbow ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

Head Office: 13 Daking Street North Parramatta NSW 2151 AUSTRALIA
Tel: 61 2 9890 5099 Fax: 61 2 9890 5399
Email: admin@benbowenviro.com.au
Visit our website: www.benbowenviro.com.au

DOCUMENT CONTROL

Prepared by:	Position:	Signature:	Date:
Linda Zanotto	Senior Environmental Engineer		27 November 2014
Daniele Albanese	Senior Environmental Engineer		27 November 2014
R T Benbow	Principal Consultant		27 November 2014

Reviewed by:	Position:	Signature:	Date:
R T Benbow	Principal Consultant		27 November 2014

Approved by:	Position:	Signature:	Date:
R T Benbow	Principal Consultant		27 November 2014

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Benbow ENVIRONMENTAL

Head Office:
13 Daking Street North Parramatta NSW 2151 Australia
P.O. Box 687 Parramatta NSW 2124 Australia
Telephone: +61 2 9890 5099 Facsimile: +61 2 9890 5399
E-mail: admin@benbowenviro.com.au
Visit our Website at www.benbowenviro.com.au

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Attachment 1: Sample AUSPLUME Configuration File

1. INTRODUCTION

Benbow Environmental was commissioned by Jemena to prepare an air impact assessment for the proposed addition of a gas-fired boiler at 194-202 Chandos Road, Horsley Park, NSW.

The primary objective of this study was to assess significant sources of air emissions from the subject site and make recommendations regarding any necessary amelioration and management techniques if required.

The air quality impact assessment has been carried out in accordance with the requirements from the document "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales"* published by the NSW Environment Protection Authority (NSW EPA 2005) for the estimation of mixing height and stability class were also utilised and adopted for the assessment (herein referred to as the "NSW EPA Approved Methods" throughout this report). All significant emissions of concern from the site have been considered.

The above document sets limits at ground level for the emissions from the operation of the proposed boiler heat exchanger. These limits are discussed in Section 4 of this report.

In addition, the concentration of the stack emissions from the operation of the gas-fired boiler are required to meet the limits stipulated in Schedule 6 of the Protection of the Environment Operations (Clean Air) Regulation 2010 for a plant operating within an unscheduled premises.

The Impact Assessment Criteria contained in the above document have been referenced to determine the acceptability of the potential impacts from the site.

1.1 SCOPE

The scope of works for this air impact assessment has been limited to the following:

- Review proposed operations;
- Determine significant potential air emission sources associated with the operations;
- Predict potential air quality impacts at the nearest receptors to the site for the pollutants nitrogen oxides (NO_x) and carbon monoxide (CO);
- Assess potential impacts against relevant legislation and guidelines; and
- Provide a report containing a concise statement of potential air quality impact.

2. SITE INFORMATION

A brief description of the subject site and proposed operations has been provided below.

2.1 SITE LOCALITY

The proposed Horsley Park gas-fired boiler would be installed within an existing natural gas facility located at 194-202 Chandos Road, Horsley Park, NSW.

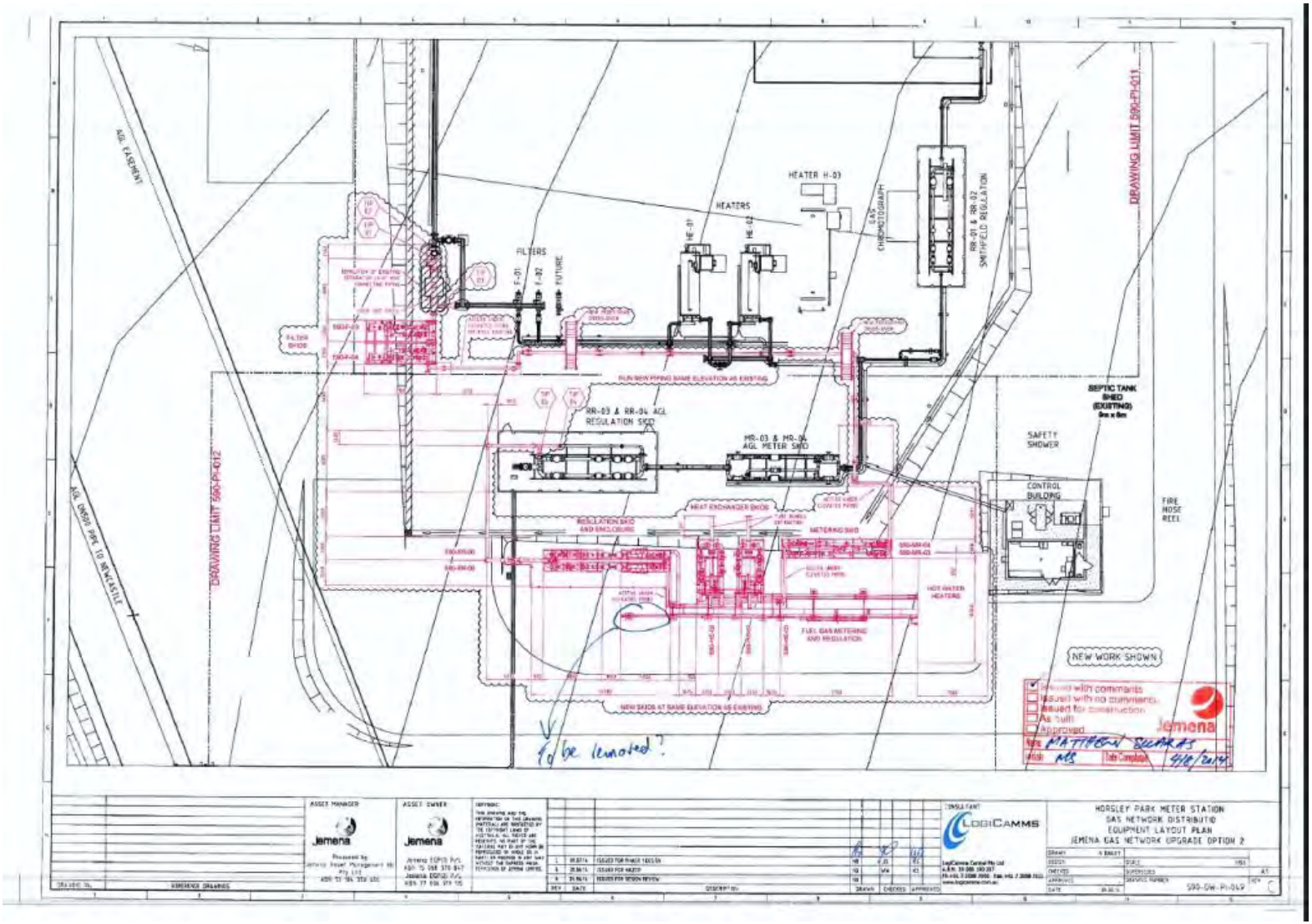
The site is located in Western Sydney and is situated south of a major extraction and brick manufacturing operation. The land immediately near to the site is generally flat and consists of large land holdings used for rural purposes. To the north-east and near to the above brick manufacturing operation is Prospect Reservoir. The site is nearby to the M7 Motorway.

Figure 2-1 has been provided to show an aerial photograph of the existing natural gas facility in which the proposed gas-fired boiler would be installed, while Figure 2-2 shows the site layout of the new infrastructure proposed within the existing facility, including the gas-fired boiler.

The site is already developed with hardstand, control rooms and gas metering equipment in operation.

Figure 2-1: Aerial Photograph of the Site

Figure 2-2: Horsley Park gas-fired boiler – Site Layout



2.2 SURROUNDING LAND

The Horsley Park gas-fired boiler would be located within the existing site of Jemena that has development present as shown on the site layout presented in Section 2.1.

The site is free of any nearby elevated structures or stockpiles which would cause building wake effects. The nearest commercial activity is to the south-east and approximately 250 m from the site. The nearest rural residence, which is associated with the above commercial activity, is 295 m from the site. There are further residences in the south-east, south and south-west sectors that are 310-330 m from the site.

The brick manufacturing plants are 630–780 m from the site.

The nearest land (south bound) of the M7 is approximately 700 m from the site.

The nearest point at the western end of the Wetherill Park Industrial Estate is approximately 1,650 m from the site.

Nearest residential suburbs are to the south-east at approximately 2,500 metres from the site.

The location of the site is not in a sensitive area.

The dataset provided by the National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission indicates that undulating terrain surrounds the subject site, with the south-western to south-eastern part of the site being close to a terrain peak point within the regional area.

A description of each receptor has been presented in Table 2-1.

Table 2-1: Nearest Potentially Affected Receptors

Receptor	Description	Address	Direction
R1	Brickworks	780 Wallgrove Road, Horsley Park	NW
R2	Brickworks	780 Wallgrove Road, Horsley Park	NE
R3	Structure on rural land	168-174 Chandos Road, Horsley Park	E
R4	Structure on rural land	168-174 Chandos Road, Horsley Park	SE
R5	Residence on rural land	187-201 Chandos Road, Horsley Park	S
R6	Residence on rural land	203-209 Chandos Road, Horsley Park	S
R7	Residence on rural land	259-273 Chandos Road, Horsley Park	SW
R8	Residence near M7	741-747 Wallgrove Road, Horsley Park	W
R9	Residence near M7	763-783 Wallgrove Road, Horsley Park	W

A two dimensional view of the regional topography surrounding the subject site is presented in Figure 2-4.

