DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Air Quality Monitoring Plan for the Albury–Wodonga Region 2021–25

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Cover photo: Streetscape of Albury looking down Kiewa Street. Destination NSW

Published by:

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ISBN 978-1-922493-77-4
EES 2021/0144
First published in December 2020; reprinted April 2021 with amendments.

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1. About this document

1.1 Purpose

The purpose of this document is to explain how the NSW Government intends to monitor ambient air quality in Albury during the next five-year period: 2021 to 2025.

This air quality monitoring plan meets the requirement of National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM), Part 4 Section 10, that each jurisdiction must have a plan setting how it proposes to monitor air quality for the purposes of this measure.

1.2 Target audiences

Concerned citizens and advocates

This document is for those who wish to learn about the methods and systems used to monitor air quality in their region so they can take informed action to reduce pollutants and populations' exposure to them. They can learn how certain types of pollutants, landforms and weather patterns might result in higher localised air pollution, and how nearby activities such as industry and traffic may affect amenity, and public and environmental health.

Industry

For businesses with activities subject to air quality regulation and licensing, this document explains how the NSW Government uses industry monitoring as part of an integrated and rigorous air quality monitoring system. Monitoring helps local industry understand the community's concerns.

NSW Government policymakers

This information can help Ministers and senior public servants to assess the adequacy of monitoring and pollution control for managing public health. Monitoring helps policymakers allocate and prioritise resources for air quality and make decisions about the adequacy of policies, programs and regulations to manage air pollution.

National Environment Protection Council

This regional plan describes monitoring in the Albury–Wodonga urban area, which is in the geographically large Riverina–Murray Region, for the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM).

1.3 Plan update and review

This monitoring plan will be updated annually and reviewed every five years.

Table 1 Monitoring plan updates and reviews

Version	Release date	Purpose
Version 1.0 (original plan)	2001	Initial monitoring plan required under NEPM 1998.
Major periodic reviews 2017–18	2018	To evaluate how well NSW is meeting the AAQ NEPM requirements, what is monitored for non-NEPM purposes, and where available resources could best be deployed to gather required and additional information about air quality. The reviews identified extra monitoring requirements due to growing populations, new sources of air pollution, new technologies and specific community concerns.
Version 2.0	December 2020	Major plan update based on the 2017–18 major periodic reviews.
Version 2.01	April 2021	Minor corrections
Version 2.1	December 2021	Next scheduled annual update.
Version 3.0	December 2025	Next scheduled five-year review.

2. Recommended air quality monitoring plan for the Albury–Wodonga Region

Air quality is monitored to assess if the air we breathe poses a risk to human health. Monitoring information provides evidence to the public, health professionals and policymakers when choosing short-term and long-term actions to reduce harm. Risk of harm is a function of the number of people exposed (population), and the level of exposure – pollutant types, concentrations, and durations.

