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QUEENSLAND COKE & ENERGY

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Summary

The proposed Coke Plant will release emissions to the air from stack and low-level sources. The operation of the Power Plant will not produce emissions to air as it has no combustion sources. This section describes the environmental values at the project site in relation to air (i.e. the existing air quality and sources of air pollutants), the expected emissions of pollutants to air and the predicted impacts of the air emissions from the Coke Plant around Stanwell.

The project activities at Fisherman's Landing near Gladstone may generate low levels of dust. However due to the screening of the coke at Stanwell, the coarse grained nature of the coke and the distance to receptors these activities are not considered to be the source of significant impact.

Ambient air quality monitoring has been undertaken in the Stanwell area for six years. Baseline meteorological and air quality measurements for the Project have been derived from monitoring station data collected by SCL over the period 1997 – 2003. The Stanwell area has one existing industrial source of air pollutants, the Stanwell Power Station (SPS). In addition to existing monitoring data, modelling of the predicted emissions from SPS at the licence limit coal quality conditions, maximum load and 100% plant availability (i.e. worst case scenario) has been undertaken to provide the background air quality for SO_2, nitrogen dioxide (NO_2) and PM_{10}.

Sources of air pollutants in the production of coke are from the coal handling, charging, coking process, pushing, quenching and coke handling operations. The pollutants that are expected to be emitted from the Project are SO_2, NO_2, PM_{10}, carbon monoxide (CO), volatile organic compounds (VOCs), poly aromatic hydrocarbons (PAHs) and metals. The emissions of these pollutants have been estimated using coal quality specifications that represent the required criteria for the coking process and Stage 2 production scenario (3.2 Mtpa), as this represents the worst case scenario in terms of project emissions. The design of the Project will incorporate features that minimise air quality impacts, such as the use of stamp charging to reduce emissions during charging and pushing and operation of the coke ovens under negative pressure to control gas combustion and substantially reduce fugitive air emissions.

Dispersion modelling was conducted to determine compliance with ambient air quality guidelines for human health. This has required multiple stages, firstly to generate windfields for the Stanwell region using specialised meteorological models and utilising the meteorological monitoring data collected in the region. The windfields have been used in the dispersion model Calpuff to calculate the predicted ground-level concentrations of pollutants emitted from the Project.

The predicted impacts from operation of the Project will satisfy air quality guidelines for human health for NO_2, PM_{10}, CO, VOC, PAH and metals. Predicted combined impacts of SO_2 from the Project and SPS indicate that under worst case conditions one exceedence (above an allowable eight exceedences) of the 10-minute air quality guideline may occur in a year, while the 1-hour and annual average guidelines are met at existing residential locations. The modelling of SPS is based on operation of SPS at licence limit conditions for coal quality, maximum capacity and 100% plant availability, therefore estimated emissions of SO_2 are significantly (in the order of 45%) higher than the typical operation of SPS, and thus the modelling outputs are very conservative and represent the worst-case combined impact scenario.

The potential impacts of SO_2 and NO_2 on vegetation are examined in Section 6 – Nature Conservation. Photochemical smog impacts are not currently a problem for the Stanwell region. The operation of the Project will add slightly to the existing situation but will not reach or exceed recognised guideline levels.

7.1 Description of Environmental Values

The environmental values related to air quality can be discussed in terms of State and National guidelines or goals which identify acceptable air pollutant levels, and also in terms of air quality monitoring conducted in the area, particularly in and around Stanwell. The climate of the region is described in Section 4 – Climate, which discusses the winds, temperature, radiation, rainfall and climate extremes of the area.

7.1.1 Air Quality Guidelines

State air quality guidelines that are in force in Queensland are set in the *Environmental Protection (Air) Policy 1997* (*EPP (Air)*). The National standards that are used to evaluate air quality impacts are the National Environment Protection Council's (NEPC) (Ambient Air Quality) Measure (1998, revised in 2003) (NEPM-Air). The *EPP (Air)* guidelines do not address some pollutants, such as PAHs, VOC and most metals, hence guidelines have been sourced from the Victorian State Environmental Protection Policy (Victorian SEPP) Design Criteria (2001) and the NEPM for Air Toxics (2004).

The *EPP (Air)* guidelines are reported in three parts: Part 1 for aesthetic enjoyment of places and visual and local amenity; Part 2 for biological integrity; and Part 3 for other indicators and goals (generally considered to be for protection of human health). These are presented in Table 7.1 to Table **7.3** respectively for the substances that are relevant to the Project.

Table 7.1 *EPP (Air)* Schedule 1 Part 1 – Indicators and Goals Relevant to the Aesthetic Enjoyment of Places and Visual and Local Amenity

Air Quality Indicator	Averaging Time (mins)	Air Quality Goal (µg/m³)
Carbon disulphide	30	20
Styrene	30	70
Toluene	30	1,000

Table 7.2 *EPP (Air)* Schedule 1 Part 2 – Indicators and Goals Relevant to Biological Integrity

Air Quality Indicator	Averaging Time	Air Quality Goal (µg/m³)
Nitrogen dioxide	4 hours	95
	1 year	30
Ozone	1 hour	210
	24 hours	65
	100 days of a growing season	60
Sulphur dioxide	24 hours	100
	1 year	60

Table 7.3 *EPP (Air)* Schedule 1 Part 3 – Other Indicators and Goals

Air Quality Indicator	Averaging Time	Air Quality Goal (µg/m³)
Cadmium	1 year	0.02 µg/m³ (maximum with no increase above existing levels)
Carbon disulphide	24 hours	100
Carbon monoxide	8 hours	10,000
Dichloromethane	24 hours	3,000
Formaldehyde	30 minutes	100
Lead	90 days	1.5
Manganese	1 year	1
Nitrogen dioxide	1 hour	320
Ozone and photo-chemical oxidants	1 hour	210
Particles (as PM_{10})	24 hours	150
	1 year	50
Particles (as total suspended particulate)	1 year	90
Styrene	24 hours	800
Sulphur dioxide	10 minutes	700
	1 hour	570
	1 year	60
Toluene	24 hours	8,000
Trichloroethylene	24 hours	1,000

The NEPM-Air standards for ambient air quality are presented in Table 7.4. These standards are for the protection of human health, and are to be evaluated at performance monitoring stations in each state. The monitoring locations in the vicinity of Stanwell Power Station are not performance monitoring locations.

Table 7.4 NEPM-Air Schedule 2 - Standards and Goals

Pollutant	Averaging Time	Air Quality Standard ($\mu g/m^3$)	Goal within 10 years. Maximum Allowable Exceedences
Carbon monoxide	8 hours	11247	1 day a year
Nitrogen dioxide	1 hour	246	1 day a year
	1 year	62	none
Photochemical oxidants (as ozone)	1 hour	214	1 day a year
	4 hours	171	1 day a year
Sulphur dioxide	1 hour	570	1 day a year
	1 day	228	1 day a year
	1 year	60	none
Lead	1 year	0.50	none
Particles (as PM_{10})	1 day	50	5 days a year
Particles (as $PM_{2.5}$)	1 day	25	Advisory reporting standard, to gather data for review of NEPM-Air
	1 year	8	

Odour guidelines for new industries are specified by the Queensland Environmental Protection Agency (EPA) (EPA, 2004) based on whether the source is a tall stack source or a ground-level source. These are presented in Table 7.5, and are used to evaluate the modelled odour concentrations at the most exposed existing or likely future off-site sensitive receptors.

Table 7.5 Odour Guidelines for New Industries, (EPA, 2004)

Source Type	Averaging Period	Air Quality Goal
Stack sources	1 hour	0.5 odour units, 99.5th percentile
Ground-based sources	1 hour	2.5 odour units, 99.5th percentile

Many pollutants that are likely to be emitted from the Project are not addressed in the *EPP (Air)* goals, such as PAH, VOC and many metals. The Victorian Government has published design criteria for these pollutants, based on odour, toxicity, carcinogenic effects or bioaccumulation in Schedule A of the State Environment Protection Policy (Victorian SEPP, 2001). These are listed in Table 7.6 for pollutants that are emitted from the Project, as well as the reason for the classification. In some instances, the pollutant may be listed for toxicity and odour, in which case the lowest design criteria are used. All design criteria listed are for 3-minute average concentrations.

Table 7.6 Victorian SEPP Design Criteria for Toxic Air Pollutants (3-Minute Average Ground-Level Concentrations)

Pollutant	Reason for Classification	Design Criteria (µg/m³)
Sulphuric Acid	Toxicity	33
Benzene	International Agency for Research on Cancer (IARC) Group 1 carcinogen	53
Bromoform	Toxicity	170
Bromomethane	Toxicity	630
2-Butanone	Odour	5900
Carbon Disulphide	Odour	130
Chlorobenzene	Odour	200
Chloromethane	Toxicity	3400
Chloroform	Toxicity	330
Cumene	Odour	390
EthylBenzene	Toxicity	14500
Methylene Chloride	Toxicity	5800
n-Hexane	Toxicity	5900
4-Methyl-2-Pentanone	Odour	410
Phenol	Odour	36
Styrene	Odour	210
Toluene	Odour	650
1,1,1-Trichloroethane	Toxicity	22700
1,1,2-Trichloroethane	Toxicity	1800
Xylenes	Odour	350
Total PAH	IARC Group 2A carcinogen	0.73
Antimony	Toxicity	17
Arsenic	IARC Group 1 carcinogen	0.17
Beryllium	IARC Group 1 carcinogen	0.007
Cadmium	IARC Group 1 carcinogen	0.033
Chromium VI compounds	IARC Group 1 carcinogen	0.17
Chromium III compounds	Toxicity	17
Manganese	Toxicity	33
Mercury Organic	Bioaccumulation	0.33
Nickel	IARC Group 1 carcinogen	0.33

The National Environment Protection Council has recently published the National Environment Protection (Air Toxics) Measure (NEPC, 2004). The aim of this measure is to gather sufficient information on a number of air toxics over the next eight years to facilitate the development of national standards. The monitoring investigation levels are presented as a guide to air quality values and are not enforceable. These monitoring investigation levels are presented in Table 7.7.

