New South Wales Air Quality Statement 2013

Bushfires lead to poorer air quality in NSW during 2013

Compared with previous years, NSW experienced poorer air quality during 2013, due mainly to drier and hotter weather through the middle of the year and the impacts of bushfires in September, October and November.

Air quality in NSW is generally good by international standards and has been steadily improving over time.

While levels of nitrogen dioxide, sulfur dioxide and carbon monoxide continue to be well below national standards, levels of ozone and particles (PM_{10} and $PM_{2.5}$) can exceed the standards from time to time.

Ozone and fine particle pollution levels are affected by:

- the annual variability in the weather
- natural events such as bushfires and dust storms
- the location and intensity of local emission sources, such as coal mines, wood heaters, transport and industry.

After several years of very good air quality across much of the state, air quality in 2013 was poorer due mainly to warmer and drier conditions and severe bushfires. The year began with above-average temperatures and increased bushfire activity (RFS 2013). January 2013 saw the warmest maximum temperatures on record in Sydney and across the state, followed by above-average temperatures during July–October and long periods of little or no rain (BOM 2014).

Warm, dry and windy conditions in September and October led to severe early season bushfire activity in western Sydney, the Blue Mountains, Wollondilly and the Hunter Valley.

During the bushfire emergency, NSW Health issued a number of Air Pollution Health Alerts. This saw a significant increase in visits to the Air Quality Index webpage and subscriptions to the automated air pollution alert system.

Air Quality Index

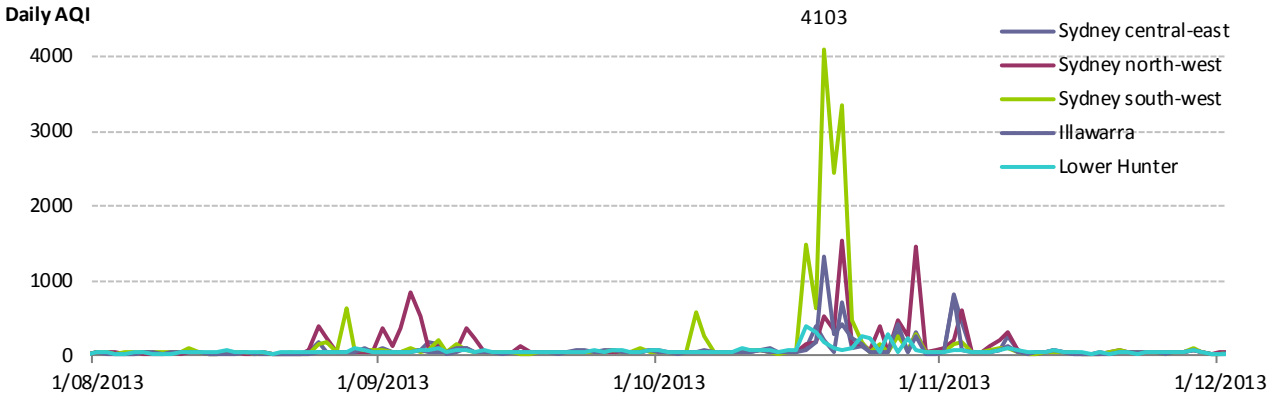
During the bushfire emergency, hazardous air quality was recorded in Sydney, the Illawarra, Central Coast and Hunter regions.

The Office of Environment and Heritage (OEH) uses the Air Quality Index (AQI) to provide a simple comparison of pollutants affecting air quality. The AQI standardises measurements of ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, air particles and visibility into one easy-to-understand index. Find out more about the AQI on the OEH website.

An AQI of 100 or above indicates that one or more pollutants have exceeded relevant standards. AQI values above 200 indicate that air quality is in the hazardous category and people sensitive to air pollution are advised to avoid all outdoor physical activities.

During extreme events such as bushfires, very high AQIs can be recorded. In the bushfires of September–November 2013, AQI values in the hazardous category were observed on a number of days (Figure 1). The maximum AQI of 4103 was recorded at the Bargo monitoring station in Sydney SW on 19 October as smoke from a bushfire in the Bargo/Balmoral/ Yanderra area blanketed the town.