2.1 Region definition

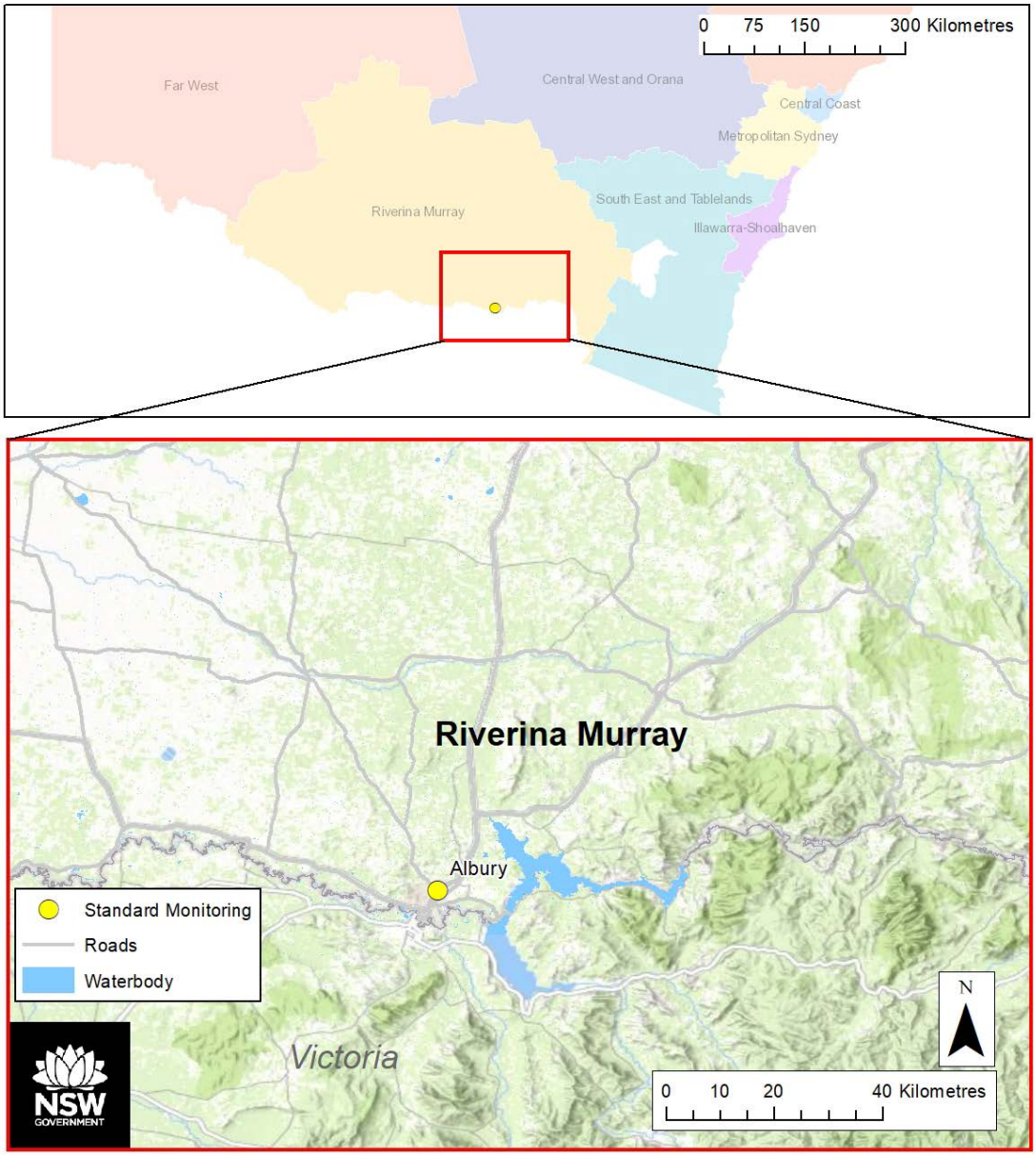

Figure 1 **Air quality monitoring in the Albury–Wodonga air quality region**

The top insert shows its location within the Riverina–Murray planning region.

This plan is presented by air quality monitoring region based on NSW strategic planning regions, an administrative boundary determined by the Department of Planning, Industry and Environment, broadly in line with population centres and human land-uses. Human activities (such as burning fossil fuels for energy and transport) and land-use patterns (such as population density, travel patterns, location of polluting industries and their proximity to vulnerable types of people such as children, and urban heat-island effect) influence air quality and its effect on the population.

Underlying atmospheric and pollution analysis is based on natural boundaries – mainly airshed, which is a function of terrain and meteorology. Smoke, dust and gaseous chemical pollutants are moved by thermal currents and blown by the wind. Natural convection causes hot air to rise, taking pollution with it. Landscape features – such as hills and valleys – are natural barriers that limit the dispersal of pollutants and can result in pollution pools with

higher pollution concentrations. Winds and air movement patterns often follow a diurnal and seasonal pattern – for example, sea breezes in the afternoon. Changes to the climate mean historically typical meteorological patterns might change in future.

