International Power

CHAPTER 7

Air Quality

URS

Air Quality – Summary of Key Outcomes

To meet growing electricity demand, IPRA proposes to construct and operate a nominal 120MW to 150MW open cycle peaking power plant at Parkes in central west NSW.

URS has undertaken an air quality assessment of the proposed Parkes Peaking Power Plant investigating local air quality impacts and aviation safety. A greenhouse gas assessment has also been performed.

The impact of the proposed Parkes Peaking Power Plant on local air quality has been assessed using the TAPM dispersion model. The modelled species included oxides of nitrogen (NO_X), particulate matter (PM_{10}), carbon monoxide (CO), sulphur dioxide (SO_2) and Hazardous Air Pollutants (HAP).

The assessment has used a conservative approach, in accordance with the DEC (2005) *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW.* This conservative approach assumed that all three turbines would be running for every hour of the year and assessed both natural gas and distillate fuel scenarios.

IPRA is seeking a licence to only operate for up to 10% of a year except where extraordinary market or transmission system circumstances prevail as identified by the Minister in granting the Approval and stipulated in the associated environmental licence conditions. Low sulphur distillate is proposed as a backup fuel in the event of an interruption to or constraint of the natural gas supply.

In order to calculate the cumulative impact of the peaking power plant emissions on the local air quality, worst case background concentrations of the primary pollutants were obtained from the nearest Department of Environment & Climate Change (DECC) monitoring stations.

The results of the “All Units Operating All hours” dispersion modelling showed that the predicted peak impacts in ground level concentrations of NO_2, PM_{10}, CO and SO_2, when added to peak background concentrations, were still within the DECC regulatory criteria (notwithstanding the plant run regime would only be up to 10% of the modelled scenario).

The highest concentration of NO_2 (1 hour averaging - assuming all peaking power plant emitted NO_x presented as NO_2) was predicted to be 179.8 µg/m^3 against the criteria of 246 µg/m^3. This peak NO_2 concentration was shown to occur at approximately 3.5 km south of the site. The annual average impact of NO_2 was shown to be minor and within regulatory criteria.

The 24 hour averaged background levels of PM_{10} were shown to have a cumulative maximum impact of 47.6µg/m^3 against the criteria of 50 µg/m^3, however a background PM_{10} concentration of 45.0 µg/m^3 was used, indicating impacts from the peaking power plant were low, whilst the worst case background concentrations were approaching regulatory criteria. The annual average impact of PM_{10} was shown to be minor and within regulatory criteria. SO_2 and CO were shown to have minor impacts.

HAPs were also assessed for incremental impact (from the power plant alone) and were well below regulatory criteria. Under natural gas operation, the most significant incremental impact was formaldehyde, for which the worst case 1 hour concentration (0.268 µg/m^3) constituted 1.3% of DECC assessment criteria. Under distillate operation, Polycyclic Aromatic Hydrocarbons (PAH) emissions formed the most significant incremental impact, in which the worst case 1 hour concentration (0.021 µg/m^3) constituted 5.2% of DECC regulatory criteria.

The greenhouse gas assessment indicated that based on the upper limit of proposed operation, total greenhouse gas emissions from the Parkes Peaking Power Plant are estimated to be 0.109 Mt CO_2-e per year, which will contribute 0.07% of all existing greenhouse gas sources in NSW, and up to 0.019% of the Australian emissions of greenhouse gases for all sectors.

A plume rise assessment / aviation safety study was performed which shows that the peaking power plant would produce exhaust plumes with vertical velocities that exceed 4.3m/s above the Obstacle Limitation Surface for approximately 5% of the year, based on a full year of three turbines operating.

Given the infrequent operating time of the peaking power plant and the conservative nature of the air quality assessment, it is considered that the potential for adverse air quality impacts of the proposed Parkes Peaking Power Plant will be negligible.

7.1 Introduction

The study of the likely impact of the Parkes Peaking Power Plant has comprised the following three components:

- impact on local air quality;
- aviation safety; and
- a greenhouse gas assessment.