Table 7.7 National Environment Protection (Air Toxics) Measure – Monitoring Investigation Levels

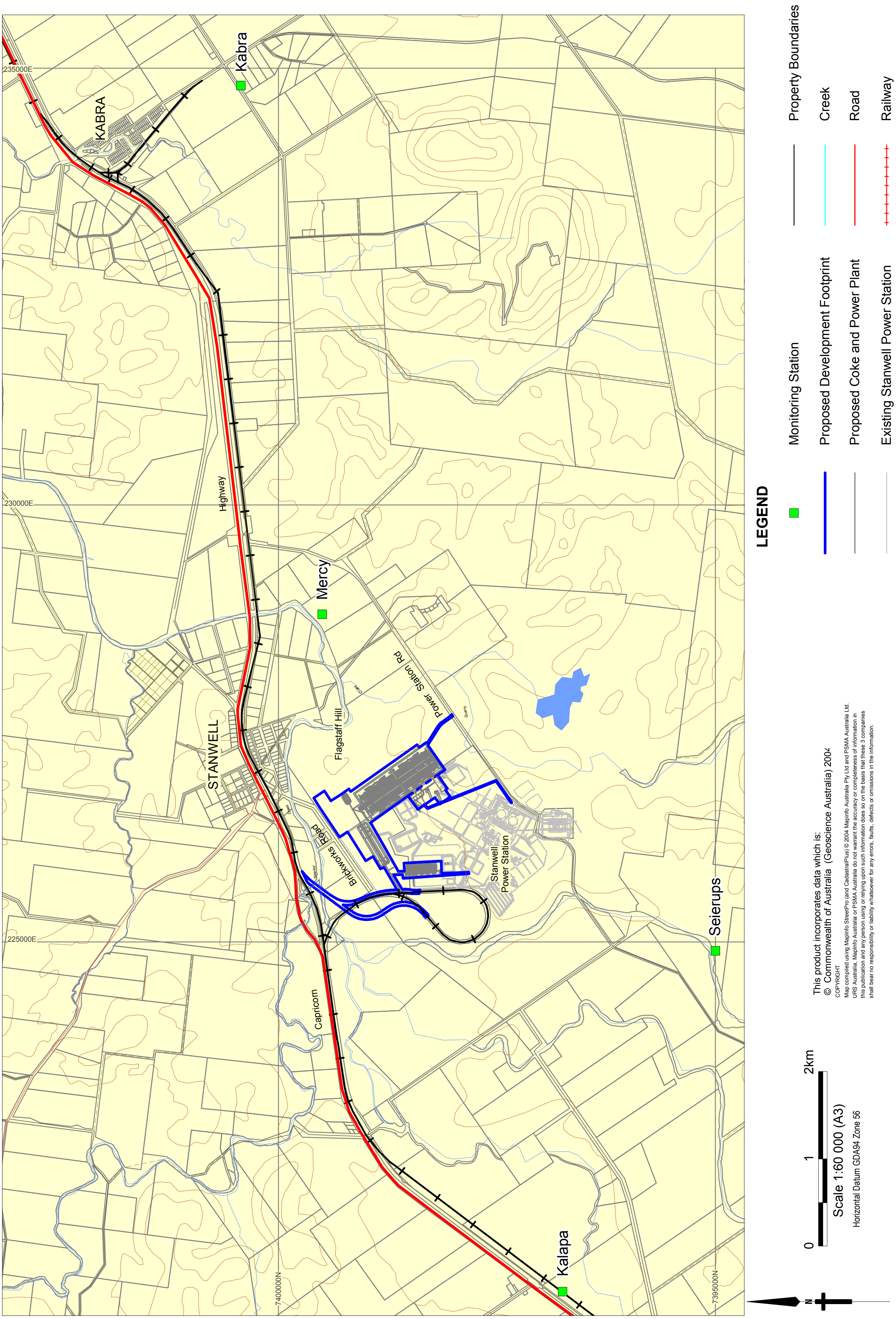
Pollutant	Averaging Period	Monitoring Investigation Level	Goal
Benzene	Annual average	0.003 ppm	8-year goal is to gather sufficient data nationally to facilitate development of a standard.
Benzo(a)pyrene as a marker for PAH	Annual average	0.3 ng/m^3	
Formaldehyde	24 hours	0.04 ppm	
Toluene	24 hours Annual average	1 ppm 0.1 ppm	
Xylenes (as total of ortho, meta and para isomers)	24 hours Annual average	0.25 ppm 0.2 ppm	

7.1.2 Existing Air Quality

Based on formal complaint records it would appear the general community perception of existing air quality in the Stanwell area is that it is at least of an acceptable standard. Since January 2001 only one formal complaint relating directly to air quality ("visible brown smog not dispersing" - June 2005) in the Stanwell area has been received by the EPA.

Air quality measurements were undertaken around SPS between 1997 and 2003. A total of seven sites measured SO_2, nitrogen oxides (NO_x), ozone (O_3), total suspended particulates (TSP), PM_{10} and $PM_{2.5}$ over various time periods. The Seierup (south-west of SPS), Kalapa (west/south-west of SPS) and Mercy (north-east of SPS) monitoring sites provide long-term datasets. The locations of these sites which were used to provide input data for the meteorological modelling are provided on Figure 7.1. Further details on the parameters measured at each site are provided in Appendix I.1. Due to the proximity to SPS, the ambient monitoring stations for which data are presented cannot be regarded as performance monitoring stations for the purpose of comparing air quality levels with the NEPM Air. The ambient monitoring data has not been quantitatively compared to the NEPM - Air standards for PM_{10} and $PM_{2.5}$, however they are included in the table as a reference.

Table 7.8 presents a summary of the existing air quality monitoring data around SPS, indicating the maximum concentration recorded at any of the sites in the monitoring network, and the highest number of exceedences over the *EPP (Air)* goals that were recorded at any of the sites. Current ambient air quality in the vicinity of SPS is within the air quality guidelines for most pollutants. Four exceedences of the 10-minute SO_2 guideline and one exceedence of the 4-hour O_3 guideline have been measured at the Seierup site over six years of continuous monitoring. The 24-hour average concentration of PM_{10} has exceeded the *EPP (Air)* goal of 150 µg/m³ on two occasions over six years of monitoring. The *EPP (Air)* goal for biological integrity for NO_2 was exceeded on one occasion at the Mercy monitoring site to the north-east over the two years of monitoring data. These recorded exceedences, over six years of



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QUEENSLAND COKE
AND POWER PLANT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

AIR QUALITY MONITORING LOCATIONS

Drawn: VH | Approved: JMcD | Date: 06-01-06

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monitoring, are acceptable as the *EPP (Air)* allows for up to eight exceedences of the one-hour goals per year.

Table 7.8 Summary of Existing Air Quality Monitoring Data around SPS (µg/m³)

Pollutant	Averaging Period	Maximum Concentration Recorded at any Site	Number of Exceedences of EPP (Air) Goal at any Monitoring Sites	Air Quality Guideline or Standard
Sulphur dioxide	10-minute	811	4 (all at Seierup)	700, *EPP (Air)*
	1-hour	471	0	570, *EPP (Air)*
	24-hour	77	0	100, *EPP (Air)*[1]
	Annual	8	0	60, *EPP (Air)*
Nitrogen dioxide	1-hour	217	0	320, *EPP (Air)*
	4-hour	111	1 (Seierup)	95, *EPP (Air)*[1]
	Annual	9	0	30, *EPP (Air)*[1]
Ozone	1-hour	186	0	210, *EPP (Air)*
TSP	Annual	17.8	0	90, *EPP (Air)*
PM_{10}	24-hour	257	2 (Seierup)	150, *EPP (Air)*
				50, NEPM-Air[2]
$PM_{2.5}$	24-hour	16.5	0	25, NEPM-Air[2]

Notes: [1] *EPP (Air)* goal for biological integrity
[2] The air monitoring stations were not intended to be performance monitoring stations for measuring compliance with NEPM Air, thus these data cannot be used for this purpose.

7.1.3 Existing Sources of Air Pollutants

The Project is located adjacent to the SPS which is the major industrial source of SO_2, NO_x and PM_{10} and other coal combustion pollutants in the local airshed. Dispersion modelling of the SO_2, NO_2 and PM_{10} emissions from SPS was conducted for situations where the SPS is operating at full capacity (full load), at licence limits for coal quality (0.8% sulphur) and at 100% plant availability.

