Chapter 4: Atmosphere

4.1 Summary and indicators

4.1.1 Summary

State
The air quality in the City of Gold Coast is currently believed to be of a high standard. This is based mainly on the fact that the Gold Coast does not yet have the industry or population levels to have significant air-quality problems. In addition, short-term monitoring has not revealed any significant air-quality issues. Studies of the Brisbane Air Shed indicate that some northern parts of the Gold Coast around Coombabah may be affected, at times, by air pollution from Brisbane's Central Business District.

Pressure
However, the population growth rates for the Gold Coast and high vehicle use rates, particularly with low occupancy rates, indicate potential future problems. Studies in conjunction with the Pacific Motorway have identified potential air-quality black-spots along the Pacific Highway.

Response
The Council and the Department of Environment are discussing the placement of extra permanent air-quality stations; one in the northern half of the Gold Coast where air-quality decline may be experienced; and another in the south of the City.

Conclusion
At present there are no apparent major problems with air quality on the Gold Coast, although there are few data for this to be conclusive. An increase in air-quality monitoring on the Gold Coast is occurring. The growth in vehicle use and the development of the Pacific Motorway are expected to begin to cause problems of air quality on the Gold Coast in the next 20-30 years. The development of the City's Transport Plan that seeks to encourage better use of private vehicles, and a greater use of public transport, cycling and walking.

4.1.2 Indicators

Sub-theme	Indicator
State- ⇒ industrial, commercial, domestic and mobile sources	Particulates, Nox, Sox, Toxics, lead in air.
Pressures- ⇒ Stationary industrial sources	Location of licensed emissions (by type, total annual volume) including Council facilities
Pressures- ⇒ Traffic	Traffic flow, volume
Current Responses- ⇒ Traffic management plans	Nature of plans zones

4.2 Introduction

The air quality of the Gold Coast is a vital part of the environment of the city. It is a fundamental part of the lifestyle of the City that is enjoyed by residents and visitors alike.

Air quality depends on the natural condition of the atmosphere in a location (eg, dry and dusty, salt spray etc.). As well, this also includes any extra effects human activity has. While the local fauna and flora, and usually people, are able to thrive with the natural air quality of an area, human impacts can significantly alter this and make the area unpleasant at some times or even uninhabitable.

The surrounding natural environment has a tremendous capacity to absorb many of the excesses of human development and maintain environmental values such as air quality. However, in many places the ability of the local environment to absorb and dissipate our increasing levels of emissions is being exceeded on at least some days of each year.

The earth's atmosphere forms a vital protective shield without which, life as we know it, would be impossible. The atmosphere is considered to have four layers, the thermosphere (80-100km above the earth's surface), the mesosphere (50-80km), the stratosphere (11-50km), and the troposphere (0-11km). Of these layers it is the troposphere and the stratosphere, which are the most immediately important to the environment because it is within these layers that life exists and the impacts of human development are being observed.

The stratosphere includes the ozone layer. This layer acts as a filter that prevents most of the suns ultra-violet radiation from reaching the earth's surface. It is this radiation that causes most skin cancers and has other damaging effects on living organisms. Hence, the ozone layer is vital to life on earth.

The troposphere contains most of the living organisms on the earth. Therefore, the mixture of gases in the troposphere is essential to life. There is around 78% nitrogen, 21% oxygen, 1% argon and 0.03% carbon dioxide. There are at least another 4 gases which make up the remaining 0.01% including neon and helium.

As well as providing the air necessary for life, the atmosphere acts as an ultra-violet filter and a thermal blanket. This "*thermal blanket"* consists of water vapour, carbon dioxide and other trace gases which allow the penetration of sunlight but absorb some of the outgoing infra-red radiation. This natural process is known as the Greenhouse Effect and keeps the surface temperature of the planet at a level approximately 30^0C higher than it would otherwise be.

