Blue Mountains and Lithgow
Ambient Air Quality Monitoring

Spring Report 2019
23 March 2020

Participating Organisations:

Blue Mountains City Council
Blue Mountains Conservation Society
Blue Mountains Union and Community
Doctors for the Environment
Environment Protection Authority
Lithgow Environment Group
Lithgow City Council
Nepean Blue Mountains Local Health District
Department of Planning, Industry and Environment
Western Sydney University

ACRONYMS

AM	Arithmetic Mean
AQM	Air Quality Monitoring
BMCC	Blue Mountains City Council
BMCS	Blue Mountains Conservation Society
BMUC	Blue Mountains Union and Community
CI95	95% Confidence Interval
CO	Carbon monoxide
DPIE	Department of Planning, Industry and Environment
EPA	Environment Protection Authority
GM	Geometric Mean
KOALA	Knowing Our Local Ambient Air Quality
LCC	Lithgow City Council
NBMLHD	Nepean Blue Mountains Local Health District
NEPM	National Environment Protection Measure
PM	Particulate matter
$PM_{2.5}$	Particles with a mass median aerodynamic diameter of 2.5μm
PM_{10}	Particles with a mass median aerodynamic diameter of 10 μm
Ppm	Parts per million
Pphm	Part per hundred million
QUT	Queensland University of Technology
WSU	Western Sydney University

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Ruby Kan, DPIE (formerly OEH)
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1. BACKGROUND

The Blue Mountains and Lithgow Air Watch project is a 12-month community initiated research project supported by the NSW Environment Protection Authority (EPA) and the NSW Department of Planning, Industry and Environment (DPIE, formerly the Office of Environment and Heritage), as well as other local stakeholders.

The purpose of the project is to provide a better picture of air quality in the region and help inform future initiatives to protect air quality. This report presents the spring findings from, September to November 2019.

2. RESULTS & DISCUSSION

Katoomba Compliance Station Monitoring

Spring air quality monitoring was undertaken between the 1st September and 30th November 2019 at the Katoomba compliance station. During this period, air quality in the region declined as the months progressed (Figure 1; Table 1). The decline in air quality is associated with a combination of bushfires ($PM_{2.5}$) and dust storms (PM_{10}). Daily average November $PM_{2.5}$ concentrations were significantly higher in comparison to winter 2019, while PM_{10} concentrations were significantly higher for October and November in comparison to winter 2019.

