Air Quality Monitoring: Joint Report by RBBC and GAL for 2016.

1. The following report presents the results from the 2016 air pollution monitoring program undertaken on, and in the vicinity of, Gatwick Airport.

2. Committee members are reminded that details of:
    i. the legislation,
    ii. the rationale for the monitoring of certain pollutants,
    iii. and factors to bear in mind when examining the data e.g. the impact of the weather, and / or changes in the source of a pollutant, were covered in a separate report to the GP sub committee on 11th January 2007[1].

Off Airport Monitoring at Relevant Receptors on the Horley Gardens Estate.
Annual Monitoring of Compliance with UK air quality objectives – Nitrogen Dioxide.

3. The annual average concentration of nitrogen dioxide across the Horley Gardens Estate in 2016 is shown in Figure 1. The map includes the two additional diffusion tube sites - RB149 located on the south side of the A23 Brighton Road and RB151 located on Victoria Road in Horley - added to the monitoring programme following concerns over the possible underestimation of road traffic pollution close to roads as a result of diesel vehicles failing to meet emissions standards in real world driving.

4. Nitrogen dioxide concentrations were below the UK annual average objective of 40 µg m^{-3} (micrograms per cubic metre) at sites normally assessed on the Horley Gardens Estate and on Victoria Road, but exceeded the objective at the A23 site (RB149) where the annual average concentration was 50 µg m^{-3} in 2016 (45 µg m^{-3} in 2015).

5. Additional monitoring was introduced on the A23 in 2016 to examine the spatial extent of the non attainment along this section of road but at the time of writing a full 12 months of data is not yet available, although preliminary data (not shown) suggests that the non achievement of the air quality objective is confined to a handful of residential properties in the vicinity of RB149, near to the junction of the A23 with Massetts Road.

6. On Victoria Road nitrogen dioxide concentrations were 32 µg m^{-3} (31 µg m^{-3} in 2015), while the highest concentration measured on the Horley Gardens Estate was 29 µg m^{-3} at the RB59 'worst case' receptor, and 28.6 µg m^{-3} at the RG2 site both located towards the southern end of The Crescent. This compares to the highest concentration in 2015 of 26 µg m^{-3} and 28 µg m^{-3} in 2014.

7. Local sources of pollution on the estate remained unchanged throughout 2016, and so the results are comparable to previous years monitoring work.

8. Data capture from all the real time monitoring sites was over 90 %, and so the data from these sites along with the diffusion tube data is valid for monitoring compliance with the air quality objectives.

9. The results from 2016 are in line with the predicted distribution of nitrogen dioxide concentrations for the Horley Gardens Estate, with the highest concentrations (excluding main road sites) found towards the southeast corner of the estate. Concentrations in 2016 were typically around 2 to 3 µg m^{-3} higher than in 2015 at the 'worst' affected residential premises, but comparable to those seen in 2013 and 2014. Elsewhere on the estate concentrations increased by 1 to 4 µg m^{-3}, in line with increases seen elsewhere in the borough of 2 to 4 µg m^{-3}. Thus the decline in air quality seen in the vicinity of the airport in 2016 reflects the natural year to year variation due to the weather and / or regional changes rather than a specific change related to the airport.

[1] Contact GATCOM Secretariat for historical reports.

10. The non attainment of the air quality objective at the monitoring site on the Brighton Road (RB149) is caused by road traffic, and modelling by Gatwick Airport[2] in 2013 examining 2010 suggests around 12 % of the NO_x pollution at this site is airport related, although an updated traffic model output is due in 2017.

11. RBBC and Gatwick agree that the RB149 site needs further attention and potential mitigation measures are currently being explored with other partners.

12. Concentrations in Charlwood and Hookwood remain low, while concentrations in Smallfield have fallen slightly in 2016 by around 1 µg m^{-3}.

13. Passenger numbers and aircraft movements at Gatwick increased by 7.1 % and 4.8 % respectively in 2016 compared to 2015 (Appendix A). However while passenger numbers now exceed pre-recession levels by 22.4 %, aircraft movements are only 5.2 % above the 2007 peak.

14. Traffic flows on the M23 spur returned to pre recession levels during 2015, and in 2016 were 6.9 % higher than the 2006 peak.

Annual Monitoring of Compliance with UK air quality objectives – PM_{10}.

15. The PM_{10} air quality objective was met on the Horley Gardens Estate in 2016, with an annual average concentration at RG1 of 16.5 µg m^{-3} (VCM methodology), which was below the 'normal' range of 18 to 23 µg m^{-3}. Although concentrations in 2016 were 2.7 µg m^{-3} lower than in 2015, this decrease is likely to reflect year to year changes due to the prevailing weather conditions rather than any decrease in local sources of PM_{10}.

Trends in Pollutant Concentrations.

Nitrogen dioxide.

16. A three year rolling average concentration is used in the trend analysis work to help remove the year to year fluctuations in concentrations caused by the prevailing weather conditions. The data to date (Figure 2) shows that the long term downward trend in annual average nitrogen dioxide concentrations at the RG1 site continued in 2016.

17. At the 'worst case' receptors closer to the airport (RG2, RB59) the downward trend appears to have 'paused' as it did in 2014. The cause of the general convergence of the RB59 and the RG2 concentrations in recent years is unknown, although it is worth noting that computer modelling has consistently suggested a difference of no more than 1 to 2 µg m^{-3} between these two sites as has been the case in practice in recent years.

18. The overall downward trend at RG1 and RG2/RB59 is as expected given that computer modelling indicates that non airport sources of nitrogen dioxide and airport related road traffic emissions were predicted to fall until 2015[3], and to a lesser extent 2025[4], driven mainly by improvements in road vehicle engine technology. In addition changes in the aircraft fleet and on airport operational practices post 2007 will potentially have lead to further improvements in air quality especially at the RG2/RB59 sites.

19. With aircraft movements at Gatwick back to pre recession levels in 2015, and road traffic on the M23 spur also back to pre recession levels, it is now possible to look at how much of the improvement seen in air quality in the vicinity of the airport (Figure 2) is driven by the airport and how much by non airport sources of pollution.