The assessment of the impact of local air quality has used a largely conservative approach, in accordance with the DEC (2005) *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. This section provides a summary of this assessment and the full assessment is presented in **Appendix C**.

An aviation safety assessment has been conducted for the project to determine compliance with the Civil Aviation Safety Authority's (CASA) Advisory Circular *"Guidelines for Conducting Plume Rise Assessments"* (June, 2004). This assessment is summarised in this section and presented in full in **Appendix C**.

A comprehensive greenhouse gas assessment including quantitative modelling has been conducted and is presented in **Appendix C**.

7.2 Project Description

The Parkes Peaking Power Plant is proposed to be an open cycle gas turbine power plant for peaking operation, with a capacity in the range of 120MW to 150MW. The proposed facility will comprise three gas turbines fuelled primarily by natural gas from the Central West Pipeline. The peaking power plant is to be designed with the capability to operate on distillate fuel should the gas supply be interrupted. Operating duty of the peaking power plant would be determined by National Electricity Market and high voltage transmission network support requirements, however IPRA estimate operating duty to be between 5% and 10% of the year.

7.3 Air Quality Criteria

There are three main types of air quality criteria relevant to industrial developments such as the IPRA facility.

- ***Emission Standards*** – which are maximum allowable pollutant emission concentrations (stack concentrations) specified for particular types of equipment;
- ***Air Impact Assessment Criteria*** – which are designed for use in air dispersion modelling studies and air quality impact assessments for new or modified emission sources; and
- ***Ambient Air Quality Standards*** – which set standards against which ambient air quality monitoring results may be assessed.

In general, Emission Standards and Air Impact Assessment Criteria are used to evaluate the expected impact of air emissions on air quality and the effectiveness of plant design and any associated mitigation measures. The main objective of these criteria is to ensure that the resulting local and regional ambient air quality meets the relevant Ambient Air Quality Standards.

7.3.1 Emission Standards

The *Protection of the Environment Operations (Clean Air) Regulation 2002* sets emission limits for air impurities from stationary plant and equipment. The current standards, taken from Schedule 3 (Electricity Generation) of the Regulation, relevant to the IPRA peaking power plant are presented in **Table 7-1**. The plant is classified as a Group 6 source, as it will commence operation after 1 September 2005.

Table 7-1: Emission Standards for Electricity Generation (from Schedule 3, Protection of the Environment Operation (Clean Air) Regulation 2002)

Pollutant	Applicability	Limit
Solid Particulates (Total)	-	50 mg/m^3
NO_2 or NO or both as NO_2 equivalent	Any turbine operating on gas, being a turbine used in connection with an electricity generating system with a capacity of 30 MW or more	70 mg/m^3 as NO_2
	Any turbine operating on a fuel other than gas, being a turbine used in connection with an electricity generating system with a capacity of 30 MW or more	90 mg/m^3 as NO_2

Note: An activity is designated to "Group 6"if it commenced to be carried on, or to operate, on or after 1 September 2005, as a result of an environment protection licence granted under the Protection of the Environment Operations Act 1997 pursuant to an application made on or after 1 September 2005.

The emission rates used in this assessment have been based on conservative worst case emission rates. Specific turbine emission concentrations will depend upon the type of gas turbines ultimately selected but the proponent will ensure that turbine emissions, for both natural gas and distillate, will comply with the limits stipulated in the Development Approval.

7.3.2 Air Impact Assessment Criteria

In August 2005, the Department of Environment & Conservation (DEC), which incorporated the New South Wales Environment Protection Authority (NSW EPA) and which has subsequently been succeeded by Department of Environment & Climate Change (DECC), released the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*. This document specifies a range of impact assessment criteria for toxic and odorous air pollutants. The impact assessment criteria for those pollutants associated with the proposed peaking power plant are shown in **Table 7-2**.