2.2 Regional monitoring plan 2021–25

AAQ NEPM compliance statement

The Albury–Wodonga region requires one monitoring station based on population considerations alone.

For NEPM compliance, the plan for 2021–25 sets a single site to monitor particles as PM10 and particles as PM2.5. Pollutant screening determined that monitoring for nitrogen dioxide, carbon monoxide and sulfur dioxide is not required for Albury given minimal emission sources. Ozone concentrations will be assessed in the 2020–21 summer to determine if new NEPM standard thresholds are likely to be exceeded.

The monitoring station is approximately three kilometres north-east of the city centre and in a relatively low-lying area where cold-air drainage flows transport emissions from a large portion of the residential area of the city. The station is also well-placed to receive wood smoke emissions under prevailing westerly winds.

Table 2 Regional monitoring plan for Albury–Wodonga 2021–25

Station	Station type[†]	Year est.	O_3	NO_2	PM10	PM2.5	Vis.	CO	SO_2	Met
Albury	T	2000	-[‡]	-	✓	✓(2017)*	-	-	-	✓

[†] T = trend station

* Denotes the year in which beta attenuation monitors (BAM) were installed to measure PM2.5

[‡] Campaign monitoring planned to assess against new NEPM 8-hour standard being undertaken in 2020-21

Monitoring outside NEPM compliance purposes

Within the Albury–Wodonga significant urban area (SUA), no additional monitoring outside NEPM compliance purposes is foreseen within the next five years. The exception to this is unforeseen emergency or incident monitoring, as laid out in *NSW Air Quality Monitoring Plan – Methods for creating plans* (DPIE 2020).

Planned monitoring technologies

The current monitoring technologies, including instrumentation for each pollutant, are described in 'Schedule 2 – Register of NSW monitoring stations' of *NSW Air Quality Monitoring Plan – Methods for creating plans*, and this information is also accessible on the Sharing and Enabling of Environmental Data in NSW (SEED) portal. This schedule is updated regularly by the Department's Climate and Atmospheric Science Branch.

Planned reporting of air quality monitoring results

Table 3 Reporting plan 2021–25

Reporting type	Plan for 2021–25	Schedule
Current/live results by station and region	Publish live air quality monitoring results for the region on the Department's website. Website improvements are scheduled for release in 2020 and 2021.	Website upgrade Part 1 November 2020 Website upgrade Part 2 March 2021 Website upgrade Part 3 July 2022
NSW annual compliance with AAQ NEPM	Meet AAQ NEPM requirements to report annually on compliance with the goals and standard. Publish an annual compliance report on the Department's website.	Second half of each calendar year
NSW annual air quality statement	Report annually on air quality over the past year. Publish an air quality statement on the Department's website.	Annually in January
Special air quality report	Publish special air quality analysis reports of selected air pollution episodes and events on the Department's website.	Quarterly when applicable
Inventory of pollution sources within GMR*	An inventory of pollution sources was published every five years, but is now published as required.	To be determined

* GMR refers to the Greater Metropolitan Region, as defined for NSW air emissions inventory. This includes Greater Sydney, as well as Illawarra, Lower Hunter and Central Coast. Note this does not include the Albury–Wodonga area

2.3 Changes since the 2001 monitoring plan

Key changes to monitoring stations since 2001

The Albury monitoring station was identified in the 2001 monitoring plan as a campaign station for PM10 monitoring. Monitoring undertaken at three other inland cities was also identified: Bathurst, Wagga Wagga and Tamworth. All four stations are currently maintained as permanent stations within the NSW Regional Air Quality Monitoring Network. In 2017, PM2.5 monitoring began at the Albury site.

The station moved locations in early 2016, approximately 260 metres south-west, to the opposite side of the park where it is currently located.