Figure 1: Regional AQI values during major bushfire activity – August–November 2013



Ozone pollution

Ozone levels above the 1-hour and 4-hour standards were recorded in Sydney and the Illawarra during 2013. High ozone levels were widespread in both regions on 21 October during the bushfire emergency and also on 20 December during hot summer conditions.

Ozone levels above the national standards were recorded on seven days during 2013 in the Greater Metropolitan Region (GMR) (Table 1). High ozone days were observed in both Sydney and the Illawarra while levels in the Lower Hunter and on the Central Coast remained below the standards.

Table 1: Days above the 4-hr ozone standard in the GMR – 2013

Date	Stations where 4-hour average ozone standard exceeded (8 pphm)
11/01/2013	Oakdale
12/01/2013	Camden
21/10/2013	Albion Park, Bargo, Bringelly, Camden, Chullora, Earlwood, Kembla Grange, Liverpool, Prospect, St Marys, Vineyard, Wollongong
02/11/2013	Albion Park
08/11/2013	Earlwood
04/12/2013	Bargo, Camden, Campbelltown
20/12/2013	Albion Park, Bargo, Camden, Earlwood, Kembla Grange, St Marys, Wollongong

On 21 October during the bushfire emergency, ozone levels above national standards were recorded at 12 stations across Sydney and the Illawarra. The maximum 1-hour average on this day was 11.7 parts per hundred million (pphm) at Liverpool which also recorded the highest 4-hour average of 11.0 pphm.

Another widespread ozone event occurred on 20 December during hot and calm summer conditions. Seven stations recorded levels above the national standards. The maximum 1-hour average on this day was 12.6 pphm at Kembla Grange where the maximum 4-hour average of 10.3 pphm was also recorded.

Particle pollution

PM_{10} particle levels above the national standard were recorded at most monitoring stations.

$PM_{2.5}$ levels above the daily advisory reporting standard were recorded at all stations monitoring for particles this size except Singleton. Annual average $PM_{2.5}$ levels above the advisory reporting standard were recorded at a number of stations.

Higher levels of fine particles were observed across much of NSW during 2013.

Table 2 shows that PM_{10} levels above the national standard of 50 micrograms per cubic metre (µg/m³) were recorded at most monitoring stations. The maximum daily average PM_{10} of 208.9 µg/m³ was recorded at Bargo on 17 October during the bushfire emergency.

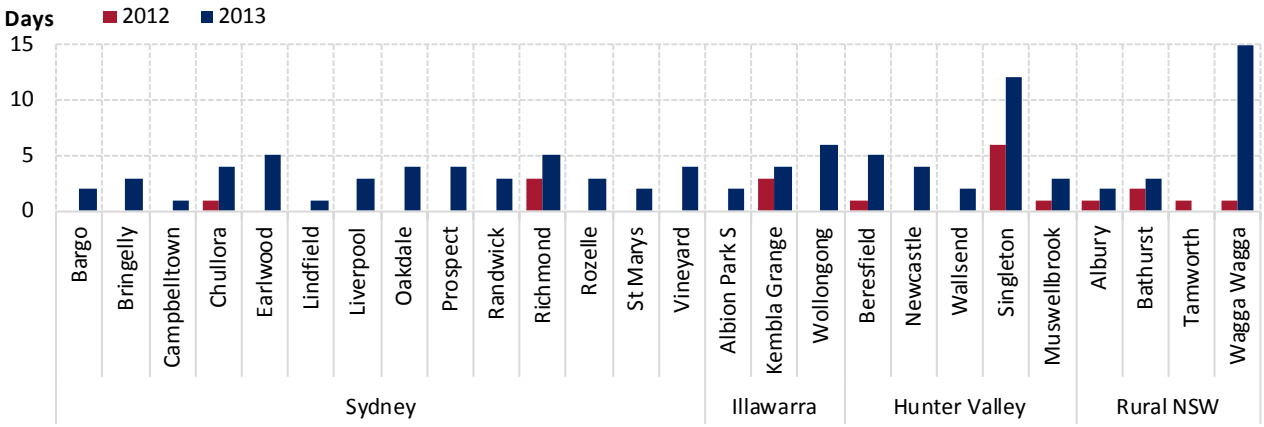
Table 2: Summary of 24-hr PM_{10} observations in NSW – 2013

