AIR QUALITY IN NSW

WHAT IS THE CURRENT STATE OF AIR QUALITY?

Air quality is generally good for much of the time in New South Wales based on information from the 43 station NSW Air Quality Monitoring Network. Over the past five years, air quality was 'very good' or 'good' for:

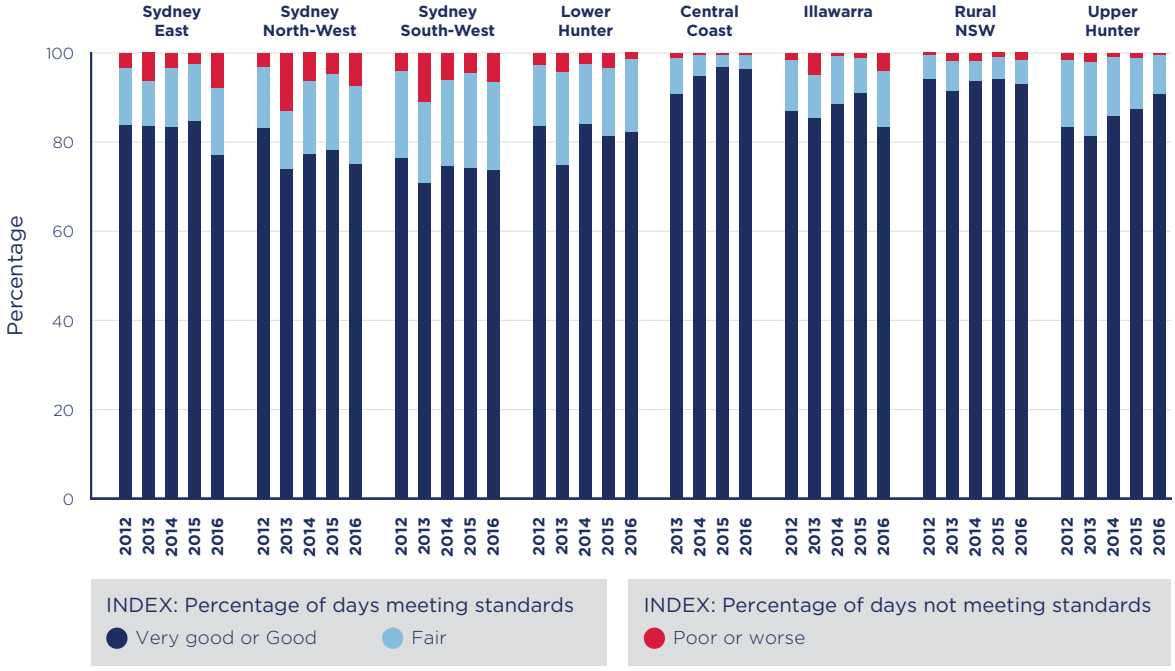
- 70-85% of days in Sydney and the Hunter
- 83-91% of days in the Illawarra
- 90% or more days on the Central Coast and rural NSW.

South-west and north-west Sydney experience more 'poor or worse' air quality days due to both ozone and particle pollution (Figure 1).

Particle pollution causes poor air quality days across NSW, with exceedances of national air quality standards usually associated with regional dust storms and vegetation fires[1]. Particle pollution includes particles released directly from sources, and particles formed by chemical reactions in the air and involving precursor gases. Human activities such as motor vehicles, residential wood heaters, mining, industry and power generation and non-road vehicles and equipment contribute to particle pollution.

In Sydney and the Illawarra, poor air quality days are also caused by ozone[2,3]. Ground-level ozone is a secondary photochemical pollutant formed in the air when precursor pollutants, oxides of nitrogen and volatile organic compounds (VOCs), react in sunlight. High ozone in the Sydney basin and Illawarra can result from local emissions, or smog or precursors transported from other regions. Exceedances of the ozone standards usually occur in the warmer months, with peaks coinciding with high temperatures and bushfires[4].