The three-dimensional topography is presented as Figure 2-5 , with the z-axis (i.e. terrain elevation) exaggerated.

Figure 2-3: Horsley Park gas-fired boiler– Location of the Nearest Potentially Affected Receptors

S1 = Source
R1-R9 – Receptors 1 to 9

Figure 2-4: 2D Topography of the Regional Location of the Site

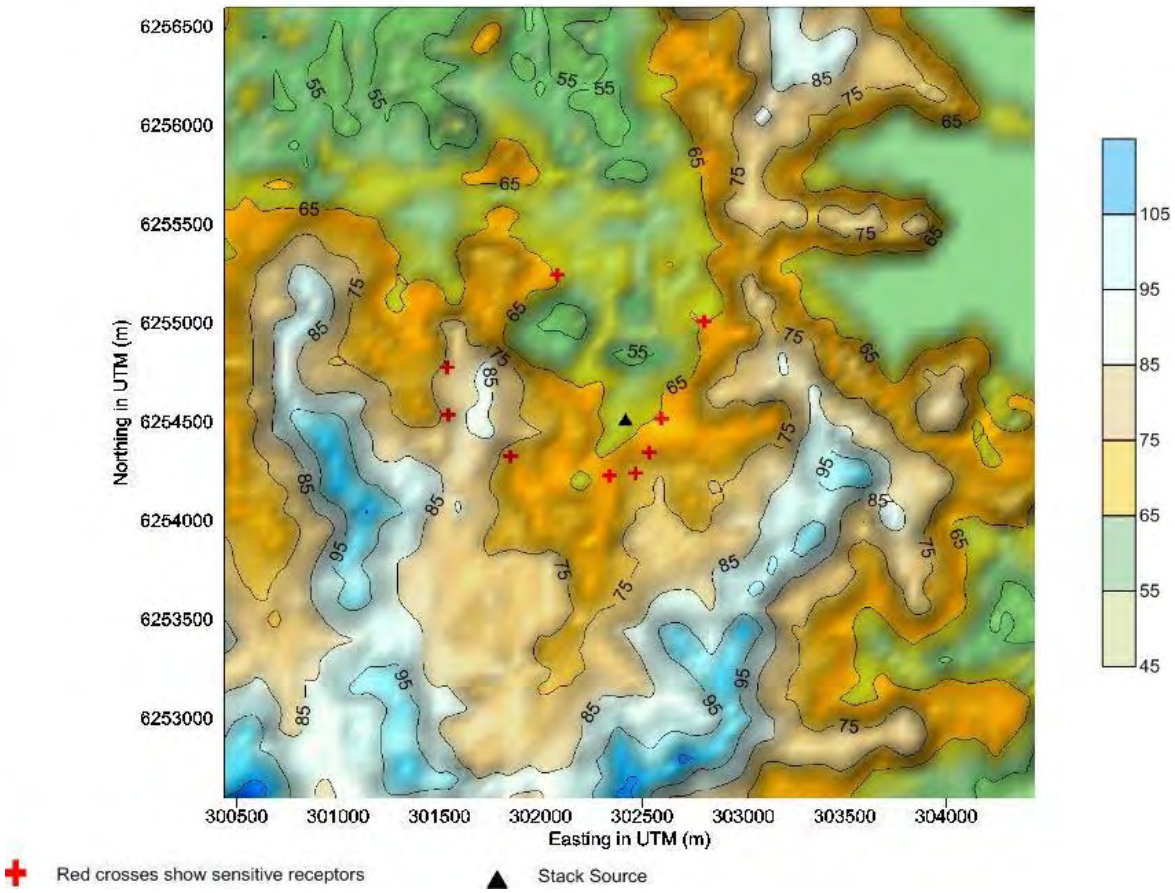
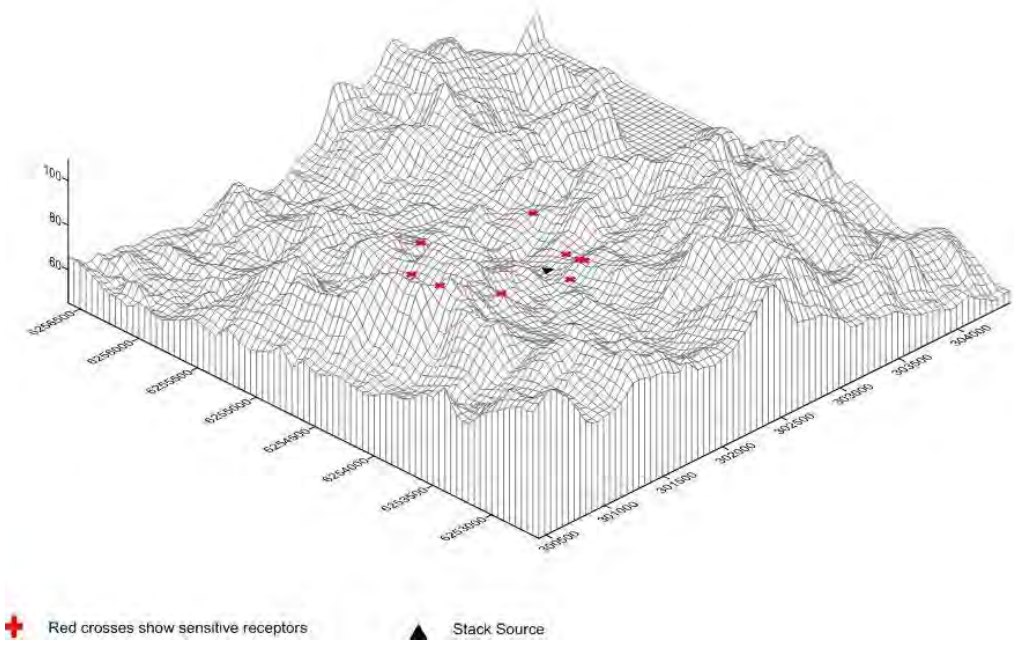


Figure 2-5: 3D Topography of the Regional Location of the Site



2.3 SITE DESCRIPTION

New natural gas conveyance and control apparatus is proposed within the southern portion of the existing natural gas facility. The new apparatus would include a gas-fired boiler with a 1.75 MW heating capacity that would supply heated water to two heat exchangers.

At the time of compiling this report the manufacturer of the gas-fired boiler equipment has not been confirmed however we are instructed that the configuration is generally consistent with the following:

- Hot Water Boiler including fuel gas train.
- Duty water pump and stand-by pump.
- Safety, control, relief and isolation valves.
- Water pipework.
- Heater Control Panel.

3. DISPERSION METEOROLOGY AND LOCAL AIR QUALITY

3.1 DISPERSION METEOROLOGY – SITE REPRESENTATIVE DATA

The nearest weather monitoring station within proximity to the subject site is the monitoring station of Horsley Park (Station No.067119) operated by the Bureau of Meteorology (BoM). This monitoring station is located approximately 2.1 kilometres away from the subject site. Weather conditions at this monitoring station provide hourly data.

Solar radiation data is required to estimate the stability class; however the adopted methodology from the NSW EPA Approved Methods using the Pasquill-Gifford classification system were instead utilised to estimate the respective hourly stability class values. Further details are provided in Section 3.1.1.

Seasonal wind rose plots for the site-representative meteorological file have been included in Section 3.1.2.

3.1.1 Atmospheric Stability

The "stability" of the atmosphere is a classification used to describe the structure of the atmosphere in terms of temperature, specifically, how temperature changes in the atmosphere with altitude. Classification is often done according to the Pasquill-Gifford classification system that consists of six stability class groups, shown in Table 3-1. The class "A" describes an atmosphere where the air is well-mixed and there is little hindrance of dispersion into the atmosphere. At the other end of the scale is class "F", which describes conditions under which temperature inversions would occur, where winds are calm or absent and air close to the earth's surface cannot rise into the atmosphere due to the presence of warmer air layers above. The classes in between A and F indicate changing degrees of stability due to variations in temperature in the atmosphere.

Table 3-1: Pasquill-Gifford Stability Class System Adopted

Stability Class	Description
A	Extremely Unstable
B	Unstable
C	Slightly Unstable
D	Neutral
E	Slightly Stable
F	Very Stable

Worst-case dispersion conditions from the site would be best associated with F-class stability conditions – generally associated with still / light winds and clear skies during the night time or early morning period (stable conditions). Analysis of the referenced site-specific meteorological data indicates the F-class dispersion conditions were present for approximately 13.9% of the time for the Horsley Park region, suggesting a reasonably moderate risk of enhanced impacts from emissions due to due to the presence of this weather condition.

