SINCLAIR KNIGHT MERZ

Hunter Economic Zone

AIR QUALITY MANAGEMENT STRATEGY

- Final
- 11 December 2007

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1. Introduction

1.1 General Introduction

The Hunter Employment Zone (HEZ) is a large industrial and business area zoned for development in the Cessnock City Council (CCC) area.

The HEZ occupies land totalling approximately 3200 ha, with approximately 923 ha zoned for employment and community uses, while the balance of 2300 ha is conservation area and National Park, as shown in **Figure 1-1**

This report presents the Air Quality Management Strategy (AQMS) for the HEZ. It should be noted that the AQMS is essentially an update of that prepared by SKM for Cessnock City Council (CCC) in their previous re-zoning of the HEZ land.

1.2 Strategy Objectives

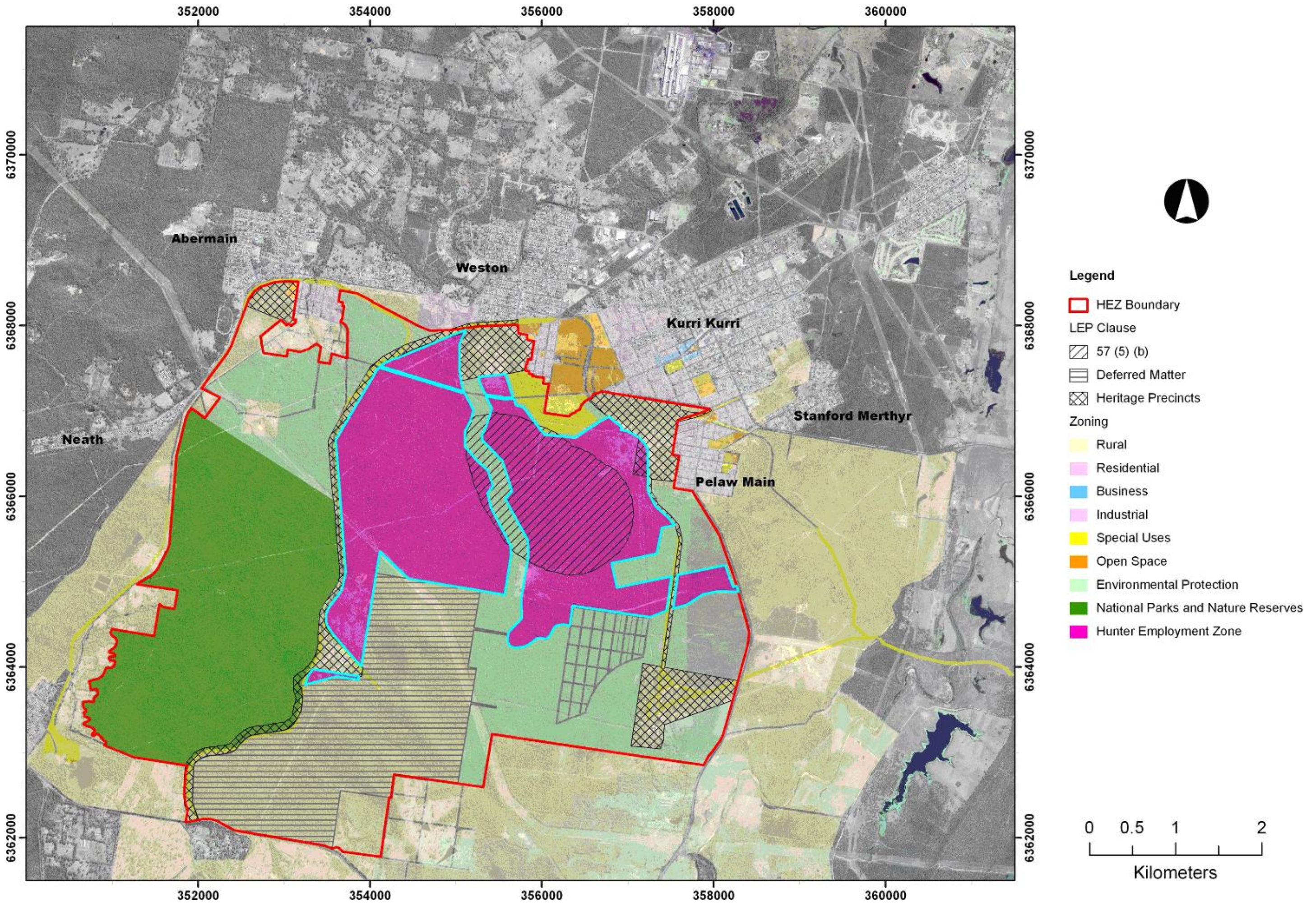
The overall objective of the AQMS is to provide a framework for corporations developing within the HEZ to ensure the sustainable protection of air quality in the area on both a local and regional basis. Specifically, the AQMS provides ambient and emissions based air quality objectives for the HEZ and promote best practice and economically achievable air pollution controls for developers. Modelling tools have been developed such that individual corporations can assess their contributions of air emissions in a holistic sense, ensuring individual as well as cumulative effects are considered.

1.3 Strategy Structure

The AQMS is structured as follows:

- Stakeholder Consultation
- Strategic Framework
- The AQM Strategy

Figure 1-1 HEZ Site Map and Surrounding Area



2. Consultation

2.1 Overview

This section of the AQMS provides a summary of the outcomes of consultation undertaken as part of preparation of the original AQMS as it relates to management of air quality as part of the HEZ development.

2.2 Representative Groups

2.2.1 Cessnock City Council

CCC is the local government authority responsible for the previous rezoning of the Tomalpin area for the purposes of developing the HEZ. As part of preparing the LEP for the HEZ at Tomalpin, Council has completed a significant amount of consultation with both community groups and other government authorities.

2.2.2 Other Statutory Authorities

Statutory authorities that have been consulted by Council as part of developing the LEP are as follows:

State Government

- Department of Mineral Resources (DMR);
- Department of Environment and Climate Change (formerly the Environment Protection Authority (EPA));
- Roads and Traffic Authority (RTA);
- National Parks and Wildlife Service (NPWS);
- Department of Natural Resources (formerly the Department of Land and Water Conservation (DLWC));
- Hunter Water Corporation (HWC);
- NSW Fire Brigades;
- NSW Agriculture;
- Hunter Catchment Management Trust;
- Mine Subsidence Board; and
- NSW Heritage Office.

Local Government

- Newcastle City Council;

- Maitland City Council;
- Singleton Shire Council; and
- Lake Macquarie City Council.

Of these authorities the DECC provided the majority of comment on air quality management as part of developing the HEZ. In letters received by Council from the DECC on 20 November 2000 and 5 October 2001 substantial comment was received regarding air quality management.

In the 20 November 2000 letter, the DECC expressed concerns regarding large-scale industrial development in the Lower Hunter without any detailed investigation of prevailing meteorological conditions within the airshed. In particular, the DECC were concerned about the impact of air emissions from existing industries which include coal fired power stations, aluminium smelters, chemical industries and coal mining, and the potential additive effect of developing new industries without a detailed understanding of meteorological and air pollution interactions.

In the 5 October 2001 letter the DECC commented on Council's intention as set out in the draft DCP to develop an "Air Quality Management Strategy" that follows National Pollution Inventory (NPI) guidelines. The DECC commented that the AQMS would be better developed in accordance with the National Environment Protection Council's (NEPC) *National Environmental Protection Measure (NEPM) for Ambient Air Quality*.

In further discussions with the DECC regarding their comments on the LEP and DCP in December 2001, they reiterated the need to provide a better understanding of the interactions between existing air quality and dispersion meteorology, and the need for the establishment of a meteorological station in the area to collect baseline data, upon which air quality impacts from individual industries can be assessed.

It is noted that since this original consultation a meteorological station gas been established at the HEZ and operated continuously since 2003, and substantial work done in investigating air pollution emission margins within the HEZ. Both of these aspects of air quality management within the HEZ are discussed in detail in this updated AQMS.

2.2.3 Community Groups and Stakeholders

Council have provided a statistical summary of responses from consultation with the community, including individual land owners and community groups, which include:

- Hunter Environment Lobby; and
- Pelaw Main Landcare Group.

Concerns regarding air quality management associated with the development of the HEZ relate to increased traffic in the area, insufficient buffer distances between future industries and residences and the potentially hazardous nature of industries which may develop in the HEZ.

2.3 Outcomes of Consultation

In developing the AQMS, comments from both statutory authorities in particular the DECC and the community have been considered. Specifically, **Section 4** sets out an appropriate approach for defining air quality standards and objectives for the HEZ. Community concerns regarding adverse air quality impacts are also addressed in the AQMS.

2.3.1 Recommendations for Future Consultation

Based on the outcomes of community consultation to date it is evident that there is a reasonable level of community concern with regards to environmental impact associated with the HEZ. This is not unexpected given the significant change in land-use the HEZ will bring to the area and the increased level of industrialisation.

In terms of air quality impacts future community consultation should provide the community with assurance that industries developing within the HEZ will manage air pollution emissions to a high standard. Specifically, all industries that have the potential to result in air pollution emissions will need to demonstrate that they are able to meet stringent guidelines as set by the DECC and specifically those prescribed within the AQMS.

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3. AQMS Strategic Framework

3.1 Overview

This section of the AQMS sets out the responsibilities and procedures to be followed by both the HEZ Association and industry at the application stage for industries establishing themselves within the HEZ.

3.2 Statutory Requirements and Controls

All industry developing within the HEZ will be required to submit an application to Council or DoP, with the degree of assessment required dependent on the size, scale and environmental impact potential of the project. Depending on the type of development other statutory authorities such as the DECC and RTA may need to be consulted as part of the process.

With respect to air quality assessment and regulation it is generally the DECC and Councils that have statutory control over industry. In general, where an industry is licensed under the *Protection of the Environment Operations (POEO) Act, 1997* the DECC will generally regulate that particular industry with respect to air quality impacts. For industries which are not licensed, Council generally provides environmental regulation.

Assessment and regulation of each facility will generally be in accordance with the DECC (2005) document *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in NSW*. **Appendix B** provides summary of air emission standards and ambient air quality criteria as set out in this document, which also details the level of assessment required for industries.

Councils also have an overall planning responsibility with respect to air quality. In particular the National Environment Protection Council (NEPC) which was formed as part of the *National Environment Protection Council Act, 1994* have developed a National Environment Protection Measure (NEPM) for Ambient Air Quality. NEPMs are broad framework-setting statutory instruments defined in the NEPC legislation and outline agreed national objectives for protecting or managing particular aspects of the environment. The NEPM for Ambient Air Quality currently sets standards for the following pollutants:

- Carbon monoxide (CO);
- Nitrogen dioxide (NO_2);
- Photochemical oxidant as ozone (O_3);
- Sulphur dioxide (SO_2);
- Lead (Pb); and
- Particulates as $PM_{10.}$

There are currently plans to extend the NEPM for Ambient Air Quality to include $PM_{2.5}$ particles and establish a separate NEPM for Air Toxics.

While the NEPC is responsible for developing NEPMs, state Environmental Authorities generally administer them and have responsibility for authorising monitoring programs under the NEPMs. In general the pollution standards quoted in the NEPM for Ambient Air Quality are regional standards that should be set in central population zones rather than industry specific standards that need to be achieved at the boundary of industrial estates such as the HEZ. As NEPMs are largely planning tools to be managed across regions for example local government areas (LGAs) local Councils generally have the responsibility of co-ordinating activities under the NEPM.

For the HEZ, the Association will provide a point of contact for industries within the HEZ regarding their commitment to environmental protection including air quality.

3.3 Type of Development

All industries will need to refer to the AQMS. However, for many industries such as warehousing or industry supply and servicing workshops where the potential for impacts on air quality will be minimal or non-existent, only brief reference to the AQMS will be required as part of the overall assessment process. However, for industries where emission will be released to atmosphere, a more detailed assessment of air quality impacts will be required using the procedures set out in the AQMS.

3.4 Air Quality Model

A Master Air Quality Model (MAQM) should be developed for the HEZ and surrounding area. The model will need to provide a mechanism for assessing air quality impacts from industry developing in the HEZ in a systematic way and on a continuous basis.

The modelling approach is in accordance with Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in NSW (DECC 2005)

A structured approach to assessment is fundamental for managing air quality in areas of possible rapid development such as the HEZ, as there may be insufficient time for monitoring impacts from individual industries following their establishment and before the subsequent development of industries which may emit similar pollutants.

A full description of modelling considerations to be observed by industry when assessing air quality impacts is outlined in **Section 4.2**.

4. The Strategy (AQMS)

4.1 Overview

This section of the AQMS details the strategy for considering air quality impacts for industrial development within the HEZ. Discussed are the requirements of industry developing in the HEZ in terms of their responsibility to air quality management. Specifically the AQMS has 3 main parts:

- Establish suitable locations for industry to develop based on the potential pollutant load on the airshed. Emitters may be classed as high, medium and low.
- Provide a procedure for the assessment of emissions from industry once location has been determined
- Provide a framework for the monitoring of emissions, ambient air quality and meteorology.

4.2 Location of Industries

4.2.1 General

In order for the HEZ to develop in a way that maximises the potential industrial development of the site without compromising existing ambient air quality consideration needs to be given to the location of different industry types with the HEZ. The scale of air pollutant control technologies would also be likely to reflect the selected location, i.e a high polluter located closer to sensitive receivers would likely be required to implement a greater degree of pollution control.

In most cases locating larger more polluting industries further away from existing or future sensitive receiver communities will provide for the lowest possible air quality impacts on these communities. Site features, eg. topography and local meteorology are, however, important and need to be studied prior to applying broad scale recommendations for locating large emission industries furthest away from sensitive receivers and smaller industries with lower emissions closer to these same receivers. This has been done in a previous assessment of "Emission Margins" for the HEZ and a summary of results relevant to the AQMS are included in **Appendix C**.

In general larger pollution emitting industries should be located as far as possible away from sensitive receiver areas eg, Kurri Kurri and Pelaw Main. The Strategy outlined here applies this principle to advise on recommended development areas for different industry types.

4.2.2 Consideration of Emission Loads

In going forward with the approach of locating higher pollution emitting industries as far away from sensitive receivers as possible, it is necessary to devise a system for categorising industry types by air pollutant emission size (load). In this case industries have been defined as "high", "medium" or "low" emitters by using the National Pollution Inventory (NPI) 2005-06 reporting

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database for the Greater Metropolitan Region (GMR). The data utilised in this analysis was segmented by pollutant type, year, and industry group. Pollutants analysed include common criteria pollutants in NSW and those most likely to be associated with HEZ industry. The pollutants are oxides of nitrogen (NO_x), sulphur dioxide (SO_2), particulate matter <10µm (PM_{10}) and total volatile organic compounds (VOC) The data analysis incorporated the number of facilities reporting emissions of each of the specified criteria pollutants and the total mass emission per year from each facility type.

For the purpose of analysing the NPI data, an average emission of each pollutant by facility type was determined. The average emission was calculated by dividing the total emission (of each pollutant) for an Australia and New Zealand Standard Industrial Classification (ANZSIC) group by the number of reporting facilities emitting the criteria pollutant in the GWR.