Table 7-2: DECC Air Quality Impact Assessment Criteria

Pollutant	Concentration		Averaging Period
	(ppm)	(µg/m³)	
NO_2	0.12	246	1 hour
	0.03	62	Annual
PM_{10}	-	50	24 hour
	-	30	annual
SO_2	0.25	712	10 minutes
	0.20	570	1 hour
	0.08	228	24 hours
	0.02	60	Annual
CO	87	100,000	15 minutes
	25	30,000	1 hour
	9	10,000	8 hours
Acetaldehyde	0.023	42	1 hour
Acrolein	0.00018	0.42	1 hour
Benzene	0.009	290	1 hour
Ethylbenzene	1.8	8000	1 hour
Formaldehyde	0.018	20	1 hour
PAH	-	0.4	1 hour
Toluene	0.09	360	1 hour
Xylenes	0.04	190	1 hour

7.3.3 Ambient Air Quality Criteria

The relevant ambient air standards and goals are contained in 'Action for Air' - the NSW Government's 25-year Air Quality Management Plan (DEC, August 2006) and the National Environment Protection (Ambient Air Quality) Measure (NEPC, 1998).

The air quality goals contained within these guidelines are designed for use in assessing regional air quality and are generally not intended for use as site boundary or atmospheric dispersion modelling criteria. Although the proposed peaking power plant emissions have not been assessed directly against these guidelines, it should be noted that the maximum concentrations in these guidelines for NO_2, PM_{10}, SO_2 and CO are identical to the DEC (2005a) criteria.

Therefore, the DECC Criteria described in **Section 7.3.2** has been adopted in this assessment.

7.4 Climate and Meteorology

A summary of climatological data collected at the Parkes (MacArthur Street) station by the Bureau of Meteorology is provided in **Appendix C**. The Parkes Meteorological Station is located approximately 9km to the south east of the site. These data indicate that the region experiences hot summers and mild winters. The records show that average daily temperatures for summer generally range between 23-30°C and can exceed 40°C in January. The area has a low rainfall, with a mean annual rainfall of 585 mm reported over an average of 86 rain days per year.

As site specific meteorology was not available, the meteorological data used in the dispersion modelling was generated using the CSIRO's *The Air Pollution Model (TAPM)* dispersion model (Hurley, 2005). To further augment the meteorological data, local meteorological data from Parkes Airport (which is distinct from the Parkes Macarthur Street station) was also incorporated into TAPM. The method for developing site specific meteorological data is provided in **Appendix C**.

The predicted wind on site primarily blows from the north east, with south west winds also having significant influence.

7.5 Background Air Quality

7.5.1 Background Concentrations used for Modelling

Background air quality is generally a function of regional industrial and residential air emission sources. The area investigated is a comparatively sparsely populated rural area and combustion source emissions such as NO_x, SO_2 and CO and ozone are low. The main air pollutant of concern is particulate matter (PM_{10}) which is primarily due to the natural processes in the surrounding environment and rural and industrial activities. It is necessary to assess the background concentrations of air pollutants as they provide a baseline level to which the impact of the development can be added in order to produce a cumulative air quality impact from the development.

The DEC (2005a) requires that the peak annual background (pre-existing) concentration of a pollutant, measured by an appropriate monitoring station is used to represent the background concentration of that pollutant for the region. This results in a conservative assessment, as the concentrations of an individual pollutant are constantly varying in time and space, whereas a full year's data most likely contains several anomalous peaks in concentration due to specific events.

The background data for PM_{10} was taken from the closest DECC monitoring station at Bathurst, (located approximately 150km ESE from the proposed site), however, levels of NO_x, SO_2, CO were not available at Bathurst, consequently, background NO_x, SO_2 and CO data for 2005 was sourced from the most suitable DECC monitoring stations as per the objectives above. The closest monitoring stations were found to be Bargo (north of Goulburn) and Liverpool, which lie in the Sydney air shed. As Bargo data was considered more representative of Parkes compared with Liverpool, where possible, data from Bargo was used.