Table 4.1 Major air pollutants

Pollutant	Description
Lead	*"Exhaust emissions from vehicles running on leaded petrol are the source of about 90% of the lead in our urban air."* (Brisbane City Council, 1994, p4). The lead is in the form of very small particles which are easily inhaled and absorbed into the bloodstream. Long and short term exposure to high lead levels can have varying effects on human health.
Carbon monoxide	Is produced when not enough oxygen is made available to completely burn the fuel being used in the engine. Normally the fuel will burn to produce Carbon dioxide. Only small concentrations of Carbon monoxide are needed to be toxic to life.
Nitrogen oxides (No_x)	Nitrogen dioxide is known to affect the lower respiratory tract and lungs. The sources of nitrogen dioxide are motor vehicle exhausts and emissions from industries such as power stations, cement works, glass manufacturing and large boilers.
Odours	Odour related complaints comprise a large proportion of air pollution related complaints to state and local government bodies. Odour complaints arise from a variety of sources, including domestic, agricultural and industrial activities
Ozone	The main component of photochemical smog is ozone. Ozone can seriously damage soft tissue of organisms. Its immediate effects during periods of high smog levels include eye irritation and breathing difficulties.
Particulates	In air pollution terms, particulates are defined as solids, liquids and/or gases which condense into particles or are adsorbed onto existing particles. Large particles quickly settle out and are effectively removed from the air by the nose and mouth. Chronic exposure to fine airborne particulates can, however, restrict breathing, reduce the body's ability to remove foreign matter from the air passages and lungs, and aggravate illnesses such as asthma, bronchitis and emphysema. The black emissions from diesel trucks are fine particulates.
Hydrocarbons	These gases result from incomplete combustion, biological processes, and leakages from stored hydrocarbon.
Sulphur dioxide	The main sources of sulphur dioxide are coal and oil burning in power stations, petrol refineries and smelting of non-ferrous ores. It is not yet a significant problem in Australian cities, due to use of low sulphur fuels and relatively light level of industrialisation.
Smog	Smog, or more correctly photochemical smog, is a major secondary pollutant formed when sunlight reacts with gaseous pollutants principally Hydrocarbons and Nitrogen oxides. These pollutants arise mainly from motor vehicles but also from commercial or industrial processes.

However, human activity is causing a rapid increase in the concentration of carbon dioxide and other gases (methane, chloroflurocarbons or CFCs, and nitrous oxide) in the atmosphere. In 1985 the ozone layer was shown to be reduced in thickness over Antarctica. This thinning has been attributed to the extra concentrations of these greenhouse gases in the upper atmosphere, particularly chlorine in the form of CFCs which have been shown to last for up to 400 years in the atmosphere (Miller 1992, p 296). Nonetheless, carbon dioxide is considered the principal greenhouse gas and its increased concentration in the atmosphere has been shown to be linked to increases in global temperatures and changes in weather patterns.

Hence, an increase in these gases will enhance the greenhouse effect. An enhanced greenhouse effect is expected to alter the global climate and weather patterns. While there is general agreement on there being some increase in global temperature overall, there is considerable uncertainty as to the net effect on any single area. One effect of global warming may be that cyclones will more directly affect Southeast Queensland than they currently do.

However, local air quality is most directly affected by local pollutants. Most air pollution results from ever increasing energy consumption to meet modern society's industrial and transportation needs. The major air pollutants are lead, carbon monoxide, nitrogen oxides, odours, ozone, hydrocarbons, sulphur dioxide and smog.

4.3 State

As stated previously, air quality in Gold Coast City is generally considered to be of a high quality. The area currently does not appear to have the number or type of industry or the volume of traffic to generate significant air pollution. Nonetheless, the air quality of the Gold Coast is affected by industrial emissions, burning and dust from agriculture, but mainly from vehicle emissions. Growth projections for the Gold Coast indicate that significant air-quality problems are likely to arise in the future.

A recent study of the air quality adjacent to the new Pacific Highway at Beenleigh showed low, safe levels of lead in the air (Rust PPK 1997). These air-quality studies only identified total suspended particles (TSP) as a marginal problem at the temporary sites (Beenleigh State School and Gardenvale).

TSP was shown to marginally exceed the 90 $\mu g\ m^{-3}$ annual average guideline specified by the National Health and Medical Research Council (NH&MRC) but was well below the level of 260 $\mu g\ m^{-3}$ guideline used by the United States Environment Protection Agency (USEPA) for a 24 hour averaging period. Other short term deterioration in air quality was observed due to agricultural burn-offs and bushfires.

At this stage, the retrieval of data with respect to the number, type and location of air pollution complaints is not possible, however a revised reporting format has been introduced to allow this in the future.

4.4 Pressure

The population of the Gold Coast is growing at around 4.8% or 15,000 people each year. This growth will result in the development of more industry and increase the volume of traffic.

Council's Health and Regulatory Services Branch licenses approximately 1,400 Environmentally Relevant Activities under the Environmental Protection Act.

The Branch also investigates odour and smoke complaints from domestic situations. Air-quality issues related to these activities mainly concern:

- odour (eg, fibreglass solvents, resins),
- particulates (eg spray painting, dust),

- the handling of chloroflurocarbons (CFCs) with respect to car airconditioning systems, and
- the control of smoke emissions from pit burning operations.

Recent studies into the air quality of Southeast Queensland demonstrated that a major contributor to air pollution in Brisbane is the motor vehicle (Boffinger 1993). Consequently the air quality of the Gold Coast is also likely to be heavily influenced by transport. Boffinger also showed that airborne pollutants at the mouth of the Brisbane River could migrate to the Coombabah area on some summer afternoons. In addition, studies of the Brisbane Air Shed by Coffey Partners International (1995) and Katestone Scientific (1996) indicate the potential for recirculation within the air shed and which may lead to elevated levels of ozone over areas such as Beenleigh and the Gold Coast.