An example calculation is provided below:

- **Average Facility Emission** = **Total Reported Emission** **(ANZSIC group)** / **Number of Reporting Facilities** **(ANZSIC Group)**

- **Example ANZSIC Group Facility Emissions Calculation (NO_x)**

ANZSIC Group	Air Emission (kg/year)	Number of Facilities	Average per Facility (kg/year)
Electricity Supply [361]	46000000	11	4181818
Petroleum Refining [251]	2600000	2	1300000
Iron and Steel Manufacturing [271]	7300000	6	1216667
Glass and Glass Product Manufacturing [261]	1900000	4	475000
Cement, Lime, Plaster and Concrete Product Manufacturing [263]	1200000	6	200000
Other Transport Equipment Manufacturing [282]	220000	2	110000
Basic Chemical Manufacturing [253]	1500000	14	107143

Graphical summaries of pollution loads by industry type for each of the four pollutants considered are included in **Appendix D**.

Table 4-1 sets out the categorisation of high, medium and, low emissions industries. Non-polluting industries are not shown in this table. It follows that these would be considered as lower risk than low emitters.

This assessment does not consider all criteria pollutants stipulated by the NSW DECC, and is only to be used as a guide as to the potential air quality impact of different industry types and guidance as to their likely location within the HEZ.

- **Table 4-1 Categorisation of High / Medium / Low Emission Industries**

High Emission Industry	Medium Emission Industry	Low Emission Industry
Electricity Supply	Motor Vehicle and Part Manufacturing	Rail Transport
Iron and Steel manufacturing	Other Chemical Product Manufacturing	Other Personal Services
Petroleum Refining	Plastic Product Manufacturing	Oil and Gas Extraction
Basic Non-Ferrous Metal and Steel Manufacturing	Sheet Metal Product Manufacturing	
Glass and Glass Product Manufacturing	Services to Water Transport	
Industrial Machinery and Equipment Manufacturing	Other Wood Product Manufacturing	
Printing and Services to Printing	Petroleum and Coal Product Manufacturing n.e.c.	
Other Transport Manufacturing	Ceramic Product Manufacturing	
Cement, Lime, Plaster and Concrete Manufacturing	Construction Material Mining	
Basic Chemical Manufacturing	Fabricated Metal Product Manufacturing	
Flour Mill and Cereal Food Manufacturing	Paper and Paper Product Manufacturing	
Coal Mining	Gas Supply	
Poultry Farming	Water Supply, Sewerage and Drainage Services	
Other Mining Services	Services to Air Transport	
Structural Steel Product Manufacturing	Fruit and Vegetable Processing	
	Oil and Fat Manufacturing	
	Public Order and Safety Services	
	Tobacco Product Manufacturing	
	Meat and Meat Product Manufacturing	
	Beverage and Malt Manufacturing	
	Mineral, Metal and Chemical Wholesaling	
	Bakery Product Manufacturing	
	Other Food Manufacturing	
	Dairy Product Manufacturing	
	Other Transport Equipment Manufacturing	

4.3 Air Quality Impact Assessment

While this strategy helps to identify those industry types that will likely emit high, medium and low quantities of NO_x, SO_2 PM_{10} and VOC, the ultimate directive for air quality assessment would come from regulatory authorities, e.g. DECC, DOP and local council. All directives of the regulatory authorities should be followed with regard to air quality impact assessments to ensure that all requirements of the DA process are successfully fulfilled. This Strategy does not provide a means of circumventing legislative requirements.

Where an industry proposes to develop within the HEZ it will be required to prepare an application for development. The following procedure set out the requirements of industry to assess potential air quality impacts as part of the application process.

In many cases, however, the air quality assessment will be as simple as identifying air pollutant emissions as non-existent or minimal. That is, no impacts greater than those associated with suburban residential or commercial areas and, in these instances, no detailed assessment as per the Methodology to follow will be required.

4.3.1 Air Emissions Identification

Each industry will review its air emissions potential. This will be documented and the level of emissions associated with the industry will determine the level of assessment required.

As a first check, industry will determine if it has the potential to emit criteria pollutants as defined in the DECC Regulation - Protection of the Environment Operations (Clean Air) Regulation 2002 (refer to Section 3.2.3). If such pollutants are to be emitted, the industry will need to ensure that emissions are below limit values provided in the Regulation. A second check is required to determine the extent of any emission to atmosphere of potentially harmful pollutants that may not be included in the Regulation.

4.3.2 Analysis of Ambient Air Quality

Where significant air emissions are identified the industry will need to investigate the potential for significant background levels of such pollutants. **Appendix A** of this AQMS provides a summary of ambient air quality data in the area; however, further investigation may be warranted where an industry has the potential for significant emissions of a particular pollutant(s).

4.3.3 Review of Air Quality Objectives

Following a consideration of potential air emissions and existing air quality levels, any industry with the potential to create a deterioration in air quality on any scale will be required to complete a modelling assessment of air quality.

The first step of this assessment will be to review air quality objectives as described in **Section 3.2** and identify the potential margin of safety that exists between existing air quality levels, as set out in **Appendix A** and the ambient objectives.

4.3.4 Consideration of Air Emissions Control

All industry developing within the HEZ will consider air emissions controls during the construction and operational phases. During construction the procedures identified in **Section 4.4** will be adopted for all works and an industry representative will need to be identified at the assessment stage for overall responsibility.

For the operational phase the assessment will need to clearly identify Best Available Control Technologies (BACT) that will be applied to industrial process in order to ensure no prescribed emission limits as identified in **Section 4.4** are exceeded. This process should reflect upon the selected location of the facility. That is, where high emitters are located closer to sensitive receivers, more technology is likely to be required to meet air quality objectives.

4.3.5 Air Dispersion Modelling

All air dispersion modelling shall be undertaken in accordance with the modelling methodology set out in **Appendix E**.

4.3.6 Greenhouse Gas Assessment

It is likely that all industries developing within the HEZ will be responsible for some emission of greenhouse gases. This may be as a direct result of energy generated and consumed on site in the form of emissions from fossil fuel consumption e.g. diesel powered vehicles. Alternatively it may indirectly result from energy used on-site but generated off-site, for example electricity sourced from the grid and generated at coal fired power stations.

The development of the HEZ from basically a green-field site and using a co-ordinated approach to assessment of environment impacts provides an excellent opportunity to manage and minimise greenhouse gas emissions. From an air quality perspective, industries should account for all likely emissions to atmosphere at the planning stage of the development. In particular, the procedures set out in the Energy Management and Efficiency Strategy (EgMS) which has also been developed for the HEZ should be followed by industry in order to ensure energy usage and greenhouse gas emissions are minimised.

For industries that not only use energy resulting in greenhouse gas emissions but generate greenhouse gases as a by-product of their processes, they need to ensure that control processes as described in **Section 4.4** for non-greenhouse gases are in place to minimise emissions.

4.4 Air Pollution Control Measures

This section provides a discussion on air pollution control measures that may be implemented during both the construction and operation of industries within the HEZ.

While the exact nature of industries that may be established within the HEZ, and hence potential air quality impacts, are not known at this stage, general measures that would be applicable across a range of construction sites have been included.

Similarly, a broad range of pollution control techniques that may be applied to control typical pollutants emitted during industrial operations are discussed.

4.4.1 Construction

The potential effects on air quality during construction activities at the HEZ would include the generation of dust associated with earthworks, exhaust emissions from diesel powered excavation equipment, emissions from pavement laying operations and exhaust emissions from vehicles travelling to and from the site.

Exhaust emissions from vehicles and equipment would contribute to volumes of particulates, carbon monoxide, carbon dioxide, hydrocarbons and nitrogen oxides in the atmosphere. However such emissions would occur intermittently and are not likely to result in a detectable reduction in air quality. As such, only the potential air quality effects arising from the generation of airborne dust during construction activities would specifically require management and mitigation.

Typical equipment used for construction and responsible for dust emission at the site is likely to include backhoes, scrapers, rollers, excavators, pavers, trucks and jackhammers.

The following dust control measures should be applied as part of the general site environmental management:

- Ensure that all the construction activities are undertaken in accordance with the dust management program incorporated into the EMP;
- Dust generation from roads, stockpiles, work areas and exposed soils during construction shall be controlled by regular on-site watering or other approved methods. Adequate dust suppression resources shall be available on site to reduce dust emissions;
- Dust generating activities (i.e. land clearing) shall be avoided or minimised during dry and windy conditions;
- All disturbed areas and long term stockpiles shall be stabilised as soon as practicable to prevent or minimise wind blown dust;
- Loads with the potential to generate dust on public streets shall be covered during transportation, to prevent wind blown dust emissions and spillages. The tailgates of all trucks

transporting spoil material shall be securely fixed prior to loading and immediately after unloading;

- Cleared vegetation, garbage and other combustible waste material shall not be burnt; and
- All trucks and equipment used on site shall be maintained in an efficient condition and operated in a proper and efficient manner. Visual checks of exhaust system emissions shall be periodically undertaken.

4.4.2 Specific Control Measures

All industries developing within the HEZ that have the potential for significant air emission will need to demonstrate as part of the development assessment process that Best Available Control Technologies (BACT) are applied to mitigate the effects of air pollutant emissions.

In this instance BACT is defined as:

> *"technology that will result in an emission standard, including a visible emission standard based on the maximum degree of reduction which the HEZ Association, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable for such source through application of production processes, available methods, systems, and techniques, including fuel cleaning or treatment, clean fuels, or innovative fuel combustion techniques for control of each air contaminant"*

The type of control technologies applied to industries will be dependant on the nature of the industry and their emissions. These will be wide and varying and as such no detailed discussion is provided as part of the AQMS.

4.5 Monitoring and Reporting

4.5.1 Emissions

Where an industry receives an EPL for the discharge air emissions from their operations, emissions monitoring will often be required. This monitoring is to be undertaken and reported in accordance with the conditions of their EPL.

In NSW all emissions monitoring should be completed in accordance with the DECC publication: *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW.*

4.5.2 Ambient Air

Ambient air monitoring would be the responsibility of the HEZ Association. Depending on the scale and nature of industry that develop within the HEZ it may be prudent for industry to contribute to collective monitoring stations within nearest sensitive receiver areas. Monitoring where possible should be continuous, with data collected on a single data processor, capable of being downloaded remotely.

Typical pollutants for which ambient monitoring may be required includes:

- Particulate Matter (PM_{10}); and
- Oxides of Nitrogen (NO_X); and

It is recommended that the commencement of monitoring for PM_{10} and NO_X/NO_2 at the HEZ be implemented as soon as possible to provide site specific background air quality data

Reference documents for ambient air and emissions monitoring include:

- *AS2922 – Ambient Air -Guide for Siting of Sampling Units; and*
- *Approved Methods for Sampling and Analysis of Air Pollutants in NSW (EPA).*

4.5.3 Meteorology

Council have installed a meteorological station within the HEZ. The primary purpose of this met. Station is to collect data which is suitable for air dispersion modelling purposes.

The meteorological station has been installed with consideration of:

- AS2922 – Ambient Air -Guide for Siting of Sampling Units; and
- AS2923 – Ambient Air – Guide for the Measurement of Horizontal Wind for Air Quality Applications.

As well as providing data for dispersion modelling purposes, the meteorological station will provide up to date data for industry for reporting purposes.

5. References

- Environment Protection Authority, 2001a, *Assessment and Management of Odour from Stationary Sources in NSW, Draft Policy*, NSW EPA, January 2001.
- Environment Protection Authority, 2001b, *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales*, NSW EPA, 2005.
- United States Environment Protection Agency, *Clean Air Act, 1990*.
- Macquarie University School of Earth Sciences, 1980/1981 "*The Hunter Valley Meteorological Study*".

Appendix A Existing Air Environment

A.1 Overview

This section of the report describes the air quality and meteorological conditions in the area surrounding the HEZ.

The air quality data is sourced from the NSW DECC ambient air quality monitoring site at Beresfield, approximately 25km east of the HEZ.

Donaldson Mine operates numerous air quality sampling sites in the Black Hill –Beresfield and reports six month summary data. Since 2000, the reports attributed high concentrations of particle matter to high incidences of bushfires, road works, heavy duty vehicles, dust storms and bird droppings (Donaldson 2001, 2002, 2003). Consequently, data in the Donaldson reports were considered inappropriate for characterising air quality in the local area of the HEZ.

Since June 2005, a particulate (PM_{10}) monitor has been operating at Kurri Kurri hospital, on the immediate boundary of the HEZ area. CCC imposed the installation in relation to the extraction of the remaining mining wastes on the HEZ, formerly the Hebburn No 2 mining site.

The establishment of background air quality levels in the area will enable a comparison with the pre-determined air quality criteria.

The meteorological data described in this section is taken from the HEZ site.

A.2 Topography and Surrounding Land Use

HEZ is situated approximately 35km inland from the coast, within the Hunter Valley of NSW as shown on **Figure 1-1**. The topography across the site ranges from approximately 30 m to 200 m above sea level. The topography of the HEZ is highest at Mount Tomalpin, which is located in the central area of the HEZ and within the National Park Zone. A ridgeline runs south from Mount Tomalpin and extends beyond the HEZ.

The National Park Zone within the HEZ has varied vegetation characteristics, including heath and open forest.

The HEZ is bounded by the residential suburbs of Abermain and Weston to the north, Kurri Kurri to the north-east, Pelaw Main to the east and Neath to the west. Elrington and Abernethy are located to the south of the HEZ and Kearsley is located to the south-west.

A.3 Climatology and Meteorology

The impact that air emissions from the HEZ may have on the surrounding area is dependent on the climate and dispersion meteorology.

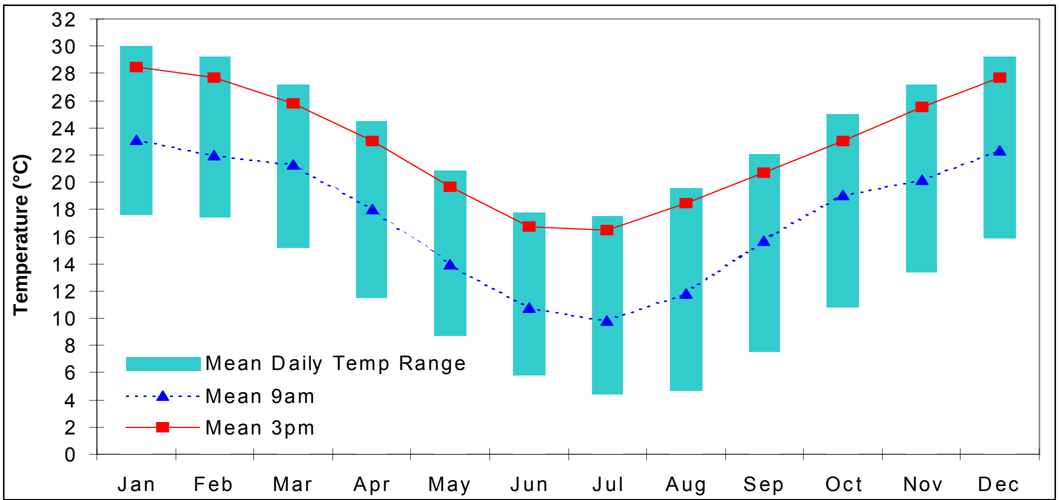
The climatology and dispersion meteorology of the area is strongly influenced by latitude, topography, elevation and proximity to the ocean. In general, the climate is mild and characterised by warm summers and cool winters. Local diurnal variations in drainage flows have a strong influence on climate throughout the year. The rainfall exhibits a distinct seasonal pattern with most rain falling during the summer months.