Table 7.9 Summary of Operating Emissions for the SPS (based on NPI calculations)

	Average 1999-2005	1999	2000	2001	2002	2003	2004	2005
Average SO2 emission rate (g/s)	1036	966	880	1123	1157	1130	955	1040
Average coal S content (%)	0.51	0.49	0.44	0.55	0.55	0.55	0.51	0.51
Average NOx emission rate (g/s)	952	994	1000	942	970	948	961	n/a

Typical operating conditions are varying loads, coal sulphur content in the order of 0.43% - 0.55% and 90% to 95% plant availability. Therefore, the modelling scenario considers the worst case possible for operational conditions for the SPS. Further discussion of the SPS worst case and typical operating condition scenarios are presented in Appendix I.1.

Model estimates for SO_2 emissions were based on the maximum sulphur content in coal of 0.8% as stipulated in SPS's operating licence. The resultant emissions of SO_2 used for this historical modelling were significantly (in the order of 45%) higher than which would actually be generated from typical operations of SPS. NO_2 emissions were also modelled using licence limits for this assessment, which is approximately 50% higher than typical operating levels (refer Table 7.9).

The modelling of the background air quality impacts due to SPS found that the short-term maximum concentrations of SO_2 are predicted to occur relatively close to SPS to the south and south-west of the facility. The model predictions are consistent with measured concentrations obtained from the network of air quality monitoring stations, with measured short-term maximum concentrations recorded at the Seierup site which is located south-west of the SPS, thus supporting the modelling methodology. The modelling also indicates that some exceedences of the 1-hour and 10-minute SO_2 guidelines may occur, although these results are an over-estimate compared to the monitored concentrations of SO_2 from 1997 to 2003, highlighting a level of conservatism in the modelling. Maximum long-term (annual average) concentrations of SO_2 are predicted to occur at approximately 5 to7 km from the SPS, near the Kalapa monitoring site. The modelled values are well within air quality goals and correspond to measured concentrations of SO_2 at Kalapa, further supporting the modelling methodology.

Modelled ground-level concentrations of particulate matter due to SPS are low, and are well below the levels recorded at the monitoring sites. This is due to other sources of particulate matter, such as bushfires and farming activities, contributing the most to particulate levels in the region.

Overall, the modelling of background emissions from SPS, shown in Appendix I.1 provides a good representation of the distribution of regional and local impacts from SPS, and when compared to monitoring data, indicates the modelled values are generally conservative.

7.2 Potential Impacts and Mitigation Measures

7.2.1 Emissions to Air

The Project at the completion of Stage 2 will have a total capacity of 3.2 Mtpa of coke product, requiring approximately 5 Mtpa of wet coking coal as the raw material in the process. The Coke Plant will likely comprise eight batteries of ovens, each with 80 individual ovens (640 coke ovens in total). The coke batteries are arranged in pairs to form a product line, with each coke product line to have one stamp charging machine, two charging and pushing cars and two quench cars. Each product line will have one quench tower and one main stack for release of combustion products. The Power Plant will be operated with steam from heat recovery from the combusted coke flue gas, referred to as normal operation of the plant. The heat recovery mode will not always be used, such as when the Power Plant is undergoing maintenance and during the early stage development of the coke oven batteries. This scenario is referred to as 'operation without heat recovery'.

Dispersion modelling was conducted to quantify the potential impacts of the Project and the initial step was to identify the types and quantities of emissions. Emissions from the Project will only arise from the

Coke Plant, as the Power Plant does not have any combustion sources. Thus, any reference to emissions or impacts due to air emissions from the Project refers to the Coke Plant emissions.

Potential sources of emissions to air arise at every stage of the coking process, from unloading of the raw coal feedstock to loading of the product coke onto trains. Emissions of pollutants to air result from a mixture of stack sources, buoyant area sources and fugitive sources. The release points and substances released are as follows:

- Material handling of coal, comprising unloading of trains, stacking and reclaiming to coal stockpile and loading to charging machine – particulate matter;
- Coal charging to ovens – particulate matter, SO_2, CO, VOC, PAH, trace metals;
- Process emissions through the main stacks – particulate matter, SO_2, NO_x, CO, VOC, PAH, trace metals;
- Pushing coke from ovens – particulate matter, SO_2, NO_x, CO, VOC, trace metals;
- Quench tower – particulate matter, VOC, PAH, trace metals; and
- Material handling of coke, comprising loadout from quench car, stacking and reclaiming to coke stockpile, stacking and reclaiming to emergency coke stockpile and loading to trains – particulate matter.

Emissions from the charging and pushing operations occur at elevated temperatures (above 200 ^{o}C). These sources have been modelled as buoyant area sources in the dispersion model to account for the initial thermal buoyancy of the emissions. Emissions from the main stacks and the quench tower have been modelled as stack sources. Other emissions due to materials handling operations (such as coal and coke transfer) have been modelled as volume sources, while the coal and coke stockpiles have been modelled as area sources in the dispersion modelling.

The emissions of pollutants from the Coke Plant have been derived using information from a number of sources:

- Data on the typical Australian coking coal blend composition and coal quality (ACARP, 1996);
- PAH compound split from typical coal combustion (provided by SCL);
- A recently proposed similar overseas coke plant (at the time of modelling data from the potential technology providers was unavailable). This facility proposes to produce 1.7 Mtpa of coke, approximately half the capacity of the Project. In particular, the permit application of this project was used to estimate the emissions from the different coking stages and emission points (charging, pushing, main stacks and quench stacks). This in turn was largely based on the emission data published in AP-42 (USEPA, 2000). Adjustments were made for the capacity of the plant and the differences in characteristics between the proposed coal used for the plant overseas and the Australian coal that will be used for the Project.

Further details of the emissions calculated for the Project are presented in Appendix I.2. The emission rates of pollutants emitted from the charging, main stack, pushing and quenching operations, as well as the total emissions from the Project, are presented in Table 7.10. The emissions of TSP and PM_{10} from the coal and coke handling operations are also included in the total emission rates for these pollutants.

Table 7.10 Summary of Annual Emission Rates from Charging, Main Stack, Pushing and Quenching Operations and Total Emissions for the Project

Pollutant	Emission Rate of Pollutants (tpa) at 3.2 Mtpa Coke Production
TSP	2,579 [1]
PM_{10}	2,375 [1]
SO_2	14,920
NO_x	2,701
CO	293.2
VOC	93.2
H_2SO_4	77.8
Benzene	1.3
Bromoform	0.003
Bromomethane	1.4
2-Butanone	0.16
Carbon Disulphide	0.046
Chlorobenzene	0.003
Chloromethane	1.9
Chloroform	0.028
Cumene	0.004
Ethyl Benzene	0.010
Iodomethane	0.016
Isooctane	0.041
Methylene Chloride	1.7
n-Hexane	0.038
4-Methyl-2-Pentanone	0.023
2- Methylphenol	0.040
4- Methylphenol/ 3-Methylphenol	0.13
Phenol	0.27
Styrene	0.018
Tert-butyl Methyl Ether	0.0001
Tetrachloroethene	0.001
1,1,2,2-Tetrachloroethane	0.005
Toluene	1.3
1,1,1-Trichloroethane	0.006
1,1,2-Trichloroethane	0.001
Trichloroethene	0.022

Pollutant	Emission Rate of Pollutants (tpa) at 3.2 Mtpa Coke Production
Vinyl Acetate	0.018
Xylenes	0.059
Benzene-soluble organics	0.54
Total PAH	0.86
Naphthalene	0.27
Acenaphthylene	0.044
Acenaphthene	0.062
Fluorene	0.19
Phenanthrene	0.11
Fluoranthene	0.026
Pyrene	0.088
Benzo[a]pyrene	0.004
Indeno[123-c,d]pyrene	0.009
Benzo[g,h,I]perylene	0.044
Antimony	0.025
Arsenic	0.030
Beryllium	0.004
Cadmium	0.001
Chromium	0.10
Cobalt	0.006
Lead	0.84
Manganese	0.40
Mercury	0.19
Nickel	0.048
Phosphorous	3.5
Selenium	0.054

Note: [1] Includes emissions from coal and coke handling.

Source parameters for the main stacks and quench towers are presented in Table 7.11. The main stacks will release the same in-stack concentration of pollutants whether they are operating with heat recovery, or without heat recovery, however the temperature of the flue gas will increase without heat recovery.

Table 7.11 Source parameters for Main Stacks and Quench Tower Sources

Source Parameter	Main Stacks, with Heat Recovery	Main Stacks, without Heat Recovery	Quench Tower
Number of stacks	4		4
Stack height above ground level	90 m		20 m
Stack diameter	5.64 m		8 m
Exit temperature	94 ^{o}C	827 ^{o}C	100 ^{o}C
Exit velocity at exit temperature	20.7 m/s	62 m/s	5 m/s
Exit flowrate at normal temperature	384.7 Nm^3/s	384.7 Nm^3/s	183.9 Nm^3/s
Building wake effects included	No		Yes, 15 m high batteries

The source characteristics for the charging and pushing operations are summarised in Table 7.12. The initial plume diameter is an estimated parameter which is used to specify the initial dimensions of the plume from these sources for the dispersion modelling. It accounts for the temperature of the exhaust and the length of the charging and pushing sources. There is potential (albeit minimal) for early pushing of coke (green push) prior to the coking process being complete, this scenario would result in the release of additional air contaminants due to the incomplete combustion of parameters such as VOCs and PAHs. This scenario would only occur as a result of operator error and is an undesirable operational occurrence. Consequently, systems such as program logic controls and operator training will form integral components of the coke plant operating regime to prevent this scenario arising. Therefore, emissions resulting from green pushes have not been modelled.