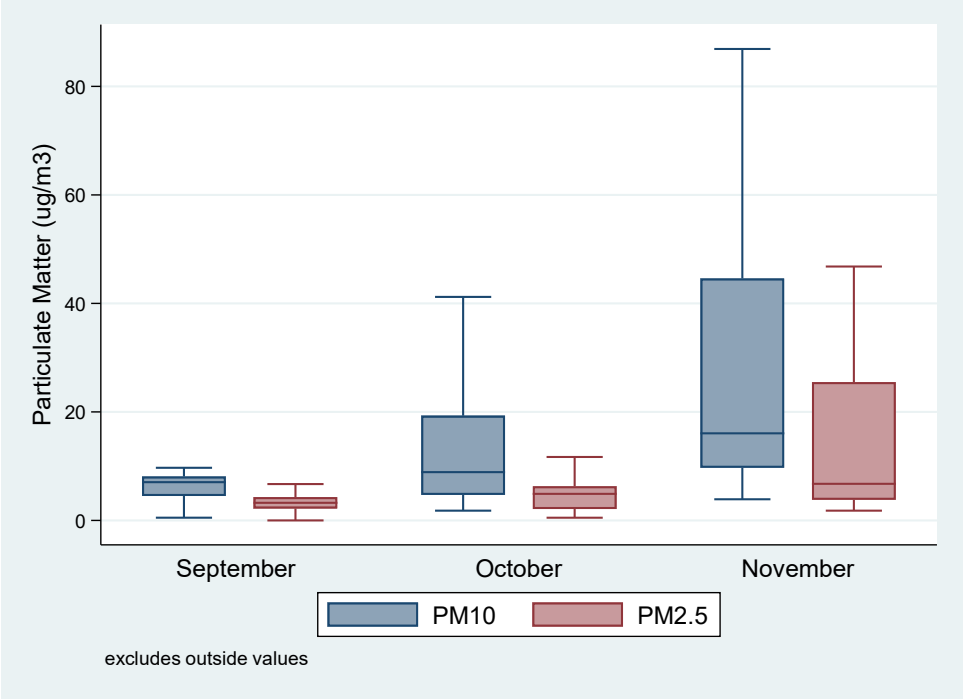

Figure 1: Comparison of Daily $PM_{2.5}$ and PM_{10} Averages from Katoomba Compliance Station, Spring 2019

Table 1: Comparison of Katoomba Monthly Particulate Concentrations for Spring 2019

Monthly Particulate Concentration average µg/m³ (minimum & maximum; number of measurements)			
Measure	**September**	**October***	**November****
$PM_{2.5}$	4 (<1-13; 30)	6 (<1-27; 31)	17 (2-115; 30)
PM_{10}	7 (1-21; 30)	13 (2-46; 31)	29 (4-122; 30)

* October had one (1) $PM_{2.5}$ exceedance
** November had eight (8) $PM_{2.5}$ exceedances and five (5) PM_{10} exceedances

PM_{10} particulate concentrations exceeded the healthy air quality standard of 50 µg/m^3, averaged over 24-hours,[3] on five (5) days (peak 122 µg/m^3) in November 2019. There were also smaller peaks of greater than 40 µg/m^3 towards the end of October that coincided with dust storm events in the Sydney region (Figure 2, Table 1). Atmospheric $PM_{2.5}$[1] concentrations exceeded the air quality standard of 25 µg/m^3, averaged over 24-hours, on nine (9) occasions between October and November 2019, with a peak of 115 µg/m^3 on the 21st of November 2019 (Figure 2). The high particulate concentrations during these events pose a significant health risk to the respiratory health and wellbeing of residents, especially at-risk populations including children, the elderly, pregnant women and people with pre-existing health conditions.