The Australian Bureau of Meteorology operates a meteorological station at Cessnock (Nulkaba), approximately 8km north west of the HEZ. The temperature, humidity, rainfall and wind data presented in the following sections were obtained from the Nulkaba station. This data have been recorded by the Bureau of Meteorology for over a period of 20 years. The Nulkaba station is considered to experience similar climatic conditions to the HEZ.

A.3.1 Temperature, Humidity and Rainfall

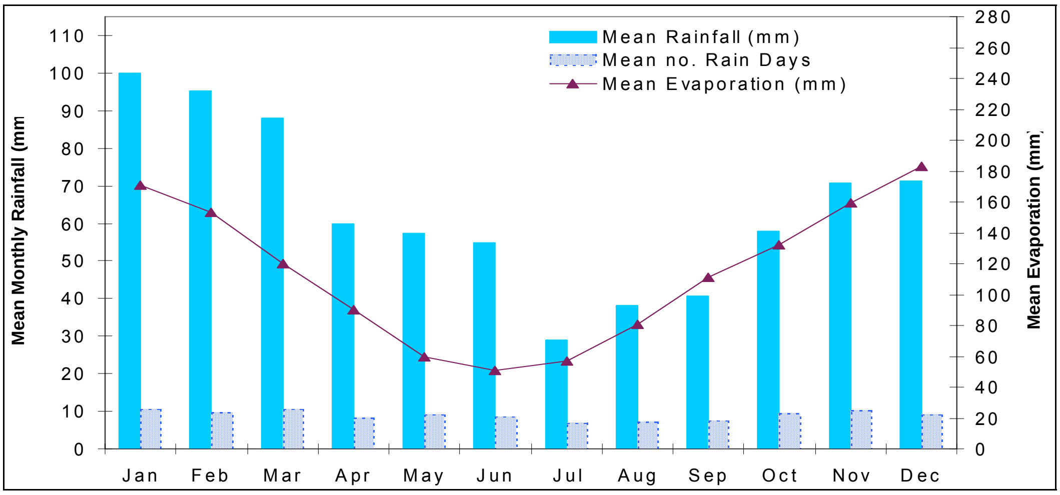
As shown in **Figure A-1,** the area experiences a relatively mild climate with the 9:00 am mean temperatures ranging between 23°C in January to 9.8°C in July. The 3:00 pm mean temperature range is between 28.4°C in January and 16.4°C in July. Overall, the warmest month of the year is January which experiences a mean daily maximum temperature of 29.9°C, while July is the coolest month experiencing a mean daily maximum temperature of 17.5°C.

▪ **Figure A-1 Mean Monthly Temperature Range, Cessnock (Nulkaba)**



The rainfall data presented in **Figure A-2** shows January, February and March as the wettest months of the year, receiving mean monthly rainfall of 99 mm, 95 mm and 84 mm, respectively. The driest months are July and August, receiving average rainfall of 31 mm and 40 mm, respectively. The mean annual rainfall of 760 mm occurs over an average of 108 rain days throughout the year.

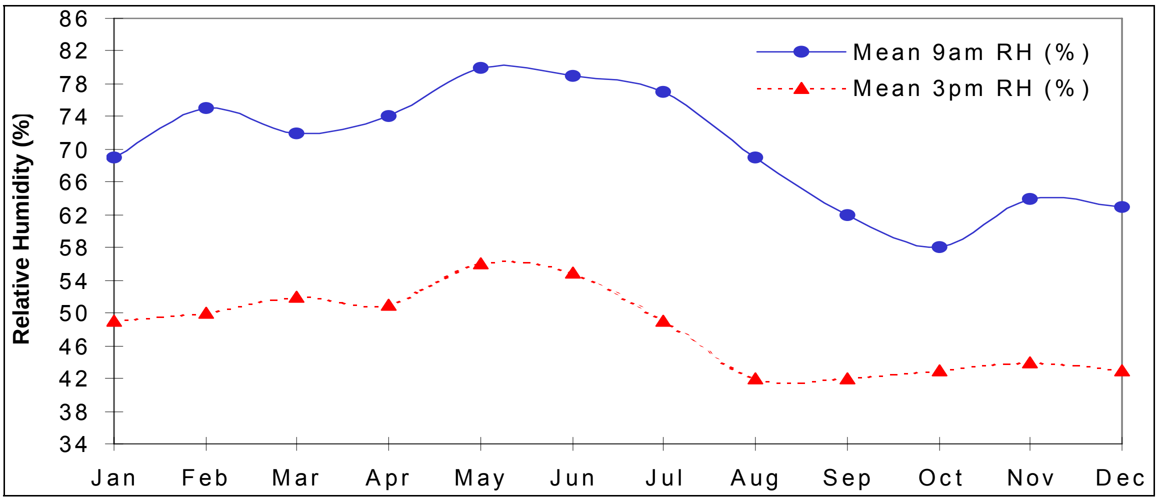
▪ **Figure A-2 Mean Monthly Rainfall and Evaporation, Cessnock (Nulkaba)**



The mean monthly evaporation rates (refer to **Figure A-2**) show a strong seasonal pattern, being greatest during the warmer months and least during the cooler months. Mean monthly evaporation rates range from approximately 51 mm/month in June to 183 mm/month in DECCember. Evaporation typically exceeds rainfall in all months except June, when they are approximately equal.

The 9:00 am relative humidity readings recorded at the Nulkaba Station, shown on **Figure A-3**, are lowest during the warmer months and highest during the cooler months. The relative humidity readings for 9:00 am range between 58% in October to 81% in May. The 3:00 pm relative humidity readings are significantly lower than the 9:00 am readings, exhibiting a range between 42% in August to 56% in May.

▪ **Figure A-3 Monthly Average Relative Humidity, Cessnock (Nulkaba)**



A.3.2 Wind Speed and Direction

The general wind flow patterns for the HEZ have been described using surface wind roses and wind frequency data based on 1-hourly data for 2004 obtained from the HEZ meteorological site (refer to **Figure A-5** and **Figure A-6** for HEZ wind roses). The topographical features within the HEZ, and in particular the ridgeline running south from Mount Tomalpin, most likely influence the wind flows at the site.

Analysis of surface wind observations during 2004 illustrates the seasonal pattern of winds at the HEZ meteorological site. (**Figure A-5**) shows the seasonal wind roses. The labels on the petals of the wind rose indicate the frequency of winds recorded as blowing from that direction at the HEZ site. During summer, the HEZ site experienced a dominance of winds from the southeast. These winds turned, flowing from the south-west and northwest during autumn. North westerly winds dominated and strengthened during winter.

During the morning hours of autumn, light winds from a southerly direction dominate. These light southerly winds turn to stronger north westerly winds towards the end of autumn and continue throughout winter and the beginning of spring. During late spring, these north westerly winds are less dominant, with a higher frequency of lighter winds from the southern sector.

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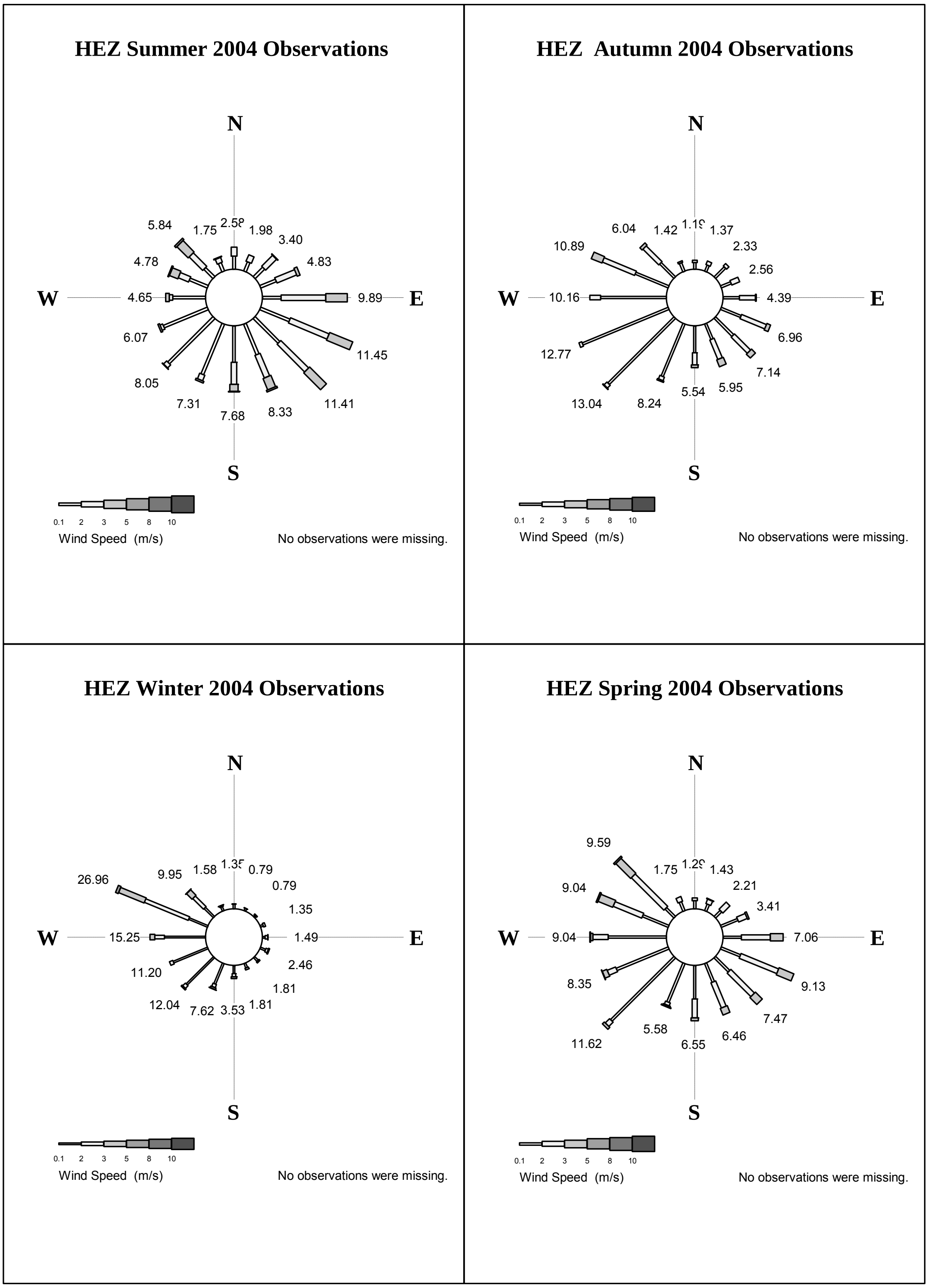
- **Figure A-4 HEZ Seasonal Wind Roses 2004 Observations**



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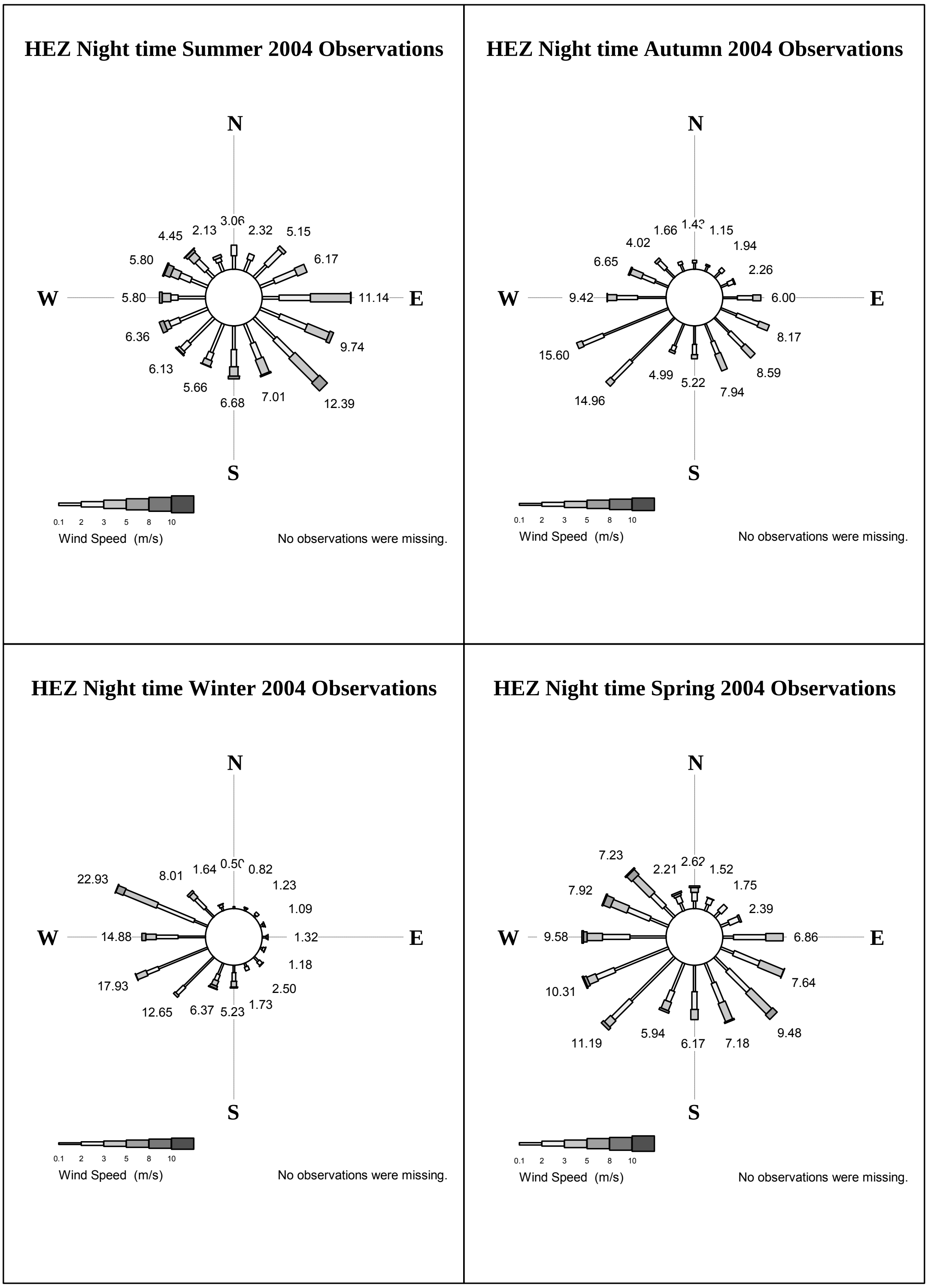
- **Figure A-5 HEZ Night time Seasonal Wind Roses 2004 Observations**



A.3.3 Drainage Flows and Temperature Inversions

Night time cold air drainage flows are described by the surface wind roses using 1-hourly data for 2004, obtained from the HEZ meteorological site. These wind roses show generally night time drainage flows from the south in summer and west-north-west to south-south-west in winter.

"The Hunter Valley Meteorological Study" (*HVMS*, MUSES 1982) presents the most detailed description of atmospheric drainage flows and temperature inversions in the Hunter Valley. The study reported that cold air drainage flows occur frequently during the evenings and night-time hours, particularly within the cooler months. North-west to southeast flows were dominant within the Hunter Valley region. These main north westerly drainage flows down the Hunter Valley were light flows, ranging between 1.5 and 1.9m/s.

The Kurri Kurri area, located immediately to the north of the HEZ, was found to mainly experience a sub-regional drainage flow within the main drainage flow from the south south-east to south south-west directions, with a slightly lower wind speed that the regional north-west to south-east flow (MUSES 1982). The significant topography of Mt Tomalpin, located to the south of Kurri Kurri in the HEZ, most likely is responsible for the drainage flows identified from the HEZ data (**Figure A-6**) and the earlier report (MUSES 1081).

