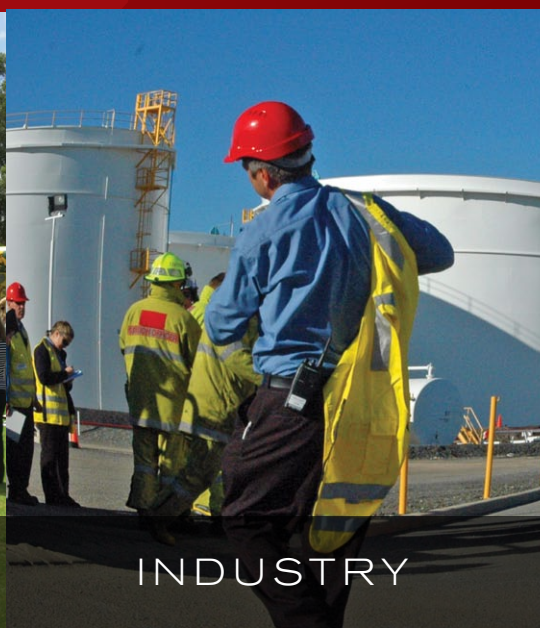
KWINANA
INDUSTRIES COUNCIL

AIR QUALITY MANAGEMENT IN KWINANA

FACT SHEET ON

Particulate Matter



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What is Particulate Matter and how is it produced?

Particulate Matter (PM) refers to airborne material such as dust, smoke, pollens, sea spray and aerosols of diverse chemical composition.

PM is generated from a range of sources including incomplete combustion of fossil fuels (e.g. smoke from bushfires, motor vehicle exhaust emissions, industrial combustion processes), and windblown sources (e.g. material handling operations, dust storms).

Studies have linked exposure to PM to a number of health problems including respiratory illnesses (such as asthma and bronchitis) and cardiovascular disease, with sensitive groups such as children and the elderly at most risk. In addition, the chemical composition of PM, specifically adsorbed organics and metals, can enhance the toxicity of the particles and may contribute to some extent to the incidence of cancer.

The following factors may influence the health effects related to PM exposure:

- mass concentration of PM in the ambient air and the duration of exposure;
- size of particles (smaller particles may be associated with more adverse effects because they can be inhaled more deeply into the lungs; and
- chemical composition and physical properties of the particles.

PM is often classified on the basis of particle size: PM_{10} is particulate matter 10 microns or less in equivalent aerodynamic diameter; $PM_{2.5}$ is particulate matter 2.5 microns or less in diameter.

Emissions information for Kwinana industry has been obtained from Australia's National Pollutant Inventory (NPI) database for the 2008/09 reporting period. NPI data for 2009/10 will not be publicly available until 2011. The NPI contains emissions information on 93 substances deemed important due to their possible effect on human health and the environment. Facility operators determine their emissions each year, and government agencies periodically estimate diffuse emissions such as from motor vehicles and households. Diffuse emissions of $PM_{2.5}$ have not been estimated for the Perth Airshed. NPI data are freely accessible via the website www.npi.gov.au.

Table 1 presents information on the relative contribution of PM_{10} and $PM_{2.5}$ emissions in Kwinana according to industry sector. Alumina Production was the largest contributor to PM_{10} emissions in 2008/09, making up just under a third (32%) of the total emissions of PM_{10} from Kwinana industry. Fossil fuel electricity generation and cement and lime manufacture were also significant contributors to PM_{10} emissions in 2008/09, each making up approximately 20% of the total emissions of PM_{10} from Kwinana industry.

Alumina production was also the largest contributor to $PM_{2.5}$ emissions in 2008/09, making up over a third (35%) of the total emissions of $PM_{2.5}$ from Kwinana industry. Fossil fuel electricity generation, fertiliser manufacturing and petroleum refining and fuel manufacturing were also significant contributors to $PM_{2.5}$ emissions from Kwinana industry.

Table 1: Summary of PM_{10} and $PM_{2.5}$ Emissions from Kwinana Industry for 2008/09

Industry Sector	Emissions (tpa)		Relative Contribution (%)	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Alumina Production	380	91	32%	35%
Basic Inorganic Chemical Manufacturing	14	4.0	1.2%	1.5%
Cement and Lime Manufacturing	233	4.2	19%	1.6%
Fertiliser Manufacturing	111	47	9.2%	18%
Fossil Fuel Electricity Generation	213	58	18%	22%
Other Basic Non-Ferrous Metal Manufacturing	7	2.9	0.6%	1.1%
Petroleum Refining and Fuel Manufacturing	88	35	7.4%	14%
Other	152	25	13%	6.8%

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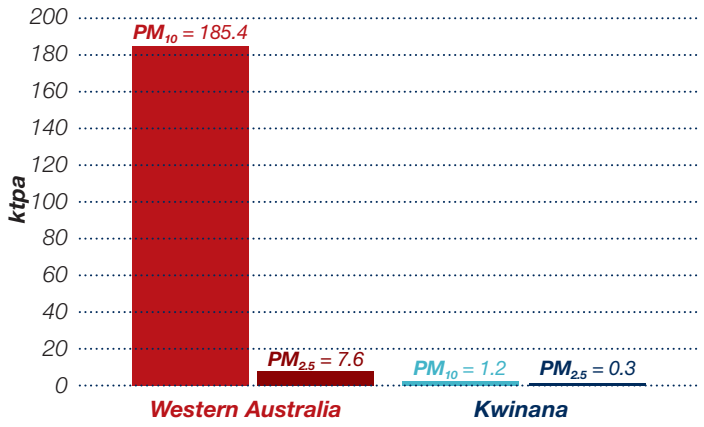
How much is emitted by Kwinana Industry?