These data don't consider the peak tourist and day-tripper loads that occur on the Gold Coast around January. These peaks equate to around 50-60,000 vehicles per day at Nerang, Southport and Bilinga from a base of around 45,000 vehicles per day (Gold Coast City Council internal report). These data correspond with the increase of tourists and day-trippers over this period.

The Gold Coast has one of the highest rates of growth for new residences and for car usage in Queensland. There are an average of 1.66 vehicles per dwelling in the Gold Coast. Around 95% of dwellings have at least one car, 50% have two cars or more (Australian Bureau of statistics 1991). Car usage has become a necessity for many residents due to the distances between residential areas and work and facility destinations. Currently the average trip taken on the Gold Coast is 9km at a speed of 44km/h and taking around 13 minutes (Veitch Lister Consulting 1994).

Private vehicle based trips are forecast to increase by around 4.3% each year due to population growth but there is also an increasing tendency for residents to travel by car. This increase is from an estimated 838,000 vehicle trips per day in 1991 to over 1.8 million trips per day with the population of the Gold Coast at 600,000 (Veitch Lister Consulting 1994).

If nothing is done to the transportation system of the Gold Coast and current proportions of mode usage (vehicle, public transport, bicycle, walk) remain the same the average trip time is forecast to increase by 2.3% each year to around 75 minutes over the next 30 years. This time will be for an average trip of 14km at a speed of 11 km/h (Veitch Lister Consulting 1994).

The development of the eight-lane Pacific Motorway will alleviate traffic congestion between Brisbane and the Gold Coast, in the short term. The study identified that the motorway will have the capacity to carry 138,000 vehicles per day (Rust PPK 1997).

As part of this project a number of studies were done to identify the likely impact of the motorway on air quality on the Gold Coast. This involved the contractors establishing temporary air-quality monitoring sites at the Beenleigh State School and the Gardenvale Caravan Park in addition to those of the Australian Bureau Meteorology at Southport, Canungra, Logan and Mt. Warren Park (Rust PPK 1997).

The Motorway studies also included computer simulation modelling of air-quality impacts. These studies revealed that pollutant levels for CO, Nox, respirable particles (PM 10), and lead would be within maximum guidelines (Table 4.1) at almost all positions along the motorway, with the exception of areas between Helensvale and Beenleigh as shown in Figure 4.1 (Rust PPK 1997).

Table 4.2: Ambient air-quality guidelines as established by the National Health and Medical Research Council (NH&MRC) and the United States Environment Protection Agency (USEPA) and the Queensland Government (EPP (air) 1997)
(Source: Rust PPK 1997, EPP (air) 1997)

Indicator/pollutant	Ambient air guideline	Source
Carbon Monoxide	10,000 ug m^{-3} or 9 ppm expressed as an 8 hour average not to be exceeded more than once per year	NH&MRC
Lead	1.5 ug m^{-3} expressed as a three month average	EPP(Air) 1997
Sulfur Dioxide	0.2 ppm expressed as an average over 1 hour 0.02 ppm expressed as an average over one year.	EPP(Air) 1997
Nitrogen Dioxide	320 mg m^{-3} or 0.16 ppm expressed as a 1 hour average not to be exceeded more than once per month	NH&MRC
Ozone	210 mg m^{-3} or 0.1 ppm expressed as a maximum hourly average not to be exceeded more than once per year 0.08 ppm expressed as an average over 4 hours	NH&MRC
Total Suspended Particles	170 ug m^{-3} or 0.08 ppm expressed as a 4 hour average 90 mg m^{-3} expressed on an annual average	NH&MRC
Respirable Particles (PM 10)	50 ug m^{-2} expressed as an annual average 150 ug m^{-2} expressed as a 24 hour average	NH&MRC USEP