[2] Air Quality Modelling – Additional R2 options. Ricardo AEA R/3396 Issue 1 Dec 2013 – 2010 Baseline Model with apron scaling.
[3] Gatwick Air Quality Assessment for 2010 (AEAT/ENV/R/2795/Issue 1 – June 2009)
[4] Gatwick Airport Master Plan: Air Quality Assessment 2024/25 (AEAT/ENV/R/3139/Issue 1 – 18th May 2011)

20. Figure C.1 (Appendix C) compares the ‘worst case’ RB59 site on the Horley Gardens Estate with background sites elsewhere in Reigate and Banstead. Here the overall fall in background nitrogen dioxide concentrations (2006 to 2016) is around 9 to 10 µg m^{-3}, which is comparable to the fall at the RB59 site, suggesting that most if not all of the improvement seen on the Horley Gardens Estate by 2016 has occurred from non airport sources of pollution.

21. The RG2 and RG3 monitoring stations are positioned such that when winds are from the SW it is possible by subtracting the RG3 readings (airflow into the airport) from the RG2 readings (air after passing over the airport), to examine the nitrogen dioxide pollution from the airport and the A23 airport way (Figure C.2, Appendix C).

22. Figure C.2 suggests that nitrogen dioxide concentrations from the airport itself fell significantly to 2012 due to a combination of recession and changes to operational practices on airport, but that levels have been rising steadily since 2013. In 2016 the airport contribution to nitrogen dioxide pollution when winds were from the SW was higher than in 2006 for the first time in 10 years, again suggesting that the improvements seen to date on the Horley Gardens Estate have been driven by improvements in non airport sources of pollution.

PM_{10}.

23. It is important to note that the airport is not a significant source of PM_{10}, and computer modelling[5] consistently indicates that the airport is responsible for no more than 1 – 2 µg m^{-3} of the total PM_{10} concentration at the worst affected properties on the Horley Gardens Estate.

24. The main purpose of monitoring PM_{10} on the Horley Gardens Estate is to examine trends in the PM_{10} concentration, as the UK Government is aiming to reduce people’s exposure to particulate matter[6] in the longer term even where the air quality standards are met.

25. Using a three year rolling average to examine the trends in the data there is evidence of an overall downward trend from 2003 to 2010, with concentrations of 23.9 µg m^{-3} in 2003 and 19.5 µg m^{-3} in 2010 (Figure 3), although much of this improvement in non airport PM_{10} to date has occurred between 2007 and 2010. Since 2010 the overall trend is flat, with the slight rise between 2011 and 2013 largely an artefact of the elevated concentration measured in 2011, and the fall in 2016 again an artefact of the low value measured in 2016.

[5] Gatwick Air Quality Assessment for 2010 (AEAT/ENV/R/2795/Issue 1 – June 2009)
[6] Specifically $PM_{2.5}$ which is a subset of PM_{10}.

Figure 2: Three year Rolling Annual Average Nitrogen Dioxide Concentration at RG1, Michael Crescent Horley (Blue diamond), RG2, The Crescent Horley (Purple square), and RB59 (Red triangle).

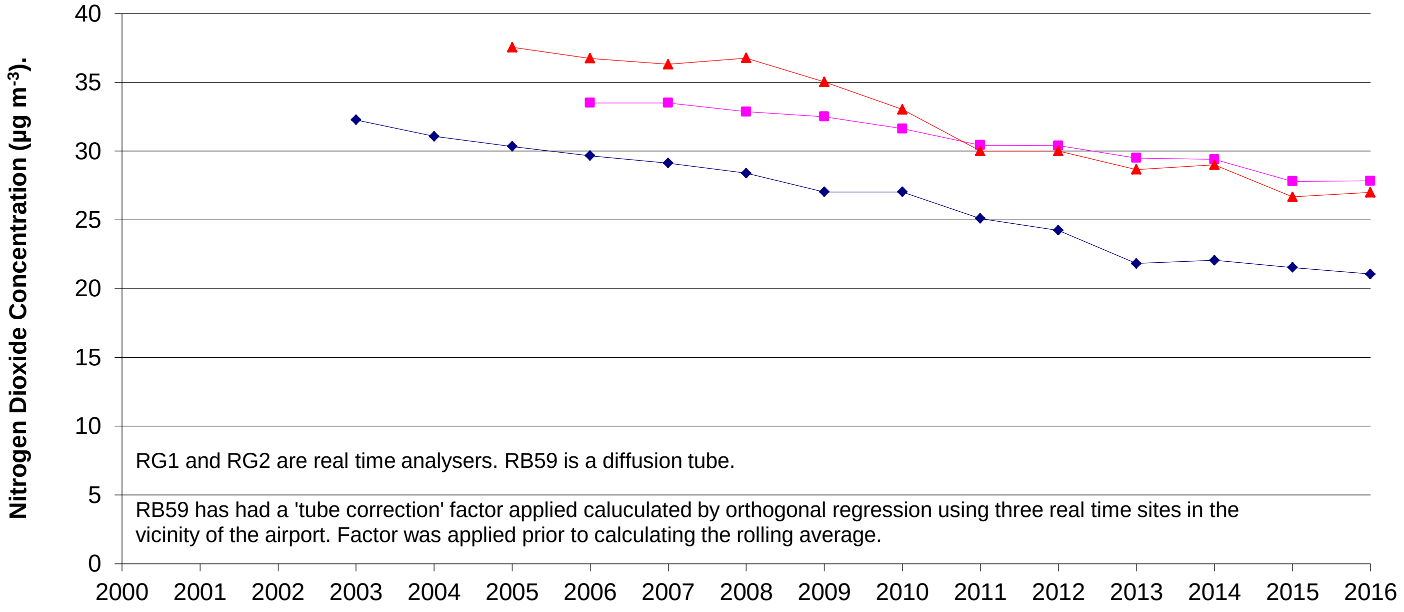
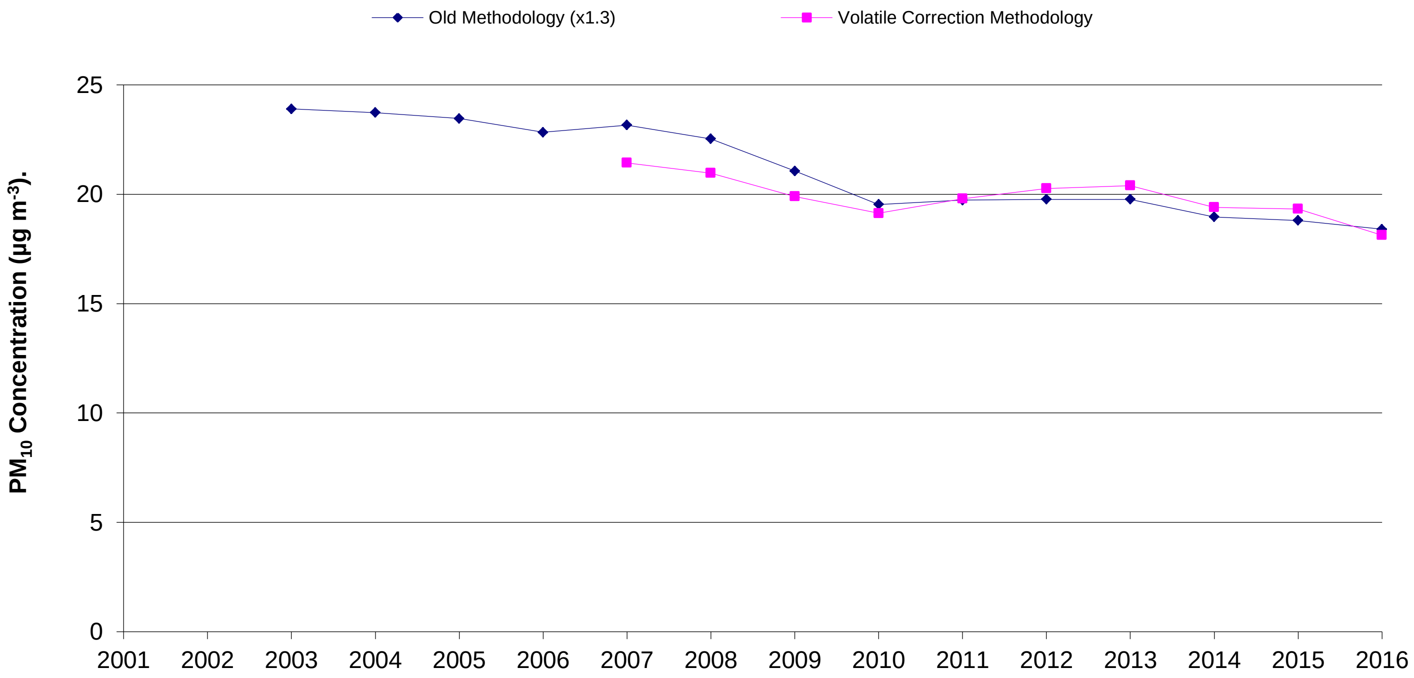