Looking at Table 3-3, it can be seen that stability class frequencies in the meteorological file have not been biased by TAPM towards giving enhanced dispersive conditions. Stability class D is the most frequent, with an occurrence of 50.35%. Stability classes A, B, C, which offered the best dispersion conditions; occur with frequencies of 10.4%, 9.8% and 15.2% respectively.

Table 3-2: Wind Direction / Stability Class Frequency Distribution (Count) for Referenced Meteorological Data Input File – Horsley Park NSW

Frequency Distribution (Count)							
Direction (Blowing From)	Stability Class						
	A	B	C	D	E	F	Total
N	46	176	289	344	97	146	1098
NE	33	127	168	334	83	101	846
E	22	61	154	446	108	110	901
SE	12	74	129	355	130	125	825
S	28	89	193	404	123	199	1036
SW	43	254	441	947	361	620	2666
W	11	68	167	323	137	180	886
NW	4	53	108	182	75	101	523
Total	199	902	1649	3335	1114	1582	**8781**

Table 3-3: Wind Direction / Stability Class Frequency Distribution (Percentage) for Referenced Meteorological Data Input File – Horsley Park NSW

Frequency Distribution (Percentage %)							
Direction (Blowing From)	Stability Class						
	A	B	C	D	E	F	Total
N	0.52	2.00	3.29	3.92	1.10	1.66	12.50
NE	0.38	1.45	1.91	3.80	0.95	1.15	9.63
E	0.25	0.69	1.75	5.08	1.23	1.25	10.26
SE	0.14	0.84	1.47	4.04	1.48	1.42	9.40
S	0.32	1.01	2.20	4.60	1.40	2.27	11.80
SW	0.49	2.89	5.02	10.78	4.11	7.06	30.36
W	0.13	0.77	1.90	3.68	1.56	2.05	10.09
NW	0.05	0.60	1.23	2.07	0.85	1.15	5.96
Total	2.27	10.27	18.78	37.98	12.69	18.02	**100.00**

3.1.2 Wind Rose Plots

Wind rose plots for the year of 2008 were generated based on the weather data obtained from the BOM weather station of Horsley Park.

Wind rose plots show the direction from which the wind is coming using triangles known as "petals". The petals of the plots in the figure summarise wind direction data into 8 compass directions i.e. north, north-east, east, south-east, etc.

The length of the triangles, or "petals", indicates the frequency with which wind blows from the direction presented. Longer petals for a given direction indicate a higher frequency of wind from that direction. Each petal is divided into segments, with each segment representing one of the six wind speed classes.

The proportion of time for which wind speed is less than speeds in the first class (i.e. 0.5 $m.s^{-1}$), when speed is negligible, is referred to as calm hours or "calms". Calms are not shown on a wind rose as they have no direction, but the proportion of calms for the period under consideration is noted under each wind rose.

The concentric circles in each wind rose are the axes that denote wind frequencies. In comparing the plots it should be noted that the axes varies between wind roses, although all wind roses are the same size. The frequencies shown in the first quadrant (top-left quarter) of each wind rose are stated beneath the diagram.

3.1.3 Local Wind Trends

At Horsley Park, winds are prominent from the south-west at frequency of 23.7%. The average wind speed throughout the year of 2008 is 2.94 m/s, with calms being present at 7.82% of the time.

In summer, winds from the south-east become prominent at 20.1%, followed by winds from the south (18.6%) and south-west (14.2%). Calms frequencies are at 7.53% whilst the average wind speed is 3.01 m/s.

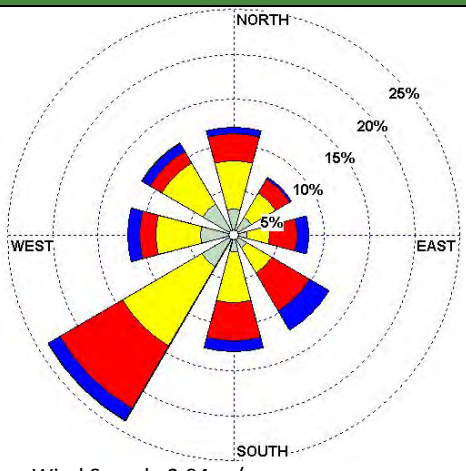
Winds in autumn follow suit to the annual average, wherein south-west (32%) wind is dominant throughout the season. Calms frequencies are recorded during this season at 6.16%, also reporting an average wind speed of 2.94m/s. These well match the long term wind patterns, reporting similar wind patterns and calms frequency.

During winter, wind patterns from autumn remain to be dominant but at frequencies of 31% (from south-west), 20% (from the west), and 18.5% (from the north-west). Average wind speed is seen to decrease during this period to 2.56 m/s, with calms frequency increasing to 8.28%.

In spring however, winds from the north, south-west and south-east become dominant at frequencies for 17%, 16% and 14% respectively. Average wind speed is up to 3.16 m/s and the calms frequency is at 5.22%, which indicates better dispersion during this period.

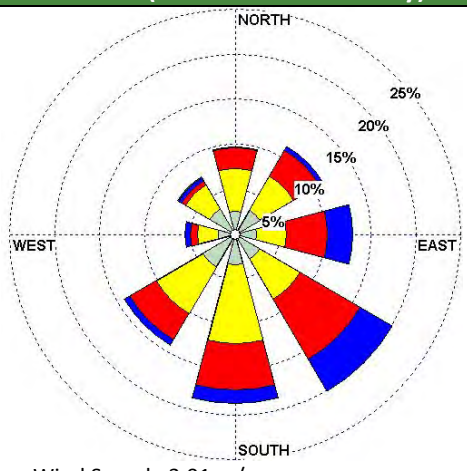
Figure 3-1: Wind Rose Plots for the Referenced Meteorological Station - Bureau of Meteorology (Horsley Park) AWS 2008

All Seasons



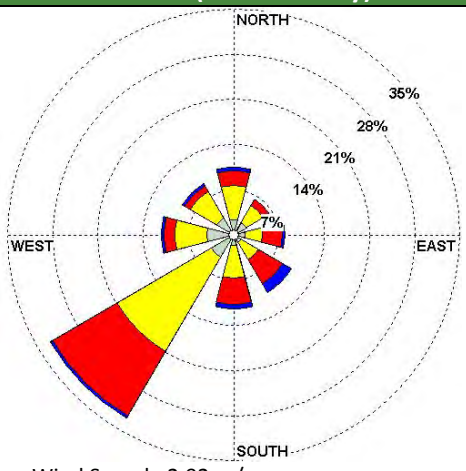
Average Wind Speed: 2.94 m/s
Calms Frequency: 7.82 %

Summer (December – February)



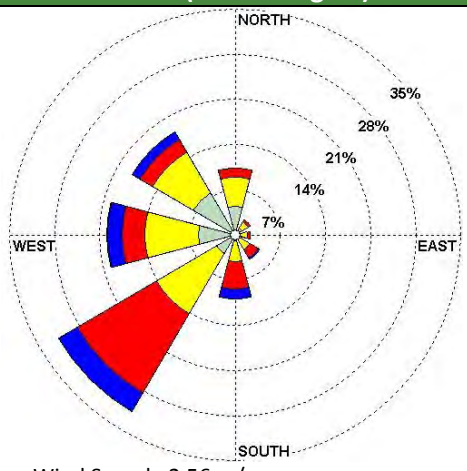
Average Wind Speed: 3.01 m/s
Calms Frequency: 7.53 %

Autumn (March – May)



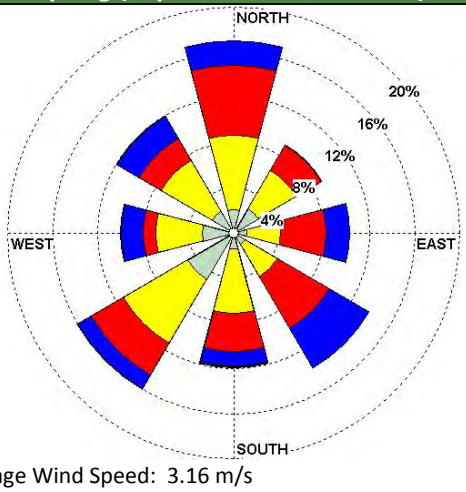
Average Wind Speed: 2.92 m/s
Calms Frequency: 6.16 %

Winter (June – August)



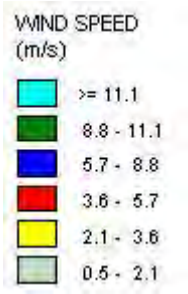
Average Wind Speed: 2.56 m/s
Calms Frequency: 8.28 %

Spring (September – November)



Average Wind Speed: 3.16 m/s
Calms Frequency: 5.22 %

Legend



3.2 AIR QUALITY DATA

The nearest background monitoring station is nearby at Prospect. This would be expected to show the influences depending on wind direction and atmospheric mixing height, of the air emissions from the kilns at the brickworks, NO_x emissions from the Wetherill Park industrial area and NO_x emissions from transport activities along the M7.

The available data from the NSW EPA monitoring station was accessed and is summarised below.

Background air quality NO_x 1 hour averaging period 94 µg/m^3. Annual average 18.8 µg/m^3.