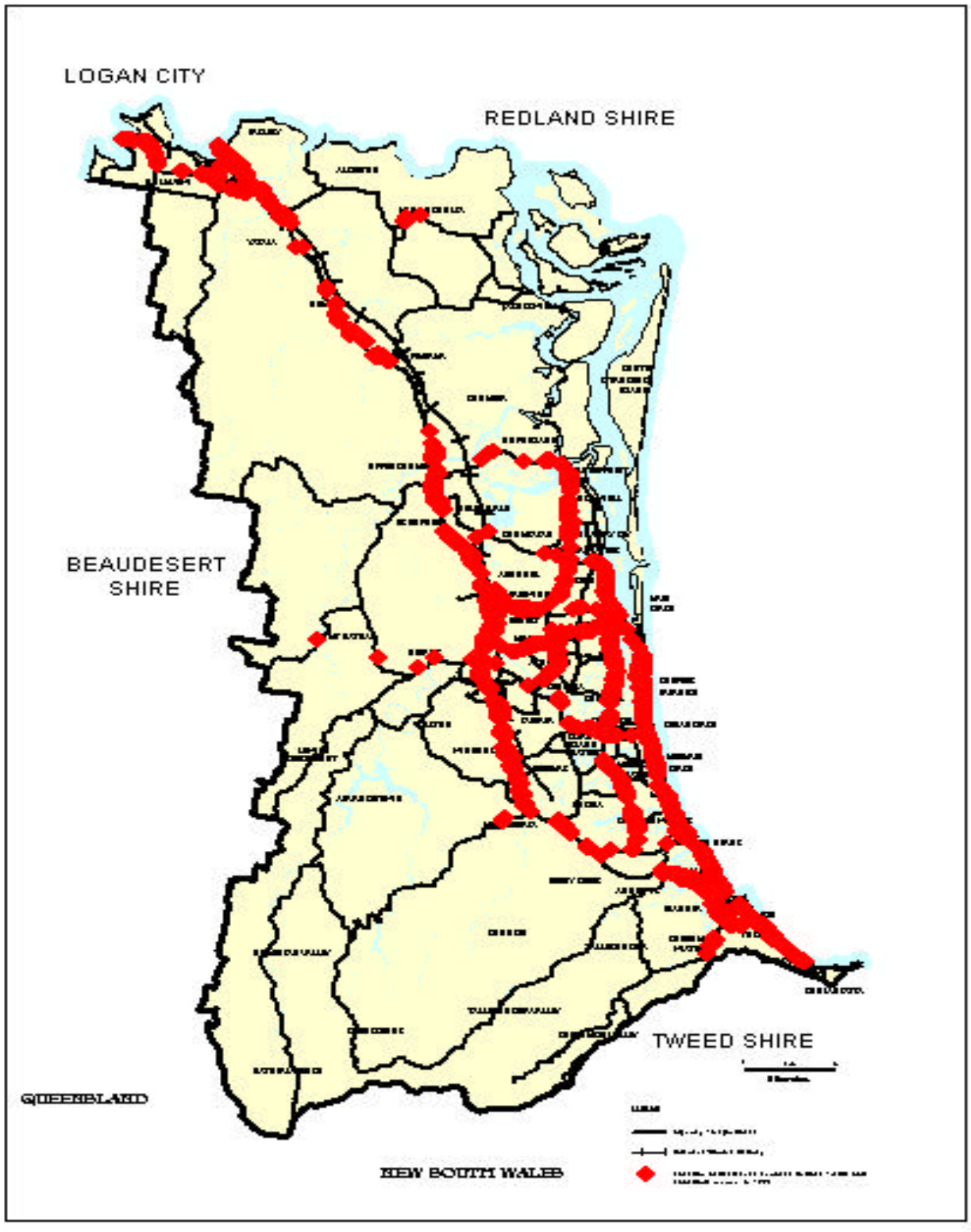

Figure 4.1: Potential air-quality black-spots along the Pacific Motorway
(source Rust PPK 1997)

4.5 Response

The City of Gold Coast only has one permanent air-quality monitoring station, at Mt Warren Park, Beenleigh and is working with the Department of Environment to establish a second. The main purpose of the station at Beenleigh was to provide data for the Brisbane Air Shed. The Gold Coast City Council is looking to locate a permanent air-quality monitoring station further south in Gold Coast City. Officers from the Department of Environment are negotiating with Council's Health and Regulatory Services section to locate an appropriate site.

All of these issues are being considered in the Transport Management Plan which is striving to set targets for increased use of public transport, cycling and walking. This plan is being developed in conjunction with the new strategic plan for the City and in urban design and planning.

4.6 Conclusions and possible future responses

At present there are no apparent major problems with air quality on the Gold Coast, although there are few data for this to be conclusive. To overcome this lack of data an increase in air-quality monitoring on the Gold Coast is occurring.

The growth in vehicle use and the development of the Pacific Motorway are expected to begin to cause problems of air quality on the Gold Coast in the next 20-30 years. The development of the City's Transport Plan that seeks to encourage better use of private vehicles, and a greater use of public transport, cycling and walking.

Other responses requiring further investigation are:

- planning measures to limit the extent of sensitive development near to major transport corridors;
- improve traffic operational efficiency, eg. signal synchronisation/coordination, speed hierarchy matched to network capacity;
- develop efficient land-use and road-use networks;
- traffic calming to improve amenity and safety;
- effective congestion management to limit traffic growth in undesirable areas;
- adoption of functional hierarchy principals for improving the efficiency of the existing network;
- develop the road and landuse system based on accessibility and functional hierarchy to reduce the volume, distance and time of travel that would otherwise occur; and,
- integration of major roads into the strategic transport network that maximises the use of public transport and high occupancy vehicles.

4.7 References

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