Region/station	Maximum daily average PM_{10} values				Days above standard
	Highest (µg/m^3)	Date of highest value	6th highest (µg/m^3)	Date of 6th highest value	
Sydney					
Bargo	**208.9**	17/10/2013	36.9	28/04/2013	2
Bringelly	**97.2**	21/10/2013	40.6	12/01/2013	3
Camden	**97.5**	21/10/2013	35.6	27/03/2013	2
Campbelltown West	**56.9**	13/05/2013	32.8	27/03/2013	1
Chullora	**69.4**	21/10/2013	41.8	22/10/2013	4
Earlwood	**63.1**	21/10/2013	49.4	02/11/2013	5
Lindfield	**63.4**	02/11/2013	33.5	29/12/2013	1
Liverpool	**98.5**	21/10/2013	42.6	07/11/2013	3
Oakdale	**99.0**	20/10/2013	34.0	21/10/2013	4
Prospect	**81.8**	21/10/2013	46.5	29/10/2013	4
Randwick	**55.3**	08/11/2013	42.6	23/12/2013	3
Richmond	**104.6**	21/10/2013	48.3	22/10/2013	5
Rozelle	**58.5**	08/11/2013	41.2	23/12/2013	3
St Marys	**93.0**	21/10/2013	39.3	25/08/2013	2
Vineyard	**67.8**	21/10/2013	45.8	03/11/2013	4
Illawarra					
Albion Park South	**69.0**	19/10/2013	44.5	22/10/2013	2
Kembla Grange	**102.2**	19/10/2013	47.9	20/10/2013	4
Wollongong	**93.8**	19/10/2013	**51.0**	09/12/2013	**6**
Lower Hunter					
Beresfield	**55.3**	17/10/2013	48.8	22/10/2013	5
Newcastle	**69.0**	17/10/2013	49.1	09/12/2013	4
Wallsend	**52.5**	23/10/2013	35.9	09/01/2013	2
Upper Hunter					
Aberdeen	42.7	09/01/2013	38.3	22/10/2013	0
Muswellbrook	**55.6**	29/10/2013	46.5	25/10/2013	3
Singleton	**62.7**	17/10/2013	**57.3**	22/10/2013	**12**
Rural NSW					
Albury	**59.2**	04/04/2013	45.8	04/04/2013	2
Bathurst	**145.0**	18/10/2013	44.0	06/11/2013	3
Tamworth	47.5	07/11/2013	38.5	17/10/2013	0
Wagga Wagga North	**110.7**	08/01/2013	**65.9**	18/01/2013	**15**

Note: Levels above the PM_{10} standard of 50 µg/m^3 are shown in **bold**.

To allow for variability in natural events, the national standards allow for up to five days each year when PM_{10} can be above the standard. Using this approach, it is the sixth highest daily value for the year that determines if a site complies with the standard. While PM_{10} levels were higher in 2013 than 2012, only Wagga Wagga North (15 days), Singleton (12) and Wollongong (6) recorded levels above the standard on more than five days (Figure 2).

Figure 2: Comparison of days above the PM_{10} standard – 2012 and 2013



The national Advisory Reporting Standards (ARS) for $PM_{2.5}$ are based on daily and annual averages. Monitoring in NSW supports the National Environment Protection Measure goal for $PM_{2.5}$ which is to 'gather sufficient data nationally to facilitate a review of the standard as part of the review of the Air NEPM' (Department of the Environment 2014).

Daily $PM_{2.5}$ levels above the advisory reporting standard of 25 µg/m³ were recorded at all $PM_{2.5}$ monitoring stations, except Singleton (Table 3). Richmond recorded 14 days above the standard, all due to bushfire activity. The maximum daily average $PM_{2.5}$ was 88.4 µg/m³ at Wollongong on 19 October during the bushfire emergency.

