

CLEAN AIR METRIC



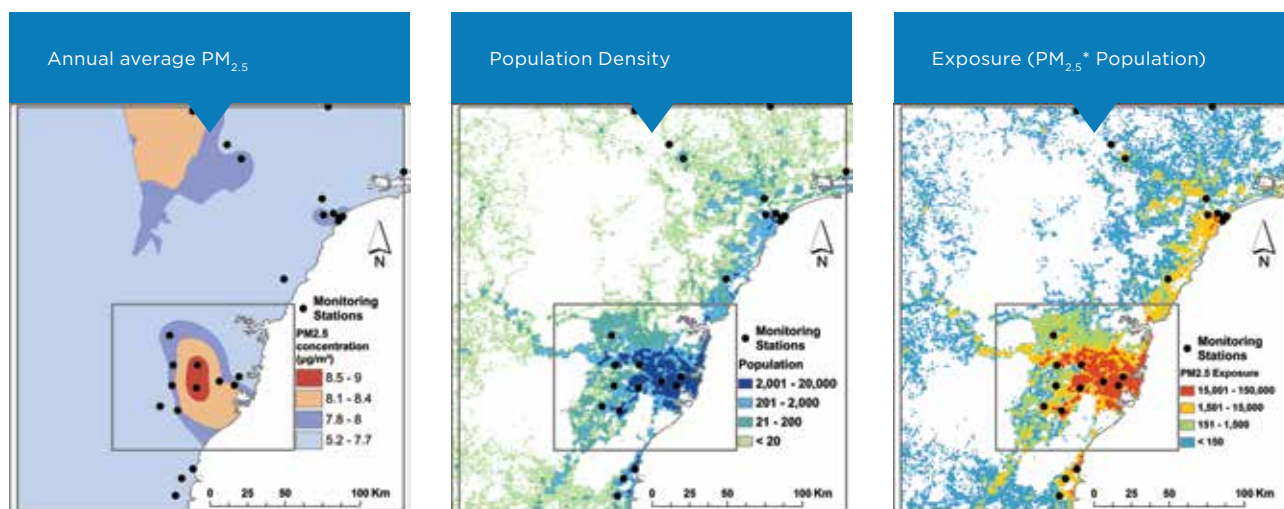
HOW WILL PROGRESS TOWARDS THE CLEAN AIR FOR NSW GOAL BE MEASURED?

The goal of Clean Air for NSW will be to improve average air quality across NSW. Describing average air quality in NSW using one number is challenging because air pollution varies between regions and years. The Air Quality Index (AQI) is used by the Office of Environment and Heritage (OEH) for hourly air quality updates as a simple but effective way to communicate how air quality compares across regions and pollutants. While the AQI has wide public acceptance and will continue to be used, it is noted that the AQI does not consider the population exposed to different levels of pollution in a town or region.

The Clean Air Metric or CAM accounts for population exposure when assessing changes to average air quality. It combines annual average, multi-pollutant assessments of air pollution levels similarly to the AQI, but also weights air pollution by population. The CAM is calculated based on measured concentrations of air pollutants for which there are annual standards in the National Environment Protection (Ambient Air Quality) Measure (Air NEPM), i.e. particulate matter (PM₁₀ and PM_{2.5}), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂). The CAM helps track whether air quality management is delivering the greatest positive health outcomes for the people of NSW.

The concept of population-weighting of air pollutant concentrations is shown in Figure 1 for PM_{2.5} for the NSW Greater Metropolitan Region (GMR). The locations of NSW Air Quality Monitoring Network stations are shown in the figure by black markers.

ANNUAL AVERAGE PM_{2.5} (LEFT) AND POPULATION DENSITY (CENTRE) ARE MULTIPLIED TO CALCULATE EXPOSURE (RIGHT), WHICH CAN BE AVERAGED OVER THE REGION TO GET POPULATION-WEIGHTED LEVELS



HOW IS THE CLEAN AIR METRIC CALCULATED?

Air quality data from OEH operated monitoring stations and population data from the Australian Bureau of Statistics are used to calculate the CAM. At this stage the metric is calculated for the NSW Greater Metropolitan Region (GMR) and the Greater Sydney region. OEH is working to progressively expand the air quality data available to enhance the spatial resolution of air pollution data used for the metric and to calculate a metric for all of NSW.