A summary of the background air quality concentrations used in this assessment, as measured by DECC, is provided in **Table 7-3**. It should be noted that ozone, whilst reported in **Table 7-3** has not been quantitatively assessed as part of this investigation, however has been discussed in relation to photochemical smog (**Section 7.8.2)**.

Table 7-3 Summary of Background Data

Species	Averaging Time	DECC Monitoring Station Data	Maximum Background Concentration (μg/m³)	Air Quality Critera (μg/m³)
NO_2	1 hour	Bargo	86.6	246
	Annual average		34.5	62
CO	15 minute	Liverpool	5900	100,000
	1 hour		4470	30,000
	8 hour		3210	10,000
SO_2	10 minute	Bargo	33.7	712
	1 hour		23.6	570
	24 hour		7.9	228
	Annual average		3.1	60
PM_{10}	24 hour	Bathurst	45	50
	Annual average		14.8	30
Ozone (O_3)	1 hour	Bathurst	120	214
	4 hour		115	171

Note: Data obtained from NSW DEC (2005b), NSW DEC (2006a), NSW DEC (2006b) and NSW DEC (2006c).

7.6 Potential Discharges to Air during Construction

The estimated duration of construction is 6-8 months, although activity on site may only be evident for 5 months. The construction phase will include mobilisation, bulk earthworks, establishing and preparing foundations, construction of buildings and plant and demobilisation.

During the construction phase, there is the potential for dust to be generated due to the excavation and handling of soils, site grading activities and vehicle movements. Given the agricultural nature of the site and its surrounds, there is considered to be no significant potential for dust emissions from construction activities to contain contaminants, or for the works to give rise to odorous emissions, consequently emissions during construction have not been quantified. The distance to the nearest residential dwellings (approximately 1 km) provides a sufficient buffer zone between the main work area and neighbouring land uses to prevent nuisance dust impacts.

7.7 Potential Discharges to Air during Operation

The operational emission parameters, pollutant data and turbine exhaust stack characteristics used in the dispersion modelling are contained in **Table 7-4**. The assessment was based on a conservative scenario of the plant using typical gas turbine emission rates provided by IPRA. Specific turbine emission concentrations will depend upon the gas turbines ultimately selected but the proponent will ensure that turbine emissions, for both natural gas and distillate, will comply with the limits stipulated in the Development Approval.

Table 7-4: Stack Parameters and Emission Rates (Full Load)

Stack Parameter	Units		
Stack Height (above ground level)	(m)	20m	
Stack Diameter	(m)	4	
Nominal Capacity	(MW)	40	
Exit Temperature	(°C)	541	
Exit Velocity	(m/s)	26	
Stack Emissions (per stack)		**Natural Gas**	**Distillate**
Primary Pollutants			
NO_X (as NO_2)	g/s	9.7	15.0
CO	g/s	6	1.4
SO_2	g/s	0.36	0.42
PM_{10}	g/s	0.6	2.1
Hazardous Air Pollutants			
Acetaldehyde	g/s	4.00E-05	-
Acrolein	g/s	6.40E-06	-
Benzene	g/s	1.20E-05	5.50E-05
Ethylbenzene	g/s	3.20E-05	-
Formaldehyde	g/s	7.10E-04	2.80E-04
PAH	g/s	2.20E-06	4.00E-05
Toluene	g/s	1.30E-04	-
Xylenes	g/s	6.40E-05	-

7.7.1 Start-up Scenario

Start-up scenarios were not included as part of this assessment. Given the relatively small scale of the proposed turbines, coupled with their open cycle configuration, they are able to reach full load within 10 minutes from the commencement of combustion. The predicted run profile for the proposed peaking power plant nominates 20-50 starts per turbine per year, which equates to a worst case start-up duty of less than 0.3% of the year.

It should also be noted that, based on the proposed turbines, formation of the primary pollutant, namely NO_2, increases in intensity throughout the load profile with greatest emissions occurring during full operational load.