Annual average $PM_{2.5}$ levels above the ARS of 8 µg/m³ were recorded at a number of stations. The highest annual average was 9.5 µg/m³ recorded at both Liverpool and Muswellbrook.

Compared with 2012, significantly more days during 2013 exceeded the $PM_{2.5}$ reporting standards (Figure 3). This increase is primarily due to the bushfires during September–November 2013.

Figure 3: Comparison of days above the $PM_{2.5}$ reporting standard – 2012 and 2013

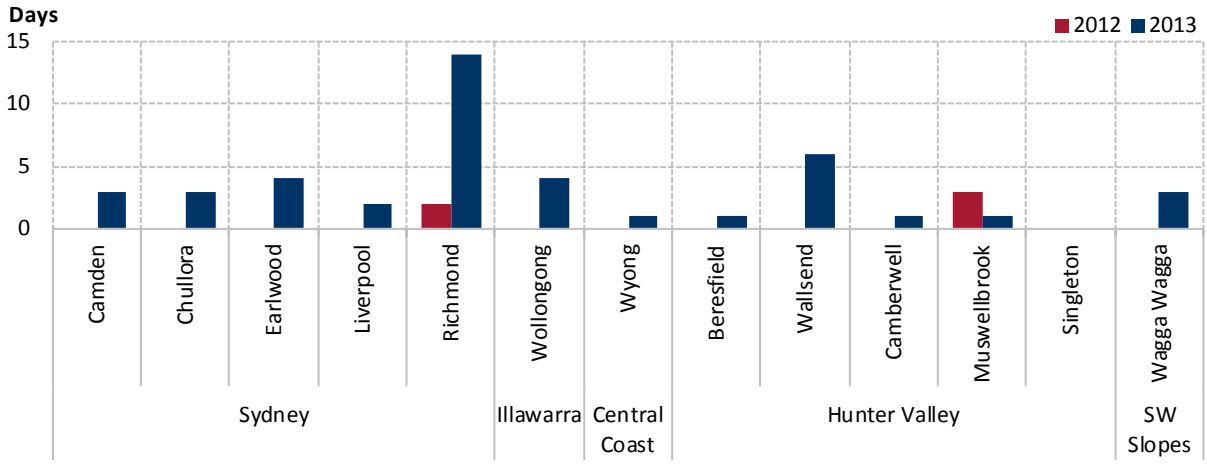


Table 3: Summary of 24-hr $PM_{2.5}$ observations in NSW – 2013

Region/station	Annual average (µg/m^3)	Daily average $PM_{2.5}$ values				Days above daily ARS
		Maximum (µg/m^3)	Date of maximum value	2nd highest (µg/m^3)	Date of 2nd highest value	
Sydney						
Camden	6.5	**61.9**	21/10/2013	**34.1**	20/10/2013	3
Chullora	**8.4**	**49.1**	21/10/2013	**33.3**	03/11/2013	3
Earlwood	7.9	**37.3**	21/10/2013	**28.0**	13/07/2013	4
Liverpool	**9.5**	**73.8**	21/10/2013	**27.0**	28/04/2013	2
Richmond	**8.4**	**68.0**	22/10/2013	**67.2**	21/10/2013	14
Illawarra						
Wollongong	7.7	**88.4**	19/10/2013	**51.3**	21/10/2013	4
Central Coast						
Wyong	6.6	**43.7**	03/11/2013	24.2	24/10/2013	1
Lower Hunter						
Beresfield	**8.3**	**38.4**	18/10/2013	23.6	17/10/2013	1
Wallsend	7.7	**37.0**	18/10/2013	**31.3**	23/10/2013	6
Upper Hunter						
Camberwell*	**8.2**	**29.5**	26/10/2013	24.7	29/08/2013	1
Singleton	7.9	22.6	29/08/2013	21.6	26/10/2013	0
Muswellbrook	**9.5**	**36.6**	29/10/2013	23.4	05/06/2013	1
Rural NSW						
Wagga Wagga North	8.0	**29.9**	19/10/2013	**28.4**	20/10/2013	3

* Small Upper Hunter Air Quality Modelling Network community monitoring station

Note: Levels above the daily (25 µg/m^3) or annual (8 µg/m^3) ARS for $PM_{2.5}$ are shown in **bold**.