These steps are followed when calculating the CAM:

- Annual average air pollutant levels for all air pollutants with annual national standards (PM₁₀, PM_{2.5}, NO₂ and SO₂), as measured at OEH-operated air quality monitoring stations, are spatially interpolated onto 1km² square grids for Sydney and the GMR.
- An AQI is assigned to each grid point for each pollutant based on Air NEPM standards, and the maximum AQI identified for each grid point across pollutants. An AQI greater than 100 indicates the national air quality standard is exceeded.
- Gridded maximum AQI is placed over 1km² population data, with the maximum AQI value at each grid point multiplied by the total population at that grid point.
- The product from multiplying the maximum AQI value and total population is summed across all grid points and divided by the total population in the region for which the metric is being calculated.

Air quality can vary significantly from year to year due to “exceptional events” such as bushfires, dust storms and climatological events like El Niño. To smooth out this natural variability the CAM uses 3-year rolling averages. This aligns with European Union and US Environmental Protection Agency exposure reporting approaches and allows us to focus on assessing progress in addressing human sources contributing to poor air quality.^{1,2}

As with the AQI and to ensure transparency, all of the data, assumptions and intermediate steps in calculating the metric will be available through the OEH website.

WHAT IS THE CURRENT 'AVERAGE AIR QUALITY'?

Current 'average air quality' as represented by the 3-year rolling CAM for 2014–2016 is given in Table 1, with rolling average, population-weighted levels for each pollutant also provided. A CAM value of greater than 100 indicates periods when the population-weighted PM_{2.5} levels were above the national air quality standard.

For this period the CAM value is the same as the 3-year rolling average, population-weighted AQI for PM_{2.5}. This confirms the importance of addressing this air pollutant to improve air quality and relative positive health outcomes.

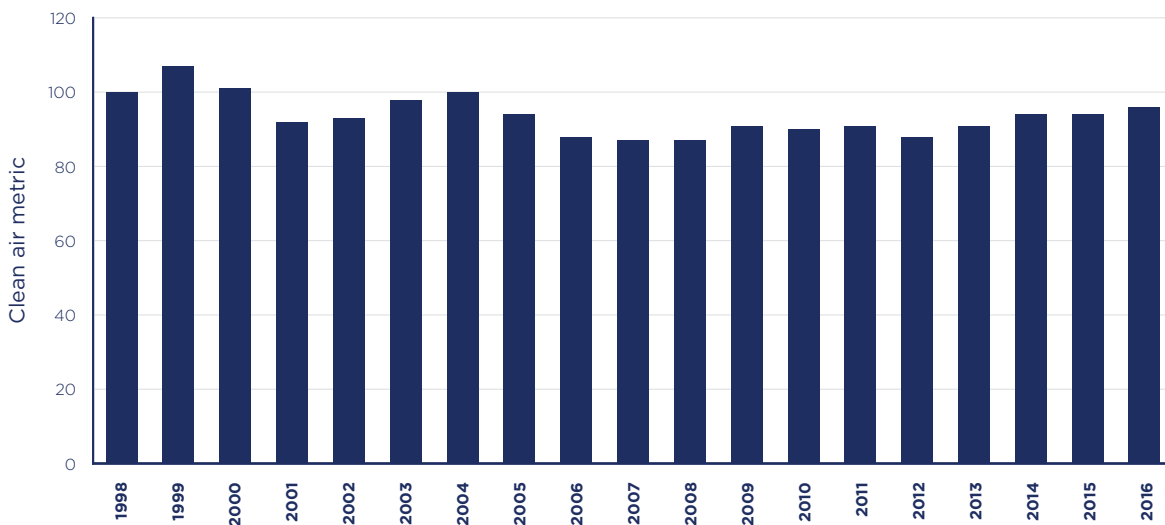
CAM AND POPULATION-WEIGHTED AQI VALUES FOR SYDNEY AND THE GMR FOR 2016

REGION	3-YEAR AVERAGE POPULATION	3-YEAR ROLLING AVERAGE, POPULATION-WEIGHTED POLLUTANT CONCENTRATION				3-YEAR ROLLING AVERAGE, POPULATION-WEIGHTED POLLUTANT AQI				CAM
		PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	NO ₂ pphm	SO ₂ pphm	PM ₁₀ INDEX	PM _{2.5} INDEX	NO ₂ INDEX	SO ₂ INDEX	
Sydney	4,606,160	17.4	7.7	0.9	0.1	70	96	29	4	96
GMR	5,760,220	17.4	7.5	0.8	0.1	69	94	28	4	94