Figure 3: Three Year Rolling Annual Average PM_{10} Concentration at RG1, Michael Crescent, Horley.



On Airport Monitoring.

26. In the absence of relevant receptors[7] at the airport monitoring site, it is largely academic whether or not the air quality objectives are breached. However the monitoring results from 2016 (Table 1) indicate that the objectives were met at the LGW3 monitoring station for PM_{10} and nitrogen dioxide.

	On Airport (LGW3)	Objective	Objective Met?
Annual Average nitrogen dioxide Concentration	29.8	40	Yes
Nitrogen Dioxide: No. of hours over 200 µg m^{-3}	0	18	Yes
Annual Average PM_{10} Concentration (Volatile Correction Method)	21.5 (17.0)	40	Yes
PM_{10}: No. of days over 50 µg m^{-3} (Volatile Correction Method)	6 (7)	35	Yes
All concentrations are in µg m^{-3}. Data Capture: Nitrogen Dioxide 99.1 %, PM_{10} 93.0 %.			

Table 1: Nitrogen Dioxide and PM_{10} Concentrations on Airport in 2016.

27. It should be pointed out that while the LGW3 monitor is of limited use for compliance monitoring, it is of particular use for verifying the computer modelling work used to make forward predictions about air quality at the airport.

28. During 2013 Pier 1 on the airport was closed for redevelopment, which represents a major change in the airport sources of air pollution affecting this monitor. Thus the results for 2014 and subsequent years are not directly comparable to data pre 2013 when examining trends in on airport pollution.

On Airport Pollutant Trends.

29. Bearing in mind the changes in the on airport sources of pollution Figure 4 shows the 3 year rolling average nitrogen dioxide concentration at the on airport monitor LGW3, and the data from the residential monitor RG1 for comparison. The graph shows a steady improvement in nitrogen dioxide concentrations at the LGW3 monitor, with a significant improvement from 2003 onwards, followed by a subsequent increase in 2007 and 2008, while concentrations from 2009 to date continue to follow the long term downward trend.

30. The sudden fall in the annual average nitrogen dioxide concentrations in 2004 and 2005 (Table 2), which is reflected in the 3 year rolling average data (Figure 4), was noted but unexplained in the 2005 monitoring report (GP sub committee January 2007). Subsequent work indicated that the falls in 2004 and 2005 were more likely to have been due to the change in contractor servicing the equipment in 2003, than 'real' improvements in air quality on airport (GP sub committee June 2007), and this appeared to be confirmed by a rise in concentrations in 2006 when the original servicing agent was reappointed.

31. Annual mean nitrogen dioxide concentrations at LGW3 increased by 1.6 µg m^{-3} in 2016 although the on airport increase was comparable to that seen elsewhere in Reigate and Banstead, and so reflects a regional increase in pollution driven by the weather and / or regional sources rather than a increase due to activities on the airport.

[7] 'Relevant receptors' were discussed in the outline air quality paper presented to the GP sub committee in January 2007. However, for the purposes of this of this report relevant exposure can be taken as residential housing, or in the case of the 1 hour nitrogen dioxide objective where a member of the public might be present for 1 hour or more.

Figure 4: Three Year Rolling Annual Average Nitrogen Dioxide Concentration at LGW3, Gatwick Airport.