Focus: Hunter Valley air quality

Like other regions, Hunter Valley air quality was poorer during 2013 than 2012, primarily as a result of above-average temperatures during the middle of the year and extended periods of little or no rain. Air quality in the Hunter was also affected by increased bushfire activity during January and September–November.

While levels of ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide remained below national standards, fine particle levels in the Hunter Valley exceeded national standards.

Observations from the Upper Hunter Air Quality Monitoring Network (UHAQMN) indicate that annual average $PM_{2.5}$ levels in Muswellbrook are higher than at other locations in the Hunter Valley. PM_{10} levels at the Upper Hunter monitoring stations that are closer to mines are also generally higher than elsewhere in the region.

Larger population centres

Monitoring at larger population centres in the Hunter Valley during 2013 showed that:

- The maximum daily average PM_{10} in the Upper Hunter was 62.7 µg/m^3 (Singleton – 17 October) and 69.0 µg/m^3 for the Lower Hunter (Newcastle – 17 October).

- Daily average PM_{10} levels exceeded national standards on 16 days (Table 4). Smoke from bushfires contributed to high pollution on a number of days during January, October and November.
- Singleton exceeded the national daily standard for PM_{10} of 50 µg/m^3 on 12 days and was the only Hunter Valley station that did not meet the NEPM annual goal of fewer than six days above the standard.
- Muswellbrook and Beresfield both recorded $PM_{2.5}$ levels above the daily and annual national advisory reporting standards and, while $PM_{2.5}$ levels at Wallsend were below the annual standard, Wallsend did record six days above the daily standard (with smoke from bushfires being the main cause of these events) (Table 5).
- Across the Hunter there were eight days during 2013 when daily $PM_{2.5}$ levels exceeded the reporting standard with all but one occurring during the bushfire emergency in October–November. In comparison, three days were above the standard in the Hunter during 2012, all at Muswellbrook.

Table 4: Days above the PM_{10} standard at Hunter Valley large population centres – 2013

Date	Stations exceeding the daily average PM_{10} national standard of 50 µg/m^3
08/01/2013	Singleton (54.5 µg/m^3)
09/01/2013	Beresfield (53.4 µg/m^3), Singleton (58.6 µg/m^3)
18/01/2013	Newcastle (50.7 µg/m^3), Singleton (51.2 µg/m^3)
01/09/2013	Muswellbrook (52.2 µg/m^3)
06/09/2013	Singleton (53.3 µg/m^3)
10/09/2013	Singleton (59.5 µg/m^3)
10/10/2013	Beresfield (52.3 µg/m^3), Singleton (58.4 µg/m^3)
13/10/2013	Singleton (57.9 µg/m^3)
17/10/2013	Beresfield (55.3 µg/m^3), Newcastle (69.0 µg/m^3), Singleton (62.7 µg/m^3), Wallsend (50.7 µg/m^3)
18/10/2013	Beresfield (55.3 µg/m^3)
22/10/2013	Singleton (57.3 µg/m^3)
23/10/2013	Beresfield (51.0 µg/m^3), Newcastle (50.5 µg/m^3), Wallsend (52.5 µg/m^3)
29/10/2013	Muswellbrook (55.6 µg/m^3)
03/11/2013	Singleton (53.5 µg/m^3)
08/11/2013	Muswellbrook (54.3 µg/m^3), Newcastle (57.2 µg/m^3), Singleton (52.2 µg/m^3)
23/12/2013	Singleton (51.4 µg/m^3)

Table 5: Days above the $PM_{2.5}$ reporting standard at Hunter Valley stations – 2013

Date	Stations exceeding the daily average $PM_{2.5}$ ARS of 25 µg/m^3
29/04/2013	Wallsend (26.9 µg/m^3)
17/10/2013	Wallsend (29.6 µg/m^3)
18/10/2013	Beresfield (38.4 µg/m^3), Wallsend (37.0 µg/m^3)
19/10/2013	Wallsend (29.0 µg/m^3)
23/10/2013	Wallsend (31.3 µg/m^3)
26/10/2013	Camberwell (29.5 µg/m^3)
29/10/2013	Muswellbrook (36.6 µg/m^3)
08/11/2013	Wallsend (25.7 µg/m^3)

Key: Large population centre site, Diagnostic site

Small community and diagnostic sites

Although comparing data from small community and diagnostic stations in the UHAQMN with Air NEPM standards is not recommended, there is a desire within the community to assess how pollution levels at these stations compare with the standards. Table 6 summarises daily PM_{10} data from the smaller community, background and diagnostic stations within the UHAQMN.