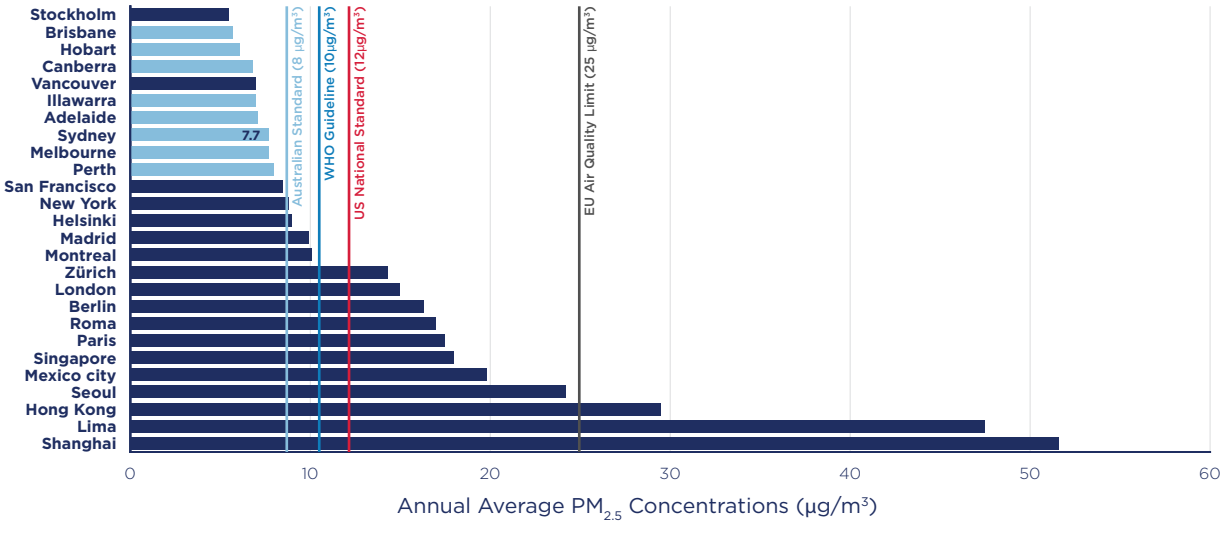
AIR QUALITY IN NSW SUBREGIONS, 2012–2016 (AT SITES MONITORED AGAINST AIR NEPM STANDARDS)



HOW DOES AIR QUALITY COMPARE TO OTHER PLACES?

Annual average $PM_{2.5}$ levels in Sydney are comparable to levels in other Australian cities and low by world standards according to a global comparison of air pollution levels conducted by the World Health Organisation (WHO) in 2016 (Figure 2). The Australian annual average $PM_{2.5}$ standard is more stringent than standards or guideline values set by the European Union, United States and the WHO.

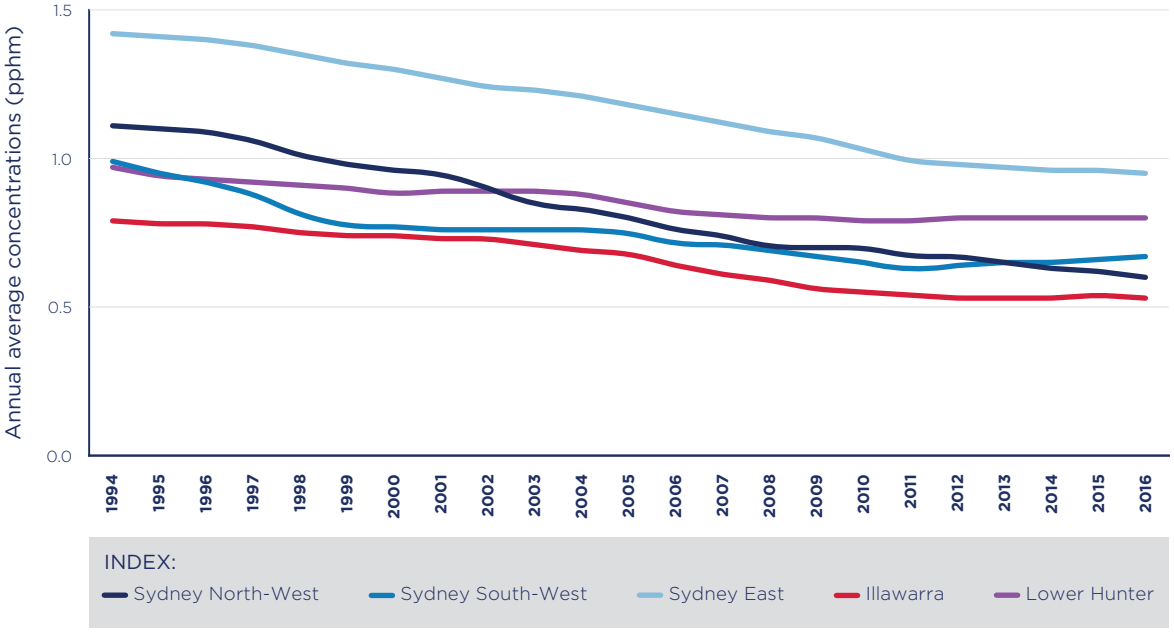
ANNUAL AVERAGE $PM_{2.5}$ LEVELS MEASURED IN SYDNEY COMPARED TO LEVELS IN OTHER CITIES NATIONALLY AND INTERNATIONALLY, BASED ON 2014 MEASUREMENTS[5]

