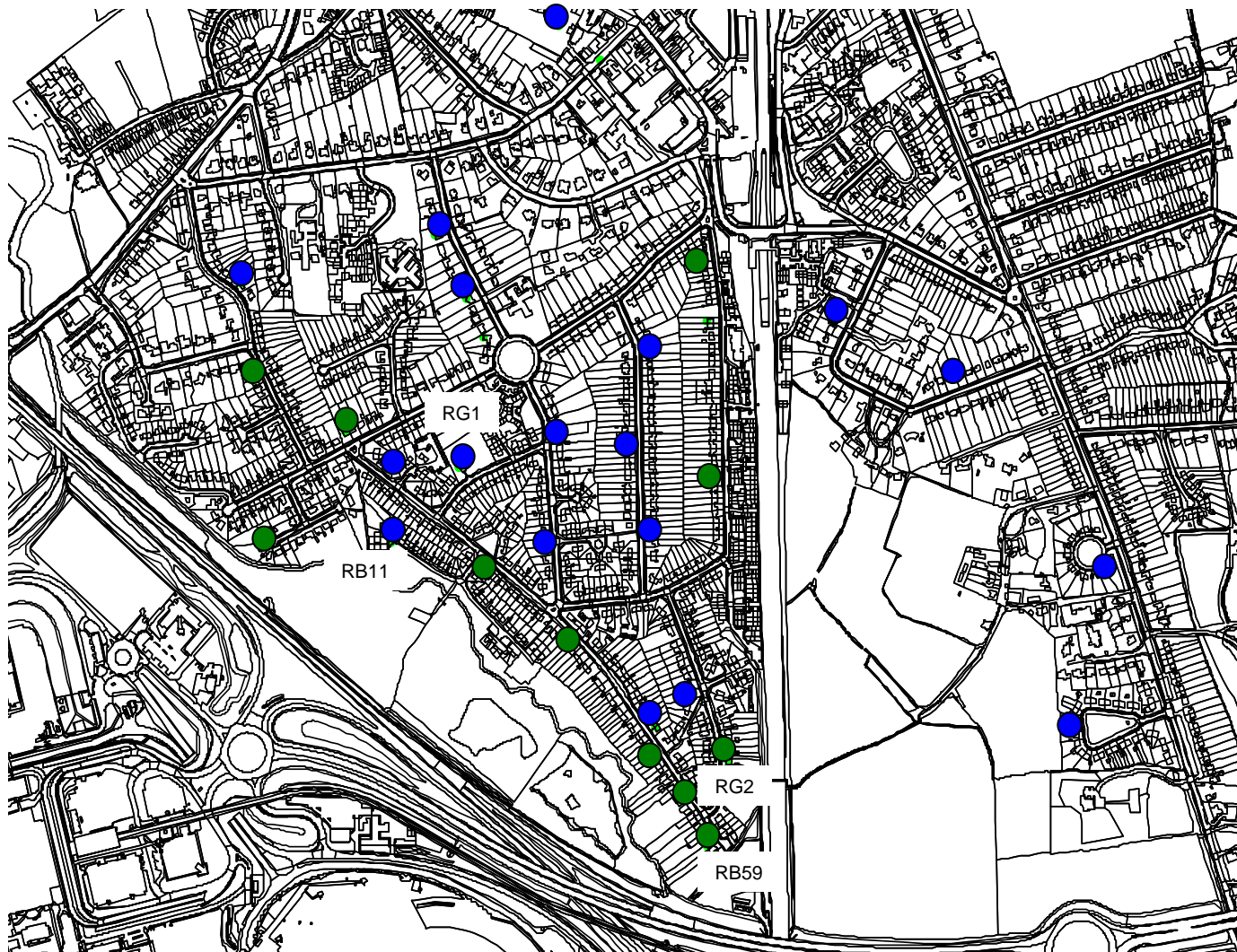


Air Quality Monitoring: Joint Report by RBBC and BAAG for 2010.

1. The following report presents the results from the 2010 air pollution monitoring program undertaken on, and in the vicinity of, Gatwick Airport.
2. Committee members are reminded that details of:
 - the legislation,
 - the rationale for the monitoring of certain pollutants,
 - 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.

Off Airport Monitoring at Relevant Receptors on the Horley Gardens Estate. Annual Compliance Monitoring – Nitrogen Dioxide.