During 2013, there were 48 days in the Upper Hunter when PM_{10} levels above the benchmark were recorded at one or more stations (Table 7). Seventy per cent of these events (34 days) occurred exclusively at stations designated as small community and/or diagnostic sites. Camberwell, Maison Dieu, Singleton NW and Mount Thorley recorded the greatest number of days when levels were above the benchmark.

During January there were five high pollution days in the Upper Hunter with elevated levels of PM_{10} recorded at stations in Singleton Shire – Camberwell, Maison Dieu, Bulga, Mt Thorley, Singleton NW and Singleton. The two-day period of 8–9 January saw strong north-westerly winds in the region combined with an extensive heatwave affecting large parts of NSW and Australia (BOM 2013). Down-valley winds, in combination with prevalent dry conditions and local bushfires, were likely to have triggered this high-pollution event. Bushfires also contributed to poorer air quality in mid-January, with fires at Cessnock and Singleton.

Table 6: Summary of PM_{10} levels at Upper Hunter small community, background and diagnostic sites – 2013

Station	Maximum daily average PM_{10} values				Days above benchmark
	Highest ($\mu g/m^3$)	Date of highest value	6th highest ($\mu g/m^3$)	Date of 6th highest value	
Small community					
Bulga	**88.4**	29/04/2013	**53.0**	17/01/2013	7
Camberwell	**104.8**	17/10/2013	**82.9**	24/09/2013	36
Jerrys Plains	**63.3**	26/10/2013	**52.2**	21/10/2013	6
Maison Dieu	**84.2**	22/10/2013	**69.7**	03/11/2013	28
Warkworth	**65.4**	22/10/2013	**52.5**	26/10/2013	8
Wybong	**83.0**	18/10/2013	41.5	21/12/2013	2
Background sites					
Merriwa	42.6	18/10/2013	38.6	19/10/2013	0
Singleton South	**60.3**	17/10/2013	49.8	29/04/2013	5
Diagnostic sites					
Mt Thorley	**88.3**	17/10/2013	**72.9**	24/09/2013	26
Muswellbrook NW	**106.8**	15/09/2013	43.0	09/01/2013	3
Singleton NW	**91.7**	01/10/2013	**69.1**	24/09/2013	28

Note: Levels above the daily average PM_{10} standard of 50 $\mu g/m^3$ are shown in **bold**.