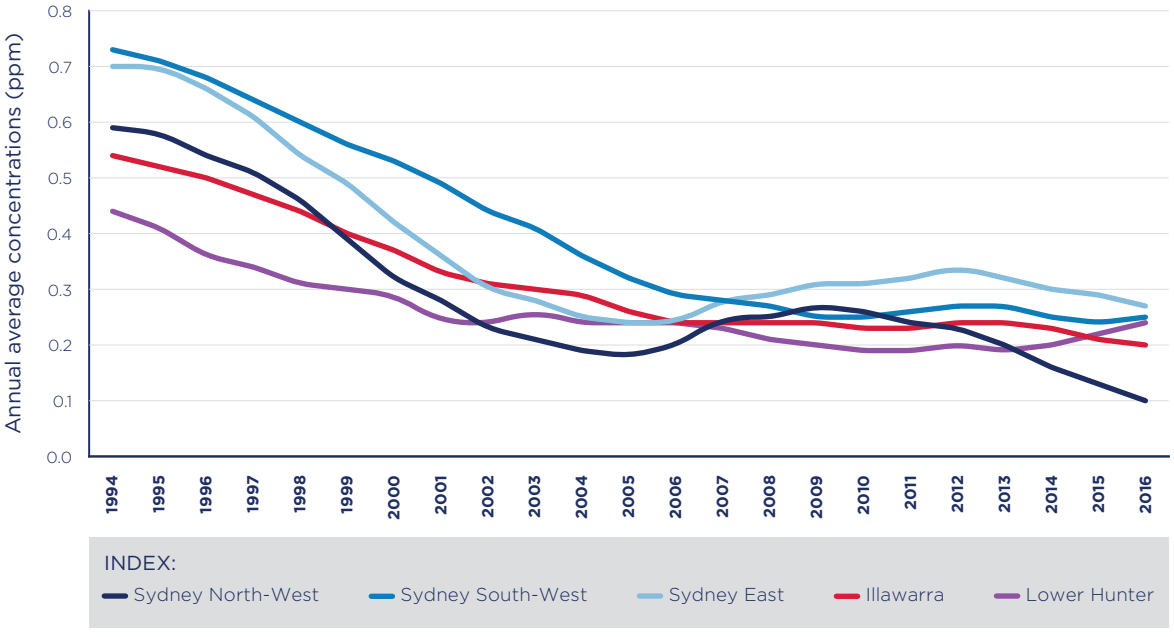


HOW HAS AIR QUALITY CHANGED IN THE PAST?

Air quality in NSW has improved since the 1980s, with reductions in ambient nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2) and lead levels. Trends for NO_2 and CO are shown in Figure 3. In recent years, reductions in ambient CO, NO_2 and SO_2 levels have tailed off.