On this basis, start-up emissions were not considered suitable for representation in hourly (or longer) averaged maximum statistics, and were excluded from the atmospheric dispersion modelling component of this assessment.

7.8 Summary of Potential Ambient Air Quality Impacts

Table 7-5 displays the results of the dispersion modelling. None of the species modelled were shown to exceed the DECC regulatory criteria.

Table 7-5: Dispersion Modelling Results for Natural Gas Operation

Species	Averaging Time	Maximum Predicted Impact (µg/m³)	Maximum Background (µg/m³)	Total Impact (µg/m³)	DECC Criteria (µg/m³)
NO_2	1 hour	60.2	86.6	146.8 [A]	246
	Annual	0.2	34.5	34.7	62
CO	15min	49.2	5900	5949.2	100000
	1 hour	37.3	4470	4507.3	30000
	8 hour	17.4	3210	3227.4	10000
SO_2	10min	3.2	33.7	36.9	712
	1 hour	2.2	23.6	25.8	570
	24 hour	0.5	7.9	8.4	228
	Annual	0.01	3.1	3.11	60
PM_{10}	24 hour	0.8	45	45.8	50
	Annual	0.02	14.8	14.82	30
Acetaldehyde	1 hour	0.015	-	0.015	42
Acrolein	1 hour	0.002	-	0.002	0.42
Benzene	1 hour	0.005	-	0.005	290
Ethylbenzene	1 hour	0.012	-	0.012	8000
Formaldehyde	1 hour	0.268	-	0.268	20
PAH	1 hour	0.001	-	0.001	0.4
Toluene	1 hour	0.049	-	0.049	360
Xylenes	1 hour	0.024	-	0.024	190

[A]: All NO_x present is assumed to be in the form NO_2.

Table 7-6: Dispersion Modelling Results for Distillate Operation

Species	Averaging Time	Maximum Predicted Impact ($\mu g/m^3$)	Maximum Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	DECC Criteria ($\mu g/m^3$)
NO_2	1 hour	93.2	86.6	179.8 [A]	246
	Annual	0.4	34.5	34.9	62
CO	15min	11.5	5900	5911.5	100000
	1 hour	8.7	4470	4478.7	30000
	8 hour	4.1	3210	3214.1	10000
SO_2	10min	3.7	33.7	37.4	712
	1 hour	2.6	23.6	26.2	570
	24 hour	0.5	7.9	8.4	228
	Annual	0.01	3.1	3.11	60
PM_{10}	24 hour	2.6	45	47.6	50
	Annual	0.05	14.8	14.85	30
Benzene	1 hour	0.028	-	0.028	290
Formaldehyde	1 hour	0.145	-	0.145	20
PAH	1 hour	0.021	-	0.021	0.4

[A]: All NO_x present is assumed to be in the form NO_2.

7.8.1 Nitrogen Dioxide

The ground level guidelines for oxides of nitrogen are limited to NO_2, the principal species of concern in terms of health effects. For both the 1 hour and annual averages, cumulative concentrations of NO_2 were shown to occur at concentrations below regulatory guidelines. The NO_2 assessment is considered to be conservative, as discussed in the following paragraphs.

Oxides of nitrogen (NO_x) from combustion sources are primarily made up of nitric oxide (NO) and to a lesser extent nitrogen dioxide (NO_2). The assessment was based on the assumption that all of the NOx emitted by the plant was emitted in the form of NO_2, consequently it is considered that the cumulative NO_2 values estimated as part of this assessment are conservative.

It should again be emphasised that the peaking power plant is expected to operate for less than 10% of the year, and that the modelling results shown in **Tables 7-5** and **7-6** represent the worst case short-term (1 hour) predictions based on the peaking power plant operating for every hour of the year, consequently the impacts will be significantly less than modelled.