Table 7: Days above the PM_{10} benchmark in the Upper Hunter – 2013

Date	Stations exceeding the daily average PM_{10} national standard of 50 µg/m^3
08/01/2013	**Singleton**, Camberwell, Maison Dieu, Singleton NW
09/01/2013	**Singleton**, Bulga, Camberwell, Maison Dieu, Singleton NW
12/01/2013	Camberwell, Mt Thorley, Singleton NW
17/01/2013	Bulga, Maison Dieu
18/01/2013	**Singleton**, Camberwell, Maison Dieu, Mt Thorley, Singleton NW
15/04/2013	Mt Thorley, Singleton NW
28/04/2013	Camberwell, Mt Thorley
29/04/2013	Bulga, Camberwell, Maison Dieu, Jerrys Plains, Warkworth, Mt Thorley, Singleton NW
14/08/2013	Camberwell
17/08/2013	Camberwell, Maison Dieu, Mt Thorley, Singleton NW
19/08/2013	Camberwell
23/08/2013	Camberwell
30/08/2013	Camberwell, Maison Dieu, Singleton NW
31/08/2013	Mt Thorley
01/09/2013	**Muswellbrook**
05/09/2013	Camberwell, Singleton NW
06/09/2013	**Singleton**, Camberwell, Maison Dieu, Singleton NW
07/09/2013	Camberwell, Maison Dieu, Mt Thorley, Singleton NW
10/09/2013	**Singleton**, Camberwell, Maison Dieu, Mt Thorley, Singleton NW
15/09/2013	Muswellbrook NW
23/09/2013	Camberwell
24/09/2013	Camberwell, Maison Dieu, Mt Thorley, Singleton NW
26/09/2013	Camberwell, Maison Dieu, Mt Thorley, Singleton NW
28/09/2013	Camberwell
01/10/2013	Camberwell, Maison Dieu, Mt Thorley, Singleton NW
06/10/2013	Camberwell, Maison Dieu
10/10/2013	**Singleton**, Camberwell, Maison Dieu, Mt Thorley, Singleton NW, Singleton South
13/10/2013	**Singleton**, Camberwell, Maison Dieu, Mt Thorley, Muswellbrook NW, Singleton NW, Singleton South
15/10/2013	Camberwell, Singleton NW
16/10/2013	Camberwell, Maison Dieu, Mt Thorley
17/10/2013	**Singleton**, Camberwell, Maison Dieu, Jerrys Plains, Warkworth, Mt Thorley, Singleton NW, Singleton South
18/10/2013	Wybong
19/10/2013	Wybong
21/10/2013	Camberwell, Maison Dieu, Jerrys Plains, Mt Thorley, Singleton NW
22/10/2013	**Singleton**, Bulga, Camberwell, Maison Dieu, Jerrys Plains, Warkworth, Mt Thorley, Singleton NW, Singleton South
23/10/2013	Camberwell, Maison Dieu, Mt Thorley

Date	Stations exceeding the daily average PM_{10} national standard of 50 µg/m^3
24/10/2013	Mt Thorley
25/10/2013	Maison Dieu, Mt Thorley, Singleton NW
26/10/2013	Camberwell, Maison Dieu, Jerrys Plains, Warkworth, Mt Thorley, Singleton NW
28/10/2013	Bulga
29/10/2013	**Muswellbrook**, Mt Thorley, Singleton NW
03/11/2013	**Muswellbrook**, **Singleton**, Bulga, Camberwell, Maison Dieu, Singleton NW, Singleton South
08/11/2013	**Muswellbrook**, **Singleton**, Camberwell, Warkworth, Maison Dieu, Jerrys Plains, Mt Thorley, Muswellbrook NW, Singleton NW
09/11/2013	Camberwell
21/11/2013	Muswellbrook NW
09/12/2013	Camberwell, Maison Dieu, Mt Thorley, Singleton NW
21/12/2013	Bulga, Camberwell, Maison Dieu
23/12/2013	**Singleton**, Camberwell, Warkworth, Maison Dieu, Mt Thorley, Singleton NW

Key: Large population centre site, Small community site, Diagnostic site, Background site

Further information

Data from the NSW air quality monitoring network is updated hourly and made available online from the Office of Environment and Heritage at http://www.environment.nsw.gov.au/AQMS/aqi.htm. You can also subscribe to automated email and/or SMS air pollution alerts at http://www.environment.nsw.gov.au/aqms/subscribe.htm.

Information about sources of emissions in NSW is available from the NSW Air Emissions Inventory:
http://www.epa.nsw.gov.au/air/airinventory.htm
http://www.epa.nsw.gov.au/air/airemissionsinmycommunity.htm

Information about the principles and programs used in NSW to manage particle pollution is available at http://www.epa.nsw.gov.au/air/20130784ManPartStr.htm

Information about sources and actions to reduce emissions in the Upper Hunter:
http://www.environment.nsw.gov.au/aqms/uhaqmnfpcs.htm.
http://www.epa.nsw.gov.au/aqms/130158uphuntap.htm
http://www.epa.nsw.gov.au/air/coalminingNSW.htm

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RFS 2013, *NSW Rural Fire Service Annual Report 2012–13* (p.26): www.rfs.nsw.gov.au/dsp_content.cfm?CAT_ID=540

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