Sydney Motorway Corporation | WestConnex

WestConnex

Ambient air quality monitoring methodology and criteria

October 2015

1. Monitoring stations

The WestConnex monitoring sites have been selected, as far as practicable, using the requirements of the Australian Standard, *AS/NZS 3580.1.1:2007 - Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*. The locations and establishment date of each monitoring station for WestConnex are listed in **Table 1** below.

Table 1 Established monitoring stations for M4 East and New M5

WestConnex Project	Site location	Station type	Date established
M4 East	Wattle Street, Haberfield	Peak (roadside): Site selected to characterise typical air quality near busy roads in Haberfield	26/05/2014
M4 East	Edward Street, Concord	Peak (roadside): Site selected to characterise typical air quality at residential locations near busy roads in Concord	09/09/2014
M4 East	Bill Boyce Reserve, Homebush	Peak (roadside): Site selected to characterise air quality at residential locations near the M4	23/09/2014
M4 East	Concord Oval, Concord	Peak (roadside): Site selected to characterise air quality at residences along Parramatta Road	04/11/2014
M4 East	St Lukes Park, Concord	Urban background: Site selected to characterise regional background air quality	12/11/2014
New M5	St Peters Public School, Church Street, St Peters	Urban background: Site selected to characterise typical air quality within the residential area of St Peters	14/07/2015
New M5	Princes Highway, St Peters	Peak (roadside): Site selected to characterise typical roadside air quality within St Peters	11/06/2015
New M5	West Botany Street, Arncliffe	Peak (roadside): Site selected to characterise air quality at residential locations near the M5 East Motorway	11/06/2015
New M5	Bestic Street, Rockdale	Urban background: Site selected to characterise air quality at residences within the Rockdale area	11/06/2015
New M5	Bexley Road, Kingsgrove	Peak (roadside): Site selected to characterise roadside air quality from both Bexley Road and the M5 East Motorway	26/06/2015
New M5	Beverley Hills Park, Beverley Hills	Urban background: Site selected to characterise residential air quality around Beverley Hills	29/06/2015
New M5	Canal Road, St Peters	Peak (roadside / industrial): Site selected to characterise roadside air quality within Alexandria	27/05/2015

2. Parameters and measurement methods

A summary of all parameters, units of measurement, instrumentation and measurement techniques used at each site in the monitoring network is provided in **Table 2** below. The instrument specifications are shown in **Table 3**.

Table 2 Parameters and measurement methods at WestConnex air quality monitoring stations

Parameter	Units	Instrument	Measurement technique
Air quality			
Carbon monoxide (CO)	Parts per million (ppm)	Teledyne Carbon Monoxide Analyser (T300)	Gas filter correlation infrared (GFC-IR)
Nitrogen oxide (NO)	Parts per billion (ppb)	Teledyne Nitrogen Oxide Analyser(T200)	Chemiluminescence
Nitrogen dioxide (NO_2)			
Oxides of nitrogen (NO_x)			
Ozone (O_3)	Parts per billion (ppb)	Teledyne Photometric Ozone Analyser (T400)	Ultraviolet photometry
Methane (CH_4)	Parts per million (ppm)	PCF Elettronica hydrocarbon monitor (529)	Flame ionisation detector (FID)
Total hydrocarbons (THC)			
Particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10})	Micrograms per cubic metre (µg/m³)	Thermo Electron Corporation Continuous Ambient Particulate Monitor (FH62C14)	Beta attenuation monitor (BAM)
Particulate matter with an aerodynamic diameter of less than 2.5 µm ($PM_{2.5}$)	Micrograms per cubic metre (µg/m³)	Thermo Electron Corporation Continuous Ambient Particulate Monitor (FH62C14)	Beta attenuation monitor (BAM)
Meteorology[a]			
Temperature	Degrees Celsius (°C)	Lufft Compact Weather Station (WS500-UMB)	Negative temperature coefficient (NTC) thermistor
Pressure	Millimetre of mercury (mm Hg)		Micro-electromechanical systems (MEMS) capacitive
Relative humidity	Percent (%)		Capacitive
Wind speed	Metres per second (m/s)		Ultrasonic
Wind direction	Degrees (°)		Ultrasonic
Rainfall	Millimetres (mm)	Lufft Rain Sensor (WTB100)	Tipping bucket
Solar radiation	Watts per square meter (W/m²)	Kipp & Zonen Pyranometer	Actinometer

Table 3 Instrument specifications

Parameter	Measurement factor	Specification
CO	Lower detectable limit	< 0.04 ppm
	Lag time	10 seconds
	Precision	0.5% of reading or 0.2 ppm (whichever is greater)
NO_X	Lower detectable limit	0.4 ppb
	Lag time	20 seconds
	Precision	0.5 % of readings above 50 ppb
O_3	Lower detectable limit	< 0.6 ppb
	Resolution	0.5 ppb
	Response time	< 5 min to 95 %
	Precision	< 0.5 % of readings above 100 pbb
THC, NMHC, CH_4	Lower detectable limit	< 0.02 ppm
	Background noise	0.01 ppm
	Response time	180 seconds
	Precision	+/- 0.5 %
PM_{10} and $PM_{2.5}$	Lower detectable limit	4 µg/m³ (1 hour average)
	Resolution	1 µg/m³
	Scanning time	1 second

3. Compliance with Australian Standards

The monitoring is conducted in accordance with the Australian Standards listed in **Table 4**.