The HEZ Air Quality Management Strategy (*HAQMS*, SKM 2002) reported that afternoon wind patterns in Cessnock during summer and autumn are predominantly from a south easterly direction. The direction of these winds changes to a north easterly direction by May, which continues to prevail throughout the winter months until October. Winds are stronger during the afternoon than the morning throughout all months of the year.

The *HVMS* also determined that nocturnal radiation inversions within the Hunter Valley are common occurring on most nights with clear skies and calm or low wind speed conditions.

These findings may be of critical importance to development within the HEZ as many industries will be locating to the south of the residential areas of Kurri Kurri and Weston and west of Pelaw Main, placing them immediately up wind of these areas during drainage flow conditions.

A.3.4 Mixed Layer Height

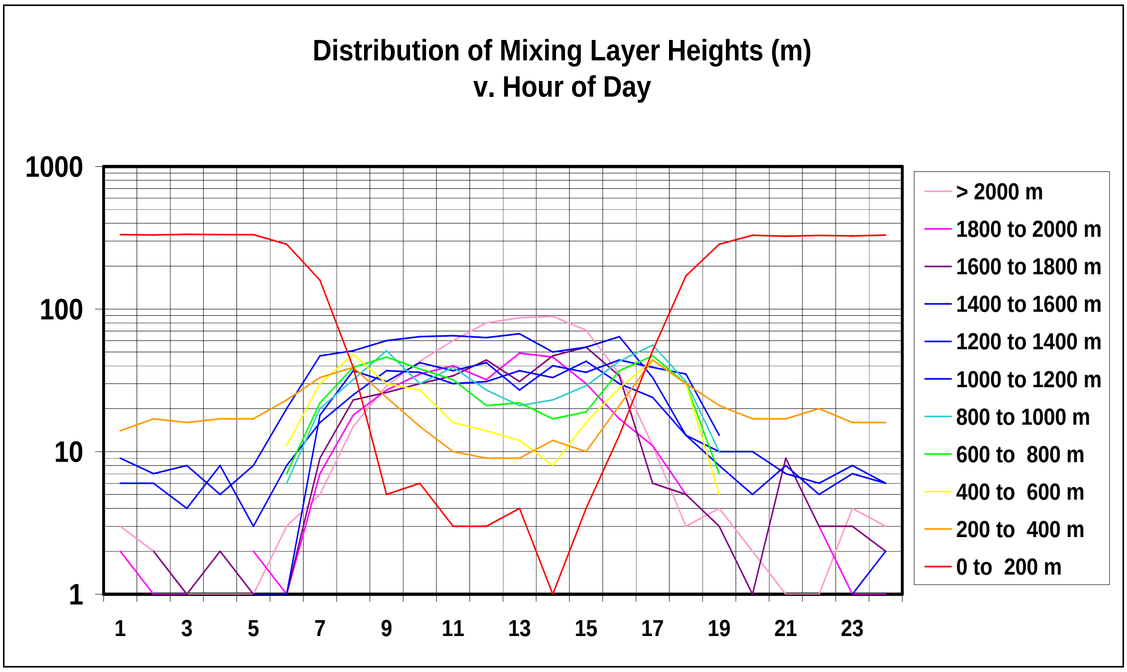
The atmospheric mixed layer (or 'boundary layer') is the lowest layer of the atmosphere in contact with the ground and characterised by turbulence caused by, for example, terrain and thermal convection. The mixed layer can range in depth from 10-100 metres (e.g. during a nocturnal temperature inversion) to well over 1,000 metres during convective conditions in the summer. Aerosols and air pollutants released from near ground level tend to get trapped in this layer and therefore, to a large extent, are dispersed throughout this layer.

In general, the mixed layer height will increase during the day as the sun causes convection and turbulence starting at ground level. The depth of the mixed layer also increases from increasing turbulence induced by flow over rougher terrain.

Thus, mixed layer depth is an important consideration for determination of the air dispersion of pollutants released at ground level, such as odour, for example.

For this report, mixing layer height was determined using the methods detailed in NSWDECC (2005a). The distribution of computed mixing layer heights versus hour of day for the HEZ 2004 dataset is provided in **Figure A-6.** These are typical mixing layer results with deeper mixing layers occurring during the day, enhancing air pollution dispersion. At night shallower mixing layers, of less than 200m, tend to trap air pollution and odours thereby increasing their ground level concentrations.

- **Figure A-6 HEZ 2004 Mixed Layer Heights**



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A.3.5 Atmospheric Stability Class

Atmospheric stability class is used to estimate turbulence parameters and therefore affects the prediction of air pollutant dispersion. The Pasquill-Gifford stability class assignment scheme uses six stability classes from A through to F. Class A refers to unstable conditions where air pollutants spread more rapidly throughout the mixed layer and class F refers to stable conditions where the spread of pollutants spread is less. Atmospheric stability class is an important consideration for dispersion of all air pollutants including odour dispersion.

To determine atmospheric stability class one of the following is required (NSWDECC 2005a):

- Cloud cover and cloud ceiling height by visual observations obtained from the Bureau of Meteorology;
- Total solar radiation measured in conjunction with temperature at two levels and electronically logged; and
- ‘Sigma theta’; i.e., standard deviation of the horizontal wind direction fluctuation, electronically logged.

For this study, (minor) gaps in the observations were filled by linear interpolations (gaps of one hour) or by copying data from an adjacent day (gaps of several hours).

First, the ‘Day’ or ‘Night’ condition was calculated for each hour of the year for the Cessnock location. Secondly, the ‘solar radiation–delta temperature’ method provided in USEPA (2000) was used to determine stability class. Thirdly, the required inputs for calculating stability class; i.e., wind speed, solar radiation and vertical temperature gradient, were obtained from the Cessnock HEZ meteorological observations.

As the measured temperature difference at Cessnock HEZ used only T(2m) and T(10m), occurrences of F class stability could have been overestimated by this method due to the possible presence of very shallow surface layers at night – however this is in accordance with NSWDECC (2005a). Also, this method does not provide a treatment of cloud layers, (there is no information in the nocturnal solar radiation measurements, i.e. incoming solar radiation is measured), and this would also lead to an overestimate of the occurrences of F-class stability. This overestimate of the occurrence of F-class stability may lead to higher predicted air quality impacts where this data set is used for air pollution prediction and therefore generally is conservative.

The distribution of computed stability class with hour of day for HEZ is provided in **Figure A-7**.

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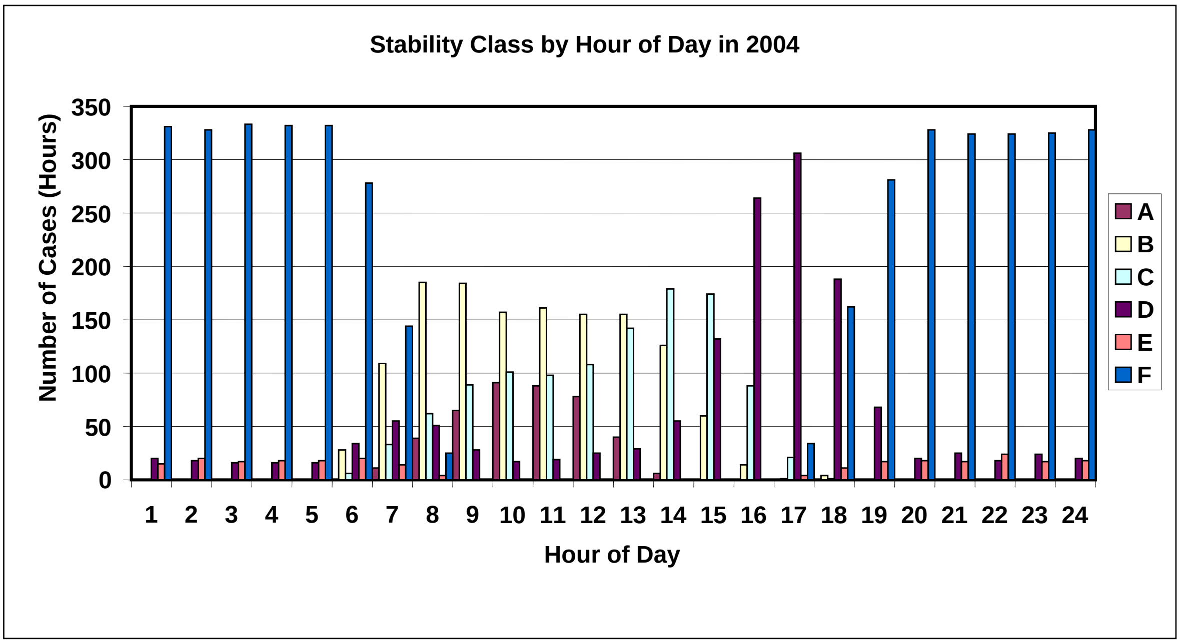
▪ **Figure A-7 HEZ 2004 Distribution of Computed Stability Class**



The figures below show the frequency of stability classes compared with wind speed in metres per second (m/s) (**Figure A-8**) and as a percentage of occurrences (**Figure A-9**).

The results suggest that the HEZ generally experiences atmospheric instability conditions favourable to dispersion of air pollutants during daylight hours. Stable atmospheric conditions at night-time typically will inhibit dispersion. These results are consistent with the mixed layer heights discussed above**.**

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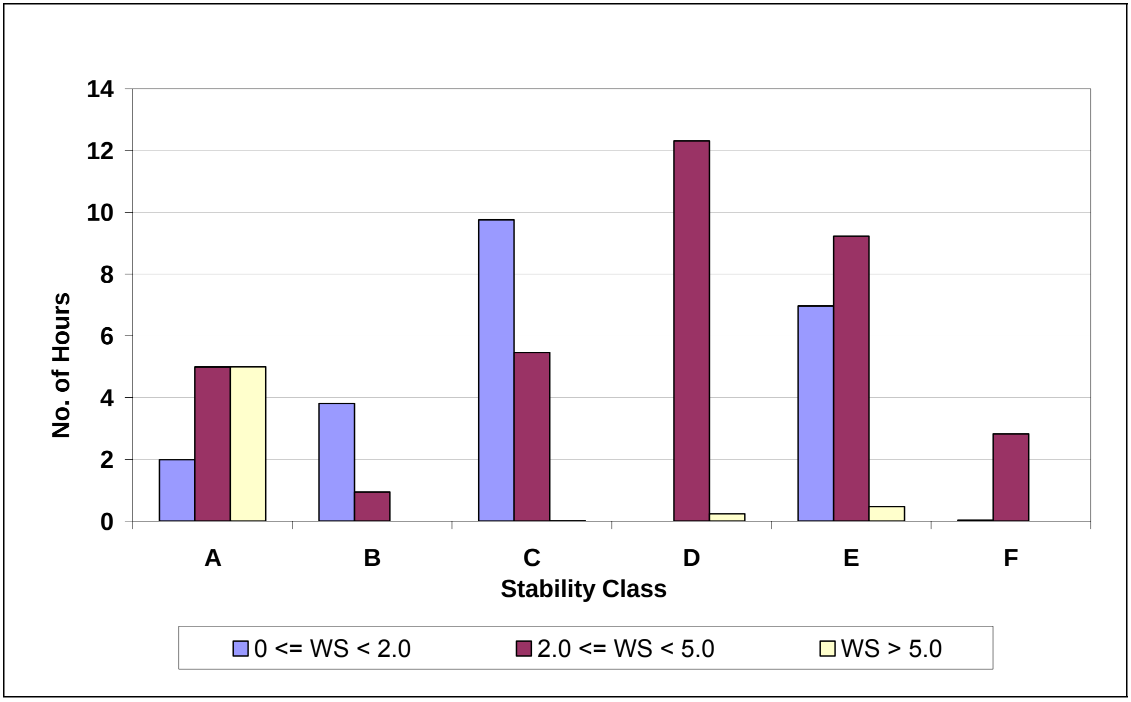
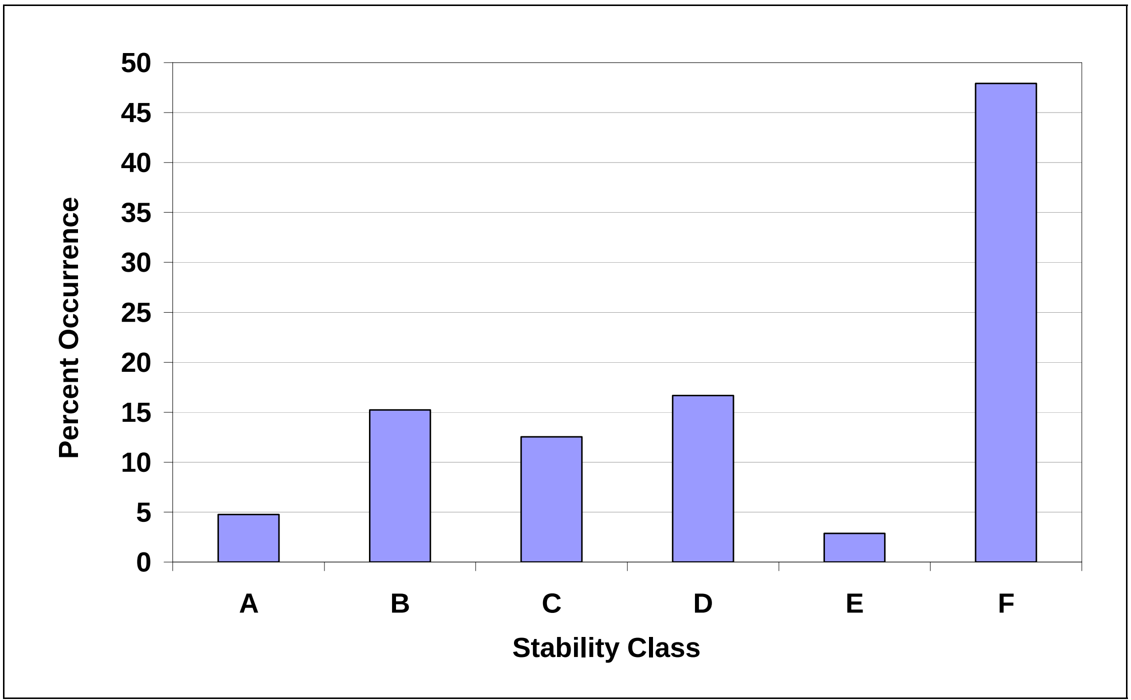
- **Figure A-8 HEZ 2004 Distribution of Stability Class compared with Wind Speed**



- **Figure A-9 HEZ 2004 Distribution of Stability Class as Percentage Occurrence**



A.4 Existing Ambient Air Quality

Existing air quality can be regarded as a function of land use, geography and climate. The HEZ is located in an area surrounded by a mixture of residential, rural residential and bushland. There are also a number of major industrial sources of air pollutants within 10km of the site, which are as follows:

- Poultry farms and processing plants which are a potential source of odour;
- Coal mining operations which are a source of potential particulates (dust); and
- Aluminium smelters which emit a range of air pollutants including acid gases (NO_X, SO_2), particulates and fluoride.