Table 7.12 Source Parameters for Charging and Pushing Sources

Source Parameter	Charging of Coal	Pushing of Coke
Number of buoyant area sources	1	1
Source height	7.5 m	7.5 m
Initial plume diameter [1]	50 m	50 m
Exhaust temperature	207 ^{o}C	207 ^{o}C
Building wake effects included	No	No

Note: [1] Initial plume diameter is estimated for the purpose of modelling

The coal and coke handling sources cover every stage of raw material transfer from the trains to the charging machines, and product transfer from the quenching towers to the trains. Coal and coke stockpiles have been modelled as area sources as they are subject to wind erosion. The other transfer points have been modelled as volume sources to allow for the initial mixing of particulate matter with air as the material is being moved. The source characteristics for coal and coke handling sources are itemised in

Table **7.13**. The source height is estimated for the dispersion modelling, and account for the initial vertical mixing of emissions from the material transfer operations.

It is possible that the coal stockpiles may have a greater height (up to 23 m) but smaller surface area (21,000 m^2) than that modelled. The movement of particulate matter from the stockpiles reduces with reduced surface area, regardless of height and therefore the affects on air quality of this source have been overestimated. The area modelled for the coke stockpiles has possibly been underestimated, with a potential area of 59,400 m^2 being required. The height of these stockpiles may breach 15 m. The underestimate of surface area is less than 10% and will not impact on the modelled results to a significant degree.

Table 7.13 Summary of Source Parameters for Coal and Coke Handling Sources for the Project

Source	Source Type	Source Height (m)	Area of Stockpile (m^2)
Coal unloading from train	Volume	10	
Coal unloading to stockpile	Volume	10	
Coal stockpiles	Area	10	45,500
Coal loadout from stockpile	Volume	10	
Coal loading to Charging Machine	Volume	10	
Coke unloading from Quenching Machine	Volume	10	
Coke loading to stockpile	Volume	10	
Coke stockpiles	Area	10 (	45,500
Coke loadout from stockpile	Volume	10	
Coke loading to train	Volume	10	
Coke loading to emergency stockpile	Volume	10	
Coke emergency stockpile	Area	10	2,500
Coke loadout from emergency stockpile	Volume	10	

The proposed levels of emissions are required by the Terms of Reference (ToR) to be compared with the National Health and Medical Research Council's (NHMRC) National Guidelines for Control of Emission of Air Pollutants from Stationary Sources (NHMRC, 1985). These guidelines were rescinded on 29 February 2000, as the NHMRC no longer endorses the emission levels that were specified for new sources, and they represent out of date technology for emission reduction. The NHMRC guidelines have thus not been applied to the emissions from the Project. Reliance has instead been placed on achieving compliance with the relevant Queensland and National guidelines and standards for ambient air quality. The project activities at Fisherman's Landing may generate low levels of dust. However, due to the screening of the coke at Stanwell, the coarse grained nature of the coke and the distance to receptors (>1.5 km) these activities are not considered to be the source of significant impact.

7.2.2 Modelling Methodology

The assessment of impacts due to air pollutants is addressed for the Project through the use of meteorological and dispersion modelling. The meteorological modelling approach was based on a combination of measured and modelled meteorological parameters for the region for the year 1999. This year was selected as it is representative of the mean meteorological conditions for the region. The meteorological modelling included consideration of the worst case meteorological conditions experienced during 1999. The meteorological parameters have been combined with the advanced models TAPM (Hurley, 2005) and Calmet (Scire *et. al.*, 2000a) to produce three-dimensional windfields over a modelling domain of 30 km by 30 km. Dispersion modelling was conducted using the Calpuff model (Scire, Strimaitis and Yamartino, 2000b) for all pollutants and all sources. Further details of the models and methodology used are presented in Appendix I.1.

The dispersion modelling was conducted with the four main stacks and four quench stacks modelled as point stack sources. The charging and pushing emissions were modelled as buoyant area sources, due to the elevated temperature. Charging operations were modelled based on gravity loading of coal to the ovens. However, the actual method for charging will be stamp charging which results in oven doors being only partially opened and remaining open for significantly less time than for gravity charging. Consequently, the modelling over-estimates the emissions from this source. Emissions due to wind erosion from stockpiles were modelled as non-buoyant area sources, while particulate matter emitted from coal and coke handling operations were modelled as volume sources.

The impacts due to the Project and background sources were evaluated at sensitive receptor locations as well as over the modelling grid. These receptor locations are shown on Figures 7.2 to 7.5 together with the proposed disturbance footprint for the Project. Dispersion modelling results are presented as either maximum (99.9th percentile) or 99.5th percentile for 3-minute, 10-minute and 1-hour average concentrations, depending on the source of the air quality guideline used. Maximum predicted concentrations are used for longer averaging times.

All pollutants that were estimated to be emitted from all coke plant sources were included in the dispersion modelling. The odour emissions from the Coke Plant were calculated by the use of odour thresholds for each compound, which were summed to provide a total odour emission rate from the Project. The estimated in-stack emission concentration of a substance is divided by its odour threshold where known (as detailed in Appendix I.2) to determine the odour strength (in odour units (ou)) of that substance. The odour emission concentrations are summed for all substances to give a total odour emission concentration which is used in the dispersion modelling to calculate the ground-level concentration of odour due to the mixture of substances.

The air quality guidelines for odour address the impacts of stack sources (namely the main stacks and quench tower emissions) separately from ground-level sources (such as the coal and coke handling, charging and pushing emissions). The dispersion modelling has been conducted independently for these different source types, and predicted odour impacts have been compared to the appropriate guideline. The results of the odour modelling are reported as the 99.5th percentile, meaning the 44th highest modelled odour concentration for a year of hourly modelled results at the receptor locations.

NO_x generally consist of 90 to 95% nitric oxide (NO) and 5 to 10% NO_2 from a combustion source such as the Project or SPS. As the plume travels downwind, the NO reacts with available O_3 to form NO_2, which is the compound of concern for human health and vegetation impacts. Estimation of the ground-level concentration of NO_2 has assumed that the proportion of NO_x that is converted to NO_2 is 30% at ground level. The monitoring data shows that for times when the SO_2 concentration is high, showing impacts from the power station plume, the ratio of NO_2 to NO_x is less than 30% for most of the time. The use of a constant conversion of 30% is a conservative method that will over-estimate ground-level concentrations close to the Project and SPS. Within 1 km from the source, a proportion of 20% is generally accepted as more realistic, however a constant ratio of 30% was applied for all receptor locations.

Calculation of impacts for averaging times less than one hour requires evaluation of the appropriate peak-to-mean ratio, an empirical factor used to scale the modelled 1-hour average concentration to 10-minute or 3-minute average concentrations using the power law correction method (Appendix I.1). For tall stack sources (i.e. the main stack, quench tower and SPS), the factor applied was 1.97 to convert 1-hour averages to 10-minute averages, and a factor of 3.12 to convert the results to 3-minute averages. The results for low-level sources such as charging, pushing and material handling, were converted using a factor of 1.43 to estimate 10-minute averages, and a factor of 1.82 to estimate 3-minute averages.

The impacts of the Project were evaluated for both normal operation of the Project with heat recovery and Coke Plant operation without heat recovery. Key pollutants also included the consideration of background sources. These results are presented separately in the subsequent sections.

7.2.3 Normal Operation of the Project

Results from dispersion modelling of the estimated emissions from the Project are presented below. The main background source of air pollutants is the SPS for SO_2 and NO_2, and SPS plus sources such as bushfires and agricultural use for PM_{10}. The impacts of SPS have been addressed through modelling the SO_2 and NO_2 emissions from SPS at licence limit conditions for coal quality, at full capacity and at 100% plant availability (i.e. the worst-case operation of SPS). These impacts have been combined with the predictions from the Project to obtain the total cumulative impacts of these pollutants. Predicted impacts from SPS and background measurements of PM_{10} from over two years of ambient monitoring at Kalapa, approximately 5.5 km south-west of the site, have been added to the modelled PM_{10} concentrations from the Project. For all other modelled pollutants (such as CO, VOC, PAH and metals), the results presented are for the Project in isolation.