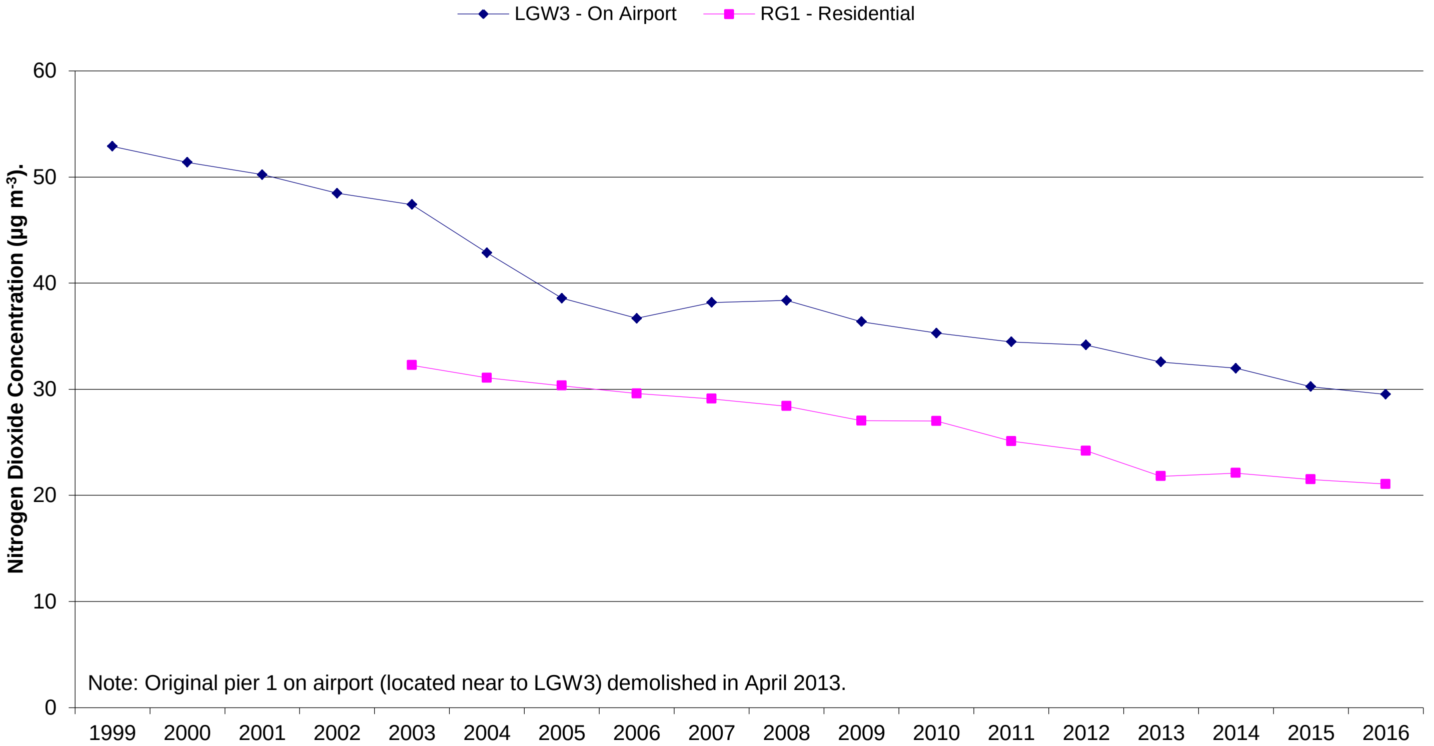
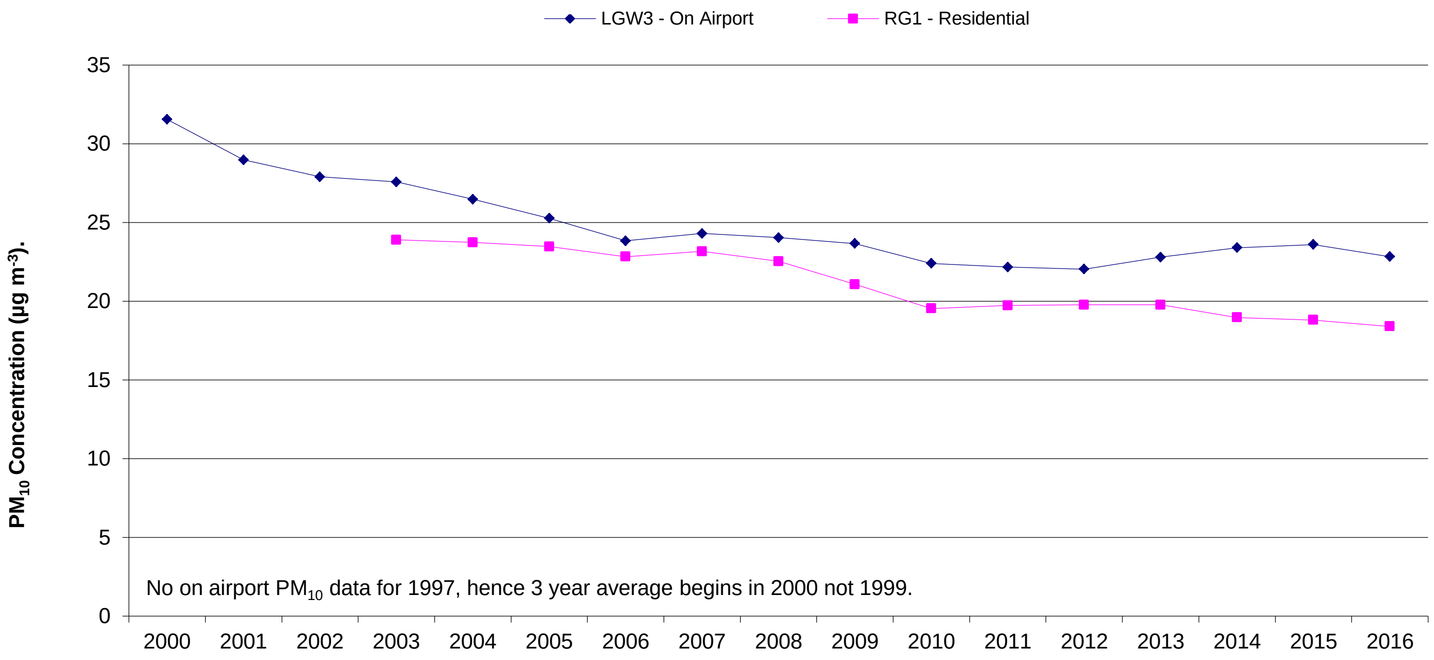


Table 2: Annual and Three Year Annual Average Nitrogen Dioxide Concentrations (µg m^{-3}).