Table 4 Standard methods for monitoring

Parameter	Australian Standard	Title
Air quality		
CO	AS/NZS 3580.7.1.2011	Determination of carbon monoxide - Direct reading instrumental method
NO, NO_2, NO_X	AS/NZS 3580.5.1.1993	Determination of oxide of nitrogen - Chemiluminescence method
O_3	AS/NZS 3580.6.1.2011	Determination of ozone - Direct reading instrumental method
CH_4, THC	AS/NZS 3580.11.1.2013	Determination of methane and non-methane organic compounds in ambient air – Direct-reading instrumental method
PM_{10}	AS/NZS 3580.9.11.2008	Determination of suspended particulate matter – PM_{10} beta attenuation monitors
$PM_{2.5}$	AS/NZS 3580.9.12.2008	Determination of suspended particulate matter – $PM_{2.5}$ beta attenuation monitors
Meteorology		
Temperature	AS/NZS 3580.14-2011	Methods for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications
Pressure		
Relative humidity		
Wind speed (scalar, vector)		
Wind direction (scalar, vector)		
Rainfall		
Solar radiation		

Calibration

Instrument calibration is performed in accordance with the relevant Australian Standard and National Association of Testing Authorities (NATA) procedures. Daily precision checks (zero and span (full-scale range)) are conducted automatically for the gaseous pollutants to identify any instrument drift or malfunction. A dynamic gas calibrator is used at each station to supply zero air and span gas to each analyser. The span values used are shown in **Table 5**.

Operational calibrations are conducted and scheduled in accordance with the relevant Australian Standard. Single point calibrations are conducted on a monthly basis, and when instruments faults have been rectified or services have been otherwise interrupted. Multi-point calibrations are conducted on a six-monthly basis.

Table 5 **Calibration span values**

Parameter	Span value
Air quality	
CO	40 ppb
NO, NO_2, NO_X	400 ppb
O_3	400 ppb
CH_4	6.2 ppm
THC, NMHC	6.2 ppm (propane)
PM_{10}, $PM_{2.5}$	N/A
Meteorology	
Temperature	N/A
Pressure	
Relative humidity	
Wind speed (scalar and vector)	
Wind direction (scalar and vector)	
Rainfall	
Solar radiation	

4. Data verification

The averaging period for each parameter is determined by the Australian Standard methods, as well as air quality assessment criteria (published by NSW Department of Environment and Conservation, 2005). The averaging periods are shown in **Table 6**.

Table 6 Averaging periods for parameters

Parameter	Averaging period
Air quality	
CO	5 minute, 1 hour, 8-hour rolling
NO, NO_2, NO_X	5 minute, 1 hour
O_3	5 minute, 1 hour, 4-hour rolling
CH_4, THC, NMHC	5 minute, 1 hour
PM_{10}, $PM_{2.5}$	1 hour, 24 hour
Meteorology	
Temperature	1 minute, 1 hour
Pressure	1 minute, 1 hour
Relative humidity	1 minute, 1 hour
Wind speed (scalar and vector)	1 minute, 1 hour
Wind direction (scalar and vector)	1 minute, 1 hour
Rainfall	1 minute, 1 hour
Solar radiation	1 minute, 1 hour

Currently, there are no Australian guidelines for the verification of air quality monitoring data. The data verification process has therefore been developed in keeping with best practice guidelines from the USEPA and Defra in the UK. The data verification process involves steps such as:

- Removal of clearly incorrect data
- Corrections for instrument drift
- Corrections for offsets
- Removal of data acquired during calibration periods
- Removal of data during services and maintenance periods.

In the NSW *Approved Methods*, air quality must be assessed in relation to criteria and averaging periods for specific pollutants. The criteria and averaging periods for the pollutants measured at the WestConnex monitoring stations are shown in **Table 7**.

Table 7 **Air quality standards for criteria pollutants in NSW *Approved Methods* (NSW DEC, 2005)**

Pollutant or metric	Concentration	Averaging period
CO	87 ppm or 100 mg/m³	15 minutes
	25 ppm or 30 mg/m³	1 hour
	9 ppm or 10 mg/m³	8 hours (rolling)
NO_2	120 ppb or 246 µg/m³	1 hour
	30 ppb or 62 µg/m³	1 year
PM_{10}	50 µg/m³	24 hours
	30 µg/m³	1 year
$PM_{2.5}$[a]	25 µg/m³	24 hours
	8 µg/m³	1 year
Photochemical oxidants (as O_3)	100 ppb or 214 µg/m³	1 hour
	80 ppb or 171 µg/m³	4 hours (rolling)

Comparisons with data collected from Office of Environment and Heritage (OEH) monitoring sites

Data collected at the WestConnex air quality monitoring sites are compared with data collected by OEH operated air quality monitoring sites to better understand the regional context and to assist with identifying the potential cause of exceedances. This data can be downloaded for free from the OEH website at: www.environment.nsw.gov.au/air/.