In terms of air quality data in the area the DECC operate a monitoring station at Beresfield located approximately 15km to the north east of the Tomalpin area. Air pollutants measured at the Beresfield station include:

- Ozone (O_3);
- Nitrogen dioxide (NO_2);
- Oxides of nitrogen (NO_X);
- Sulphur dioxide (SO_2); and
- Particulate matter (PM_{10}).

While this monitoring represents a broad range of pollutants, the significant distance between Tomalpin and Beresfield and the different land uses of the two areas limits the data in its ability to accurately describe ambient air quality in the Tomalpin area.

Other sources of air quality data in the area include Hydro Aluminium Smelter at Kurri Kurri.

Following is a summary of ambient air quality data collected at Beresfield.

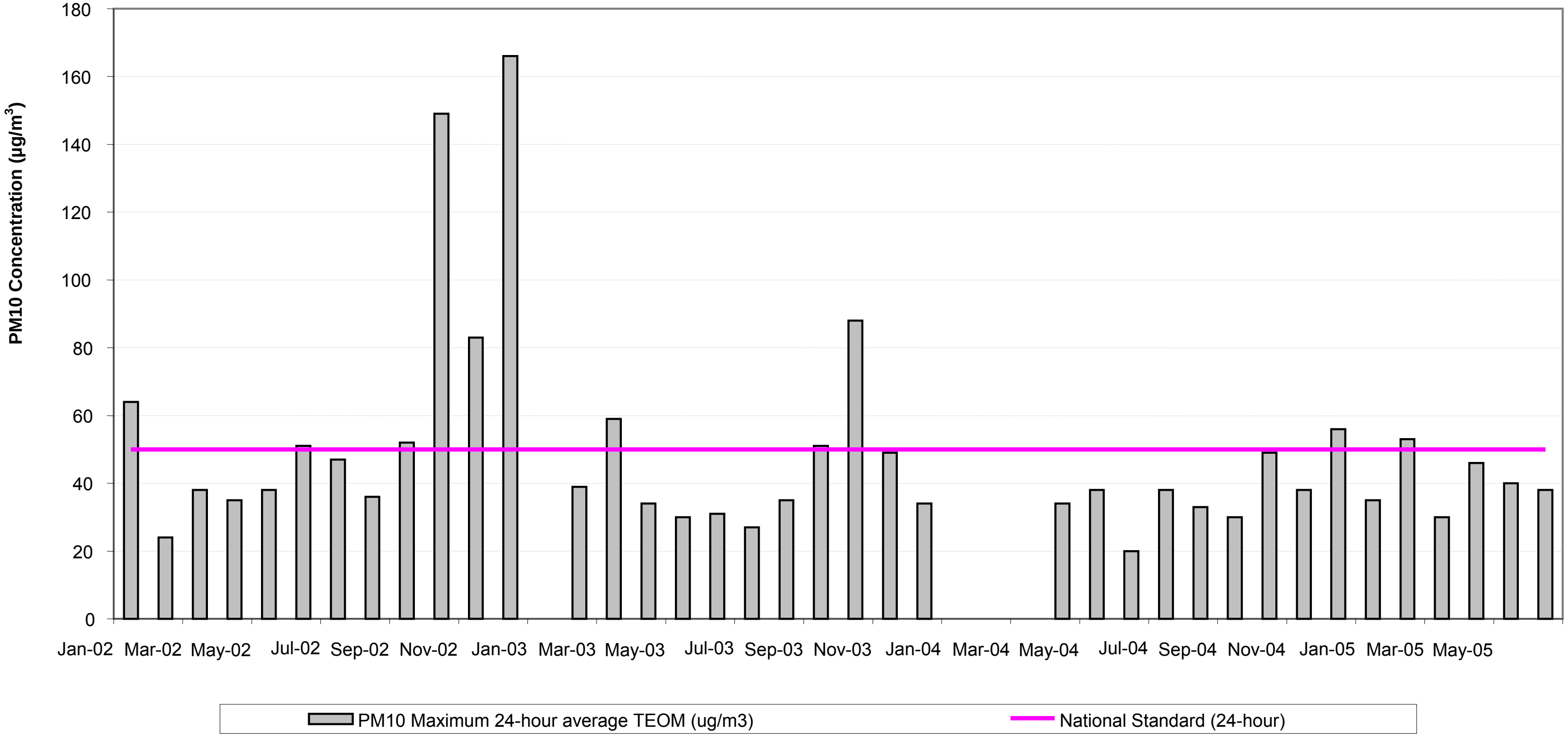
A.4.1 Particulate Matter

The main sources of PM_{10} in the Cessnock local government area are coal mining (54%) and aluminium smelting (33%). Smaller sources include motor vehicle emissions (6%), domestic solid fuel burning (2%) and open burning including bushfires (2%) (NPI 2003-2004).

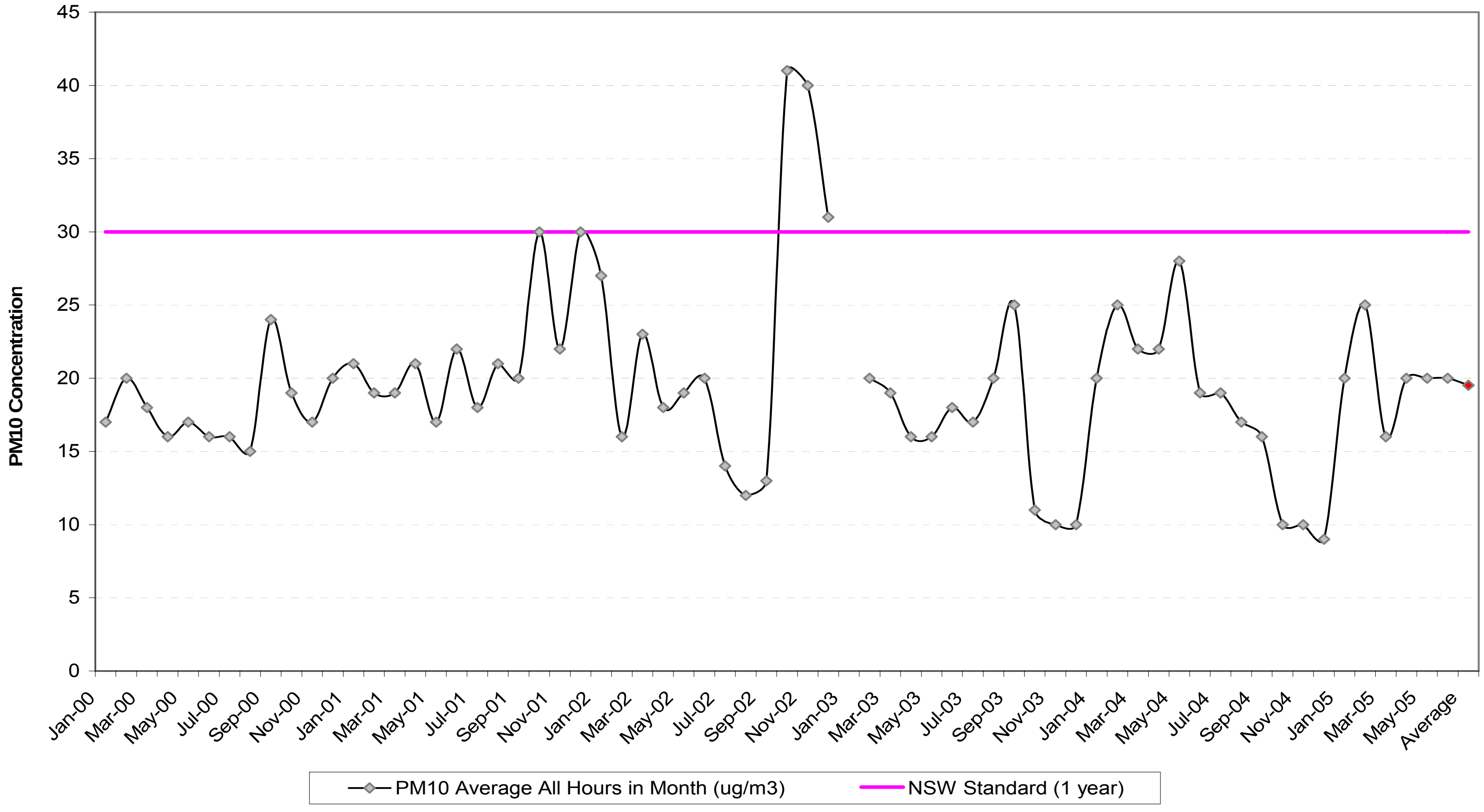
Figure A-10 and **Figure A-11** show the trends in the PM_{10} concentrations at Beresfield, measured by a continuous monitor, the Tapered Element Oscillating Microbalance (TEOM). The data are generally below the NSW DECC criteria for the 24-hour average and the annual average, except for months during spring and summer that are most likely affected by bushfire smoke (PHAA

2001, NSWRFS 2003). In excluding these peaks, average PM_{10} concentrations show a slightly downward trend over the period. It is noted that the results from the Beresfield AQM site would most likely be elevated by traffic on the New England Highway and by heavily laden coal trains on the Main Northern Railway, which passes close to Francis Greenway High, the site of the monitoring station. **Figure A-11** shows that a background PM_{10} concentration of 20 $\mu g/m^3$ represents a reasonable assumption for the HEZ.

- **Figure A-10 Beresfield PM_{10} Concentrations, Monthly Maximum 24-hour Average, January 2002 to June 2005, by TEOM**



- **Figure A-11 Beresfield PM_{10} Concentrations, Average of All Hours in Month, January 2000 to June 2005, by TEOM**



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A.4.2 Nitrogen Dioxide (NO_2) and Ozone (O_3)

NO_2 concentrations recorded at Beresfield during January 2000 to June 2005 were very low compared to NSW DECC air quality criteria. The monthly maximum 1-hour average NO_2 concentrations were less than 6 pphm, that is, less than 50% of the NSW DECC criterion of 12 pphm (refer to **Figure A-12**). Similarly, the hourly NO_2 concentrations, averaged for all months, also were less than 50% of the NSW DECC criterion of 3 pphm (refer to **Figure A-13**). **Figure A-14** shows that a background NO_2 concentration of 1 pphm represents a reasonable assumption for the HEZ. Analysis of average hourly NO_X concentrations suggested an appropriate background NO_X concentration of 19 pphm (NSWDECC, 2000, 2001, 2002, 2003, 2004, 2005c).

O_3 concentrations at Beresfield during January 2002 to June 2005 were less than the NSWDECC criterion of 10 pphm for the maximum 1-hour average concentration, with one allowable exceedances (NSWDECC 2005a) (refer to **Figure A-14**). As noted above, the results from the Beresfield AQM site would most likely be elevated by traffic on the New England Highway, in comparison with the HEZ. The hourly O_3 concentrations, averaged for all months, are shown in **Figure A-15**.

A.4.3 Summary of Background Concs for HEZ and Environmental Limits

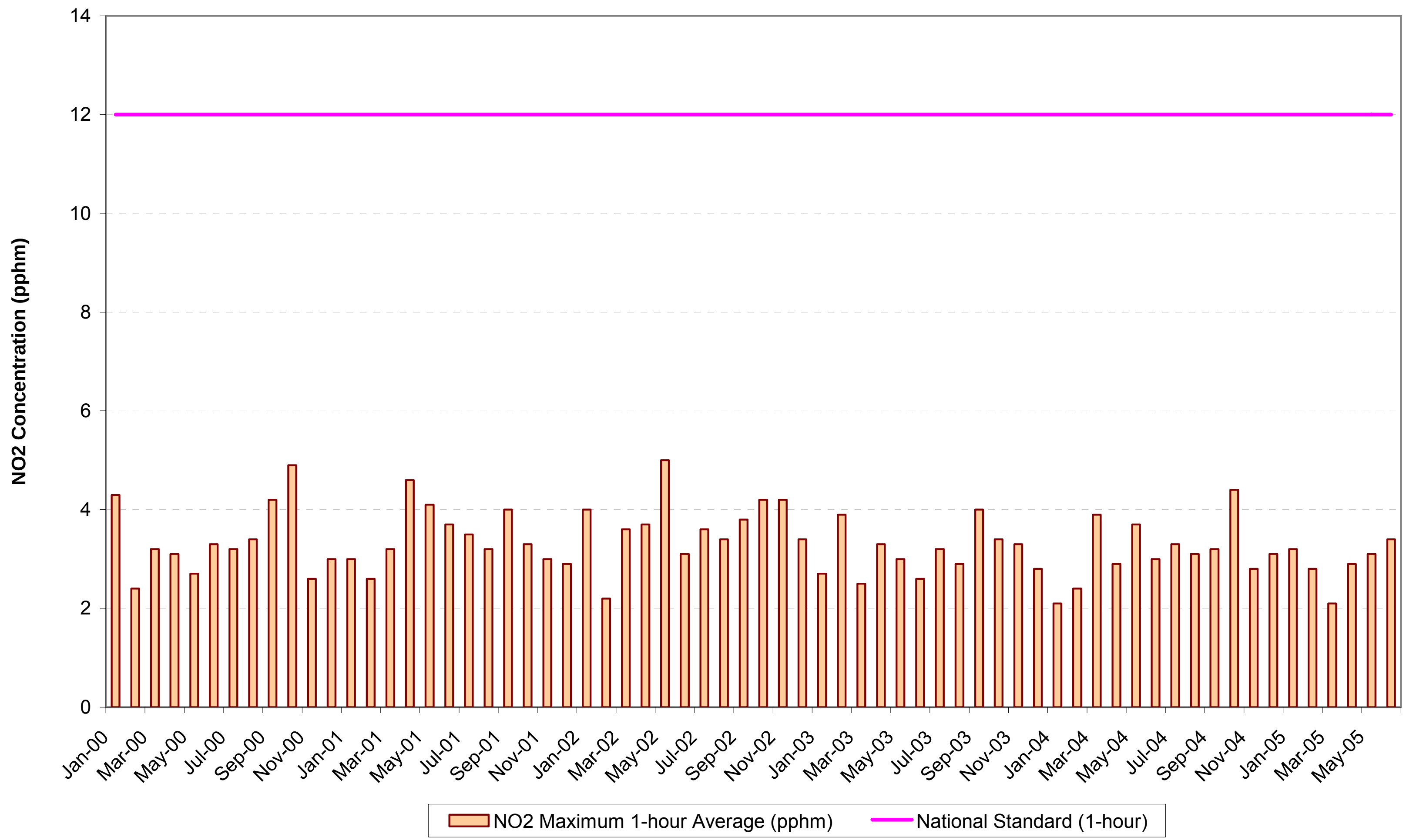
As described above, background concentrations of PM_{10}, NO_2, NO_X and O_3 were determined from averages of ambient air quality data. The environmental margin for a pollutant is defined as the difference between the environmental limit and the background concentration. These data are summarised in **Table A-1**.