This data would be added to the predicted ground level concentration to provide an assessment of cumulative impact.

4. AIR QUALITY CRITERIA AND GUIDELINES

The air impact assessment applies the air quality criteria and guidelines of the NSW EPA.

The legislative framework is the Protection of the Environment Operations Act 1997. The following therefore applies.

4.1 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) applies the following definition relating to air pollution:

> ***"Air pollution"*** *means the emission into the air of any air impurity.*
>
> *"Air impurity" includes smoke, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, mists odours, and radioactive substances.*

The following clauses of this Act have most relevance to the Project Site:

- *Clause 124 (Operation of Plan)*

  The occupier of any premises who operates any plant in or on those premises in such a manner as to cause air pollution from those premises is guilty of an offence if the air pollution so caused, or any part of the air pollution so caused, is caused by the occupier's failure:

  (a) to maintain the plant in an efficient condition, or

  (b) to operate the plant in a proper and efficient manner.

- *Clause 126 (Dealing with Materials)*

  (1) The occupier of any premises who deals with materials in or on those premises in such a manner as to cause air pollution from those premises is guilty of an offence if the air pollution so caused, or any part of the air pollution so caused, is caused by the occupiers failure to deal with those materials in a proper and efficient manner.

  (2) In this section:

  deal *with materials means process, handle, move, store or dispose of the materials.*

  Materials *includes raw materials, materials in the process of manufacture, manufactured materials, by-products or waste materials.*

- *Clause 127 Proof of causing pollution*

  To prove that air pollution was caused from premises within the meaning of Sections 124 – 126, it is sufficient to prove that air pollution was caused on the premises, unless the defendant satisfies the court that the air pollution did not cause air pollution outside the premises.

- *Clause 128 Standards of air impurities not to be exceeded*

  (1) The occupier of any premises must not carry on any activity, or operate any plant, in or on the premises in such a manner as to cause or permit the emission at any point specified in or determined in accordance with the regulations of air impurities in excess of:

  (a) The standard of concentration and the rate, or

  (b) The standard of concentration or the rate.

  Prescribed by the regulations in respect of any such activity or any such plant.

  (2) Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on any activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.

The proposed development would be required to meet the requirements of this Act.

4.2 PROTECTION OF ENVIRONMENT OPERATIONS (CLEAN AIR) REGULATION 2010

Part 5, Division 3 of the *Protection of the Environment Operations (Clean Air) Regulation 2010* (herein referred to as the Clean Air Regulation 2010) applies.

The proposal falls within Group A under the Protection of the Environment Operations (Clean Air) Regulation 2010, however due to the fact that it will be located within the Greater Metropolitan Area as defined in the same Regulation, it will have to comply with Group C requirements.

The relevant extract from the Regulation is as follows:

*"(c) belongs to **"Group C"** if it commenced to be carried on, or to operate, on or after 1 September 2005 as a result of development consent granted pursuant to a development application made on or after 1 September 2005.*

(2) If, in relation to plant operated in the Greater Metropolitan Area, an emission unit in Group A or B is replaced, the replacement emission unit is taken to belong to Group C."

Since the proposed activity is a non-scheduled activity, the proposed plant must comply with the criteria for non-scheduled activities.

Schedule 6 of the Clean Air Regulation 2010 provides standards of concentration for non-scheduled premises for general activities and plant. This Schedule regulates the emission of solid particles and smoke.

The proposed development would be required to meet the requirements of this Regulation.

4.3 NSW Environment Protection Authority Guidelines

The document, "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*" (AMMAAP) published by the NSW Environment Protection Authority (NSW EPA) provides guidance on methodology and thresholds that are to be used for the air impact assessment of a proposed development. This air impact assessment has been conducted in accordance with this guideline, and assessable pollutants (along with their corresponding limits) are summarised in Table 4-1.

Table 4-1: Relevant Limits from the Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (2005)

Pollutant	Averaging Period	Concentration		Source
		pphm	µg/m^3	
Nitrogen Dioxide (NO_s)	1 hour	12	246	NEPC (1998)
	Annual	3	62	NEPC (1998)
PM_{10}	24 hours	-	50	NEPC (1998)
	Annual	-	30	EPA (1998)
Total Suspended Particulates (TSP)	Annual	-	90	NHMRC (1996)
		g/m^2/month[a]	**g/m^2/month[b]**	
Deposited Dust	Annual	2	4	NERDDC (1988)

PM_{10} and deposited dust are not significant for the operation of these boilers and have not been modelled during construction or operation. As this does not require extensive excavation there would be a very low risk of dust emissions being generated that would contribute to the existing levels of PM_{10} and deposited dust.

Similarly negligible emissions of PM_{10}, TSP and therefore deposited dust would occur.

4.4 National Environment Protection Measure

Air quality criteria have also been referenced from the National Environment Protection Measure (NEPM) and are listed in Table 4-2. The criteria adopted represents the ground level concentration limit for the nearest identified receptors.

Table 4-2: National Environment Protection Measure – Ambient Air Quality

Pollutant	Concentration		Averaging Time
	mg/m^3	ppm	
Carbon Monoxide (CO)	10	9	8 hours
Nitrogen Oxides (NO_x) as Nitrogen Dioxide (NO_2)	0.246	0.12	1 hour
	0.062	0.03	1 year

(NEPC 2003)

In addition to those assessed in Section 4.2, compliance with the NEPM criteria were also examined and included in this study. PM_{10}, TSP and deposited dust are not associated with the operation of the gas burning equipment and were not examined.

5. AIR EMISSION SOURCES

A summary of emission sources is provided in the following section, with emission rates also provided based on supplier's information.

5.1 EMISSION SOURCES

The air emission source is the stack of the proposed 1.75 MW gas-fired boiler.

The boiler stack would be 9 m high with a discharge velocity of 6.4 m/s and an exit temperature of 200^{o}C. The stack diameter is 0.51 m.

5.2 EMISSION RATES

Boiler's stack emission rates were calculated by Jemena's engineers based on natural gas usage of 2,321 tonnes per year and reported as part of the National Pollution Inventory.

Table 5-1 outlines the estimated and maximum concentrations and emission rates for the equipment to be supplied. An emission inventory outlining the parameters for the stack is provided as Table 5-2; these were obtained based on an input of 7,223MJ/hr at 25% excess air.

Table 5-1: Source Concentrations and Emission Rates

Source	Pollutant	Emission Rates
Boiler's stack	NO_x	4,220 Kg per annum
	CO	5,010 Kg per annum

Table 5-2: Emissions Inventory for the Proposed Gas-fired Boiler

Source	Release Type	Stack Height (m)	Exit Temp (°C)	Exit Diameter (m)	Exit Velocity (m/s)
Turbine	Wake-free	9	200	0.51	6.4

6. PREDICTED AIR QUALITY IMPACTS

The results of all air modelling undertaken are presented within this section of the report.

6.1 PREDICTIVE MODEL UTILISED

The AUSPLUME (Version 6) modelling program employed in this assessment utilises consecutive meteorological data records to define the conditions for plume rise, transport, diffusion and deposition. The model's basis is the straight line, steady state Gaussian plume equation.

The model was used to estimate the impact concentrations for NO_x for each hour and for CO for every 8-hours of input meteorology and calculated using averaging times as consistent with NEPM criteria. Atmospheric dispersion curves and surface roughness heights were selected, which specifically represented the rural conditions present.

6.2 METEOROLOGICAL INPUT DATA

Meteorological conditions are the primary variable which govern (and drive) the transport and dispersion of pollutants from an emissions source. It is therefore important to use meteorological data that is specifically representative of the site and the surrounding region in general.

Meteorological data files from the nearest monitoring station operated by BoM were referenced. The estimation of mixing height and stability class using the methodology entailed in the NSW EPA Approved Methods guidelines was applied. Details of the utilised meteorological data have been provided in Section 3.1.

6.3 TERRAIN EFFECTS

The option to model terrain effects in AUSPLUME was selected, with the Egan-Half height processing approach utilised. Data supplied by the U.S. National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission were used to provide information describing the surrounding terrain as input data into the dispersion model.

6.4 MODELLED SCENARIOS

One modelling scenario was implemented by using AUSPLUME v.6.

This scenario includes all the parameters presented in section 5 of this report.

6.5 MODELLING RESULTS

Predicted 100th percentile incremental impacts (i.e. no background data included) are presented as Table 6-1.

A sample AUSPLUME configuration file is provided in Attachment 1.