Key changes to monitoring technologies since 2001

The AAQ NEPM legislation was updated in 2016, with monitoring of fine particles as PM2.5 now a mandated process. The high particle levels measured statewide during the bushfire crisis in the 2019–20 summer season has reinforced the necessity and the health benefits of measuring PM2.5 routinely at multiple locations, with live reporting of those results helping people to actively manage their exposure.

The 2001 NSW Air Quality Monitoring Plan did not mention PM2.5 specifically, however, at the time PM2.5 monitoring was undertaken at up to eight stations within the Greater Metropolitan network using tapered element oscillating microbalance instruments

(TEOM). This was based on available instrumentation, and in the absence of available standard methods at the time, these were run in accordance with United States Environmental Protection Agency (USEPA) equivalence methods. Since 2012 these have been gradually replaced in New South Wales with beta attenuation monitor (BAM) instruments. BAM instruments were further deployed across the network to most locations between 2012 and 2017 given the importance of measuring these smaller particles.

3. Key factors analysis

This regional monitoring plan has been prepared by analysing the following key factors, as defined in *NSW Air Quality Monitoring Plan – Methods for creating plans*.

3.1 Geographic extent and boundary

Albury (and its Victorian counterpart Wodonga) are located 450 kilometres to the south-west of Sydney, straddling the Murray River. Albury itself is bounded by elevated ground to the north, west and south, with the Murray River on the southern boundary between the city and the higher ground.

3.2 Population

The population of the combined urban area for Albury–Wodonga is 89,000 (ABS census data 2016), with 48,000 residing on the New South Wales side of the border. According to the Department's common planning assumptions, the Albury local government area (LGA) had an estimated population of 52,000 in 2016. This is forecast to grow to 57,000 by 2026. The majority of the LGA population resides in the urban area. Most of the rest of the population of the combined Albury–Wodonga SUA resides in the city of Wodonga in Victoria.

NEPM requirements for monitoring based on population

The AAQ NEPM population criterion in Clause 14(1) suggests at least one monitoring station is required in the region[1]. There is one monitoring station operating in the region. Population growth is not expected to change this requirement in the near future.

Conclusions and recommendations for monitoring

The current number of monitoring stations meets AAQ NEPM requirements based on overall region population.

3.3 Terrain

Albury's topography is defined primarily by its proximity to the Australian Alps, with vast areas of sloping country, and limited flat areas (Figure 2). Towards the west are lower

[1] Section 14(1) of the AAQ NEPM: (1) Subject to subclauses (2) and (3) below, the number of performance monitoring stations for a region with a population of 25,000 people or more must be the next whole number above the number calculated in accordance with the formula: 1.5P + 0.5, where P is the population of the region (in millions). (2) Additional performance monitoring stations may be needed where pollutant levels are influenced by local characteristics such as topography, weather, or emission sources. (3) Fewer performance monitoring stations may be needed where it can be demonstrated that pollutant levels are reasonably expected to be consistently lower than the standards mentioned in this measure.

sweeping plains towards the Riverina agricultural district. Rugged and high mountainous land predominates to the east, north and south, with the Murray River on the southern boundary between the city and the higher ground. Significant variation in the terrain could drive sharp variations in meteorological conditions sometimes, which may affect local air quality. There are few significant industrial sources of air pollution in the region.

3.4 Regional climate and meteorology

The climate in the Albury region is mild. The mean maximum temperature is around 22°C, with a maximum average temperature of almost 33°C in January and a minimum average temperature of 3°C in July. Mean rainfall is 691.1 mm, with July being Albury's wettest month on average (77.6 mm) and February its driest (44.2 mm) (Bureau of Meteorology). The annual wind rose at Albury, shown in Figure 2, indicates north-westerly and south-easterly winds prevail much of the time, with limited contribution from the north east and south west.