- **Table A-1 Limits, Background Pollutant Concentrations and Margins for HEZ**

Air Pollutant	Environmental limit (annual average, NSWDECC 2005a)	Estimated current background concentration for HEZ (annual average)	Estimated current environmental margin for HEZ (annual average)
NO_2, nitrogen dioxide	3 pphm (30 ppb)	1 pphm (10 ppb)	2 pphm (20 ppb)
PM_{10}, particulate matter	30 µg/m^3	20 µg/m^3	10 µg/m^3

Note: g/m3 = micrograms per cubic metre, pphm = parts per hundred million, ppb = parts per billion

- **Figure A-12 Beresfield NO_2 Concentrations, Monthly Maximum 1- Hour Average, January 2000 to June 2005**



- **Figure A-13 Beresfield NO_2 Concentrations, Average of All Hours in Month, January 2000 to June 2005**

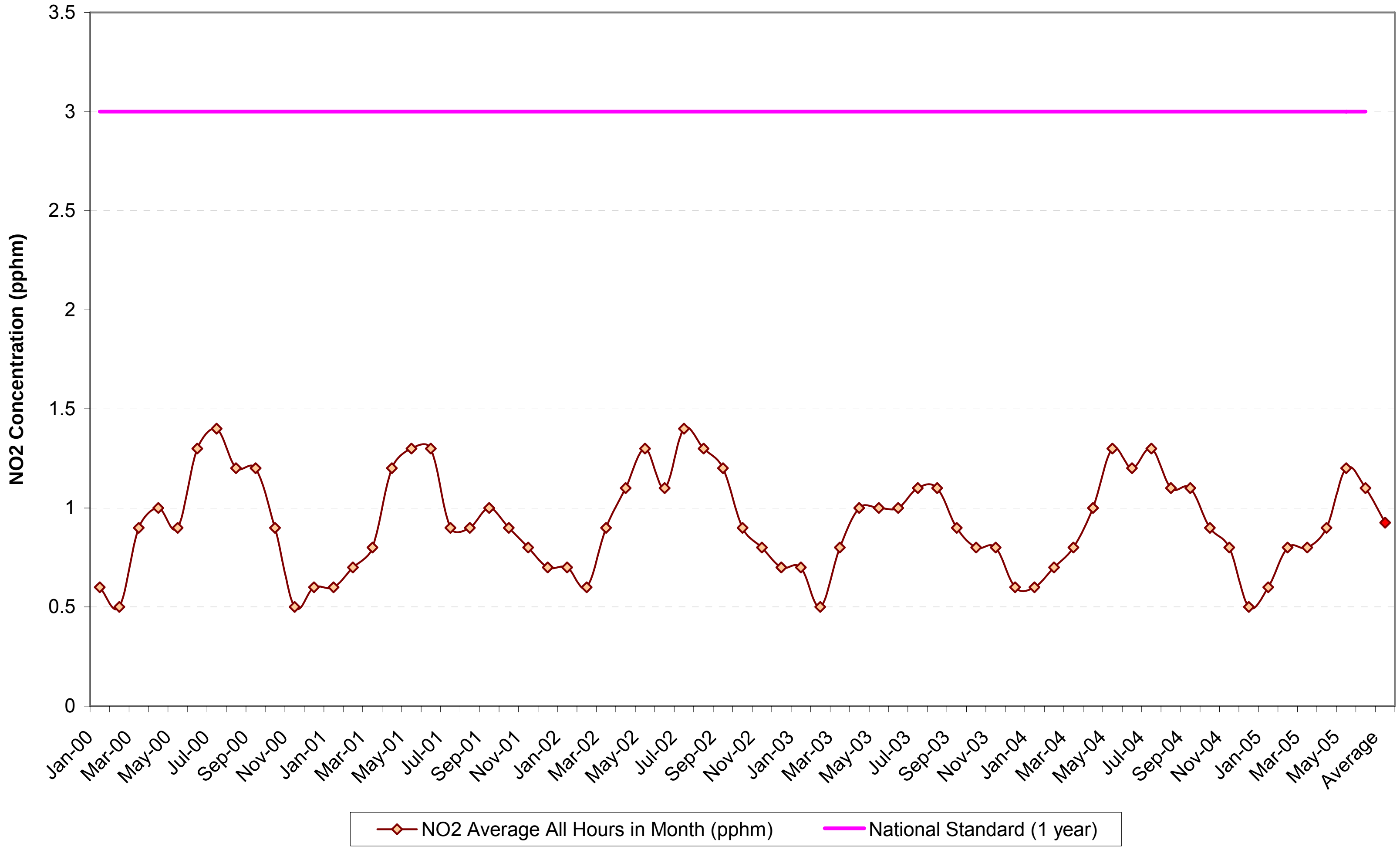
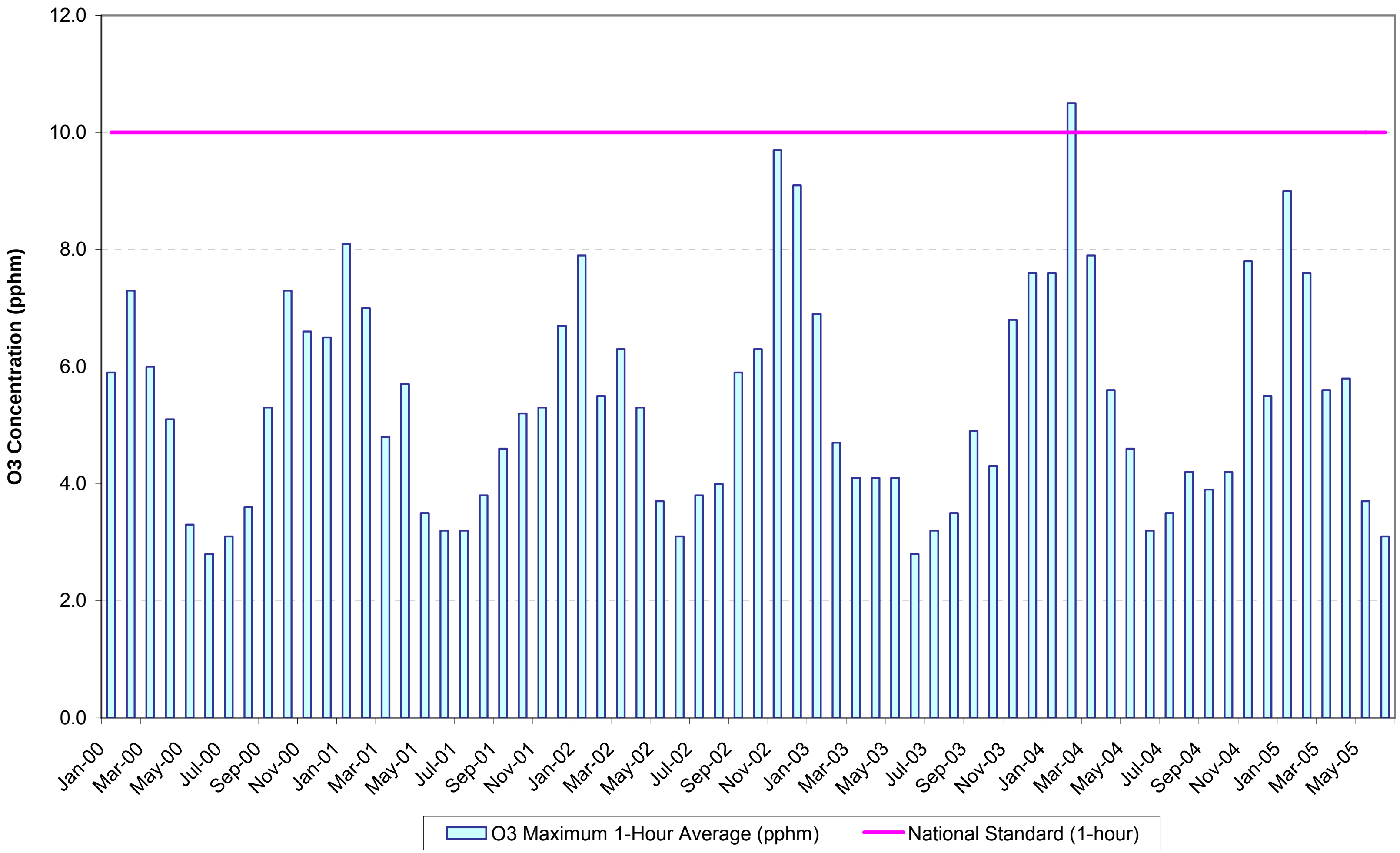
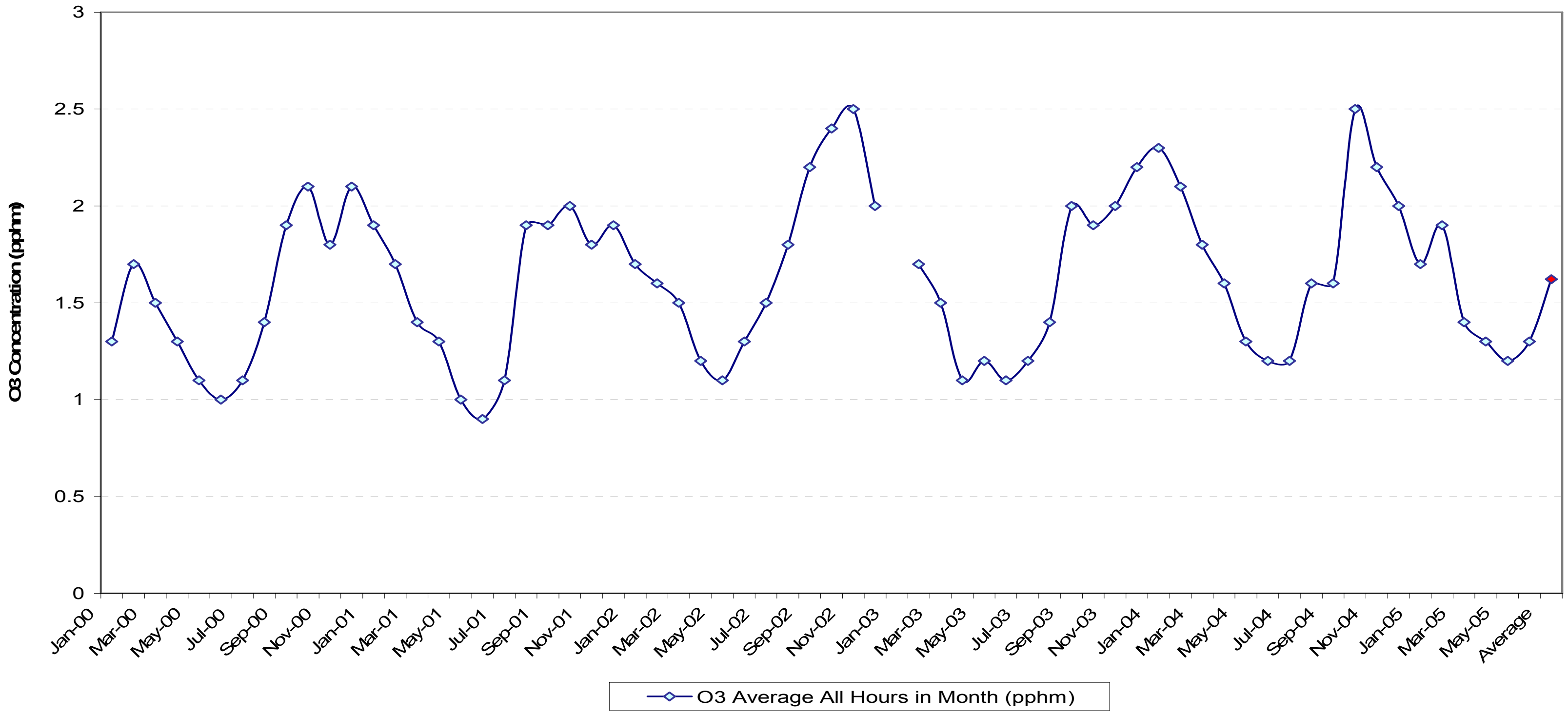


Figure A-14 Beresfield O_3 Concentrations, Monthly Maximum 1- Hour Average, January 2000 to June 2005



- **Figure A-15 Beresfield O_3 Concentrations, Average of All Hours in Month, January 2000 to June 2005**



Note: National Standard maximum 1 hour average = 10 pphm

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A.4.4 Air Toxics

No continuous background monitoring is available for the local area of the HEZ site. During 1996-2000, the NSW DECC monitored air toxics in the NSW Greater Metropolitan Region, including three sites in the Hunter, namely Beresfield, Wallsend and Newcastle, located approximately 25 km E, 25 km ESE and 30 km ESE from the HEZ site. Results indicated very low levels in the Hunter, with the three sites scoring a ranking of 4, where rank 1 represented the highest range of monitored levels and rank 4 represented the lowest range (refer to **Table A-2**) (NSWDECC 2005b). These results suggest that existing levels near the HEZ site are expected to be very low.

- **Table A-2 – Annual Average Ground Level Concentrations of Air Toxics 1996-2000**

Site	Benzene (ppb)	Toluene (ppb)	Xylene (ppb)
Beresfield	0.4	0.6	1.4
Wallsend	0.8	0.9	4.0
Newcastle	0.6	1.1	4.0

A.4.5 Odour

The main sources of odour in the vicinity of the HEZ are as follows:

- Poultry farms in the Cessnock and Kurri Kurri area;
- A poultry processing plant on the site of the old Hebburn No. 2 Colliery located within the HEZ; and
- Cessnock and Kurri Kurri Waste Water Treatment Works (WWTW).

The measurement of ambient odour is very complicated and as such is rarely undertaken. Dispersion modelling studies and community surveys generally provide the most accurate assessment of odour impacts. These are usually undertaken on a case by case basis as a result of community complaint to odours from industry or as part of a planning approval (e.g. EIS) for a new industry or industry upgrade.

Sinclair Knight Merz has completed odour studies for several of the industries noted above including the Volaric poultry processing plant on the site of the old Hebburn No. 2 Colliery and the Cessnock and Kurri Kurri WWTW for their respective upgrades. The specific results of these investigations are not presented here, however, 400 to 600m buffer zones around each industry is typical to mitigate impacts to acceptable levels.

Appendix B Air Quality Standards and Objectives

B.1 Overview

This section of the AQMS sets out air emission standards and ambient air quality criteria relevant to industrial developments in NSW.

B.2 Air Emission Standards and Objectives

Air quality in NSW is regulated by the DECC and objectives are set to minimise the adverse effects of air pollutants generated by various activities on the surrounding environment.

B.2.1 Air Emission Standards

Air emission standards are used to regulate emissions at the point of discharge. They are generally based on the ability of available technology to control emissions rather than any environmental or health considerations.

At the time of writing, the *Protection of the Environment Operations (Clean Air) Regulation 2002* provides emission standards relevant to industries developing within the HEZ.

There are many standards relating to a range of industries and a range of pollutants. The standards are not repeated here in full, and all industries developing within the HEZ with the potential for air emission releases are advised to review the Regulation as part of preparing their Environmental Management Plan in order to confirm their statutory obligation.

Table B-1 sets out new industry (Group 6) emission standards for key pollutants that may be associated with industry developing within the HEZ.