Table 6-1: Predicted Ground Level Concentrations for Horsley Park – 1.75MW Gas-fired Boiler

Pollutant	Avg Time	Notes	Predicted Concentration at Receptors									Criteria	Units	Criteria Exceeded?
			R1	R2	R3	R4	R5	R6	R7	R8	R9			
NO_x as NO_2 / NO_2	1 hour	No background	4.8	5.4	10.7	12.3	12.3	9.8	7.6	9.8	8.4	246 µg/m^3	µg/m^3	No
		Background	94										µg/m^3	No
		Cumulative	98.8	99.4	104.7	106.3	106.3	103.8	101.6	103.4	102.4		µg/m^3	No
	Annual	No background	0.1	0.4	0.6	0.7	0.7	0.4	0.2	0.1	0.1	62 µg/m^3	µg/m^3	No
		Background	18.8										µg/m^3	No
		Cumulative	18.9	19.2	19.4	19.5	19.5	19.2	20.0	18.9	18.9		µg/m^3	No
CO	15 minute	No background	0.005	0.006	0.012	0.014	0.013	0.011	0.008	0.010	0.009	100 mg/m^3	mg/m^3	No
		Background	No Background Data Available										mg/m^3	No
	1 hour	No background	0.004	0.005	0.009	0.010	0.010	0.008	0.006	0.008	0.007	30 mg/m^3	mg/m^3	No
		Background	0.025	0.025	0.030	0.031	0.031	0.029	0.027	0.029	0.028		mg/m^3	No
		Cumulative	0.029	0.030	0.039	0.041	0.041	0.037	0.033	0.037	0.035		mg/m^3	No
	8 hours	No background	0.001	0.002	0.004	0.005	0.004	0.003	0.002	0.002	0.001	10 mg/m^3	mg/m^3	No
		Background	0.022	0.023	0.024	0.025	0.025	0.023	0.023	0.022	0.022		mg/m^3	No
		Cumulative	0.023	0.025	0.028	0.030	0.029	0.026	0.025	0.004	0.023		mg/m^3	No