In addition, the annual average NO_2 concentrations, when modelled under the operating conditions were shown to be below criteria of 62 $\mu g/m^3$. Given the background concentration of 34.5 $\mu g/m^3$, and the predicted cumulative impact from operation of the natural gas and distillate scenarios showed concentrations at or less than 0.4 $\mu g/m^3$, long term impacts are considered negligible.

7.8.2 Photochemical Smog

Photochemical smog is produced during extended periods of light winds (several hours to several days) accompanied by strong sunlight, as a result of reactions involving the precursor pollutants NO_x and non-methane hydrocarbons (NMHCs). These reactions produce O_3, NO_2, peroxyacetyl nitrate and aldehydes. Aerosols are also formed, which result in visible orange-brown hazes.

While there is NO_x available, the formation of photochemical smog is said to be in a "light-limiting" regime. When NO_x is limiting the formation of smog, it is called "NO_x limited". Fresh NO_x emissions, or the reaction of nitrogen oxide with partially oxidised NMHCs, may restart these photochemical reactions.

There are few major industrial sources of hydrocarbons in the area and emissions of NO_x and VOCs from vehicles would be significantly lower than the levels experienced in major metropolitan air sheds such and Sydney and Melbourne. The potential for smog generation in Parkes is therefore considered to be low and this is reflected in the ozone concentrations recorded by DECC, shown in **Table 7-3**. Photochemical smog is unlikely to occur due to operations of the gas turbine plant..

The atmospheric dispersion modelling study has indicated that NO_2 emissions from the proposed Parkes Peaking Power Plant would not result in exceedances of relevant ambient air quality criteria under normal operating conditions. It is therefore concluded that further quantitative investigations of any likely increases in the potential for smog generation as a result of the proposed Parkes Peaking Power Plant emissions are not warranted. No further investigations into smog generation have therefore been undertaken.

7.8.3 Particulate Matter (as PM_{10})

The maximum 24 hourly background concentration of PM_{10} was shown to be 45 µg/m³ whilst the average for the 12 month period was shown to be 14.8µg/m³. The maximum incremental concentration of PM_{10} (24 hour average) for either of the modelled fuels, was 2.6 $\mu g/m^3$ which equates to 5% of the DECC criteria (50 µg/m³). The highest annual PM_{10} concentration was shown to be 0.1 $\mu g/m^3$ from the distillate turbine, which represents 0.3% of the DECC criteria. Thus it is considered that increases in PM_{10} concentrations from the proposed development are minimal.

7.8.4 Sulphur Dioxide

For the proposed peaking power plant development, the maximum predicted ground level concentration of SO_2 is 37.4$\mu g/m^3$ as a 10 minute average and occurs using distillate. This is well below the 10-minute criteria for SO_2 of 712$\mu g/m^3$. Likewise, the 1-hour, 24-hour and annual concentrations of SO_2 are well below their respective guidelines for both the natural gas and distillate fuels and hence long term impacts are considered negligible.

7.8.5 Carbon Monoxide

The predicted impact of CO from the proposed development are shown to be well below criteria, hence no adverse impacts on local air quality are expected as a result of the intermittent discharge of CO from the proposed peaking power plant and the long term impacts are considered negligible.

7.8.6 Hazardous Air Pollutants

Following approved methods, HAP were assessed for incremental impact (from the plant alone) and were well below regulatory criteria.

Under natural gas operation, the most significant incremental impact was formaldehyde, for which the worst case 1-hour concentration (0.268µg/m^3) constituted 1.3% of DECC criteria. Under distillate operation, Polycyclic Aromatic Hydrocarbons (PAH) emissions formed the most substantial incremental impact, for which the worst case 1-hour concentration (0.021 µg/m^3) constituted 5.2% of DECC criteria.

7.9 Greenhouse Gas Assessment

The Director-General's Environmental Assessment Requirements specify that both direct and indirect emissions from the project should be assessed. Consequently a greenhouse gas assessment was undertaken using the Australian Greenhouse Office's quantitative methodology.