- **Table B-1 - NSW EPA Emission Standards**

Pollutant	Industry	Emission Limit (mg/m^3)
SO_2	Sulphuric acid manufacturing	1000
H_2S	Any activity or plant	5
Sulfuric acid mist (H_2SO4) or sulphur trioxide (SO_3) or both, as SO_3 equivalent	Any activity or plant	100
Cl_2	Any activity or plant	200
HCl	Any activity or plant	100
Any Flourine (F) Compound	Any activity or plant, other than the manufacturing of aluminium from alumina	50 HF or HF equiv.
NO_2 or NO or both (as NO_2 equivalent)	Any activity (except as listed below)	350
	Any boiler operation on gas	350

Pollutant	Industry	Emission Limit (mg/m^3)
	Any boiler operating on a fuel other than gas, being a boiler used in connection with an electricity generator that forms part of an electricity generating system with a capacity of less than 30 MW	500
	Any gas turbine operating on gas, being a turbine used in connection with an electricity generating system	70
	Any gas turbine operating on a fuel other than gas, being a turbine used in connection with an electricity generating system	90
Solid Particle Emissions (total)	Any activity (except as listed below)	50
	Any crushing, grinding, separating or materials	20
Type 1and 2 substances (in aggregate)	Any activity or plant	1
Cadmium or Mercury (individually)	Any activity or plant	0.2
Dioxins or furans	Any activity or plant using a non-standard fuel that contains precursors of dioxin or furan formation or incinerators that process waste	0.1 ng/m^3
Volatile organic compounds as n-propane	Any activity or plant involving combustion (except as listed below)	40 (VOCs) or 125 (CO)
	Any stationary reciprocating internal combustion engine using a gaseous fuel	40 (VOCs) or 125 (CO)
	Any stationary reciprocating internal combustion engine using a liquid fuel	1140 (VOCs) or 5880 (CO)
Smoke	Any activity or plant in connection with which solid fuel is burnt	Ringelmann 3 or 60 % opacity in approved circumstances or Ringelmann 1 or 20 % opacity in other circumstances
	Any activity or plant in connection with which solid fuel is burnt	Ringelmann 1 or 20 % opacity

As previously stated the above information may not include all emission standards for all pollutants or all industries that may be relevant to the HEZ.

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B.2.2 Ambient Air Quality Objectives

Ambient air quality objectives are used to protect the receiving environment from the adverse effects of air pollution.

At the time of writing, the most up to date source of ambient air quality objectives for are NSW are provided in the DECC publication:

- *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in NSW, 2005*

A summary of guidelines as relevant to key pollutants are outlined in **Table B-2** and **Table B-3** below.

- **Table B-2 Ambient Air Quality Objective**

Pollutant	Averaging Period	Concentration	
		pphm	µg/m^3
SO_2	10 minutes	25	712
	1 hour	20#	570
	24 hours	8#	228
	Annual	2#	60
NO_2	1 hour	12#	246
	Annual	3#	62
O_3	1 hour	10#	214
	4 hours	8#	171
Pb	Annual	-	0.5#
CO	15 minutes	87*	100**
	1 hour	25*	30**
	8 hours	9*#	10**
PM_{10}	24 hours	-	50#
	Annual	-	30
TSP	Annual	-	90
Dust Deposition	Annual	Maximum increase 2 g/m^2/month	Maximum total 4 g/m^2/month

*ppm

**mg/m^3

NEPM, not to be exceeded: more than 5 times per year for PM_{10} (24 hours); more than once per year for SO_2 (1 hour and 1 day); NO_2 (1 hour); O_3 (1 hour and 4 hour) and CO (8 hour)

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Table B-3 Odour Performance Criteria

Population of Affected Community	Odour Performance Criterion (OU/m^3)*
Urban (≥ ~ 2000)	2.0
~ 500	3.0
~ 125	4.0
~ 30	5.0
~ 10	6.0
Single Residence (≤ ~ 2)	7.0

*OU-odour units

With regards to NEPM standards referred to in **Table B-2** these have been adopted by the DECC for air quality assessment purposes. The DECC do not regulate industries using ambient objectives or standards but generally require industry to demonstrate that their operations are able to comply with such objectives at the planning and approvals stages of the development.

With regards to odour standards referred to in **Table B-3** while these are taken from the DECC publication *"Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in NSW"* the *EPA Draft Odour Policy – Management and Assessment of Odours from Stationary Sources, May 2001* provides more information with regards to odour assessment in NSW.

The DECC publication *"Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in NSW"* also provides criteria for other specific pollutants where they have the potential for either odorous of toxic impact.

The Australian and New Zealand Environment and Conservation Council (ANZECC) has established guidelines for acceptable fluoride levels in ambient air. These guidelines which are reproduced in **Table B-4** are designed to protect against injury to plants and grazing animals.

Table B-4 ANZECC Fluoride (HF) Guidelines

Averaging Time	Maximum Acceptable Conc. ($\mu g/m^3$)	
	General Land Use	Specialised Land Use
12 hours	3.7	1.8
1 day	2.9	1.5
7 days	1.7	0.8
30 days	0.84	0.4
90 days	0.5	0.25

Appendix C HEZ Emission Margins

The air emission standards and objectives provided in **Appendix B** when applied to industry developing within the HEZ are, at this stage considered satisfactory for the protection of air quality both locally around the HEZ and within the lower Hunter airshed.

No site specific standards or objectives are considered necessary for industry developing within the HEZ, however, potential air quality impacts from these industries will need to be assessed in a holistic (cumulative) sense with a full consideration of cumulative impacts from other industries within the HEZ and existing air quality levels.

While no site specific standards or objectives are considered necessary, the method by which the "margin of safety" that exists between existing background air quality and ambient air quality objectives as set out above is managed will be critical to ensure that air quality in the future is not compromised. This is particularly important for an area like the HEZ were rapid industrial development may occur within a very short period of time.

In more typical industrial development situations it is usually possible to assess individual developments on a case by case basis having regard only to the background levels of air pollution. The reason for is that following the establishment of a particular industry in a particular locality there will be sufficient time for the impact on air quality from that industry to be realised before consideration needs to be given to a subsequent industry in the same area. This may not be the case at the HEZ. The most robust way of managing the 'margin of safety" that exists between existing background air quality and ambient air quality objectives requires a detailed knowledge of air quality within a region and the capacity of the region to accept more emissions without air quality being compromised. For the HEZ a sub-regional airshed model for the lower Hunter would be required before this carrying capacity is fully understood. While the DECC in consultation with the CSIRO are considering the development of an airshed model for the lower Hunter this is still in the planning.

In the absence of a regional understanding of air quality within the lower Hunter the "margin of safety" described above SKM together with John Court and Associates, have prepared Interim Reports for CCC investigating the emission margins potential for industrial developments within the HEZ. This work to date has focussed on PM_{10} and NO_X emissions, which are expected to be common emissions for many industries developing with the HEZ, and they are also important ambient air pollutants within the Lower Hunter area.

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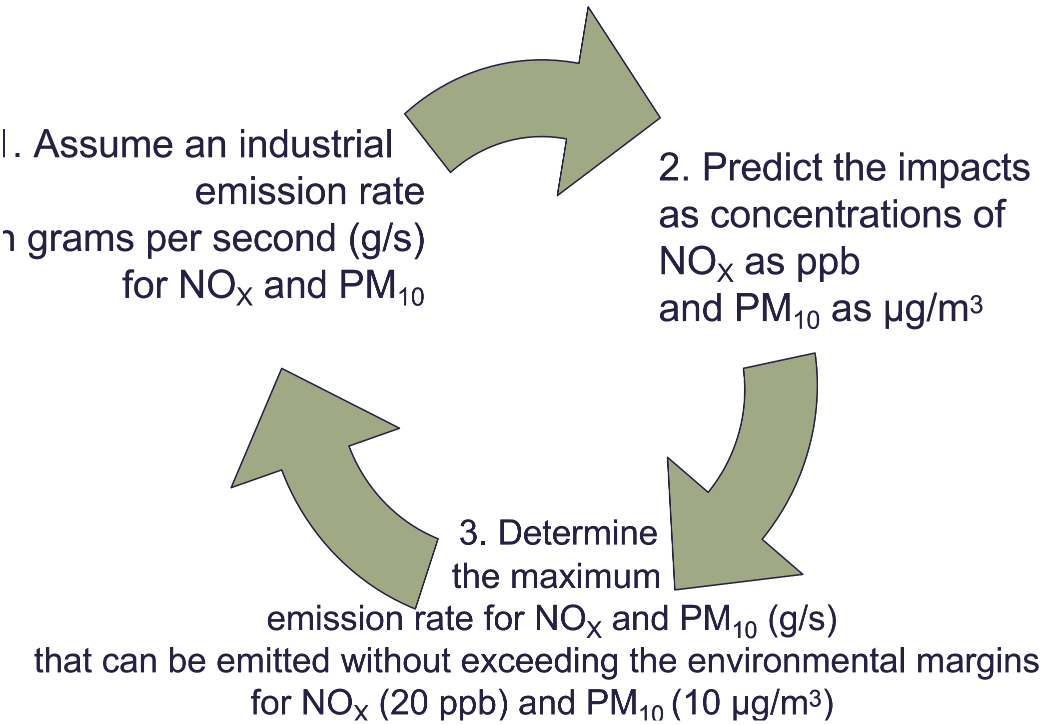
A summary of the modelling process used to develop the emissions margins for PM_{10} and NO_X is shown below:



Defining margin impacts as being the difference between ambient air quality objectives for NO_2 and PM_{10} (refer to **Appendix B**) and existing ambient air concentrations for each of these air pollutions (refer to **Appendix A**), **Table C-1** sets out the total HEZ industry mass emission rates determined (as annual averages) for various generic development scenarios:

Table C-1 Generic HEZ Emission Margins

Development Scenario	NO_X Emission Rate (g/s)	PM_{10}Emission Rate (g/s)
1) Area based emissions evenly distributed across HEZ	66	15
2) Small stack (6 m) emissions evenly distributed across HEZ	166	42
3) Larger stack (20 m) emissions evenly distributed across HEZ	200	50
4) Larger stack (20 m) emissions graded over HEZ site with increasing emissions towards SW corner of HEZ area	250	63

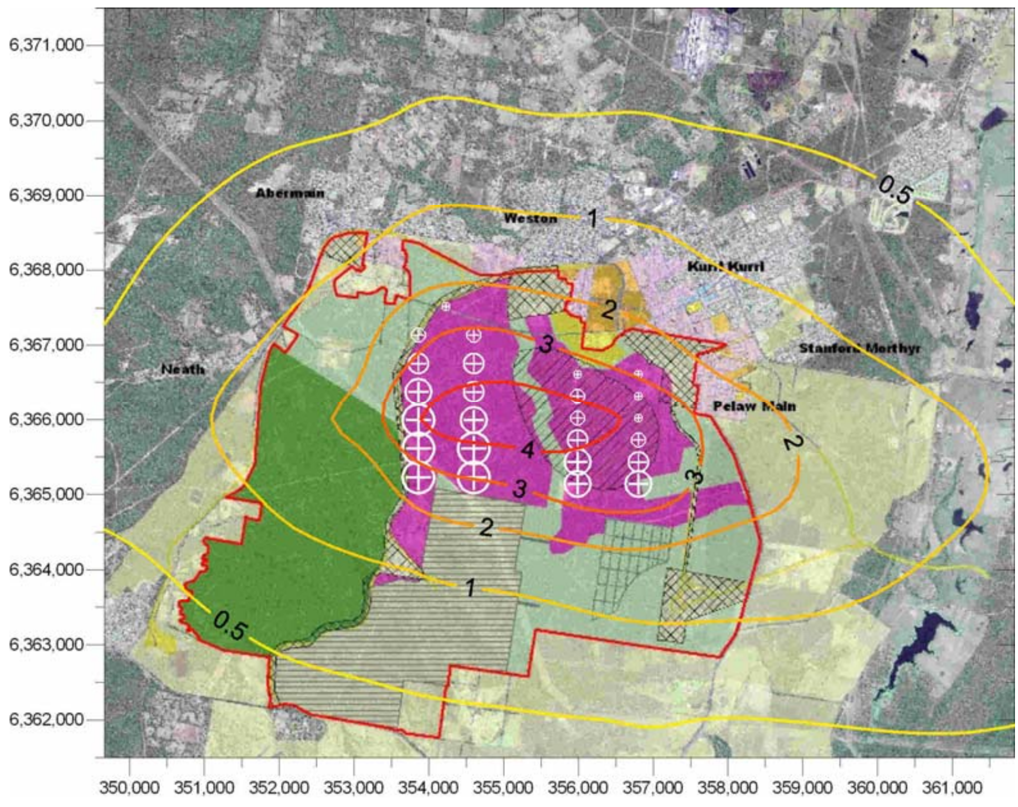
It should be noted that these results are preliminary only with the following works being required before any firm conclusions can be drawn from the magins work:

- Commencement of monitoring for PM_{10} and NO_2 at the HEZ as soon as possible to provide site specific background levels that are critical to the assessment of the relationship between air pollution dispersion and local meteorology; and
- Modelling of comprehensive mock-up scenarios of industrial development in the HEZ, following ANZIC codes, as soon as the NSWDECC emissions inventory for the Greater Sydney Region is available.

In terms of maximising the area of the HEZ available for industrial development the only key finding that can be drawn from the preliminary results is that in general larger pollution emitting industries should be located as far as possible away from sensitive receiver areas eg, Kurri Kurri and Pelaw Main.

This is demonstrated by the results of margins modelling (refer to **Table C-1**) and an example plot for air pollution impact for Scenario 4 as generated by the TAPM model is included as **Figure C-1**.

- **Figure C-1 TAPM predicted NO_2 (ppb) average annual concentration, resulting from graded emission sources, stack height 20m**



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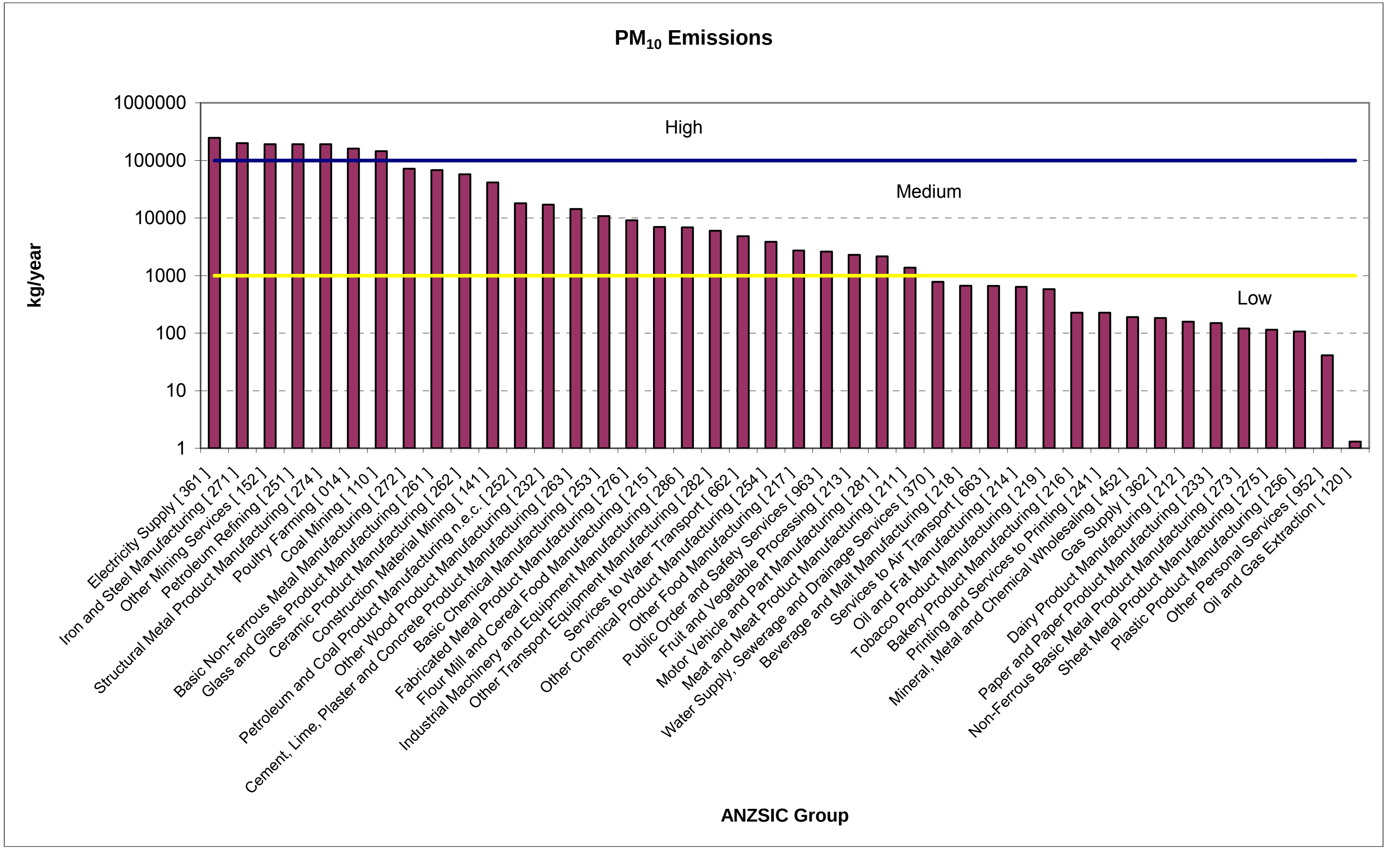
Appendix D GMR Industry Type Emission Loads