TRENDS IN ANNUAL AVERAGE NO_2 (TOP) AND CO (BOTTOM) LEVELS FOR 1994–2016 BY REGION

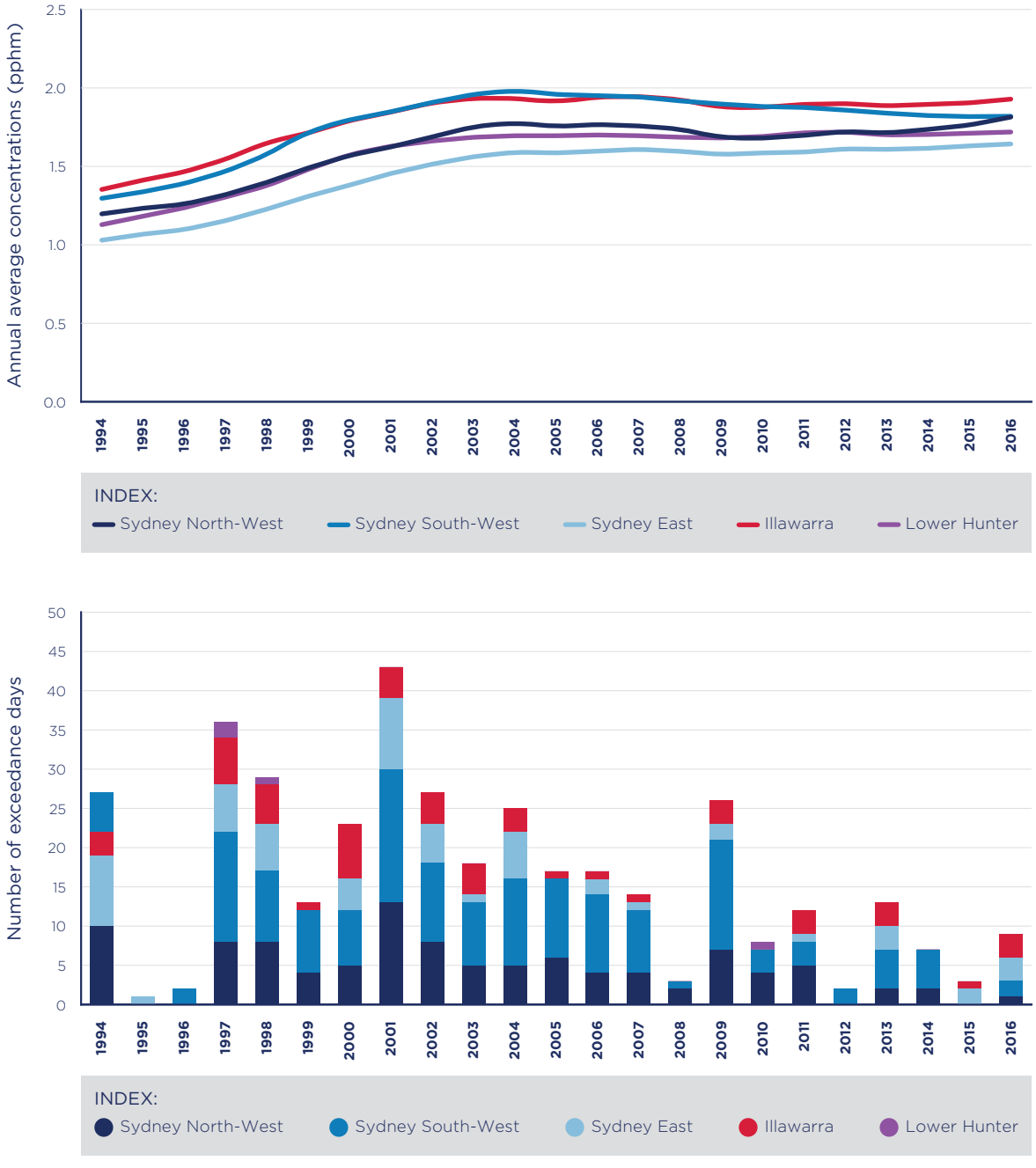




Ambient lead levels reduced significantly after the introduction of unleaded petrol in 1986 and the phasing out of leaded petrol which began in 1993. Levels are now less than 10 per cent of the national annual standard of 0.5 µg/m^3. Lead levels remain a concern in some regional towns with large sources of lead.