LGW3	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual Average	53.8	52.6	52.3	49.2	49.1	47.0	46.0	35.5	34.2	40.3	40.0	34.8	34.3	36.8	32.3	33.4	32.0	30.6	28.2	29.8
Data Capture	94.9	89.2	93.3	93.4	93.5	96.1	94.0	95.4	96.7	96.3	94.2	96.8	93.7	99.2	96.4	94.7	99.2	99.2	99.4	99.1
Hours over 200 µg m^{-3}	2	0	1	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
3 Year Rolling Av.	LGW3		52.9	51.4	50.2	48.5	47.4	42.9	38.6	36.7	38.2	38.4	36.4	35.3	34.5	34.2	32.6	32.0	30.3	29.5
3 Year Rolling Av.	RG1						32.3	31.1	30.3	29.6	29.1	28.4	27.0	27.0	25.1	24.2	21.8	22.1	21.5	21.1

Figure 5: Three Year Rolling Annual Average PM_{10} Concentration at LGW3, Gatwick Airport.



32. Figure 5 shows the three year rolling annual average PM_{10} concentrations at the airport monitor, and PM_{10} data from the residential monitor for comparison. The graph shows a steady improvement in PM_{10} concentrations on airport until 2006, at which point concentrations remained largely static for a few years before resuming a downward trend. In 2013 PM_{10} concentrations increased slightly on airport and while this trend ran to 2015 it largely reflected elevated concentrations in 2013 and 2014. Given the redevelopment of Pier 1 and the trend seen off airport the increase at LGW3 was most likely related to the local building works, especially given the subsequent fall in concentrations in 2016.

Benzene Monitoring Data.

33. The concentration of benzene is measured at one residential site (RB11) on the Horley Gardens Estate and on airport at LGW3.

34. As expected measurements met the air quality objectives in 2016 (Table 3). Concentrations were higher at the residential site than in 2015, although similar to 2011, and up slightly on airport compared to 2015. Due to the nature of the measurement technique it is difficult to compare values over the long term, but it is worth noting that residential benzene concentrations fell year on year from 2007 to 2012 before levelling off in 2013.

	Concentration ($\mu g\ m^{-3}$)	Objective	Objective Met?
Annual Average Benzene Concentration: Residential	1.2	5	Yes
Annual Average Benzene Concentration: On Airport	0.51	5	Yes

Table 3: Annual Average Benzene Concentrations on the Horley Gardens Estate at RB11 and Gatwick Airport (LGW3) in 2016 (Non pumped BTEX Tubes).

Additional Monitoring Data.
Ozone.

35. Ozone monitoring began to the SW of the airport in 2005 at the RG3 site in Poles Lane Crawley. The aim of this site is to monitor long term trends in ozone concentrations in the vicinity of the airport.

36. Although the airport is not responsible for local ozone pollution i.e. it does not emit ozone, ozone plays an important role in the formation of nitrogen dioxide which is the main pollutant of concern in the vicinity of the airport. Therefore examining the long term ozone trend is important for understanding nitrogen dioxide concentrations in both the short and longer term.

37. At present there are ten years of valid data from the ozone monitor, and based on a three year rolling average the overall trend to date is flat (data not shown).

38. Compared to the air quality standards ozone concentrations failed to meet the UK objective in 2016 for the tenth time in 11 years of monitoring (the UK standard was met in 2014), while the EU standard (which is less strict) was met in 2016 (Table 4).

	Number of exceedences.	Standard Met?	
		UK[a]	EU[b]
RG3: Poles Lane Crawley.	20 / 3.6[b]	No	Yes
Standards:			
UK: Daily Max. of running 8 hour mean of 100 $\mu g\ m^{-3}$.	10 max.	-	-
EU: Daily Max. of running 8 hour mean of 120 $\mu g\ m^{-3}$ (averaged over 3 years).	25 max.	-	-

[a] in 2015
[b] The EU standard is averaged over 3 years i.e. 2014, 2015, and 2016.

Table 4: Number of exceedences of the Ozone standard in 2016.

Ultrafine Particles.

39. As reported to the steering group in June 2012 airports have been identified as a significant source of ultrafine particulate pollution[8,9] i.e. particles that are under 0.1 µm in aerodynamic diameter, and that a large proportion of these particles are generated during take-off with the resulting ‘spike’ in ultrafine particles detected at least 600 m from the airport based on studies at LAX.

40. As research over the past 10 to 15 years has continually indicated that the finer combustion derived particle fractions, including particles under 0.1 µm in (aerodynamic) diameter, tend to have the biggest biological effects it was agreed that any further work in this area would be reported back to the steering group.

41. To date no further measurements have been made on or off airport at Gatwick, although Heathrow began on and off airport monitoring of ultrafine particles during 2016.

42. However, following a successful research bid by King's College and Imperial College in early 2017, measurements of ultrafine particle concentrations in the vicinity of Gatwick will be made during 2017/18.

[8] Atmospheric Environment 45 (2011) pp.6526 – 6533.
[9] Atmospheric Environment 50 (2012) pp.328 – 337.

Summary.

43. In summary:

i) The annual average air quality objective for nitrogen dioxide was not met at one relevant receptor in the vicinity of the airport during 2016 (Table 5), primarily due to road traffic (airport related and non airport related). However, the air quality standards were met for the other pollutants under the local authority air quality management regime (Table 5).

ii) Ozone concentrations in the vicinity of the airport failed to meet the relevant UK air quality objective, although the airport is not responsible for local ozone pollution.

iii) Trend analysis of the nitrogen dioxide concentrations at properties most at risk of breaching the air quality objective due to on airport emissions (RB59) shows that the downward trend levelled off in 2016, although similar 'pauses' have been seen in the past, while the long term downward trend at the 'background' site (RG1) continued. The overall long term decrease in pollution at the background site is most likely due to improvements in road vehicle[10] and national emissions of NO_x, while the more recent falls at the worst case receptor(s) will also reflect this and up to 2015 the changes in the aircraft fleet and operational practices at Gatwick. The long term downward trend at the RG1 site is in line with predictions for non airport nitrogen dioxide pollution at Gatwick and across the southeast.

iv) The concentration of nitrogen dioxide measured on airport in 2016 at LGW3 meets the UK air quality objective of 40 µg m^{-3}. The concentrations of the other pollutants measured at LGW3 also met the relevant air quality objectives.

v) The three year rolling annual average trend analysis of the on airport nitrogen dioxide concentrations shows a decrease in concentrations between 2008 and 2016, with the concentrations in 2016 the lowest to date.

vi) The average PM_{10} concentration (VCM measurement) measured on airport in 2016 showed a slight decrease compared to 2015, although similar improvements were seen off airport suggesting the improvement was not airport specific.