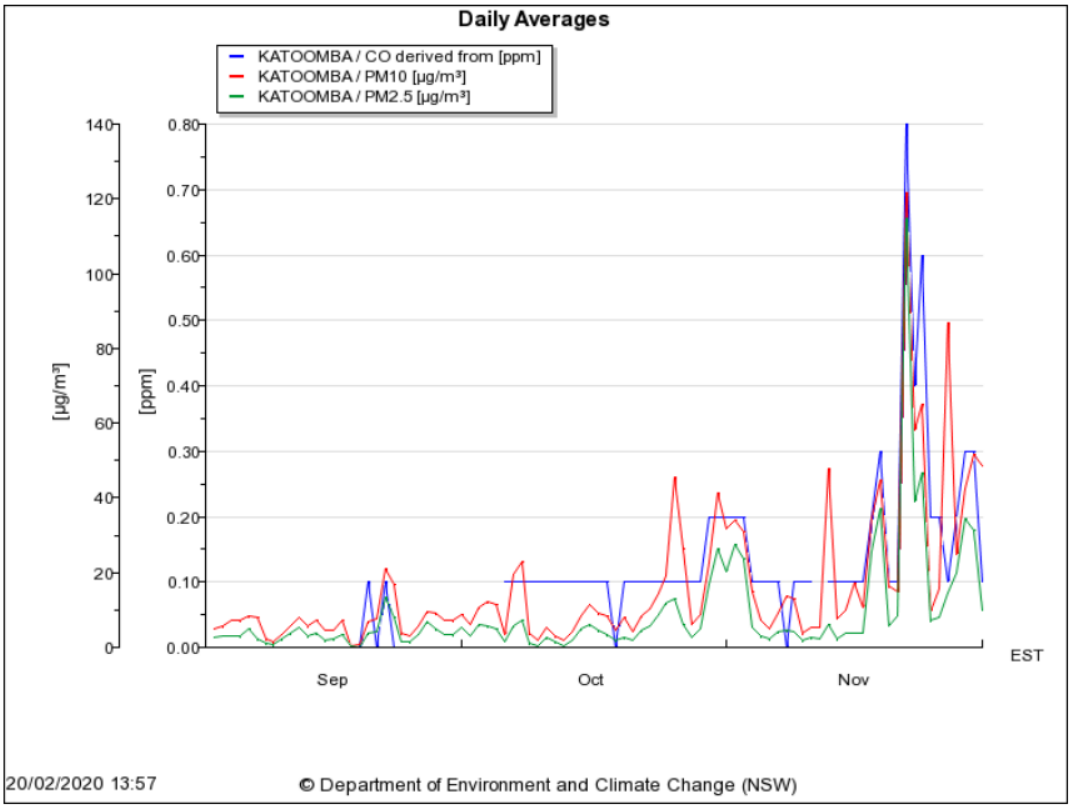

Figure 2: Daily Particulate and Carbon Monoxide Averages for Katoomba Compliance Station, June to November 2019 (DPIE 2019)

Carbon monoxide (CO) levels were significantly below the healthy air quality standard of 9 ppm (8-hour average). The trend between CO and particulate peaks during the bushfire period provides an indication of how fire events contribute to atmospheric concentrations of gaseous pollutants. The readings for other air quality indicators including, nitrogen oxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ozone (O_3) were all also considerably lower than air quality health guidelines. These results, including particulate data can be found in Appendix A.

[1] $PM_{2.5}$ = Particles with a mass median aerodynamic diameter of 2.5µm
[2] PM10 = Particles with a mass median aerodynamic diameter of10 µm
[3] Air Quality Standards are set by the National Environment Protection Council and referred to as National Environment Protection Measures (NEPMs)

KOALA Low Cost Sensor Particulate Data

Low cost air quality sensors, known as KOALAs (Knowing Our Ambient Local Air-Quality) are located at Katoomba, Lithgow, Springwood and Wentworth Falls. Hourly airborne concentrations of fine ($PM_{2.5}$) and coarse (PM_{10}) particulates were similar to winter, typically less than 15 µg/m^3, until November 2019 when bushfire smoke infiltrated the Greater Blue Mountains Region. In November, PM_{10} and $PM_{2.5}$ measurements increased at all sites, as indicated by the higher upper box region (75th percentile) of between 20-37 µg/m^3 for PM_{10} and 18-32 µg/m^3 for $PM_{2.5}$., with the highest concentrations occurring at Springwood. The PM_{10} and $PM_{2.5}$ data was modified by transforming any measurement over 500 µg/m^3 to a maximum value of 500 µg/m^3, the upper limit of detection for the unit sensor. This was required because although the sensor recorded high during pollution events, they have exceeded the upper limit of detection of the instrument. Therefore, the reading is considered as "noise" and less reliable.