Figure 6-1: NO_2 μg/m^3 1Hr Average

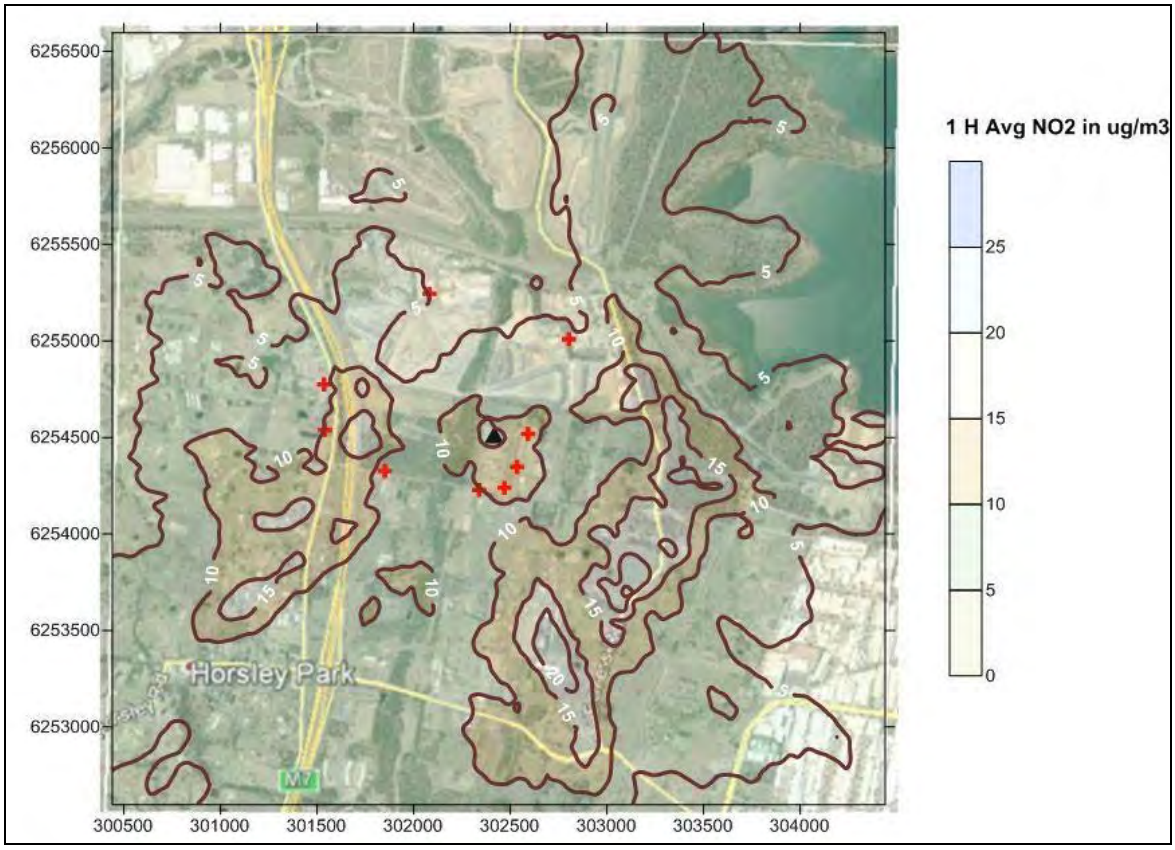


Figure 6-2: NO_2 μg/m^3 Annual Average

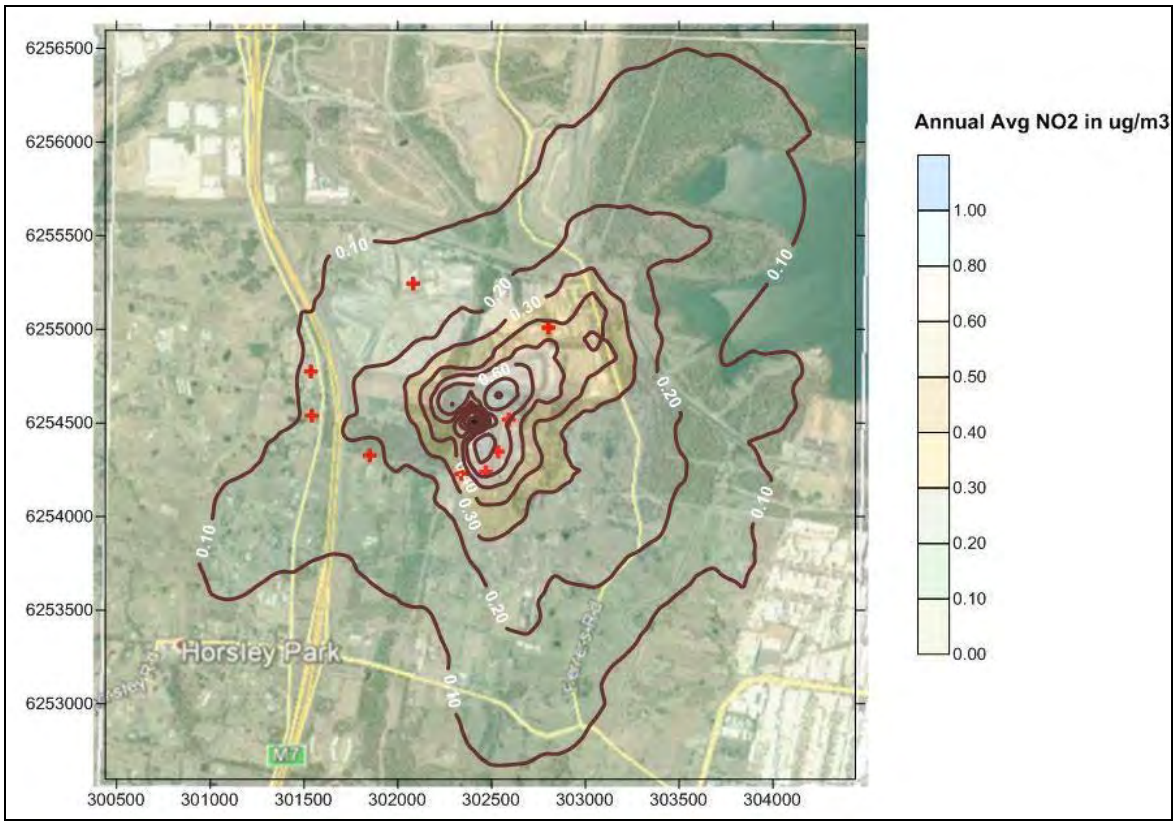


Figure 6-3: CO μg/m^3 1 Hour Average

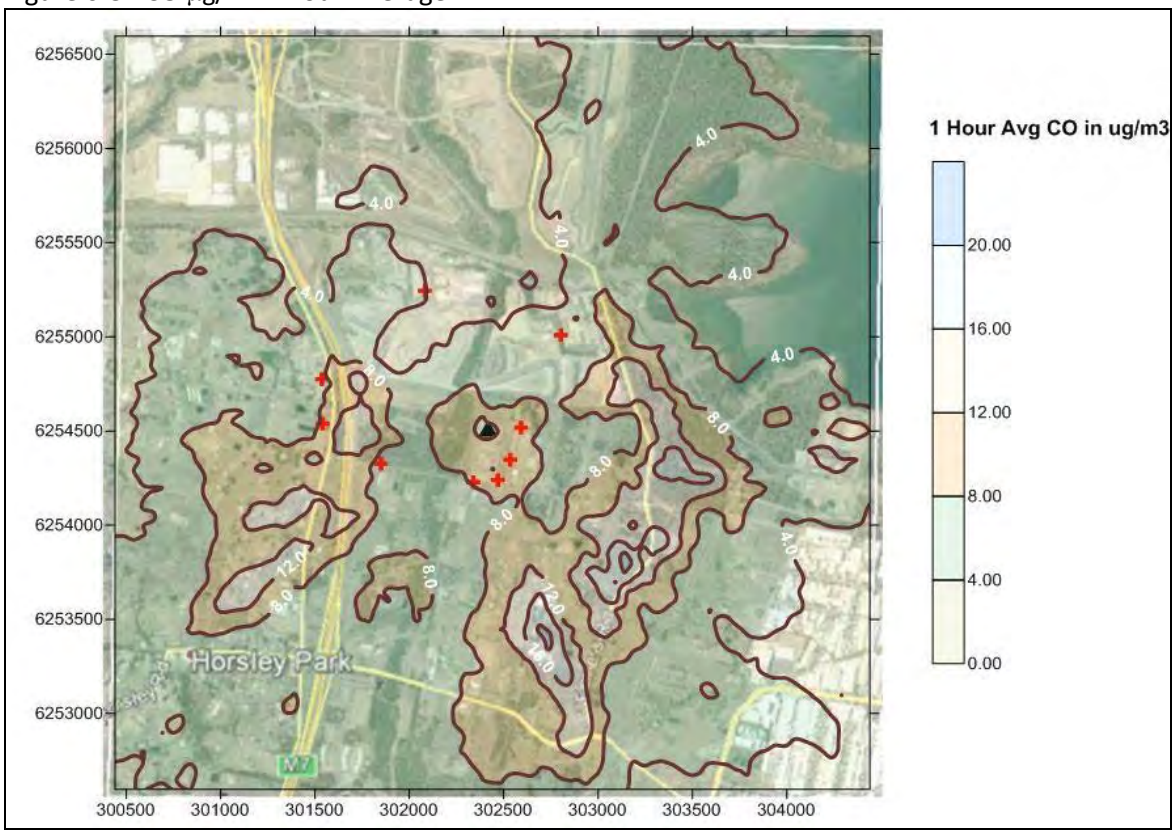
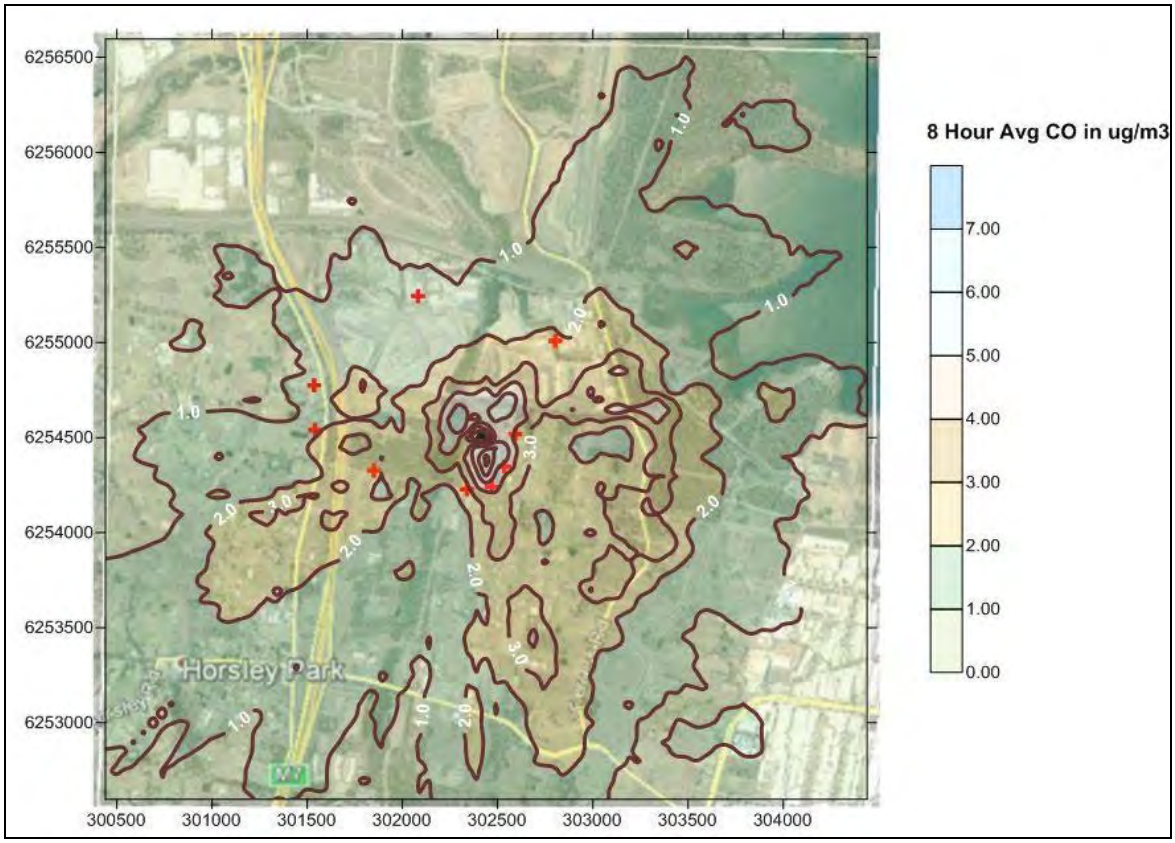


Figure 6-4: CO μg/m^3 8 Hour Average



6.5.1 Discussion of Results

The predictive modelling conducted has shown no exceedances to the assessment criteria for all pollutants.

Also observed are the minimal air impact contributions from the development when comparing the range of ground level concentration values with the respective assessment criteria. This further justifies that the development poses minimal air impact to its surrounding land use.

Given the results above, it can then be concluded that the predicted air quality impacts from the proposed development is minimal and shall not exceed the criteria stipulated by the air quality guidelines. Hence no additional actions are required.

7. RECOMMENDATIONS & CONCLUSIONS

The NSW EPA requirements were followed in preparation of this air assessment, with consultation of the methodology from NSW EPA guidelines for completing the assessment. Pollutants assessed were mainly the combustion pollutants of NO_x and CO. Predictive results from the air dispersion modelling were compared against the air impact criteria referenced from the NSW EPA Protection of the Environment (Clean Air) Regulation, 2010 and the National Environment Protection Measure. These impact criteria were used to determine if the potential impacts (incremental and cumulative) from the proposed 1.75 MW gas-fired boiler are acceptable to the air quality of the local area.

The potential air emissions for CO and NO_x from the proposed gas-fired boiler have been conservatively and thoroughly evaluated. All predicted ground level concentration results have been determined to be well below the criteria adopted from the *Approved Methods for the Modelling and Assessment of Air Pollutants*, NSW EPA, and the National Environment Protection Measure. This indicates that no air quality impacts are anticipated to occur as a result of the proposed development.

This concludes the report.

Linda Zanotto
Senior Environmental Engineer

Daniele Albanese
Senior Environmental Consultant

R T Benbow
Principal Consultant

8. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of Jemena—Horsley Park, as per our agreement for providing environmental services. Only Jemena—Horsley Park is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by Jemena—Horsley Park for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

9. REFERENCES

Guidelines and Policies

DEHP 2012, Department of Environment and Heritage Protection, Air Quality Bulletin Central Queensland, State of Queensland, Website last updated 22 October 2009.

NEPC 2003, National Environment Protection Council, National Environment Protection (Ambient Air Quality) Measure.

NSW EPA 2005, New South Wales Environment Protection Authority, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, August 2005.

Legislation

Protection of the Environment (Clean Air) Regulation, 2010

ATTACHMENTS

Attachment 1: Sample AUSPLUME Configuration File

Power Generation

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
Constant background concentration	0.00E+00
Terrain effects	Egan method
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	12 m
Roughness height at the wind vane site	0.500 m
Averaging time for sigma-theta values	60 min.

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Sigma-theta
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	0.300m
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: 1.54, 3.09, 5.14, 8.23, 10.80

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

AVERAGING TIMES
1 hour
8 hours

1

Power Generation

SOURCE CHARACTERISTICS

STACK SOURCE: PS01

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
302416	6254514	63m	9m	0.51m	200C	6.4m/s

No building wake effects.
(Constant) emission rate = 1.34E-01 grams/second
No gravitational settling or scavenging.