	Measured value	Objective	Objective Met?
Nitrogen Dioxide:			
Highest measured annual average residential concentration.	50	40	No
Annual Average nitrogen dioxide concentration Airport monitor.	29.8	40	Yes
PM_{10}:			
Annual Average PM_{10} Concentration: Residential Monitor. (VCM value)	17.5 (16.5)	40	Yes
PM_{10}: No. of days over 50 µg m^{-3}: Residential Monitor. (VCM value)	1 (3)	35	Yes
Annual Average PM_{10} Concentration: Airport Monitor. (VCM value)	21.5 (17.0)	40	Yes
PM_{10}: No. of days over 50 µg m^{-3}: Airport Monitor. (VCM value)	6 (7)	35	Yes
Benzene:			
Residential Benzene Monitor (Site RB 11).	1.2	5	Yes
Ozone:			
RG3 Monitor to SW of Airport (Number of exccedences).	20	10	No
All concentrations are in µg m^{-3}.			

Table 5: Summary of Air Quality in the Vicinity of Gatwick Airport in 2016.

[10] While vehicle NO_x emissions are not as low in practice as when on test, hence the problems at RB149, overall they are falling.

Figure A.1: Passenger and Aircraft Movement Trends at Gatwick Airport.

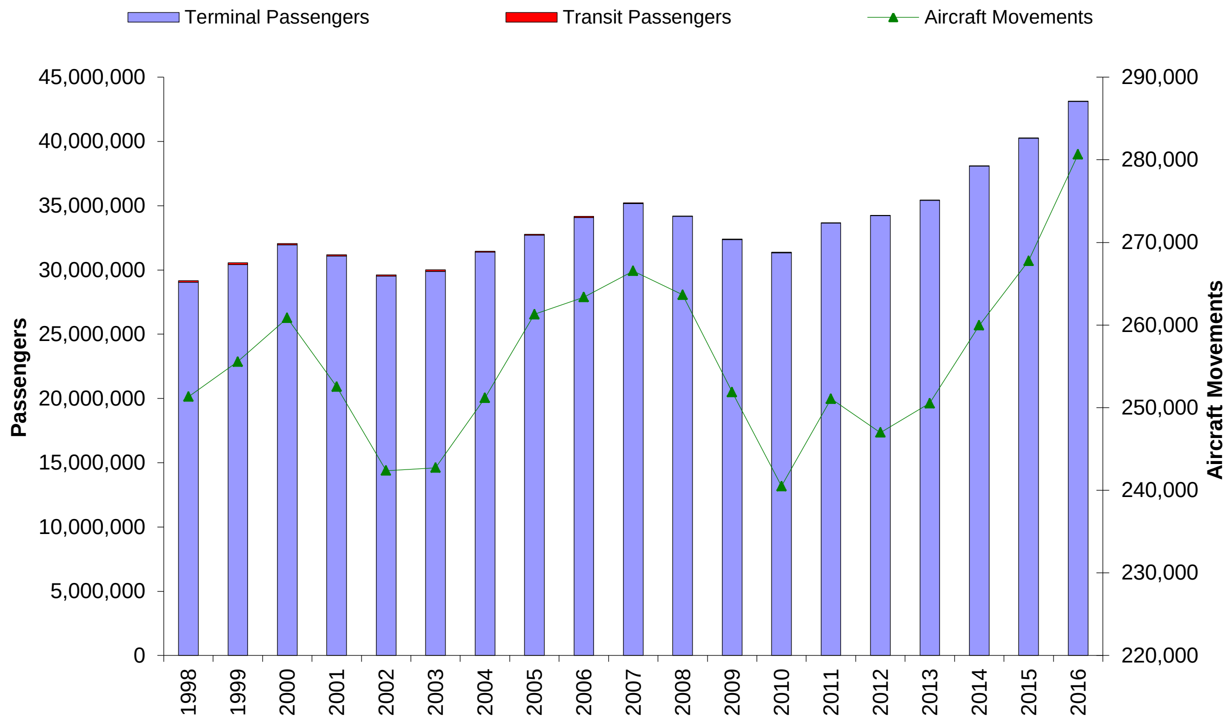


Table A.1: Annual Passenger Numbers and Aircraft Movements at Gatwick Airport.

	Number of Passengers			No. of Aircraft
	Terminal	Transit	Total	Movements
1998	29,032,838	140,292	29,173,130	251,321
1999	30,409,860	153,761	30,563,621	255,570
2000	31,947,524	119,601	32,067,125	260,859
2001	31,096,563	85,207	31,181,770	252,543
2002	29,517,894	109,515	29,627,409	242,379
2003	29,893,288	111,974	30,005,262	242,731
2004	31,391,352	75,418	31,466,770	251,195
2005	32,693,005	82,690	32,775,695	261,292
2006	34,080,345	83,234	34,163,579	263,363
2007	35,165,404	50,709	35,216,113	266,550
2008	34,162,014	43,873	34,205,887	263,653
2009	32,360,773	31,747	32,392,520	251,879
2010	31,342,263	33,027	31,375,290	240,500
2011	33,643,989	30,275	33,674,264	251,067
2012	34,218,668	17,314	34,235,982	246,987
2013	35,428,548	15,658	35,444,206	250,520
2014	38,093,930	9,737	38,103,667	259,962
2015	40,260,068	9,019	40,269,087	267,760
2016	43,114,888	4,740	43,119,628	280,666

Data from Civil Aviation Authority. www.caa.co.uk/default.aspx?catid=80&pagetype=90

From 2016: http://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Airports/Datasets/UK-airport-data/

Appendix B: Summary of Annual Monitoring Results 1999 to 2016.