D.1 PM_{10} Emission Industries Groups



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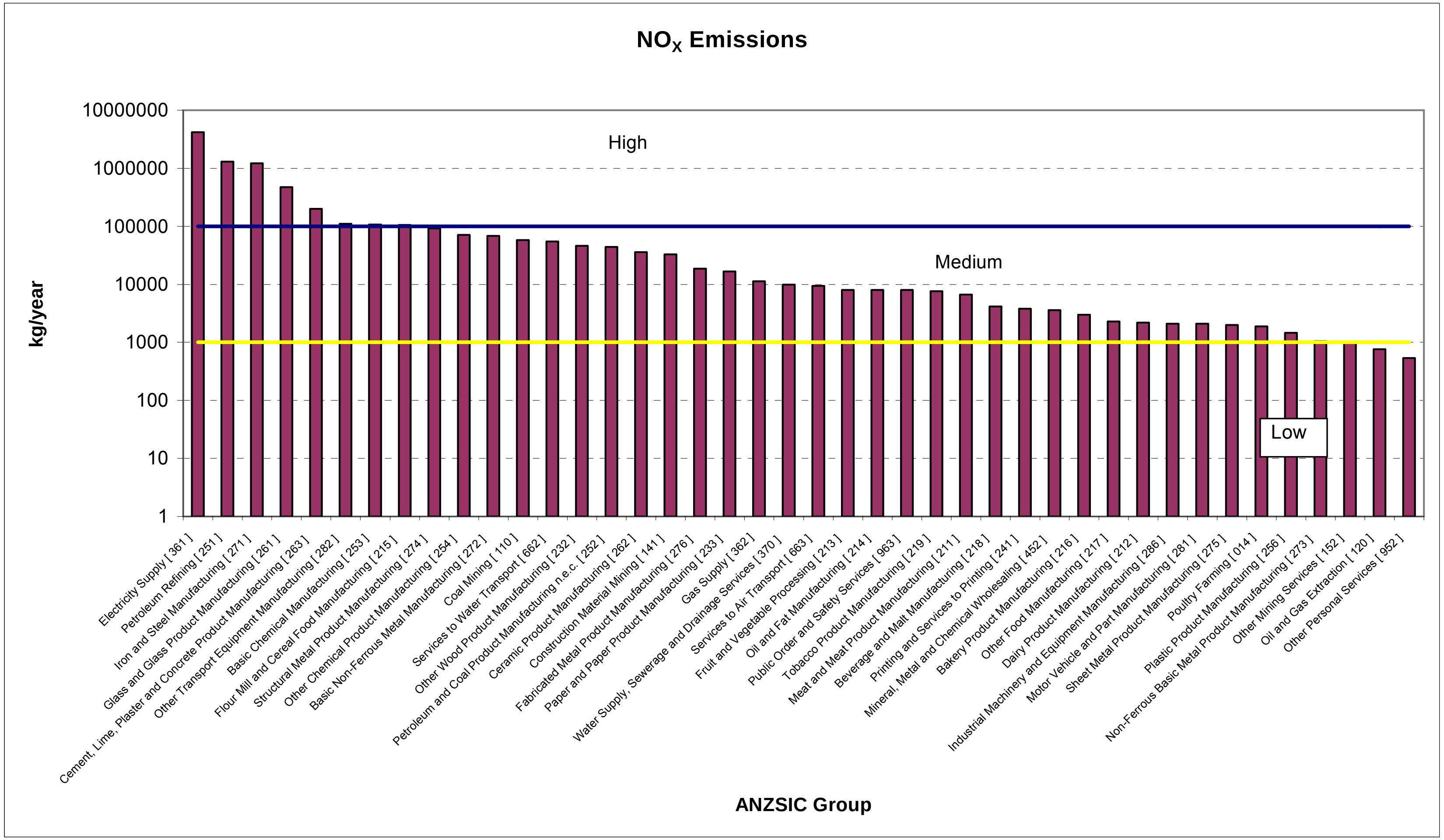
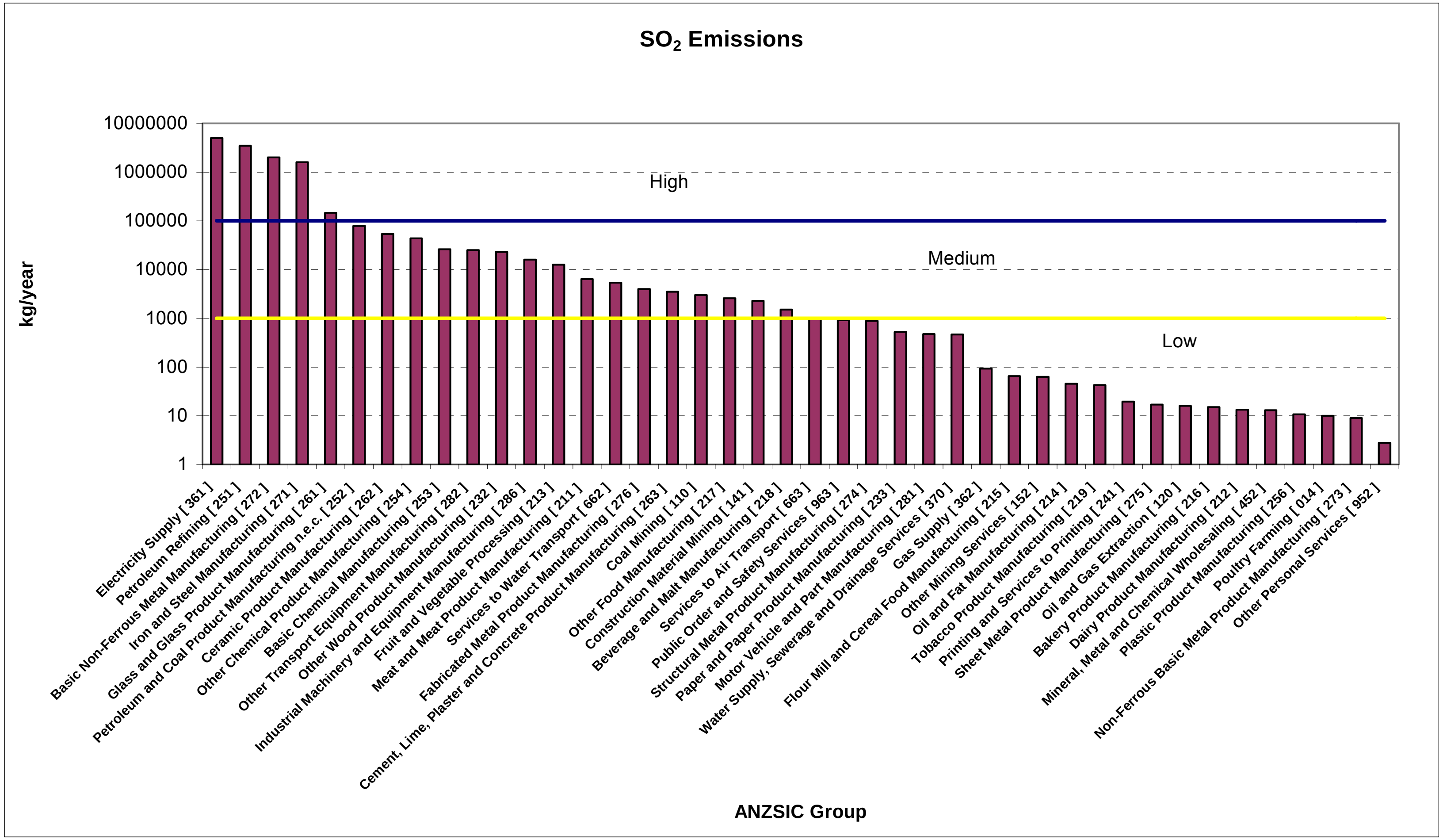
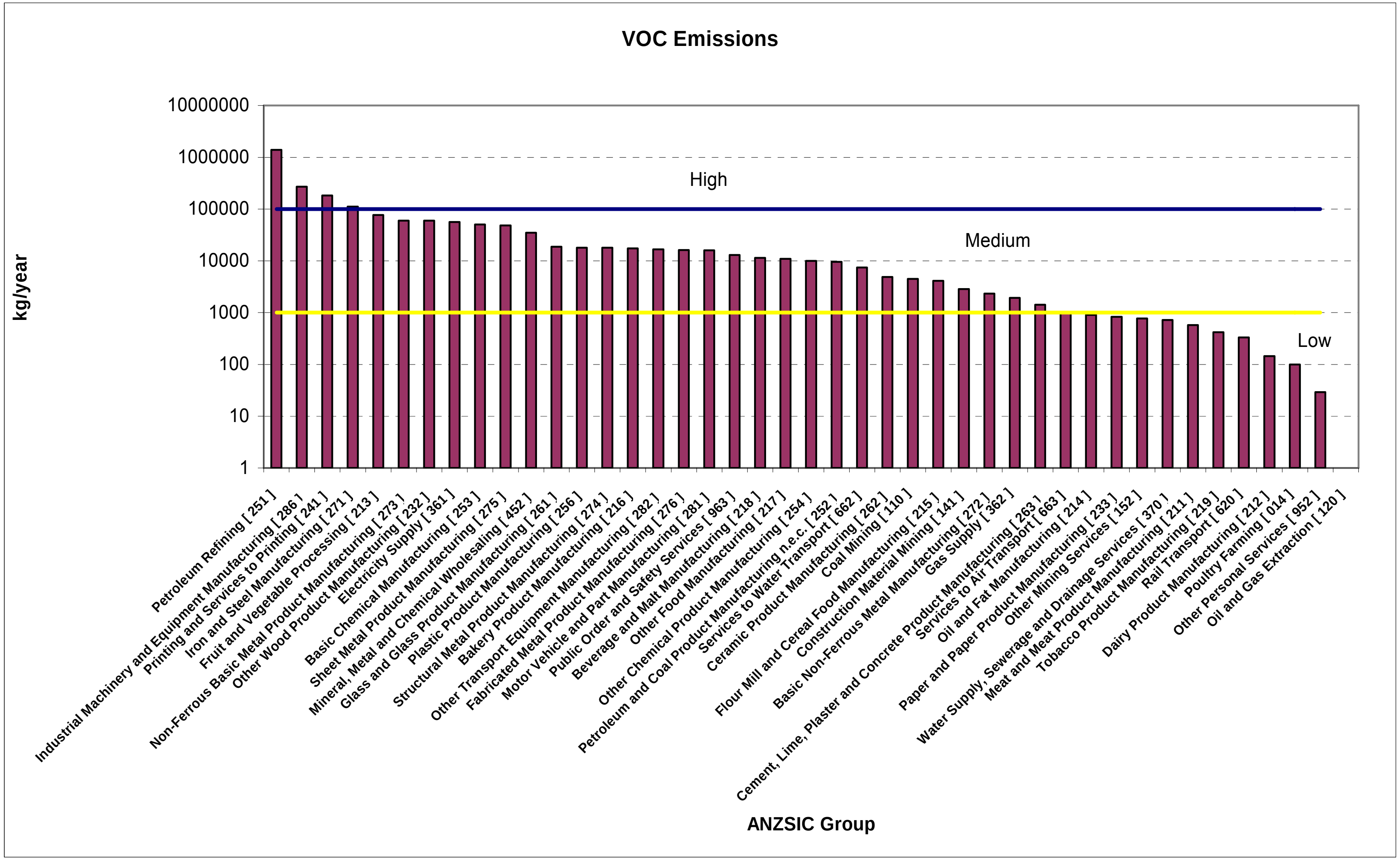
D.2 NO_x Emission Industries Groups



D.3 SO_2 Emission Industries Groups



D.4 VOC Emission Industries Groups



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Appendix E Air Quality Modelling Procedures

E.1 Overview

This appendix sets out air dispersion modelling considerations which form part of the AQMS and procedures to be followed by industry when assessing air quality impacts from proposed industrial developments within the HEZ.

E.2 The Proposed Model(s)

A range of air dispersion models were initially considered for modelling, including:

- AUSPLUME / ISC;
- TAPM; and
- CALMET / CALPUFF.

E.2.1 AUSPLUME / ISC

It is considered that the conventional Gaussian model AUSPLUME is the most appropriate model for modelling air pollution impacts in the HEZ. AUSPLUME is well used across Australia including the lower Hunter and meteorological conditions in the area are considered suitable for assessment of air quality impacts using AUSPLUME.

The US EPA suite of Industrial Source Complex (ISC) models up until recently have often been used in place of models such as AUSPLUME due to their superior consideration of pollutants such as particulates and treatment of building wake effects. However, the most recent version of AUSPLUME (version 5.1) now incorporates all features previously used by ISC and as AUSPLUME is readily available and provides a more user friendly interface than ISC it is preferred.

E.2.2 TAPM

The TAPM air dispersion model has also been considered for modelling purpose in the HEZ. TAPM is an abridged version of a weather forecasting model, designed specifically for air pollution applications. It realistically simulates the complex 3D behaviour of the atmosphere and mathematically moves plumes about in a 3D space, taking into account the main factors that affect plume ground level concentrations. TAPM can be used in a meteorological mode to generate wind field models or in an air pollution mode and is best suited to regional applications rather than to the near vicinity of specific industrial facilities.

E.2.3 CALMET / CALPUFF

The CALMET / CALPUFF modelling scheme is a second generation dispersion model which has all the key features that enable realistic representation of industrial emission sources, as well as the three-dimensional nature of the atmosphere.

CALMET / CALPUFF has the advantage over AUSPLUME in that it allows for time varying predictions of air pollution impacts rather than steady-state predictions. It also provides for more accurate consideration of impacts, in areas of complex terrain, and in areas of complex meteorology in particular convective meteorology.

The meteorological input required by CALMET / CALPUFF to fully utilise its range of operations needs to be very detailed and not all parameters required are available in all areas. This complicates modelling tasks and as such use of CALMET / CALPUFF as part of the HEZ development is only recommended where the type of industry developing in the area requires such a detailed consideration of air emissions.

Examples of industry type that may require CALMET / CALPUFF modelling are power plants or smelters where there are tall stack sources that may be significantly influenced by the surrounding topography in particular Mt Tomalpin.