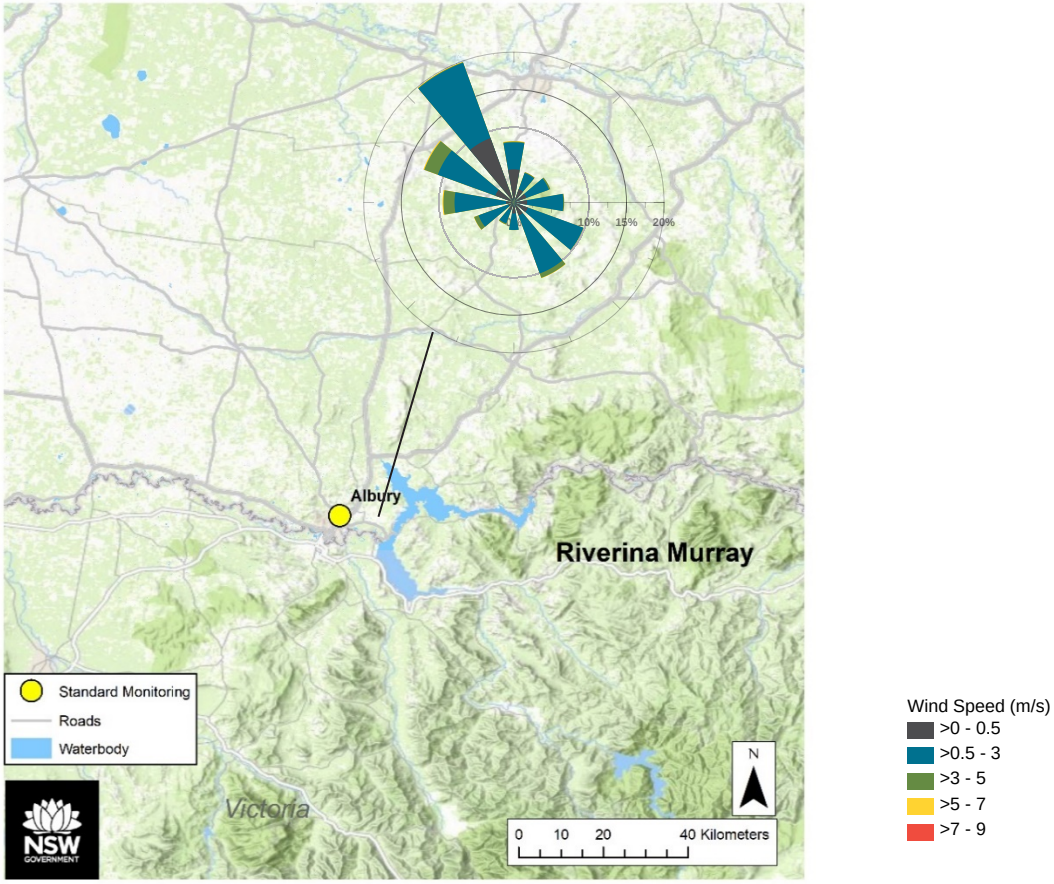

Figure 2 Topography and annual average wind rose map at Albury[2]

[2] Wind roses show the wind direction and speed at a location. The length of each bar around the circle in these wind roses shows the percentage of time the wind blows from a specific direction. The colours along the bars indicate wind speeds. Wind speed in shown in metres per second (m/s).

3.5 Emission sources

Human activities and natural sources both contribute to the emissions in the Albury region. The overall emissions of particles (PM10 and PM2.5) come from natural processes such as wildfires and regional dust storms as well as smoke from controlled burning and smoke from residential wood heating. Natural sources, notably biogenic emissions from forested areas, also contributed significantly to volatile organic compound (VOC) emissions in the region.

3.6 Historical air quality monitoring in the region

The Albury–Wodonga region is subject to continuous air quality monitoring, as shown in Table 2. A comprehensive list of metadata for the air quality monitoring stations, including location, commissioning and decommissioning dates, is available on the Department's website: Air quality monitoring network.