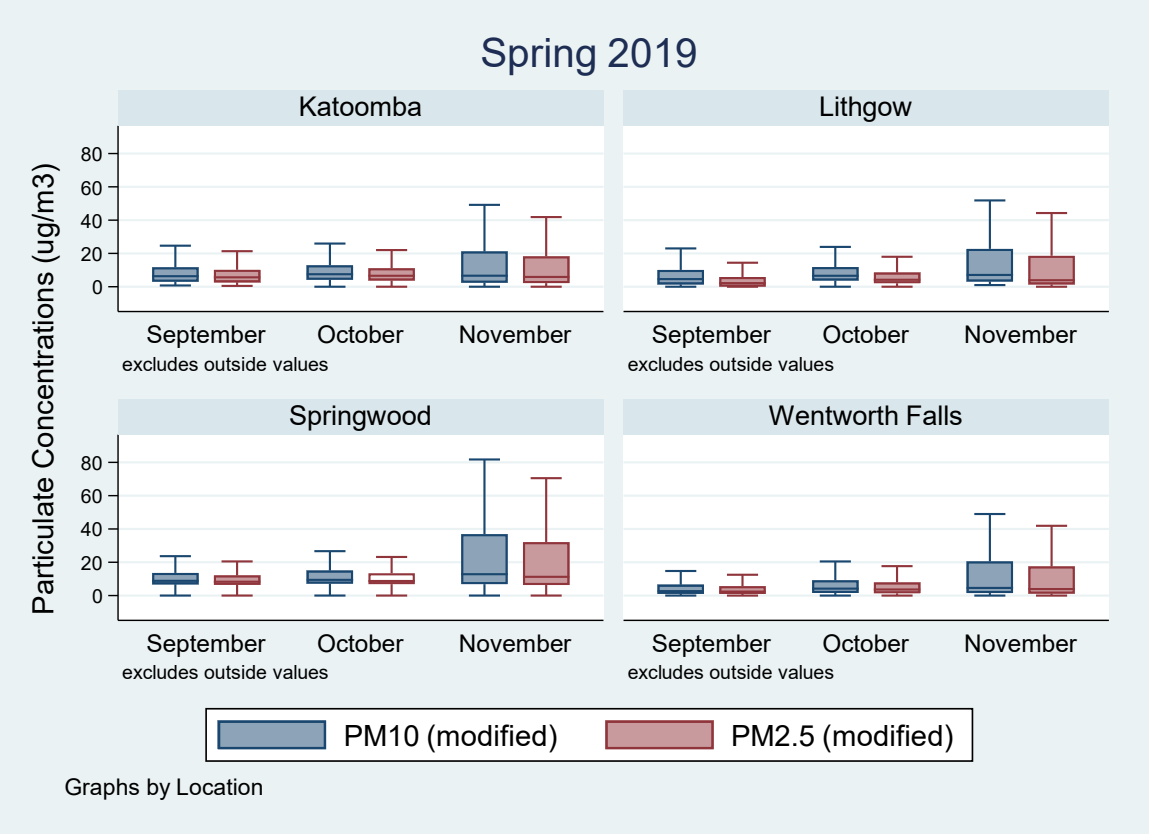

Figure 3: Comparison of Monthly Particulate Concentrations by Township, 1st September to 30th of November 2019.

A bimodal (double) peak is evident when observing hourly carbon monoxide measurements across all sites for Spring 2019. A slight rise in particulate measurements occurs around 6am to 7am and 5pm to 10pm (Figure 4). Further observation across all seasonal periods will be needed to investigate the potential

sources associated with these peaks. However, it must be noted that the higher emission of combustion pollutants associated with the Summer 2019-2020 bushfires are likely to obscure smaller fluctuations associated with day to day human activities.