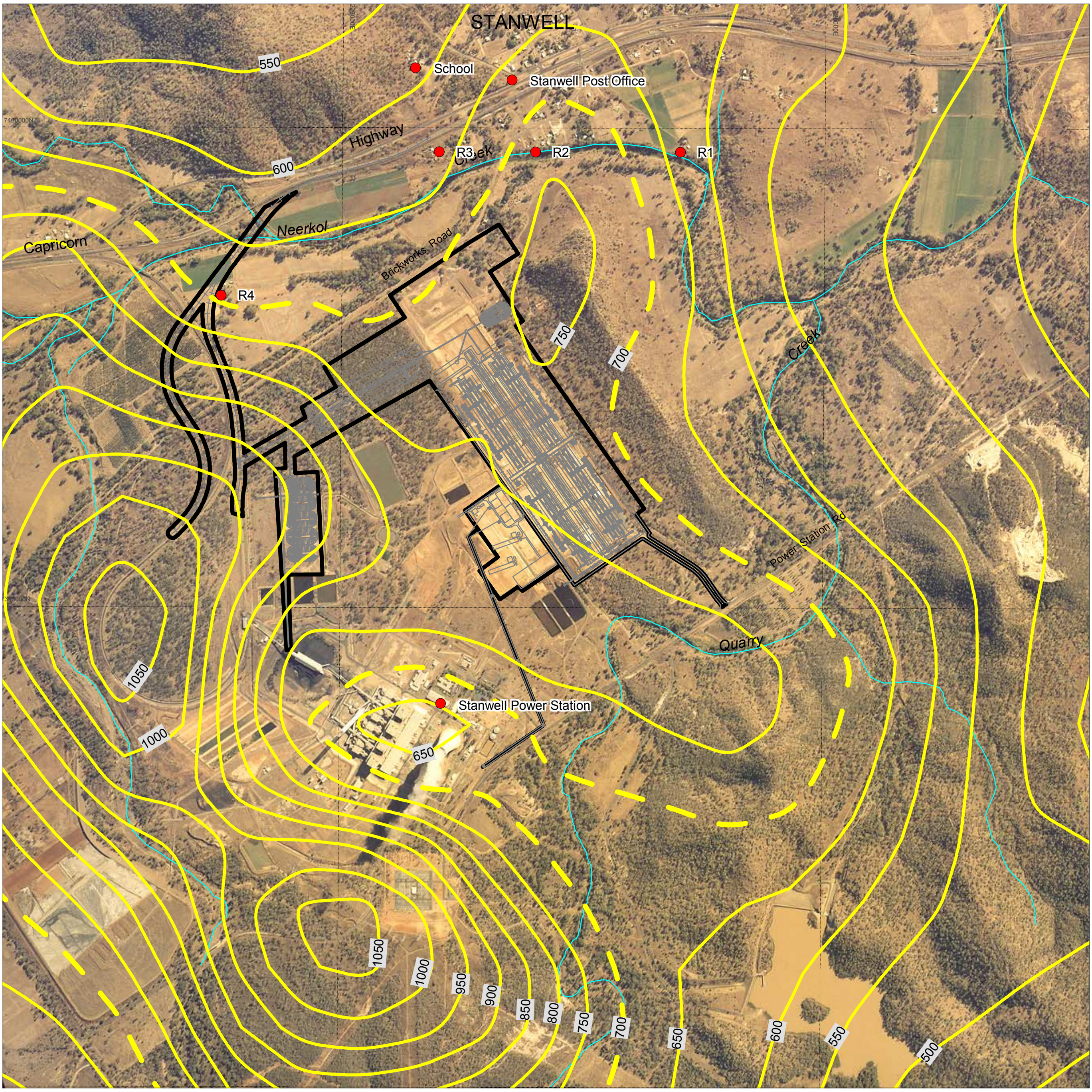
Predicted ground-level concentrations of airborne pollutants for normal operation of the Project are summarised and compared to the *EPP (Air)* goals for human health in Table 7.3. The predicted ground-level concentrations of NO_2, PM_{10}, CO, VOC, PAH and metals are below the *EPP (Air)* goal for human health. The contour plot for the 99.9th percentile 1-hour average concentration of NO_2 is shown in Figure 7.5, and demonstrates that the *EPP (Air)* goal for NO_2 is not exceeded on the modelling grid. These results show that no adverse health effects due to these pollutants are expected from operation of the Project next to the operating SPS.

The predicted impacts of SO_2 generally meet the *EPP (Air)* goal yet show some relatively high ground-level concentrations of SO_2 for short time periods. In particular, the 10-minute average concentration of SO_2 shows that there is one 10-minute period within a modelling year where concentrations are predicted to be above the guideline level of 700 µg/m³ at one of the selected nearby residential locations (above the allowable 8 exceedences). This result is partly due to the assumption of the worst-case conditions for SPS, namely, the use of the maximum allowable coal sulphur content of 0.8% and operation at maximum capacity and 100% plant availability. This results in the use of SO_2 emission rates from SPS that are significantly higher (in the order of 45%) than typical operations. As the dispersion modelling has shown substantial over-estimation of ground level concentrations, the predicted concentrations due to the Coke Plant and SPS are considered to be acceptable.

The 99.9th percentile 1-hour average concentration of SO_2 is shown to be below the *EPP (Air)* goal of 570 µg/m³ at residential locations. Contour plots of the predicted ground-level concentrations of SO_2 are presented in Figure 7.2 for the 99.9th percentile 10-minute average, in Figure 7.3 for the 99.9th percentile 1-hour average, and Figure 7.4 for the annual average concentration. The *EPP (Air)* goal for SO_2 is shown by a dashed line on Figure 7.2. The predicted impacts of SO_2 are high in some locations, as indicated on Figures 7.2 and 7.3. The areas that exceed the air quality guideline are due in part to the impacts from SPS, which is the major source of SO_2 in the locality. The predicted concentrations from SPS are considered to be conservative (i.e. over-predict the impacts of SPS), and the combined impact of the proposed Coke Plant and SPS will likewise be over-predicted.

Table 7.14 Predicted Concentrations at the Closest Sensitive Receptors of Pollutants Relevant to Human Health due to Normal Operation of the Coke Plant (plus Background Sources of SO_2, NO_2 and PM_{10}) and Comparison with *EPP (Air)* Goals

Pollutant	Averaging Periods and Percentile	*EPP (Air)* Goal (µg/m³)	Predicted Concentration at Each Residential Receptor Location due to Normal Operations (µg/m³)						
			Rec 1	Rec 2	Rec 3	Rec 4	Stanwell Post office	School	Stanwell Power Station
Sulphur dioxide [1]	10-min - 99.9th	700	634	759	589	658	668	589	614
	1-hour - 99.9th	570	321	384	298	333	338	298	311
	Annual	60	11.1	9.3	6.3	10.3	6.9	5.9	7.4
Nitrogen dioxide [1]	1-hour - 99.9th	320	58	73	62	97	69	55	93
PM_{10} [2]	24-hour max	150	47.7	42.3	36.2	35.5	37.6	34.6	42.9
	Annual	50	18.8	17.7	16.5	18.1	16.6	16.1	16.7
CO	8-hour max	10,000	82.1	96.5	72.9	55.4	66.8	57.3	86.1
Carbon disulphide	24 hour max	100	0.0013	0.0012	0.0008	0.0008	0.0008	0.0006	0.0012
Dichloro methane	24 hour max	3,000	0.0056	0.0074	0.0068	0.0040	0.0060	0.0060	0.0062
Styrene	24 hour max	800	0.00006	0.00008	0.00007	0.00004	0.00007	0.00007	0.00006
Trichloro ethylene	24 hour max	5,000	0.00007	0.0001	0.00009	0.00005	0.00008	0.00008	0.00008
Toluene	24 hour max	8,000	0.014	0.011	0.007	0.007	0.007	0.006	0.011
Lead	90 day max	1.5	0.0015	0.001	0.0005	0.0009	0.0007	0.0005	0.001



0 500m 1000m

Scale 1:25 000 (A4)

Horizontal Datum GDA94 Zone 56

LEGEND

100	SO_2 Air Quality Contour (µg/m³)
700	SO_2 Air Quality Guidline Contour (700µg/m³)
●	Sensitive Receptor
▭	Proposed Development Footprint
—	Proposed Coke and Power Plant
—	Creek