Individual contributions to the total site emissions were estimated from the use of natural gas and distillate fuel for stationary energy generation. These were compared to the estimated annual power output from the Parkes Peaking Power Plant to assess the annual greenhouse gas contribution to the NSW and the Australian greenhouse gas emissions, based on a 10% generation and over the life of the Peaking Power Plant

7.9.1 Greenhouse Gas Assessment Methodology

The greenhouse gas emission inventory for the Parkes Peaking Power Plant is based on the methodology detailed in the Greenhouse Gas Protocol (National Emissions Trading Taskforce, 2006), the relevant emission factors in the *Factors and Methods Workbook* 2006 (AGO, 2007) and the *Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2005 – Energy (Stationary Sources)* (AGO, 2006). The Protocol was first established in 1998 to develop internationally-accepted accounting and reporting standards for greenhouse gas emissions from companies.

The Greenhouse Gas Protocol is based on the concept of emission "scopes".

- **Scope 1:** Direct greenhouse gas emissions. Direct greenhouse gas emissions occur from sources that are owned or controlled by a company. For example:
  - Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.;
  - Emissions from chemical production in owned or controlled process equipment.
- **Scope 2:** Electricity indirect greenhouse gas emissions. This accounts for greenhouse gas emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.
- **Scope 3:** Other indirect greenhouse gas emissions. This is an optional reporting class that accounts for all other indirect greenhouse gas emissions resulting from a company's activities, but occurring from sources not owned or controlled by the company. Examples include extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

7.9.2 Greenhouse Gas Inventory

The greenhouse gas inventory for the Parkes Peaking Power Plant reports Scope 1 and Scope 3 emissions to account for the direct (Scope 1) and indirect (Scope 3) emissions from the project. The operational boundary is defined as the boundary of the power plant site. Scope 3 emissions are limited to upstream emissions from the production of natural gas and distillate fuel used for electricity generation.

The estimated fuel consumption and power generated per year (power sent out) are presented in **Table 7-7**.

Table 7-7 Estimated Gas and Distillate Consumption and Electricity Sent Out

Parameter	Value	Units
Amount Gas Combusted	1,240,000	GJ/yr
Amount Distillate Combusted	6,000	tonne/yr
Electricity Sent Out	115,000	MWh/yr

The following parameters were not included in the assessment as they contribute negligibly to the site's GHG inventory:

- liquid fuel combusted by off-site vehicles;
- liquid refrigerant losses; and
- electricity purchased from the grid.

Table 7-8 summarises the direct and indirect greenhouse gas emissions from the project.

Table 7-8 Greenhouse Gas Inventory for Parkes Project - Direct Emissions

Parameter	Value	Units
Total Direct Greenhouse Gas Emissions	82,358,000	**kg CO_2-e per year**
	0.082	**Mt CO_2-e per year**
Total Indirect Greenhouse Gas Emissions	26,305,000	**kg CO_2-e per year**
	0.026	**Mt CO_2-e per year**
Total combined Greenhouse Gas Emissions	0.109	**Mt CO_2-e per year**

7.10 Management of Greenhouse Gases

The principal greenhouse gas emission from the Parkes Peaking Power Plant is carbon dioxide. Minor quantities of other greenhouse gases may be emitted and have been quantified in this report. Due to the nature of the efficient combustion process inherent in the modern gas turbine and the limited period of actual operations, greenhouse gas emissions from the Parkes Peaking Power Plant relative to the emissions from intermediate and base load power plants are very low. The total greenhouse gas emissions from the Parkes Peaking Power Plant are estimated to contribute 0.07% of all existing greenhouse gas sources in NSW, and up to 0.019% of the Australian emissions of greenhouse gases for all sectors.

Although there are currently no regulated limits on greenhouse emissions, there are a number of recent developments at the State, National and international levels to manage greenhouse gas emissions. Parkes Peaking Power Plant will participate in the relevant programs to manage greenhouse gas emissions, including the Generator Efficiency Standards, the Greenhouse Challenge Plus program and will develop an Environmental Management System for the site.