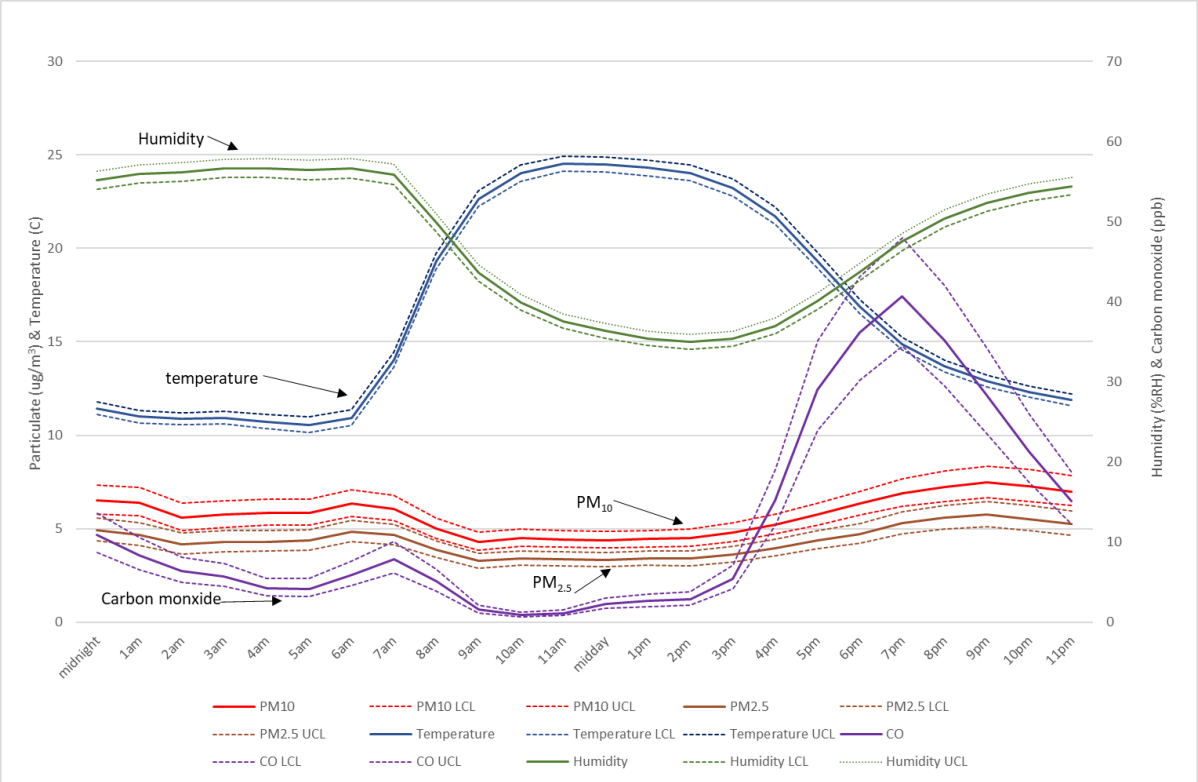

Figure 4: Hourly Fluctuations in PM_{10}, $PM_{2.5}$ and CO averaged across all KOALAs for 1st September to 30th November 2019.

Please note that the data presented has not been adjusted for the effects of sensor variability, temperature or humidity. The findings presented here looks at trends and identifies where additional background data on local activities may need to be collected for individual sites.

KOALA Low-cost Sensor Carbon Monoxide Data

The hourly CO concentrations were extremely low, typically less than 100 ppb (0.1 ppm) averaged over an hour, and at the limits of detection for the sensor (Figure 5). There was a small increase in CO concentrations in November as seen by the higher upper box limit (75th percentile) in Figure 5. The increase was highest in Springwood and Wentworth Falls. The ambient exposure limit for CO is 9000 ppb averaged over an 8-hour period.