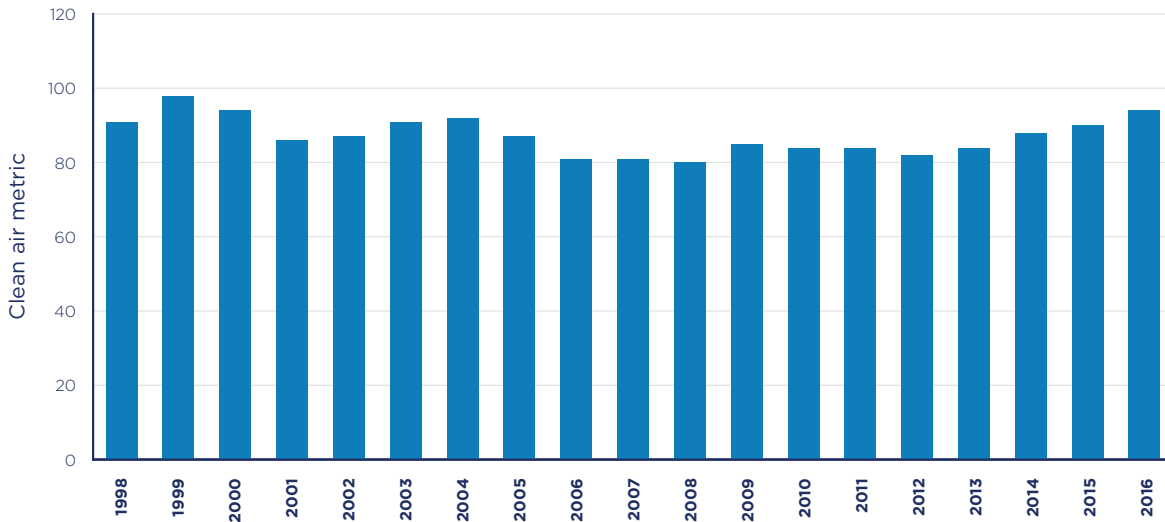
HOW HAS 'AVERAGE AIR QUALITY' CHANGED IN THE PAST?

To understand how average air quality has changed in the past 20 years, historical air quality and population data was used to calculate the metric back to 1996 as shown in Figure 2 for Sydney and Figure 3 for the GMR. As for recent years, the CAM coincides with the population-weighted AQI for PM_{2.5} throughout the period in both the Sydney and GMR.

CLEAN AIR METRIC TIME SERIES FOR GREATER SYDNEY FOR 1998–2016



CLEAN AIR METRIC TIME SERIES FOR THE NSW GMR FOR 1998-2016



NATIONAL REPORTING OF POPULATION EXPOSURE TO PM_{2.5}

The National Environment Protection (Ambient Air Quality) Measure requires that jurisdictions “evaluate and report population exposures to particles as PM_{2.5} annually from June 2018” and that “to ensure national consistency, evaluation and reporting shall be undertaken in accordance with any procedures or methods agreed by participating jurisdictions”. The inter-jurisdictional Expert Working Group providing advice to the Air NEPM review is working to develop a nationally consistent approach to evaluate and report population exposures to PM_{2.5}. OEH will review the approach adopted to derive the Clean Air Metric once a nationally consistent approach to evaluating population exposure to PM_{2.5} is agreed as part of the Air NEPM review process.

1 European Commission Air Quality Standards, <http://ec.europa.eu/environment/air/quality/standards.htm>

2 United States Environmental Protection Agency National Ambient Air Quality Standards, <https://www.epa.gov/criteria-air-pollutants/naaqs-table>