According to National Pollutant Inventory (NPI) data for the 2008/09 reporting period, the total quantity of PM emitted to air by Kwinana Industry (i.e. all NPI reporting facilities located in the Cockburn, Kwinana and Rockingham local government areas) was equal to 1.2 ktpa of PM_{10}, and 0.3 ktpa of $PM_{2.5}$. To put this quantity of emissions into context, according to NPI data for the same reporting period the total quantity of PM emitted to air by Western Australian industry (i.e. all NPI reporting facilities located in Western Australia) was equal to 185.4 ktpa of PM_{10}, and 7.6 ktpa of $PM_{2.5}$ (Figure 1). Therefore, Kwinana Industry contributed less than 4% to the State's total industrial emissions of PM_{10} and $PM_{2.5}$ during 2008/09.

NPI data for the 2008/09 reporting period has also been analysed to compare the quantity of emissions released into the Perth Airshed by Kwinana Industry to large domestic sources, including motor vehicles and domestic solid fuel burning (e.g. wood heaters). The analysis shows that more emissions of PM_{10} are released into the Perth Airshed from motor vehicles, and from domestic solid fuel burning (e.g. wood heaters) than from Kwinana Industry. Notwithstanding, Kwinana Industry considers it important to manage emissions of PM.

Figure 1: Annual Quantity of PM_{10} and $PM_{2.5}$ Emissions Generated by Industry in 2008/09



How are emissions managed?

In order to minimise emissions of PM, Kwinana industry:

- manages choice of fuel;
- optimises combustion conditions;
- alters material properties and/or design of material handling equipment to limit the generation of windblown dust; and
- uses pollution control equipment.

Combustion processes fuelled on natural gas produce less PM emissions than alternative fossil fuels such as coal and distillate. Natural gas has been supplied to Kwinana since 1984, making it the preferred fuel for most Kwinana industry, providing local air quality benefits.

A source of PM emissions from Alcoa's Kwinana Alumina Refinery is the Residue Storage Areas (RSAs) (pictured below). Dust management at the RSAs consists of a range of proactive and reactive strategies to minimise windblown emissions of PM. Daily weather forecasts for the next three days are used to define a "Dust Risk Rating" that takes into account rainfall, wind speed and wind direction, and is used to help deploy strategies such as pre-wetting the residue areas well before strong winds arrive. The mud in the drying beds is also turned over to bring moist material to the surface (pictured below right).

The dust control management plan for the RSAs is constantly reviewed by Alcoa, and progress is tracked in weekly review meetings. The results of continuous monitoring of ambient dust levels around the boundary of the RSAs are used to gauge the effectiveness of dust control measures and pinpoint areas requiring additional focus.

PM emissions from the Kwinana Power Station are primarily comprised of fly ash, a by-product of coal combustion containing unburnt material suspended in the exhaust gas. PM emissions are controlled using Electrostatic Precipitator (ESP) pollution control equipment fitted to each coal-fired boiler. Under optimal conditions the ESPs operate at an efficiency of 99.5%, and are slightly less efficient under abnormal conditions. To assist with day-to-day management of emissions and ensure compliance to relevant Environmental Licence Limits, PM emissions from the stacks servicing the coal-fired boilers are continually monitored.

As part of the Environmental Improvement Plan for the Kwinana Power Station, Verve Energy has set an internal PM emission target of 0.1 g/m^3 from Stage A and C stacks (i.e. stacks servicing the coal-fired boilers), which is well below the PM emission target specified in their Environmental Licence of 0.25 g/m^3. To achieve the PM emission target of 0.1 g/m^3, the ESPs have undergone a complete rebuild to improve the particulate collection efficiency, and improvements have been made to the in-stack monitoring system to allow plant operators to take immediate corrective action to manage PM emissions.

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What monitoring is conducted?

Source emission monitoring is conducted by Kwinana industry in accordance with Environmental Licence conditions. Depending on the significance of the emission source, this may involve continuous monitoring, periodic manual stack testing, or calculation techniques that estimate emissions based on process operation measurements.

Ambient air quality monitoring for PM10 and $PM_{2.5}$ is conducted by the Department of Environment and Conservation (DEC) at various residential locations surrounding the Kwinana Industrial Area. The Kwinana Industries Council (KIC) also conducts ambient air quality monitoring on behalf of Kwinana industry. Details of the ambient air quality monitoring network established in the Kwinana area is summarised in the Table 2.