1

Power Generation

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
300440.m 300490.m 300540.m 300590.m 300640.m 300690.m 300740.m
300790.m 300840.m 300890.m 300940.m 300990.m 301040.m 301090.m
301140.m 301190.m 301240.m 301290.m 301340.m 301390.m 301440.m
301490.m 301540.m 301590.m 301640.m 301690.m 301740.m 301790.m
301840.m 301890.m 301940.m 301990.m 302040.m 302090.m 302140.m
302190.m 302240.m 302290.m 302340.m 302390.m 302440.m 302490.m
302540.m 302590.m 302640.m 302690.m 302740.m 302790.m 302840.m
302890.m 302940.m 302990.m 303040.m 303090.m 303140.m 303190.m
303240.m 303290.m 303340.m 303390.m 303440.m 303490.m 303540.m
303590.m 303640.m 303690.m 303740.m 303790.m 303840.m 303890.m
303940.m 303990.m 304040.m 304090.m 304140.m 304190.m 304240.m
304290.m 304340.m 304390.m 304440.m

and these y-values (or northings):
6252597.m 6252647.m 6252697.m 6252747.m 6252797.m 6252847.m 6252897.m
6252947.m 6252997.m 6253047.m 6253097.m 6253147.m 6253197.m 6253247.m
6253297.m 6253347.m 6253397.m 6253447.m 6253497.m 6253547.m 6253597.m
6253647.m 6253697.m 6253747.m 6253797.m 6253847.m 6253897.m 6253947.m
6253997.m 6254047.m 6254097.m 6254147.m 6254197.m 6254247.m 6254297.m
6254347.m 6254397.m 6254447.m 6254497.m 6254547.m 6254597.m 6254647.m
6254697.m 6254747.m 6254797.m 6254847.m 6254897.m 6254947.m 6254997.m
6255047.m 6255097.m 6255147.m 6255197.m 6255247.m 6255297.m 6255347.m
6255397.m 6255447.m 6255497.m 6255547.m 6255597.m 6255647.m 6255697.m
6255747.m 6255797.m 6255847.m 6255897.m 6255947.m 6255997.m 6256047.m
6256097.m 6256147.m 6256197.m 6256247.m 6256297.m 6256347.m 6256397.m
6256447.m 6256497.m 6256547.m 6256597.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	302082	6255246	64.4	0.0	6	302339	6254229	68.1	0.0
2	302803	6255010	64.6	0.0	7	301850	6254328	72.1	0.0
3	302592	6254519	65.1	0.0	8	301541	6254540	78.0	0.0
4	302535	6254348	68.9	0.0	9	301536	6254776	77.2	0.0
5	302469	6254240	72.9	0.0					

METEOROLOGICAL DATA : BoM Horsley Park AWS Data BoM Sydney Clouds Sydney U
a

1 Peak values for the 100 worst cases (in microgram/m3)
Averaging time = 1 hour

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)
1	2.37E+01	20,14/07/08	(302640, 6253447, 0.0)
2	2.34E+01	20,05/05/08	(302640, 6253447, 0.0)
3	2.34E+01	03,25/06/08	(303290, 6253897, 0.0)
4	2.34E+01	06,09/05/08	(303290, 6253897, 0.0)
5	2.34E+01	01,27/07/08	(303290, 6253897, 0.0)
6	2.33E+01	03,02/01/08	(303140, 6253797, 0.0)
7	2.32E+01	03,15/08/08	(303140, 6253797, 0.0)
8	2.32E+01	24,15/05/08	(303140, 6253797, 0.0)
9	2.32E+01	05,18/07/08	(303140, 6253797, 0.0)
10	2.32E+01	01,16/05/08	(303140, 6253797, 0.0)
11	2.31E+01	01,01/07/08	(303140, 6253797, 0.0)
12	2.30E+01	23,14/03/08	(303390, 6254197, 0.0)
13	2.30E+01	05,16/08/08	(303140, 6253797, 0.0)
14	2.30E+01	04,15/08/08	(303140, 6253797, 0.0)
15	2.29E+01	06,02/07/08	(303340, 6253947, 0.0)
16	2.29E+01	04,20/08/08	(303340, 6253947, 0.0)
17	2.29E+01	24,14/03/08	(303390, 6254247, 0.0)
18	2.28E+01	02,20/08/08	(303290, 6253897, 0.0)
19	2.28E+01	06,23/06/08	(303340, 6253947, 0.0)
20	2.28E+01	02,13/02/08	(302690, 6253447, 0.0)
21	2.28E+01	04,13/02/08	(302690, 6253447, 0.0)
22	2.28E+01	04,14/11/08	(302690, 6253447, 0.0)
23	2.27E+01	22,02/10/08	(302640, 6253447, 0.0)
24	2.27E+01	04,02/01/08	(303140, 6253847, 0.0)
25	2.26E+01	03,23/06/08	(303440, 6254297, 0.0)
26	2.26E+01	04,23/06/08	(303440, 6254297, 0.0)
27	2.26E+01	01,15/03/08	(303440, 6254297, 0.0)
28	2.25E+01	05,20/08/08	(302690, 6253447, 0.0)
29	2.24E+01	04,19/06/08	(302640, 6253447, 0.0)
30	2.24E+01	23,11/07/08	(303390, 6254347, 0.0)
31	2.24E+01	01,18/11/08	(303040, 6253647, 0.0)
32	2.23E+01	01,06/05/08	(303290, 6253897, 0.0)
33	2.23E+01	06,20/08/08	(302990, 6253447, 0.0)
34	2.23E+01	03,20/08/08	(303290, 6253897, 0.0)
35	2.23E+01	05,18/09/08	(303440, 6254297, 0.0)
36	2.23E+01	05,23/06/08	(303440, 6254297, 0.0)
37	2.22E+01	24,11/07/08	(303390, 6254347, 0.0)
38	2.22E+01	04,31/07/08	(303440, 6254247, 0.0)
39	2.22E+01	02,02/10/08	(303040, 6253647, 0.0)
40	2.21E+01	01,10/12/08	(302690, 6253447, 0.0)
41	2.20E+01	05,02/07/08	(303040, 6253647, 0.0)
42	2.20E+01	03,13/02/08	(302690, 6253447, 0.0)
43	2.20E+01	05,12/07/08	(303040, 6253647, 0.0)
44	2.19E+01	24,17/11/08	(303090, 6253697, 0.0)
45	2.18E+01	02,18/11/08	(303090, 6253697, 0.0)
46	2.18E+01	06,18/07/08	(303190, 6253847, 0.0)
47	2.17E+01	06,27/07/08	(303090, 6253747, 0.0)
48	2.17E+01	06,10/08/08	(303090, 6253747, 0.0)

49	2.17E+01	23,31/08/08	(303040, 6253697, 0.0)
50	2.17E+01	03,18/11/08	(303040, 6253697, 0.0)
51	2.17E+01	04,25/06/08	(303090, 6253697, 0.0)
52	2.17E+01	04,12/09/08	(303390, 6254397, 0.0)
53	2.15E+01	04,06/05/08	(302590, 6253447, 0.0)
54	2.11E+01	06,12/07/08	(303040, 6253647, 0.0)
55	2.10E+01	24,19/10/08	(302990, 6253647, 0.0)
56	2.10E+01	04,12/07/08	(302990, 6253497, 0.0)
57	2.10E+01	02,10/12/08	(302740, 6253447, 0.0)
58	2.09E+01	05,21/05/08	(303440, 6254397, 0.0)
59	2.09E+01	06,03/05/08	(303340, 6254047, 0.0)
60	2.09E+01	22,02/08/08	(303340, 6254047, 0.0)
61	2.09E+01	03,12/09/08	(303440, 6254397, 0.0)
62	2.08E+01	05,19/06/08	(302740, 6253397, 0.0)
63	2.08E+01	06,19/06/08	(302740, 6253397, 0.0)
64	2.07E+01	04,09/05/08	(302740, 6253397, 0.0)
65	2.07E+01	21,02/08/08	(303340, 6254047, 0.0)
66	2.07E+01	05,03/05/08	(303340, 6254047, 0.0)
67	2.06E+01	22,04/05/08	(301740, 6254447, 0.0)
68	2.05E+01	20,21/07/08	(303390, 6254097, 0.0)
69	2.05E+01	22,25/08/08	(301190, 6254047, 0.0)
70	2.04E+01	19,05/05/08	(302740, 6253447, 0.0)
71	2.04E+01	20,08/05/08	(301140, 6254097, 0.0)
72	2.03E+01	03,09/05/08	(302740, 6253447, 0.0)
73	2.02E+01	04,03/05/08	(303390, 6254097, 0.0)
74	2.00E+01	04,28/11/08	(301290, 6254047, 0.0)
75	2.00E+01	20,01/09/08	(301140, 6254097, 0.0)
76	1.99E+01	21,08/05/08	(301140, 6254097, 0.0)
77	1.99E+01	21,04/05/08	(301740, 6254447, 0.0)
78	1.98E+01	04,21/05/08	(303390, 6254447, 0.0)
79	1.95E+01	24,09/12/08	(302890, 6253247, 0.0)
80	1.95E+01	01,13/02/08	(302890, 6253247, 0.0)
81	1.95E+01	06,20/05/08	(303390, 6254447, 0.0)
82	1.94E+01	02,03/01/08	(301290, 6254047, 0.0)
83	1.94E+01	01,12/07/08	(303390, 6254447, 0.0)
84	1.92E+01	24,03/03/08	(301740, 6254697, 0.0)
85	1.91E+01	02,19/03/08	(301090, 6254147, 0.0)
86	1.89E+01	22,08/10/08	(301740, 6254797, 0.0)
87	1.88E+01	19,01/09/08	(301040, 6254197, 0.0)
88	1.82E+01	06,21/05/08	(303340, 6254497, 0.0)
89	1.81E+01	23,10/03/08	(301740, 6254447, 0.0)
90	1.81E+01	02,03/08/08	(303340, 6254647, 0.0)
91	1.80E+01	01,11/03/08	(301740, 6254447, 0.0)
92	1.80E+01	23,25/08/08	(301140, 6253897, 0.0)
93	1.80E+01	21,19/08/08	(303340, 6254497, 0.0)
94	1.80E+01	22,19/08/08	(303340, 6254647, 0.0)
95	1.79E+01	23,19/08/08	(303340, 6254647, 0.0)
96	1.79E+01	05,28/02/08	(303340, 6254647, 0.0)
97	1.78E+01	02,01/09/08	(301740, 6254447, 0.0)
98	1.77E+01	04,27/02/08	(303340, 6254547, 0.0)
99	1.76E+01	02,14/07/08	(303190, 6254797, 0.0)
100	1.75E+01	04,14/05/08	(303190, 6254847, 0.0)