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ENVIRONMENTAL IMPACT STUDY

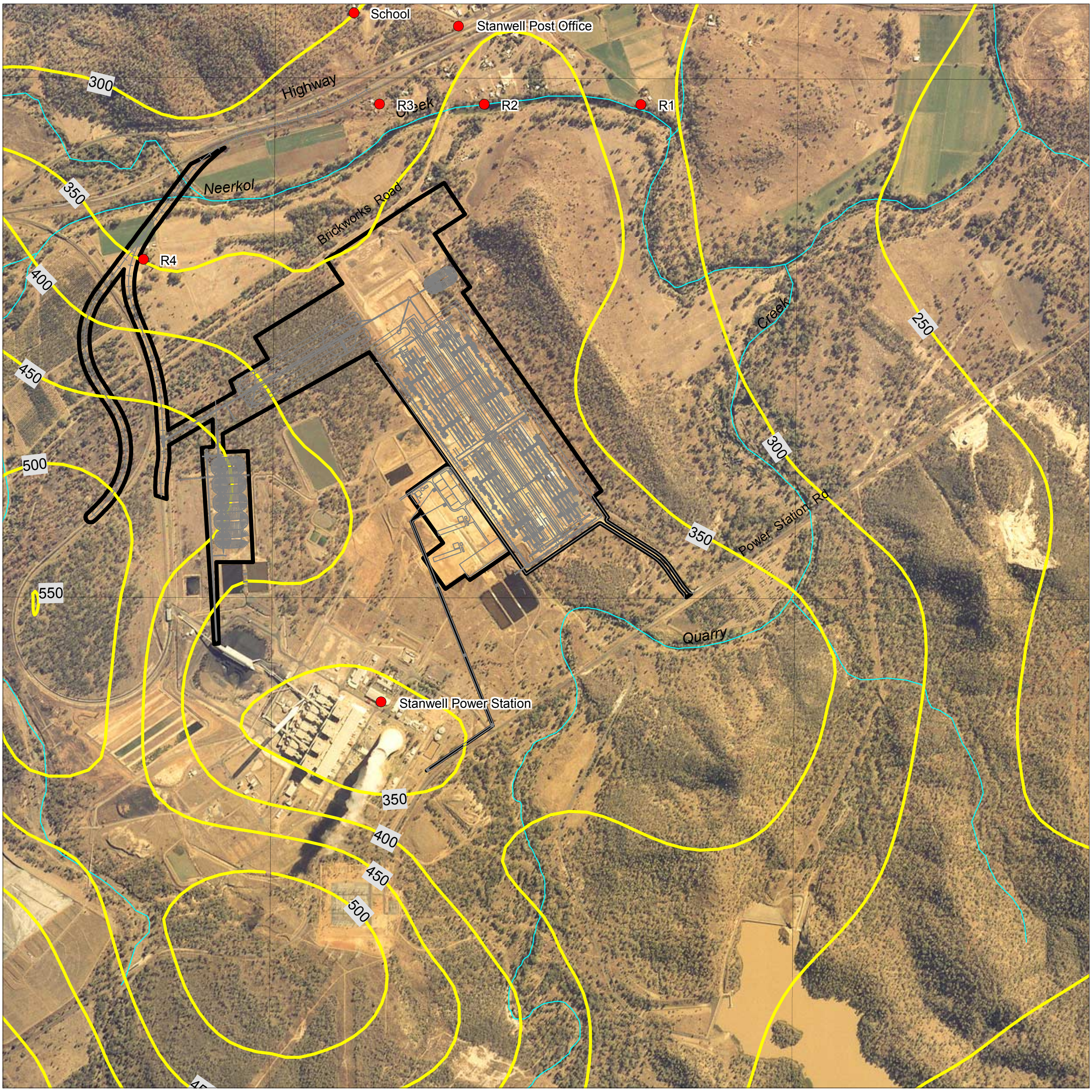
PREDICTED SO_2
AVERAGE CONCENTRATION
99.9th PERCENTILE 10min MAXIMUM -
PROJECT AND BACKGROUND SOURCES

Drawn: VH	Approved: JMcD	Date: 06-01-06
Job No: **42625626**	File No: 42625626-g-040b.wor	

Figure: **7.2**

Rev:B

A4



LEGEND

100 — SO_2 Air Quality Contour (µg/m³) (Guideline 570µg/m³)

Sensitive Receptor

Proposed Development Footprint

Proposed Coke and Power Plant

Creek

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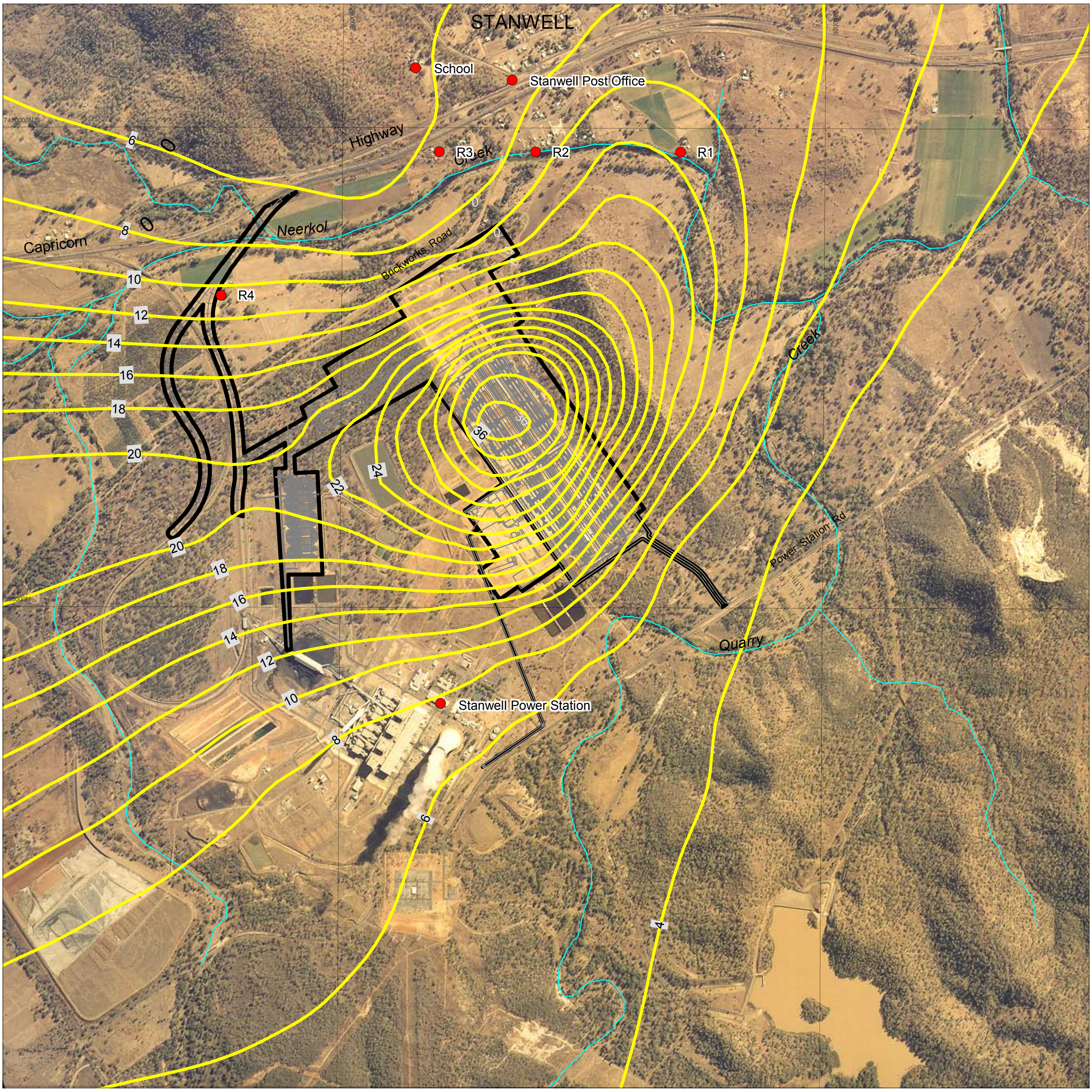
PREDICTED SO_2
99.9th PERCENTILE 1hr AVERAGE CONCENTRATION -
PROJECT AND BACKGROUND SOURCES

Drawn: VH	Approved: JMcD	Date: 06-01-06	Figure: **7.3**
Job No: **42625626**	File No: 42625626-g-041b.wor		Rev:B A4



0 500m 1000m

Scale 1:25 000 (A4)

Horizontal Datum GDA94 Zone 56

LEGEND

22 — SO_2 Air Quality Contour (µg/m³) (Guideline 60µg/m³)