Long-term trend analyses of pollutants are available at numerous sources, so are not replicated here. These include:

- annual NEPM compliance reports, which give a comprehensive summary of air quality trends and statistical data for this region against the NEPM air quality standards and goals: Air quality annual reports
- NSW State of the Environment Reports (Air Quality), which are published on three-year cycles
- NSW annual air quality statements, which summarise air quality across the network by calendar year.

Summary

Since 2000, air quality was 'very good' or 'good' for 90% of days in Albury–Wodonga. Albury–Wodonga experienced 'poor or worse' air quality days due to particle (PM10 and PM2.5) pollution.

Particle pollution remains to be the main air quality issue for the region.

Further details by pollutant

Particles

Particle pollution consists of both primary particles (released directly from sources) and secondary particles (produced by chemical reactions between gases or between gases and other particles in the air).

Sources of primary particle emissions include residential wood heaters in winter, bushfires, construction work, motor vehicle exhaust, mining activities and occasional regional dust storms.

Gaseous pollutants such as SO_2, VOCs, NOx and ammonia contribute to the formation of secondary particles in the air. Rates of formation of secondary inorganic and organic aerosol (SIA and SOA) increase during the summer, when increased solar radiation enhances chemical reaction rates.

Major dust storms, bushfire and hazard reduction burn days from 2000 to 2020 that affected particle levels in the Albury–Wodonga Region were:

- November 2019 to January 2020 – 'black summer' bushfires impacted south-east Australia and burnt 18 million hectares

- February 2009 – 'Black Saturday' bushfires
- March 2003 – Riverina dust storm
- early 2003 – Eastern Victoria alpine bushfire event.

PM10

Since 2000, PM10 concentrations and the number of exceedance days have varied across the years due to climatic conditions and there is no discernible trend. However, in 2018 and 2019 there has been a marked increase in the number of PM10 exceedance days. Higher concentrations and more exceedances have occurred in years with more-frequent bushfires, hazard reduction burns and dust storms. Dry El Niño years (e.g. 2002–07) are generally characterised by higher concentrations and a greater number of exceedance days, with lower levels occurring during wetter La Niña years such as 1998–2001 and 2010–11. In 2019, due to the 'black summer' bushfires, the Albury–Wodonga Region recorded its highest number of exceedance days (25) since 2003.

PM2.5

Long-term trends for PM2.5 are difficult to discern since approved PM2.5 monitoring instrumentation was not deployed in Albury–Wodonga until 2017. Since then there has been an increase in the number of exceedance days due to bushfires and hazard reduction burns. In 2019, due to the 'black summer' bushfires, the Albury–Wodonga Region recorded its highest number of exceedance days (19) since 2017.

3.7 Community engagement

Monitoring must serve community needs. The NSW Government listens and learns from communities, pursuing the best outcomes and creating opportunities that benefit all. Monitoring must always be done for the sake of people's wellbeing and the prosperity of NSW. The NSW Environment Protection Authority (EPA) leads engagement activities to identify and respond to community needs. It produces a range of draft policies, agreements and reports that call for community involvement, engagement and consultation. For example:

- In 2017, the NSW Government invited air quality stakeholders to complete an online survey to help inform the development of a clean air policy for New South Wales. The survey findings are available on the NSW EPA website.
- At the Clean Air Summit in June 2017, the NSW Government committed to expanding the NSW air quality monitoring network, including new stations in central business districts (CBDs) and at a busy roadside location in Sydney.

NSW Government Air Program scientists participate in community engagement activities and panels administered by the NSW EPA. There are several continuous feedback channels for the public to discuss air quality monitoring and reporting. These include:

- website feedback forms
- Environment Line online, or email info@environment.nsw.gov.au, or phone 131 555
- correspondence arising from email newsletters and reports.

Feedback and queries from these channels has resulted in a number of actions for improving air quality monitoring and reporting. For example:

- Community feedback during the NSW 2019–20 bushfire period demonstrated a need to improve our public information services. The NSW Government is working with other jurisdictions, through the National Air Technical Advisory Group (NATAG), to ensure a nationally consistent approach to air quality data reporting and to deliver health

information that is easier to understand. The NSW Government has implemented the Environmental Health Standing Committee (enHealth) recommendation for hourly PM2.5 reporting and related health messaging on its website.