Nitrogen Dioxide

Site	Parameter	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
RG1	Ann. Average (µg m^{-3})	-	-	34.1	31.3	31.4	30.5	29.1	29.4	28.9	26.9	25.3	28.9	21.1	22.7	21.7	21.8	21.1	20.3
RG2	Ann. Average (µg m^{-3})	-	-	-	-	-	33.8	34.3	32.4	33.8	32.4	31.3	31.2	28.8	31.2	28.5	28.5	26.4	28.6
RG3	Ann. Average (µg m^{-3})	-	-	-	-	-	-	-	19.4	20.9	18.9	18.2	20.5	17.8	23.2	19.3	17.5	14.0	16.7
LGW3	Ann. Average (µg m^{-3})	52.3	49.2	49.1	47.0	46.0	35.5	34.2	40.3	40	34.8	34.3	36.8	32.3	33.4	32.0[c]	30.6[c]	28.2[c]	29.8[c]
RB59	Ann. Average (µg m^{-3})	-	-	-	-	40	39	34	37	38	35	32	32	26	32	28	27	25	29
RG1	Data Capture (%)	-	-	99.0	100.0	99.7	99.6	98.0	98.5	99.1	99.4	100.0	91.4	99	99.5	99.5	89.1	98.6	98.9
RG2	Data Capture (%)	-	-	-	-	-	89.0	97.0	96.0	96.3	92.8	95.0	92.4	88.5	85.1	99.3	99.4	98.7	97.6
RG3	Data Capture (%)	-	-	-	-	-	-	-	97.8	98.8	99.2	99.0	97.5	92.3	99.4	96.9	99.4	99.3	98.2
LGW3	Data Capture (%)	93.3	93.4	93.5	96.1	94.0	95.4	96.7	96.3	94.3	96.8	93.7	99.2	96.4	94.7	99.2	99.2	99.4	99.1
RB59	Data Capture (%)	-	-	-	-	91.6	100	91.6	100	100	100	100	100	91.6	100	100	100	100	91.6
RG1	Hours Over 200 µg m^{-3}	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0[b]	0	0
RG2	Hours Over 200 µg m^{-3}	-	-	-	-	-	0	0	0	0	0	0	0	0[b]	0[b]	0	0	0	0
RG3	Hours Over 200 µg m^{-3}	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
LGW3	Hours Over 200 µg m^{-3}	1	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
RB59	Hours Over 200 µg m^{-3}	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Particulate Matter (PM_{10})

Site	Parameter	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
RG1	Ann. Average (µg m^{-3})	-	-	22.8	23.2	25.7	22.3	22.4	23.8	23.3	20.5	19.4	18.7[a]	21.1	19.5	18.7	18.7	19.0	17.5
	Ann. Average VCM* (µg m^{-3})								21.2	22.0	19.7	18.0	19.7	21.7	19.4	20.1	18.7	19.2	16.5
LGW3	Ann. Average (µg m^{-3})	31.0	28.7	27.2	27.8	27.8***	23.8***	24.2***	23.3	25.3	23.4	22.3	21.6	22.7	21.9	23.8[c]	24.5[c]	22.5[c]	21.5[c]
	Ann. Average VCM* (µg m^{-3})								21.1	23.7	21.8	20.9	22.0	23.0	22.0	22.9[c]	23.6[c]	21.6[c]	17.0[c]
RG1	Data Capture (%)	-	-	99.7	100	99.5	100	100	99.4	99.3	99.0	100	73.1	97.8	98.1	98.9	100	80.2	97.9
	Data Capture VCM** (%)								96.4	98.1	99.0	99.1	73.1	98.6	98.1	98.1	99.0	80.2	97.9
LGW3	Data Capture (%)	91.5	92.9	97.3	99.2	97.3	97.3	97.3	96.2	95.1	93.4	85.7	97.2	100	98.9	99.0	97.8	100	93.0
	Data Capture VCM** (%)								93.6	93.6	93.4	85.7	97.2	99.5	98.9	99.0	97.8	100	93.0
RG1	No. days over 50 µg m^{-3}	-	-	6	6	16	0	3	5	9	4	0	0[b]	1	2	1	0	1[b]	1
	No. days over 50 µg m^{-3} (VCM)								6	18	5	2	0[b]	9	7	2	4	3[b]	3
LGW3	No. days over 50 µg m^{-3}	35	28	20	17	31***	10***	9***	7	18	13	0[b]	3	1	6	7[c]	10[c]	5[c]	6[c]
	No. days over 50 µg m^{-3} (VCM)								10	23	16	2[b]	4	19	15	11[c]	14[c]	7[c]	7[c]

Locations:

RG1 is located on the Horley Gardens Estate in Michael Crescent (NE of the Airport).

RG2 is located on the Horley Gardens Estate in The Crescent (NE of the Airport).

RG3 is located to the SW of the airport in Poles Lane, Crawley.

RB59 is a diffusion tube (not a real time site) located at the southern most end of the Horley Gardens Estate to the NE of the Airport.

*for details on volatile correction methodology see www.volatile-correction-model.info. Spreadsheets downloaded 05/05/09 for values to 2009. From 2009 data direct from London Air Website www.londonair.org.uk.

** as the VCM requires data from three other sites VCM data capture can be lower than from the site of interest.

*** figures have been revised down as data originally supplied for these 3 years was incorrect. Correction made in July 2010 report.

[a] data capture under 75 %. Therefore these values cannot be compared to the relevant air quality standard.

[b] data capture under 90 %. Therefore these values cannot be compared to the relevant air quality standard. Data shown will be minimum number of hours or days depending on standard.

[c] pier 1 on the south terminal closed 8th April 2013 for redevelopment. Thus values from 2013 onwards not necessarily comparable to pre 2013 values.

Appendix C.

Figure C.1: 3 Year Rolling Mean Nitrogen Dioxide Concentrations at Background sites and RB59.