Sensitive Receptor

Proposed Development Footprint

Proposed Coke and Power Plant

Creek

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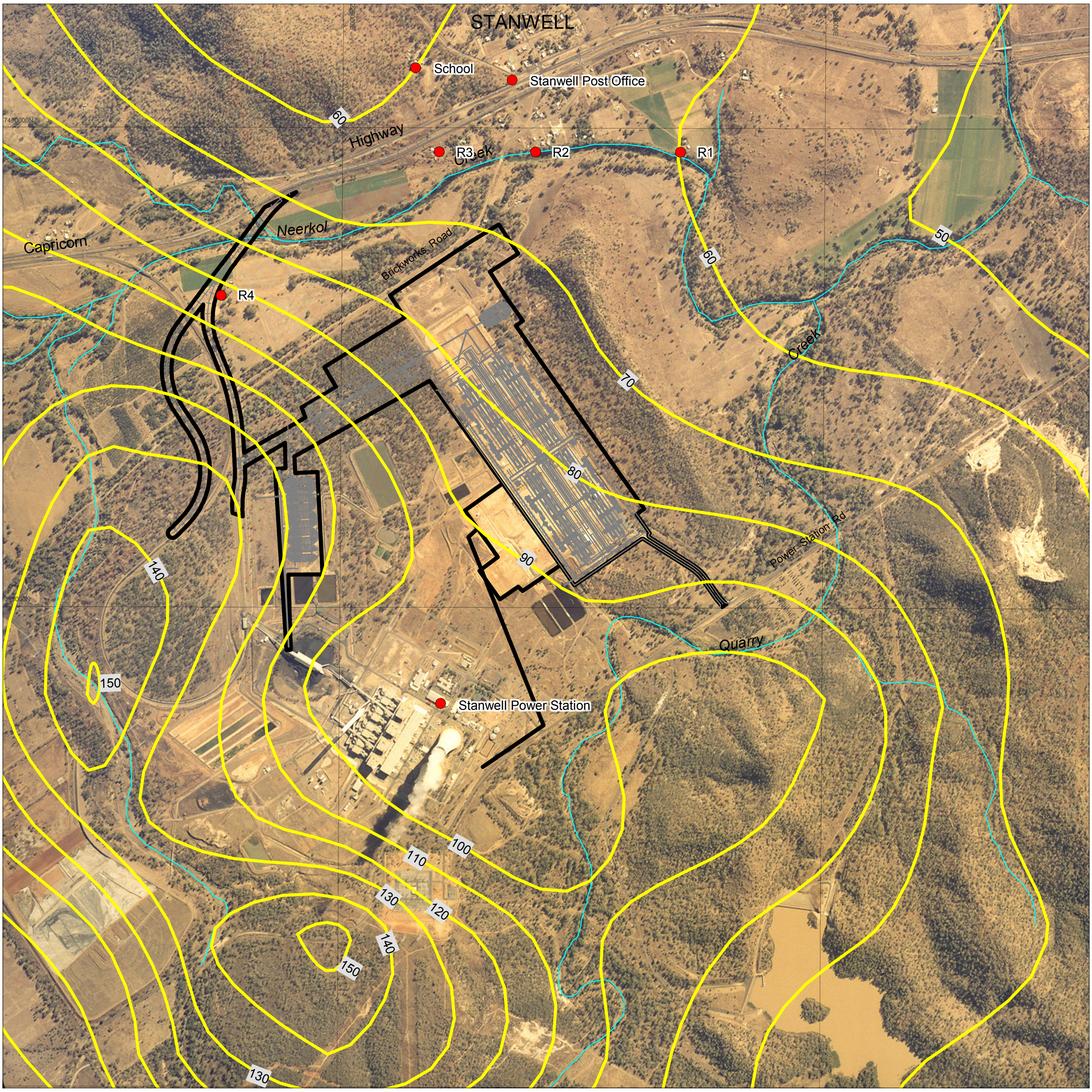
PREDICTED SO_2 CONCENTRATION ANNUAL AVERAGE - PROJECT AND BACKGROUND SOURCES

Drawn: VH	Approved: JMcD	Date: 06-01-06
Job No: **42625626**	File No: 42625626-g-042b.wor	

Figure: **7.4**

Rev:B

A4



0 500m 1000m

Scale 1:25 000 (A4)

Horizontal Datum GDA94 Zone 56

LEGEND

- 150 — NO_2 Contour (μg/m³) (Guideline 320μg/m³)
- Sensitive Receptor
- Proposed Development Footprint
- Proposed Coke and Power Plant
- Creek

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QUEENSLAND COKE AND POWER PLANT PROJECT ENVIRONMENTAL IMPACT STUDY

PREDICTED NO_2 CONCENTRATION 99.9th PERCENTILE 1hr AVERAGE - PROJECT AND BACKGROUND SOURCES

Drawn: VH	Approved: JMcD	Date: 06-01-06	Figure: **7.5**	Rev:B
Job No: **42625626**	File No: 42625626-g-043b.wor			A4

Pollutant	Averaging Periods and Percentile	*EPP (Air)* Goal (µg/m³)	Predicted Concentration at Each Residential Receptor Location due to Normal Operations (µg/m³)						
			Rec 1	Rec 2	Rec 3	Rec 4	Stanwell Post office	School	Stanwell Power Station
Manganese	Annual	1	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001	0.0002
Cadmium	Annual	0.02	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Notes: [1] Results include emissions from SPS
[2] Results include emissions from SPS and background measurements from Kalapa

Evaluation of the predicted ground-level concentrations of airborne pollutants against the *EPP (Air)* goal for biological integrity is addressed fully in Section 6 – Nature Conservation.

Predicted ground-level concentrations of airborne pollutants for normal operation of the Project in isolation, without other background sources, are summarised and compared to the *EPP (Air)* goal for aesthetic enjoyment of places and visual and local amenity in Table 7.15, as well as the EPA's guidelines for odour. These predictions at the closest residential locations indicate that the Project by itself will not cause exceedences of the guidelines for aesthetic enjoyment and local amenity.

The odour impacts have been assessed separately for the stack sources and for the ground-level sources, as discussed in Section 7.2.2. Comparing the predictions to the odour guidelines shows that these guidelines are satisfied for the 99.5th percentile value, thus odour nuisance would not be expected due to operation of the Project.

Table 7.15 Predicted Concentrations of Pollutants Relevant to the Aesthetic Enjoyment of Places, Local Amenity and Odour due to Normal Operation of the Coke Plant in Isolation and Comparison with *EPP (Air)* Goals and the EPA Odour Guideline

Pollutant	Averaging Periods and Percentile	*EPP (Air)* Goal (µg/m³)	Predicted Concentration at Each Residential Receptor Location due to Normal Operations (µg/m³)						
			Rec 1	Rec 2	Rec 3	Rec 4	Stanwell Post Office	School	Stanwell Power Station
Carbon Disulphide	30-min max	20	less than 0.01						
Styrene	30-min max	70	less than 0.001						
Toluene	30-min max	1,000	less than 0.1						
Odour – stack sources	99.5th percentile 1-hour average	0.5 ou	0.23 ou	0.24 ou	0.17 ou	0.18 ou	0.23 ou	0.21 ou	0.22 ou
Odour – ground-level sources	99.5th percentile 1-hour average	2.5 ou	0.12 ou	0.12 ou	0.11 ou	0.09 ou	0.09 ou	0.09 ou	0.11 ou

The air quality regulations in Queensland do not cover all potential pollutants that are likely to be emitted from the Coke Plant. For pollutants that are emitted from the Project but are not addressed in the *EPP*

(Air) goal, the predicted concentrations of toxic air pollutants have been compared to the Design Criteria from the Victorian SEPP in Table 7.15. These predictions are all for the maximum 3-minute average concentration at residential receptors due to the Project in isolation. The results demonstrate that the levels of pollutants at the residential locations modelled will be well below the relevant criteria based on short-term impacts. As these criteria were developed to protect people from adverse health effects or from odour nuisance, no significant health effects would be anticipated from the low levels of these pollutants.

Table 7.16 Predicted 3-minute Average Ground Level Concentrations of Various Toxic Air Pollutants for Normal Operation of the Coke Plant in Isolation and Comparison with the Victorian SEPP Design Criteria.

Pollutant	Vic SEPP Design Criteria (μg/m³)	Predicted Concentration at Each Residential Receptor Location due to Normal Operations (μg/m³)						
		Rec 1	Rec 2	Rec 3	Rec 4	Stanwell Post Office	School	Stanwell Power Station
H_2SO_4	33	3.3	3.5	2.9	2.2	3.2	3.2	3.3
Benzene	53	0.10	0.12	0.11	0.09	0.11	0.09	0.11
Bromoform	170	0.0001	0.0001	0.0001	0.00009	0.0001	0.0001	0.0001
Bromomethane	630	0.06	0.07	0.05	0.04	0.06	0.06	0.06
2-Butanone	5,900	0.007	0.007	0.006	0.005	0.007	0.007	0.007
Carbon Disulphide	130	0.006	0.007	0.006	0.005	0.006	0.005	0.007
Chlorobenzene	200	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chloromethane	3,400	0.08	0.09	0.07	0.06	0.08	0.08	0.08
Chloroform	330	0.001	0.001	0.001	0.0008	0.001	0.001	0.001
Cumene	390	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002
Ethyl Benzene	14,500	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Methylene Chloride	5,800	0.07	0.08	0.06	0.05	0.07	0.07	0.07
n-Hexane	5,900	0.002	0.002	0.001	0.001	0.002	0.002	0.002
4-Methyl-2-Pentanone	410	0.0010	0.0010	0.0009	0.0006	0.0009	0.0009	0.0010
Phenol	36	0.009	0.010	0.009	0.006	0.009	0.009	0.010
Styrene	210	0.0008	0.0008	0.0007	0.0005	0.0007	0.0007	0.0007
Toluene	650	0.06	0.06	0.06	0.04	0.06	0.06	0.06
1,1,1-Trichloroethane	22,700	0.0003	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003
1,1,2-Trichloroethane	1,800	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Xylenes	350	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Total PAH	0.73	0.1	0.1	0.1	0.10	0.1	0.1	0.1
Antimony	17	0.0008	0.0008	0.0007	0.0006	0.0008	0.0007	0.0008
Arsenic	0.17	0.0009	0.0010	0.0008	0.0007	0.0009	0.0008	0.0010
Beryllium	0.007	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Cadmium	0.033	0.00004	0.00004	0.00003	0.00003	0.00004	0.00004	0.00004
Chromium	0.17	0.004	0.004	0.004	0.003	0.004	0.004	0.004
Lead	3	0.04	0.04	0.03	0.03	0.03	0.03	0.04
Manganese	33	0.02	0.02	0.02	0.01	0.01	0.01	0.02
Mercury	0.33	0.008	0.009	0.007	0.006	0.008	0.008	0.008
Nickel	0.33	0.002	0.002	0.002	0.001	0.002	0.002	0.002

The NEPM (Air Toxics) has recommended monitoring investigation levels so that sufficient information can be gathered to develop a standard for toxic air pollutants. The predicted impacts of the Project have also been compared to these investigation levels, as presented in Table 7.16. The predicted impacts at all residential locations are well below the monitoring investigation levels. The NEPM (Air Toxics) is not currently enforceable, and the comparison to the monitoring investigation levels has been presented as a guide only.