- The Enhance Website and Data Delivery (EWADD) project, commissioned in 2019, is implementing a system for managing, reporting and delivering air quality data to meet changing business needs and customer expectations. A new website will deliver enhanced public-facing air quality data and information services and replace the data management and reporting system that has operated since 2008.

3.8 Overall analysis

The significant bushfire crisis of 2019–20 across Australia, and the consistently high levels of air pollution measured across NSW, highlighted the dual purposes of an active air quality monitoring network: monitoring air quality impacts across long time periods, and providing information to help members of the public manage impacts on their health in real time. To perform the second task adequately, monitors (whether fully NEPM-compliant or not) need to be located in areas where they can provide accurate information to the widest cohort of the community as possible.

The NSW Government is considering providing monitoring in locations which have a large population base and which are not significantly close to existing monitoring stations, or where unique terrain or emission sources mean the expected air quality cannot be inferred from other monitoring stations. Deployment of new monitoring must also be considered against available resources, geographic equity across the entire State, and frequency of pollution events expected.

Within Albury–Wodonga, the current monitoring situation is sufficient to satisfy NEPM compliance and community monitoring expectations. An indicative comparison of emergency monitoring undertaken in Wodonga by the Victorian EPA during January 2020, due to the ‘black summer’ bushfires, indicated comparable concentrations during the emergency event on both sides of the border (unpublished results). Location of a single affordable optical-based particle monitoring device in Albury would complement existing compliance monitoring for situations where compliance monitors may not provide the most rapid response for public health warnings.

4. Further information

4.1 Albury site move

In early 2016, the Albury site was relocated approximately 260 metres to the south-west of its former location. Comparison of PM10 data between both sites run concurrently for a six-month comparison period shows a slight decrease in PM10 averages, but daily trends were consistent between locations (Figure 3). Variation in overall averages is less than allowed variation between similar instruments.