A number of Kwinana industry have also established their own ambient PM monitoring networks in the immediate vicinity of their operations to assist with ongoing management of their emissions.

Table 2: Summary of Kwinana Ambient Air Quality Monitoring Network

Location	SO_2	NO_x	PM_{10}	$PM_{2.5}$
South Lake	■	■	■	■
Miguel Rd, Bibra Lake	■			
Fancote Av, Beeliar	■		■	
Wattleup	■			
Abercrombie Rd, Postans	■			
Calista		■		■
North Rockingham	■	■		
Hillman Primary School		■		■

■ ***DEC monitoring site*** ■ ***KIC monitoring site***

Trends in ambient PM_{10} and $PM_{2.5}$ levels measured in South Lake over the last decade are presented in Figures 2 and 3 respectively. ($PM_{2.5}$ monitoring at Calista and Hillman Primary School commenced in May 2009, providing insufficient monitoring data to properly assess air quality at these locations.) The monitoring results for South Lake are compared to the relevant Standards specified in the National Environment Protection Measure (NEPM) for Ambient Air Quality. It should be noted that the NEPM allows for up to five days per year of exceedances of the 24-hour Standard for PM_{10}. It should also be noted that at this time the NEPM has only established an Advisory Reporting Standard for $PM_{2.5}$.

The monitoring results show that 24 hour average PM_{10} concentrations measured at South Lake comply with the relevant Standard specified in the NEPM for Ambient Air Quality, and that the levels of PM_{10} have remained relatively steady over this time period. The monitoring results also show that there have been relatively few exceedances of the Advisory Reporting Standard for $PM_{2.5}$ since monitoring commenced in 2006.

The highest levels of PM_{10} and $PM_{2.5}$ measured throughout the Perth metropolitan area tend to be associated with smoke from bushfires. This is also the case for South Lake, where exceedances of the NEPM Standards measured during 2008 and 2009 have been attributed to smoke from bushfires by the DEC.

To find out about ambient air quality in your area, the KIC and the DEC operate interactive websites that enable users to define their search according to location, pollutant, and time period. The DEC also publishes an annual Western Australia Air Monitoring Report which includes monitoring results for the Kwinana area.

Figure 2: Trends in Ambient PM_{10} - South Lake

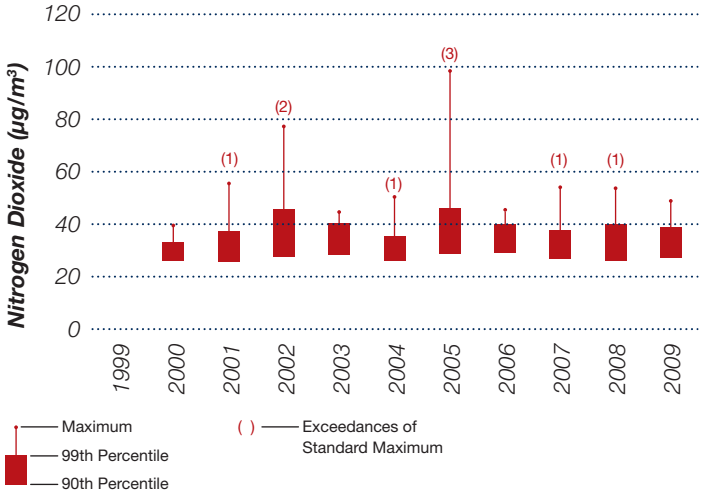
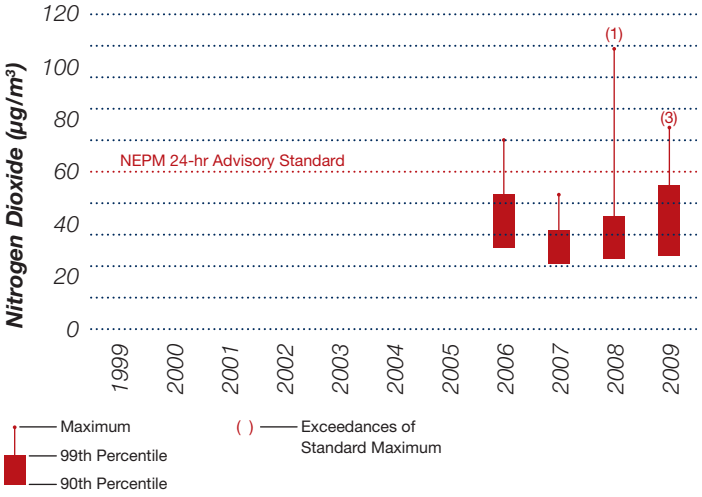


Figure 3: Trends in Ambient $PM_{2.5}$ - South Lake



More Information

Fact Sheets in the “Air Quality Management in Kwinana” series include:

- Sulphur Dioxide;
- Nitrogen Dioxide;
- Particulate Matter (including PM_{10} and $PM_{2.5}$);
- Toxic Organic Compounds; and
- Heavy Metals.

Fact Sheets and the associated presentations are available on the KIC website www.kic.org.au

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