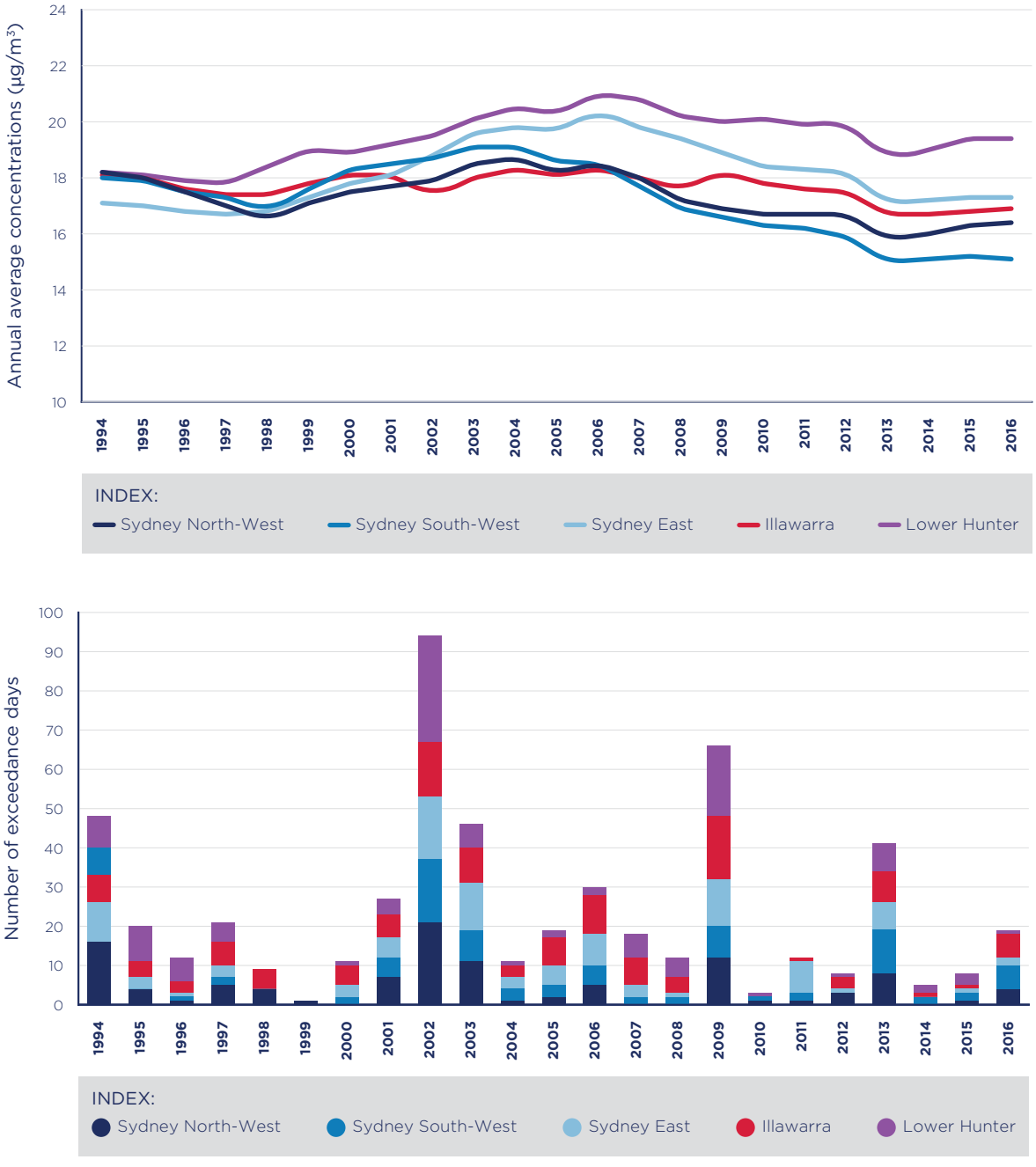
Ozone levels increased from 1994 to 2002, but from 2003 onwards have shown little change (Figure 4). Although less ozone exceedance days are apparent in Sydney in recent years, there is no discernible upward or downward trend in average ozone levels. Early morning and afternoon peaks in oxides of nitrogen (NO_x) and VOCs emissions from motor vehicles significantly influences the daily timing of peak ozone concentrations.