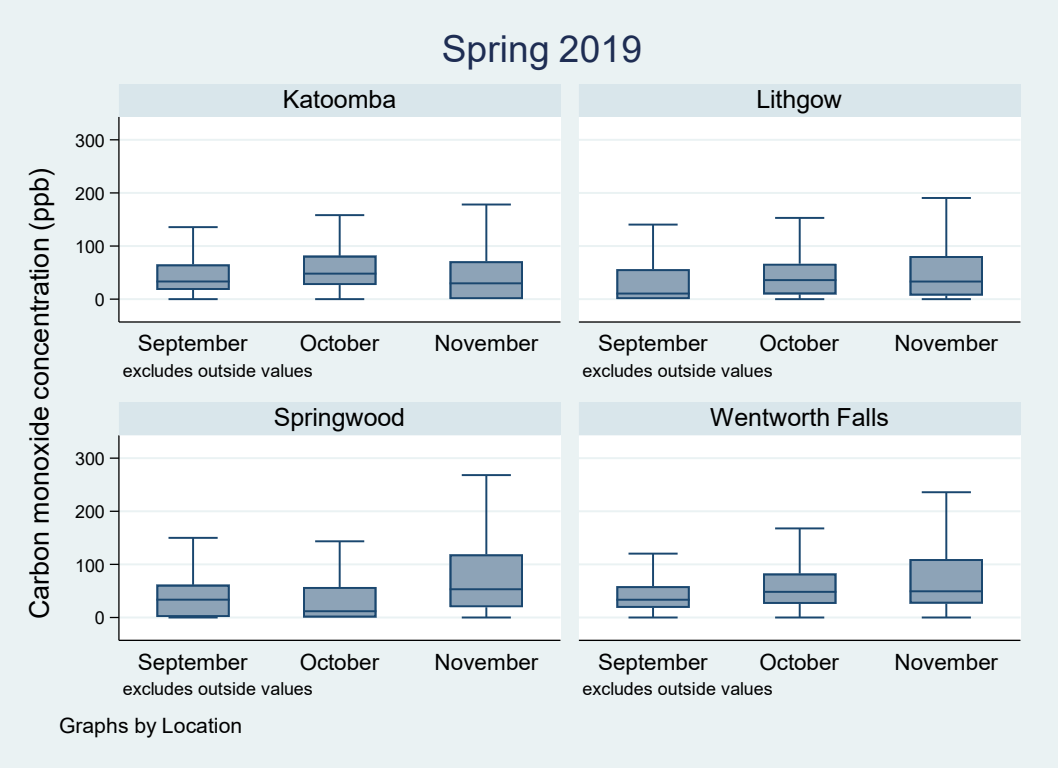

Figure 5: Comparison of Hourly Carbon Monoxide Readings Location and Month, 1st September to 30th November 2019.

3. INTERIM FINDINGS

The spring period findings show that outside of bushfire and dust storm events there is little variation in air quality both within and between the Blue Mountains and Lithgow townships. During the dust storms and bushfires in October and November, the daily air quality standards for $PM_{2.5}$ (25 µg/m^3) and PM_{10} (50 µg/m^3) were exceeded on nine (9) and five (5) days respectively, as measured at the Katoomba DPIE compliance station data. Daily averages peaked at 115 µg'm^3 for $PM_{2.5}$ (greater than 4-times exposure limit), and 122 µg/m^3 for PM_{10} (over double exposure limit), and posed a significant risk to the respiratory health and wellbeing of residents in the region.

Appendix A: DPIE Compliance Station Results – Spring 2019

Table A1: Comparison of Air Quality Indicator Data for NSW DPIE Stations, Winter 2019, [Arithmetic mean (range) *n*]

Station	PM_{10} 24 hour average ($\mu g/m^3$)	$PM_{2.5}$ 24 hour average ($\mu g/m^3$)	CO 1 hour average (pphm)	NO 1 hour average (pphm)	NO_2 1 hour average (pphm)	O_3 1 hour average (pphm)	SO_2 1 hour average (pphm)
Katoomba							
November	29.0 (3.9-121.7) n=30	16.8 (1.8-114.7) n=30	0.2 (0-2.0) n=720	0.01 (0-0.2) n=720	0.10 (0.-1.4) n=720	3.1 (0-11.6) n=720	0.09 (0-0.8) n=720
October	12.8 (1.8-45.7) n=31	6.1 (<1-26.5) n=31	0.1 (0-0.3) n=720	0.02 (0-0.7) n=744	0.11 (0-1.2) n=744	3.1 (0-8.3) n=744	0.05 (0-0.7) n=744
September	6.7 (<1-20.9) n=30	3.7 (<1-13.3) n=30	<0.1 (0-0.2) n=720	0.02 (0-0.5) n=720	0.08 (0-1.2) n=720	2.7 (0-4.4) n=720	0.03 (0-2.6) n=720