Parkes Peaking Power Plant will contribute to the reduction of greenhouse gas emissions at the network transmission network level by displacing power that would otherwise be generated by more carbon-intensive fossil fuelled power plant. By injecting power at the local level when high local demand requires it, the line loss inefficiencies associated with long transmission lines are also minimised.

IPRA have committed to meeting the State and Federal greenhouse gas programs that are applicable to the site. All IPRA assets operating in Australia are participants in the Greenhouse Challenge Plus program, and all have either committed or are in process of committing to the legally binding targets under the Commonwealth Government's Generator Efficiency Standards. As part of these programs, IPRA monitors GHG emissions, thermal efficiency and heat rate at each generator site, and implement programs to improve operational performance and reduce emissions. The Parkes Peaking Power Plant will also become a participant in these programs.

In addition to the above IPRA and working with the Commonwealth and the Victorian Governments to trial Carbon Dioxide capture and storage in Victoria

Given the negligible GHG contribution from the Parkes Peaking Plant, IPRA is not proposing to implement any additional greenhouse gas offsets for this project.

7.11 Aviation Safety

Due to the plume rise from the gas turbine exhaust stack emissions, an aviation hazard analysis based on the predicted impacts of the proposed facility has been performed and is shown in **Appendix C**. The statistics have been compiled in accordance with the Civil Aviation Safety Authority's (CASA) Advisory Circular *"Guidelines for Conducting Plume Rise Assessments"* (June, 2004). Where there is potential for an exhaust plume with a vertical velocity greater than 4.3m/s at the Obstacle Limitation Surface (OLS) of 110m, a hazard analysis is required.

This assessment involved use of the TAPM model which was used to create site-specific meteorological data, including meteorology for the upper atmosphere. TAPM was also used to calculate plume rise trajectories for the turbine emissions.

The modelling results show that the peaking power plant would produce exhaust plumes with vertical velocities that exceed 4.3m/s above the OLS for approximately 5% of the year (assuming the plant was running at full load for all hours of the modelled year, 2005). The maximum, minimum and average heights at which the plume velocity is greater than 4.3 m/s are provided in **Table 7-9**. It should be noted that the plume exhausts from the turbines running on natural gas and distillate were considered identical. Consultation on this assessment with CASA has been initiated and a process agreed upon to address identified issues.

Table 7-9 Maximum, Minimum and Average Critical Plume Extents

Natural Gas	Critical Vertical Plume Extent (m)	Critical Horizontal Plume Extent (m)
Maximum	360	96
Minimum	28	13
Average	50	26

7.12 Summary of Mitigation Measures

Table 7-10 presents a summary of the air quality mitigation measures.

Table 7-10 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
As part of the detailed design of the development, the assumptions and emission estimates used in this assessment will be reviewed and should the expected emission rates or stack details increase over the values used here, the modelling will be revised to ensure that DECC air quality standards and goals will be met.	✓		
Throughout the design process, opportunities to minimise emissions to air will be investigated and implemented wherever practicable to ensure that off-site impacts are kept to a minimum.	✓		
Liaise with CASA to address the issue of potential aviation hazard of the plant.	✓		
Any emissions of dust particulates during construction would be specifically controlled through the implementation of mitigation measures, which would be incorporated into a Construction Environment Management Plan (CEMP).	✓	✓	
The CEMP would consider the most appropriate dust mitigation method suited to the activity and circumstances. This would include: • watering, spraying or covering earthworks during excavation and handling and on exposed surfaces and stockpiles; • scheduling activities for more favourable meteorological conditions; • ceasing earthmoving activities when wind speeds exceed 30 km/hr; • covering or limiting truck soil loads; • reducing speed limits on unsealed surfaces; • cleaning soil off the undercarriage and wheels of trucks		✓	
Any long-term stockpiles would be stabilised using measures such as fastseeding grass or synthetic cover spray.		✓	