TRENDS IN ANNUAL AVERAGE OZONE LEVELS (TOP) AND NUMBER OF OZONE EXCEEDANCE DAYS (BOTTOM) FOR 1994–2016 BY REGION

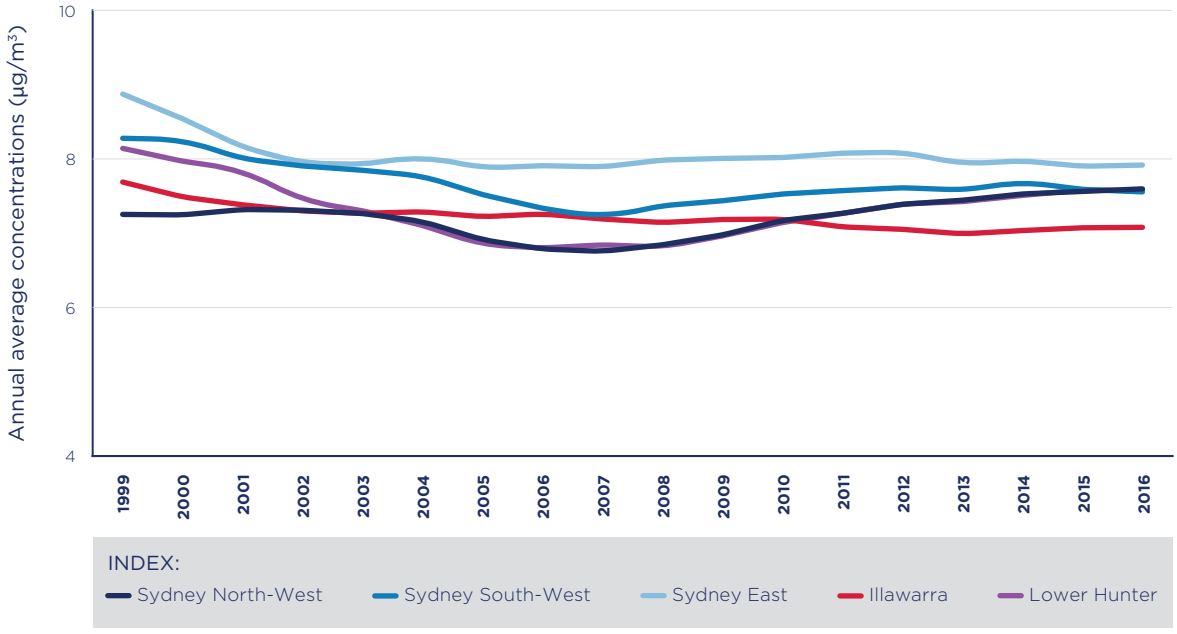


PM_{10} concentrations vary across years with higher levels and more exceedances occurring in bushfire and dust storm affected years, and no discernible upward or downward trend in average levels (Figure 5). Dry El Niño years (2002–2007) are associated with a greater frequency of bushfires and dust storms and therefore higher particle pollution levels. Lower particle pollution levels occur during wetter La Niña years (2010–2012). Regional dust storms, bushfires and planned burns contributed significantly to particle levels in 2009, 2013 and 2016 respectively.

TRENDS IN ANNUAL AVERAGE PM_{10} LEVELS (TOP) AND PM_{10} EXCEEDANCE DAYS (BOTTOM) FOR 1994–2016 BY REGION



TRENDS IN ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATIONS FOR 1996–2016 BY REGION[7]



HOW WILL AIR QUALITY AND EXPOSURE CHANGE IN FUTURE?