Table 7.17 Predicted Ground-level Concentrations of Toxic Air Pollutants due to Normal Operation of the Coke Plant in Isolation and Comparison with the NEPM (Air Toxics) Monitoring Investigation Levels.

Pollutant	Averaging Period	NEPM Investigation Level (µg/m³)	Predicted Concentration at Each Residential Receptor Location due to Normal Operations (µg/m³)						
			Rec 1	Rec 2	Rec 3	Rec 4	Stanwell Post Office	School	Stanwell Power Station
Benzene	Annual	9.4	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Toluene	24 hr	52.8	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Annual	5.3	0.0020	0.0018	0.0011	0.0020	0.0012	0.0009	0.0013
Xylenes	24 hr	7.8	0.13	0.12	0.08	0.08	0.09	0.07	0.11
	Annual	6.1	0.03	0.02	0.01	0.02	0.01	0.01	0.01
Benzo(a) Pyrene	Annual	0.0003	0.00003	0.000001	0.00001	0.00002	0.00001	0.00001	0.00002

7.2.4 Operation of the Project without Heat Recovery

Operation of the Project without heat recovery will occur during the initial phases of the development of the Coke Plant but infrequently at full Stage 2 capacity during power plant maintenance shutdowns. Operation without heat recovery will result in much higher temperature emissions from the main stack, and consequently enhanced plume rise. This will result in lower ground-level concentrations from the Project when operated without heat recovery. The dispersion modelling of most pollutants released from the Project during normal heat recovery operations has demonstrated that predicted ground level concentrations will be well below the relevant air quality guidelines. Therefore, the impacts for NO_2, PM_{10}, CO, VOC, PAH and metals have not been quantified for the non-heat recovery scenario as the impacts will be less than the normal operation scenario.

The predicted ground-level concentrations of SO_2 are of most concern for normal operation of the Project when considered in conjunction with impacts from SPS. The ground-level concentrations of SO_2 for the Project without heat recovery and including background sources are presented in Table 7.18. The 3.2 Mtpa including heat recovery project scenario will operate without heat recovery for short periods only (eg: maintenance activities), therefore, only the 1-hour and 10-minute average concentrations have been presented. The determination of ground-level concentrations for SO_2 was based on modelling without heat recovery for a one-year period to determine the worst-case results.

Comparison with the results from Table 7.13 (with heat recovery scenario) shows that the predicted concentrations of SO_2 will be reduced under non-heat recovery operating scenario, with reductions in the peak impacts of between 10 to 40%. This is primarily due to the additional buoyancy of emissions resulting from the stack temperature being in the order of 800 ^{0}C compared to 100 ^{0}C for the heat recovery scenario. The *EPP (Air)* goals are predicted to be satisfied for all relevant averaging times.

Table 7.18 Predicted Concentrations of Sulphur Dioxide Relevant to Human Health due to Operation of the Project without Heat Recovery plus Background Sources and Comparison with *EPP (Air)* Goals

Pollutant	Averaging Periods and Percentile	*EPP (Air)* Goal (µg/m³)	Predicted Concentration at Each Residential Receptor Location due to Operation without Heat Recovery plus Background Sources (µg/m³)						
			Rec 1	Rec 2	Rec 3	Rec 4	Stanwell Post Office	School	Stanwell Power Station
Sulphur dioxide	10-min - 99.9th	700	387	423	391	601	425	364	593
	1-hour - 99.9th	570	196	214	198	304	215	184	300

7.2.5 Photochemical smog

Photochemical smog is generally associated with urban areas and heavily industrialised regions. The main indicator of photochemical smog is the presence of high levels of ozone, which is generated in the atmosphere through a series of complex chemical reactions of NO_x in the presence of VOCs and sunlight. Naturally occurring sources of NO_x and VOC are the main sources of ozone formation in rural areas. Most NO_x emitted from combustion sources such as the SPS occurs as NO.

The presence of ozone is generally low overnight, with peak levels occurring in the early afternoon around the Stanwell area. Measurements of O_3 around Stanwell have shown that the levels are typical of rural areas. Over the six years of monitoring, only 13 days recorded ozone concentrations above 130 µg/m³ and four of those days exceeded 170 µg/m³ (80% of the 1-hour average *EPP (Air)* goal of 210 µg/m³). There were no recorded exceedences of the 1-hour average guideline for ozone at the monitoring locations.

A qualitative assessment of the theoretical maximum conversion of nitrogen oxides emitted from the Project to ozone has shown that it could contribute an additional 5 to 30 µg/m³ of ozone. When added to typical levels of ozone in the afternoon of 105 µg/m³ from the Stanwell area (which accounts for background sources such as SPS), the total impact would be well below the guideline level of 210 µg/m³. It is thus concluded that the Project would contribute only a small amount to the worst-case ozone levels, and ambient concentrations of ozone would remain below the guideline levels.

7.2.6 Acid Rain

The potential for formation of acid rain in Australia is low due to the low sulphur content of Australian coal compared to that used in other countries where acid rain is a significant environmental issue. Low sulphur content of coal results in low SO_2 emissions when the coal is burnt, thereby reducing the potential for acid rain generation. The Project will be using coking coals with an approximate coal sulphur content of 0.5%, of which only 35% is assumed to be emitted in gaseous form as SO_2. The SPS typically uses coals with a sulphur content below 0.8% (in the order of 0.43 - 0.55%). Further quantification of acid rain or the acidification of other atmospheric condensation such as dew is therefore not required.

7.2.7 Mitigation Measures

The EIS community consultation process highlighted emissions and potential impacts on local air quality as key concerns for local residents and other stakeholders (Appendices B and K). Consequently, the technology selection process for the Project is focusing on emissions as a primary selection criteria.

At key areas or sources of air emissions, Project proponents intend minimising emissions by applying appropriate industry practice techniques. Emission control devices are not needed on the operating coke ovens, as these are under negative pressure during the coking process and thus no fugitive emissions to air are anticipated. Emissions that may arise during coal charging, coking and coke pushing operations of the oven are minimised by the design of the process, incorporating:

- Stamp charging of coke ovens, minimising the time required to load the ovens and reducing the exposure of raw coal to a hot environment whilst oven doors are partially open;
- Design incorporating small gaps between coal charge and oven doors;
- Use of travelling hoods on charging and pushing equipment to capture emissions during charging and pushing;
- Operation of coke ovens and related ducting under negative pressure to eliminate air emissions;
- Essentially complete combustion of gases generated during coking process to minimise release of volatile organic matter and poly aromatic hydrocarbons;
- Pushing coke product onto flat-bed receiving car, in a manner which minimises the drop height such that the coke charge remains in a stamped block; and
- Dust suppression equipment (baffles) on the quench tower to capture particulate matter in the steam.

Coal and coke handling operations require the use of various control measures to minimise dust emissions. These include a combination of enclosure of transfer points and watering of exposed surfaces. Details on the assumed efficiency of these control measures are presented in Appendix I.2. These mitigation measures and related assumptions have been used in the estimation of pollutant emissions prior to input into the dispersion modelling.

Further mitigation of potential air impacts during the construction and operations phases of the Project is presented in the Air Quality Management Plan (Section 16 – Environmental Management Plan). Any complaints or incidences relating to project air emissions will be resolved in compliance with provisions of the Incidents and Complaints Management Plan (Section 16 – Environmental Management Plan).

7.2.8 Summary of Impacts

The air quality assessment for the Project has shown the following:

- The predicted impacts from operation of the Coke Plant will satisfy air quality guidelines for human health for NO_2, PM_{10}, CO, VOC, PAH and metals.
- Predicted combined impacts of SO_2 from the Project and SPS indicate that one exceedence (above the allowable 8 exceedences) of the 10-minute air quality goal may occur per year[1]. The modelling of SPS is based on operation at licence limit conditions, maximum capacity and 100% plant availability with estimated emissions of SO_2 significantly (in the order of 45%) higher than the typical operation of SPS, thus representing worst-case combined impacts.
- The predicted 1-hour average and annual average concentrations of SO_2 will achieve the *EPP (Air)* goal for human health for the combined impact of the Project and SPS.
- The predicted combined impacts (worst case) from the Project and SPS will exceed the *EPP (Air)* goal for biological integrity for SO_2 and NO_2 at some locations. The potential adverse impacts are addressed further in Section 6 – Nature Conservation.
- Photochemical smog impacts are not currently a problem for the Stanwell region. The operation of the Project will add slightly to the existing situation but will not reach recognised guideline levels.
- The Stanwell airshed appears to have sufficient tolerance to accommodate this project. This assessment is based on the modelling of emission sources and the review of ambient monitoring data.

[1] This is one exceedence of the *EPP (Air)* goal for 10-minute SO_2, at the 99.9th percentile SO_2 concentration level.