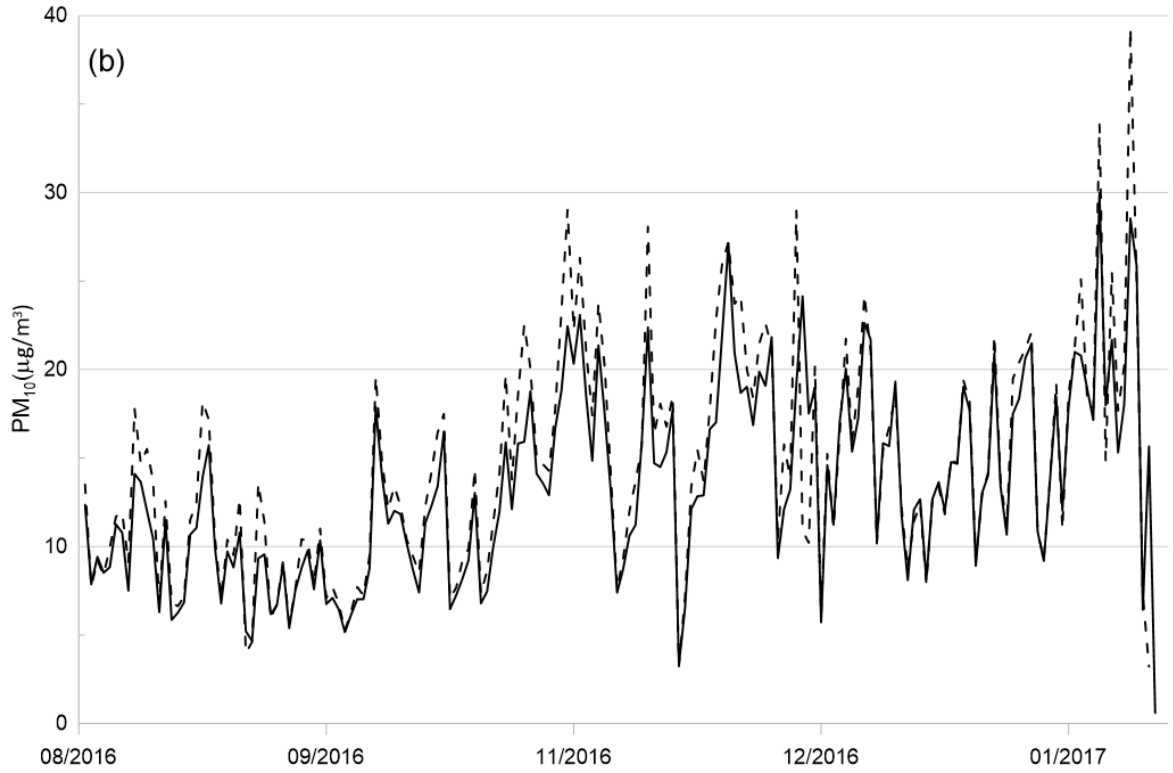

Figure 3 **Comparison of daily averaged PM10 concentrations at Albury during site relocation in 2016–17**

Dashed lines indicate data recorded at the original site; solid lines indicate data recorded at the new site.

4.2 Riverina–Murray Region

Outside Albury–Wodonga, monitoring is undertaken at 10 locations in the Riverina–Murray Region. Compliance monitoring for particles as PM2.5 and PM10 is undertaken at Wagga Wagga, approximately 100 kilometres north of Albury, which has a population of 54,000.

Indicative monitoring of particles as part of the rural network is undertaken across the Riverina–Murray Region, both to monitor particles from smoke but also wind-blown dust which can be common in the area during drought-impacted years.

Urban areas in the region where indicative monitoring is undertaken include:

- Griffith (population 19,000)
- Deniliquin (population 6800)
- Junee (population 4700)
- Temora (population 4100)
- Narrandera (population 3700)
- West Wyalong (population 2700)
- Hay (population 2300)
- Kyalite (10–15 kilometres south of Balranald, population 1200)
- Hillston (population 1100).

Co-located sampling of indicative and compliance monitoring is undertaken at Wagga Wagga, to allow direct comparison between instrumentation for particle measurements in the region.

4.3 NEPM requirements for monitoring based on pollutant in regional areas

As with monitoring in Bathurst, Tamworth and Wagga Wagga, pollutant screening procedures were applied in preparing the 2001 monitoring plan for Albury. The urban centre of Albury is small, less than six kilometres in radius. Because the production of ozone by photochemical processes takes several hours, it is unlikely that emissions from the region could be retained for a sufficient length of time to generate significantly elevated concentrations of ozone. The results of campaign monitoring of ozone in Bathurst over the period 2001–04 provide some justification for excluding ozone monitoring in Albury based on those standards.

The exception to this rule is during bushfire events, where ozone concentrations may be exceeded, as was observed in Gunnedah and Goulburn during the 2019–20 bushfire season. However, the impacts on human health due to particles from bushfires at these levels is expected to be much greater. In addition, future ozone standards are likely to exclude ozone events which are directly caused by bushfires, and therefore particle monitoring is sufficient to cover the major health impacts from these scenarios.

However, these assessments were made against monitoring undertaken at the current ozone standard levels (0.080 ppm averaged over four hours, and 0.100 ppm averaged over one hour). Should these standards change as is expected in 2021, then screening of ozone in inland regional centres in New South Wales in summer is recommended. This ozone screening monitoring is being undertaken in five regional locations during the 2020-21 summer, including Albury.

Monitoring data from the Sydney and Lower Hunter regions suggest that CO emissions will be low in Albury and that screening criteria will be satisfied. Similar arguments were applied to sulfur dioxide and nitrogen dioxide, which are likely to be much lower given much lower direct or indirect emission sources of these pollutants in the region.