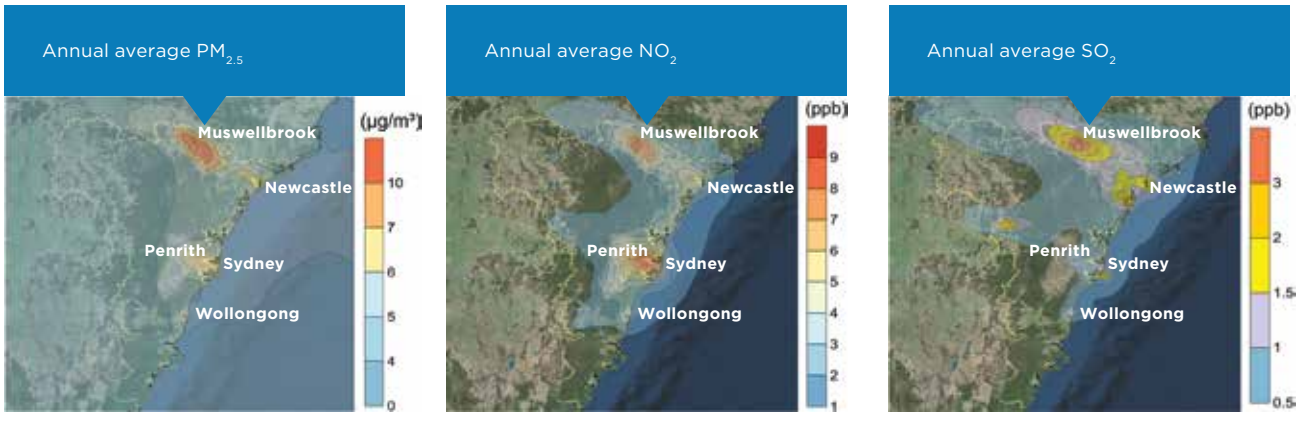
Pressures on future air quality include population growth, urbanisation and increase in energy and transport demand. Population exposure to air pollution increases when new growth and development occur in areas subject to elevated ozone and particle concentrations or at the interface with natural bushland subject to bushfires and hazard reduction burning.

Changes in climate are likely to affect future air quality in NSW. Changes to rainfall, temperature and weather patterns (including fire weather) may increase the frequency of dust storms and bushfire-related events, leading to higher air pollution emissions. Higher air temperatures may result in increases in the occurrence and geographical extent of exceedances of ozone standards.

HOW DOES AIR QUALITY VARY ACROSS REGIONS?

The NSW Air Quality Monitoring Network provides robust information on regional air quality based on data from monitoring stations. Regional airshed modelling can be used to further assess how air quality varies across regions and to project how air quality will change in response to emission reduction measures[6]. Annual average $PM_{2.5}$, NO_2 and SO_2 levels modelled for 2008 based on the Greater Metropolitan Region Air Emissions Inventory for that year are illustrated in Figure 7.

MODELLED ANNUAL AVERAGE $PM_{2.5}$, NO_2 AND SO_2 LEVELS FOR 2008 BASED ON THE GREATER METROPOLITAN REGION AIR EMISSIONS INVENTORY



1 NSW Office of Environment and Heritage (2017). Towards Cleaner Air. NSW Air Quality Statement 2016, http://www.environment.nsw.gov.au/aqms/nsw-air-quality-statement-2016-170003.htm

2 NSW Office of Environment and Heritage (2015). Air Quality Trends in the Illawarra, http://www.environment.nsw.gov.au/resources/air/air-quality-trends-illawarra-2015.pdf

3 NSW Office of Environment and Heritage (2014). Air Quality Trends in Sydney, http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0003/52986/Road-Tunnels_TP02_Air_Quality_Trends_in_Sydney.pdf

4 Jiang N, Scorgie Y, Hart M, Riley ML, Crawford J, Beggs PJ, Edwards GC, Chang L, Salter D, Virgilio GD. (2016). Visualising the relationships between synoptic circulation type and air quality in Sydney, a subtropical coastal-basin environment. International Journal of Climatology, doi:10.1002/joc.4770

5 World Health Organisation (2016). Global Urban Ambient Air Pollution Database, updated 2016, http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/

6 Duc HN, Trieu T, Scorgie Y, Cope M, Thatcher M. 2015. Air Quality modelling of the Sydney region using CCAM-CTM, 22nd Annual Clean Air and Environment Conference, Melbourne, Australia, 20-23 September 2015, pp. 1-2.

7 Long-term trend analysis for $PM_{2.5}$ is complicated by a change in monitoring instrumentation in the NSW Air Quality Monitoring Network, with beta attenuation monitors (BAMs) replacing tapered elemental oscillating microbalance (TEOM) monitors in 2012. Based on the high correlation between BAM $PM_{2.5}$ measurements and long-term nephelometer visibility measurements at each monitoring site, a more consistent annual average $PM_{2.5}$ time series was developed for trend analysis.