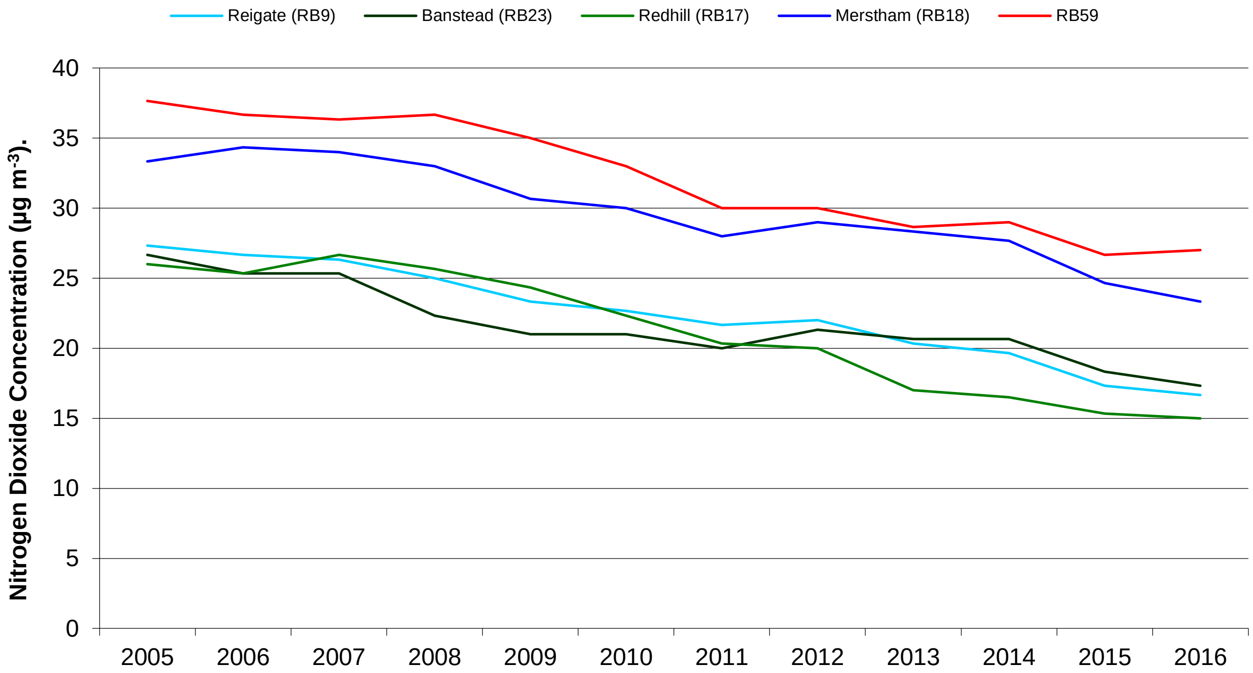
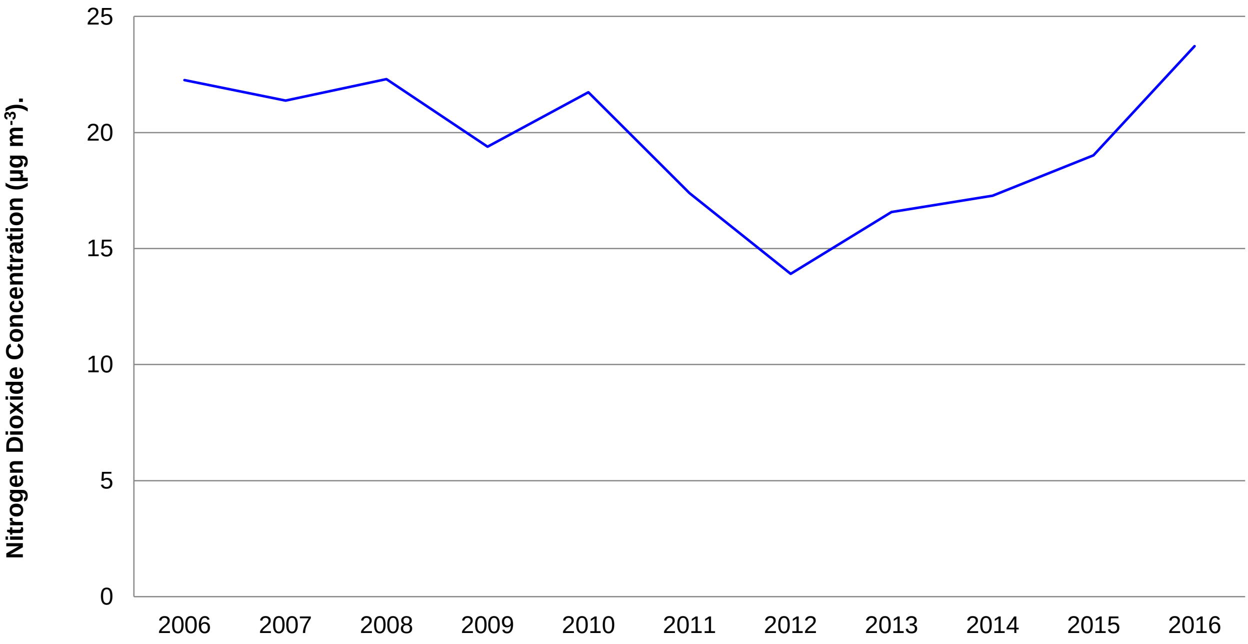


Figure C.2: RG2 minus RG3 when wind on 202 to 248 degrees - Mean of hourly values.



Abbreviations and Definitions.

AQMA	Air Quality Management Area.
GAL	Gatwick Airport Limited.
m^3	cubic metre.
mg	milligram (1 thousandth of a gram).
NETCEN	National Environmental Technology Centre, UK.
ng	nanogram (1 billionth of a gram).
nm	nanometre (1 billionth of a metre or 1 millionth of a millimetre)
NO_2	Nitrogen Dioxide.
NO_x	Oxides of Nitrogen (mainly NO and NO_2 expressed as NO_2 equivalent).
O_3	Ozone.
PM	Particulate Matter.
PM_{10}	Essentially particles under 10 µm in diameter. Officially defined as the size fraction below 10µm in aerodynamic diameter, which has a cut off point at 50% of the particles which are 10µm in aerodynamic diameter.
$PM_{2.5}$	Essentially particles under 2.5 µm in diameter.
ppb	part(s) per billion.
ppm	part(s) per million.
TEOM	Tapered Element Oscillating Microbalance. (Device for measuring PM_{10} concentrations in real time).
µg	microgram (1 millionth of a gram).
µg/m^3	microgram(s) per cubic metre
µg m^{-3}	microgram(s) per cubic metre, This scientifically is the correct form to use rather than µg/m^3, though either can be used.
µm	micrometre (1 millionth of a metre or 1 thousandth of a millimetre)
VCM	Volatile Correction Method. (used to correct PM_{10} measurements made using a TEOM. This results in data equivalent to measurements made using the European Union's 'preferred' PM_{10} monitoring technique).