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1 Peak values for the 100 worst cases (in microgram/m3)
Averaging time = 8 hours

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)
1	1.02E+01	08,13/02/08	(302690, 6253447, 0.0)
2	9.52E+00	24,26/10/08	(302440, 6254347, 0.0)
3	9.21E+00	08,12/07/08	(303040, 6253647, 0.0)

4	9.09E+00	16,31/12/08	(302490, 6254497,	0.0)
5	9.09E+00	08,23/06/08	(303440, 6254297,	0.0)
6	9.03E+00	16,28/11/08	(302440, 6254397,	0.0)
7	8.87E+00	16,31/08/08	(302440, 6254397,	0.0)
8	8.80E+00	24,28/10/08	(302240, 6254597,	0.0)
9	8.57E+00	16,01/08/08	(302540, 6254447,	0.0)
10	8.47E+00	08,14/07/08	(303140, 6254847,	0.0)
11	8.46E+00	08,10/03/08	(301140, 6253647,	0.0)
12	8.34E+00	08,20/08/08	(303290, 6253897,	0.0)
13	8.33E+00	16,27/12/08	(302440, 6254397,	0.0)
14	8.33E+00	08,13/08/08	(302490, 6253447,	0.0)
15	8.22E+00	24,28/06/08	(301740, 6254547,	0.0)
16	8.22E+00	16,14/09/08	(302440, 6254397,	0.0)
17	8.10E+00	08,28/04/08	(302540, 6254397,	0.0)
18	8.10E+00	08,21/05/08	(303390, 6254447,	0.0)
19	8.05E+00	16,13/09/08	(302440, 6254397,	0.0)
20	8.00E+00	08,03/04/08	(302440, 6254297,	0.0)
21	7.99E+00	08,18/11/08	(303040, 6253697,	0.0)
22	7.99E+00	08,23/11/08	(302540, 6254447,	0.0)
23	7.87E+00	16,17/05/08	(302440, 6254397,	0.0)
24	7.76E+00	08,03/05/08	(303340, 6254047,	0.0)
25	7.69E+00	16,04/02/08	(302290, 6254547,	0.0)
26	7.62E+00	16,30/03/08	(302490, 6254447,	0.0)
27	7.52E+00	16,27/04/08	(302440, 6254397,	0.0)
28	7.38E+00	24,04/02/08	(302290, 6254597,	0.0)
29	7.37E+00	16,27/10/08	(302440, 6254397,	0.0)
30	7.34E+00	16,26/09/08	(302440, 6254397,	0.0)
31	7.33E+00	16,20/11/08	(302490, 6254397,	0.0)
32	7.31E+00	24,18/06/08	(301140, 6253597,	0.0)
33	7.24E+00	08,20/06/08	(302590, 6254647,	0.0)
34	7.22E+00	08,04/12/08	(302340, 6254697,	0.0)
35	7.21E+00	08,19/06/08	(302690, 6253447,	0.0)
36	7.20E+00	08,16/09/08	(302592, 6254519,	0.0)
37	7.19E+00	16,30/06/08	(302490, 6254397,	0.0)
38	7.19E+00	16,29/10/08	(302390, 6254597,	0.0)
39	7.18E+00	16,26/05/08	(302490, 6254397,	0.0)
40	7.15E+00	16,11/12/08	(302290, 6254597,	0.0)
41	7.12E+00	24,13/12/08	(302540, 6254447,	0.0)
42	7.12E+00	16,22/11/08	(302490, 6254497,	0.0)
43	7.11E+00	08,27/04/08	(302440, 6254297,	0.0)
44	7.03E+00	16,14/07/08	(302440, 6254397,	0.0)
45	7.02E+00	16,05/11/08	(302440, 6254447,	0.0)
46	7.00E+00	08,20/09/08	(302490, 6254297,	0.0)
47	7.00E+00	16,07/07/08	(302440, 6254397,	0.0)
48	6.95E+00	16,11/01/08	(302390, 6254447,	0.0)
49	6.94E+00	24,19/08/08	(303340, 6254597,	0.0)
50	6.94E+00	16,14/12/08	(302490, 6254547,	0.0)
51	6.93E+00	16,25/06/08	(302490, 6254397,	0.0)
52	6.92E+00	24,24/02/08	(302290, 6254597,	0.0)
53	6.90E+00	08,02/01/08	(303140, 6253847,	0.0)
54	6.88E+00	24,26/11/08	(302240, 6254397,	0.0)
55	6.86E+00	16,03/01/08	(302290, 6254547,	0.0)
56	6.85E+00	24,22/09/08	(302440, 6254397,	0.0)
57	6.82E+00	16,18/11/08	(302390, 6254397,	0.0)
58	6.80E+00	16,18/05/08	(302540, 6254547,	0.0)
59	6.79E+00	24,02/08/08	(303340, 6254047,	0.0)
60	6.78E+00	24,08/08/08	(303140, 6254647,	0.0)
61	6.73E+00	08,04/07/08	(302540, 6254647,	0.0)
62	6.73E+00	24,19/07/08	(302740, 6253597,	0.0)
63	6.72E+00	08,15/04/08	(302540, 6254647,	0.0)
64	6.68E+00	16,03/10/08	(302490, 6254447,	0.0)
65	6.63E+00	24,04/05/08	(301740, 6254447,	0.0)
66	6.63E+00	16,21/06/08	(302490, 6254597,	0.0)
67	6.60E+00	08,12/06/08	(302469, 6254240,	0.0)
68	6.59E+00	24,26/09/08	(303090, 6253797,	0.0)
69	6.59E+00	16,26/10/08	(302440, 6254397,	0.0)
70	6.57E+00	16,13/01/08	(302390, 6254447,	0.0)

71	6.57E+00	24,02/04/08	(302440, 6254347, 0.0)
72	6.53E+00	08,14/01/08	(302340, 6254697, 0.0)
73	6.52E+00	16,17/01/08	(302390, 6254597, 0.0)
74	6.48E+00	16,02/01/08	(302390, 6254447, 0.0)
75	6.48E+00	16,11/07/08	(302490, 6254447, 0.0)
76	6.47E+00	08,22/05/08	(302540, 6254697, 0.0)
77	6.45E+00	08,27/06/08	(303190, 6254097, 0.0)
78	6.44E+00	08,05/06/08	(302490, 6254647, 0.0)
79	6.42E+00	08,15/06/08	(302540, 6254597, 0.0)
80	6.41E+00	16,22/09/08	(302440, 6254397, 0.0)
81	6.40E+00	16,04/11/08	(302340, 6254597, 0.0)
82	6.39E+00	16,04/09/08	(302290, 6254647, 0.0)
83	6.39E+00	08,18/04/08	(302540, 6254697, 0.0)
84	6.38E+00	16,19/09/08	(302390, 6254397, 0.0)
85	6.37E+00	08,25/07/08	(302540, 6254697, 0.0)
86	6.35E+00	08,11/03/08	(301740, 6254447, 0.0)
87	6.34E+00	16,14/08/08	(302540, 6254547, 0.0)
88	6.34E+00	16,17/04/08	(302490, 6254647, 0.0)
89	6.32E+00	16,05/06/08	(302490, 6254647, 0.0)
90	6.26E+00	24,07/12/08	(302290, 6254597, 0.0)
91	6.26E+00	08,23/10/08	(302490, 6254647, 0.0)
92	6.26E+00	16,04/12/08	(302290, 6254547, 0.0)
93	6.24E+00	24,21/03/08	(302590, 6254697, 0.0)
94	6.24E+00	16,02/04/08	(302440, 6254397, 0.0)
95	6.24E+00	08,06/06/08	(302540, 6254647, 0.0)
96	6.24E+00	16,27/03/08	(302490, 6254597, 0.0)
97	6.23E+00	08,18/07/08	(303140, 6253847, 0.0)
98	6.23E+00	16,16/05/08	(302440, 6254397, 0.0)
99	6.20E+00	08,17/04/08	(302540, 6254647, 0.0)
100	6.20E+00	08,25/04/08	(302540, 6254697, 0.0)