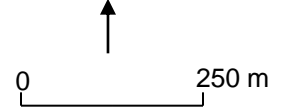
3. The annual average concentration of nitrogen dioxide across the Horley Gardens Estate in 2010 is shown in Figure 1.
4. Concentrations were below the UK annual average objective of 40 $\mu\text{g m}^{-3}$ (micrograms per cubic metre), and so the UK air quality standards were met within the Horley air quality management area (AQMA) in 2010.
5. The highest concentrations measured on the estate were 32.4 $\mu\text{g m}^{-3}$ at two sites towards the southern end of The Crescent, including the 'worst case' receptor at RB59, and 34.5 $\mu\text{g m}^{-3}$ on Cheyne Walk.
6. Local sources of pollution on the estate remained unchanged throughout 2010, and so the results are comparable to previous years monitoring work.
7. Data capture from the real time monitoring site RG1 was 91.4 %, and from site RG2 92.4 %, and so the data from these sites, along with the diffusion tube data is valid for compliance monitoring purposes.
8. The results from 2010, as in previous years, are in line with the predicted distribution of nitrogen dioxide concentrations for the Horley Gardens Estate with elevated concentrations towards the southeast corner of the estate. Concentrations in 2010 were around 2 to 3 $\mu\text{g m}^{-3}$ higher than in 2009 across much of the Horley Gardens Estate and Hookwood, and 6 $\mu\text{g m}^{-3}$ higher in Smallfields, although similar increases were seen elsewhere in Reigate, Banstead, Merstham, and nationally, and simply reflects the natural year to year variation due to the weather rather than a specific change related to the airport.
9. Passenger numbers and aircraft movements at Gatwick declined by 3.1 % and 4.5 % respectively in 2010, compared to 2009 (Appendix A). Since 2007, when passenger numbers and aircraft movements peaked, passenger numbers have fallen by 10.9 % and aircraft movements by 9.7 %, reducing nitrogen dioxide concentrations in the vicinity of the airport by 2 to 3 $\mu\text{g m}^{-3}$ at the worst affected properties.



Key:

- 20.1 to 25 $\mu\text{g m}^{-3}$
- 25.1 to 30 $\mu\text{g m}^{-3}$
- 30.1 to 35 $\mu\text{g m}^{-3}$
- 35.1 to 40 $\mu\text{g m}^{-3}$
- 40.1 to 44 $\mu\text{g m}^{-3}$

North



Other sites in the vicinity of the Of the Airport:

- Charlwood: 14 $\mu\text{g m}^{-3}$
(Russ Hill)
- Hookwood: 24 $\mu\text{g m}^{-3}$
(Withey Meadows)
- Smallfield: 31 $\mu\text{g m}^{-3}$
(Ontario Close)

Comparable sites elsewhere within the Borough:

- Reigate: 24 $\mu\text{g m}^{-3}$
- Banstead: 23 $\mu\text{g m}^{-3}$
- Redhill: 24 $\mu\text{g m}^{-3}$
- Merstham: 31 $\mu\text{g m}^{-3}$

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Figure 1: Monitoring Results for Nitrogen Dioxide Concentrations across the Horley Gardens Estate in 2010.

Tube Correction Factor = 1.05 (n=12).

Annual Compliance Monitoring – PM₁₀.

10. The PM₁₀ air quality standard was met on the Horley Gardens Estate in 2010, with an annual average concentration at RG1 of 19 µg m⁻³, which was within the expected range of 18 to 23 µg m⁻³. An instrument fault in 2010 meant that technically insufficient data was collected (73 % compared to the required 75 %) for comparisons to be made to the air quality standard, but based on the data collected at RG1 and LGW3 (where a valid data set was collected) there is no reason to suspect that the air quality standard was not met nor that the calculated annual mean is unrealistic.

Trends in Pollutant Concentrations.**Nitrogen dioxide.**

11. 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, and the data to date (Figure 2) shows that the once clear downward trend in annual average nitrogen dioxide concentrations at the RG1 site has (in 2010 at least) begun to level off.
12. At the 'worst case' receptors closer to the airport (RG2, RB59) the downward trend continued in 2010, reflecting the further reduction in passenger numbers and aircraft movements.
13. The 'levelling off' in nitrogen dioxide concentrations at RG1 where non airport sources of pollution dominate, is most likely a result of the unusually low concentrations in 2009 affecting the three year rolling average. If this is the case then the downward trend in concentrations should resume in 2011, and computer modelling indicates further reductions in non airport sources of nitrogen dioxide should continue until at least 2015 driven mainly by improvements in road vehicle engine technology.

PM₁₀.

14. It is important to note that the airport is not a significant source of PM₁₀, and computer modelling¹ consistently indicates that the airport is responsible for no more than 1 – 2 µg m⁻³ of the total PM₁₀ concentration at the worst affected properties on the Horley Gardens Estate.
15. The main purpose of monitoring PM₁₀ on the Horley Gardens Estate is to examine trends in the PM₁₀ concentration, as the UK Government is aiming to reduce people's exposure to particulate matter in the longer term even where the air quality standards are met.
16. Using a three year rolling average to examine the trends in the data there is evidence of a 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 PM₁₀ has occurred in the last 3 years.

¹ Gatwick Air Quality Assessment for 2010 (AEAT/ENV/R/2795/Issue 1 – June 2009)

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).

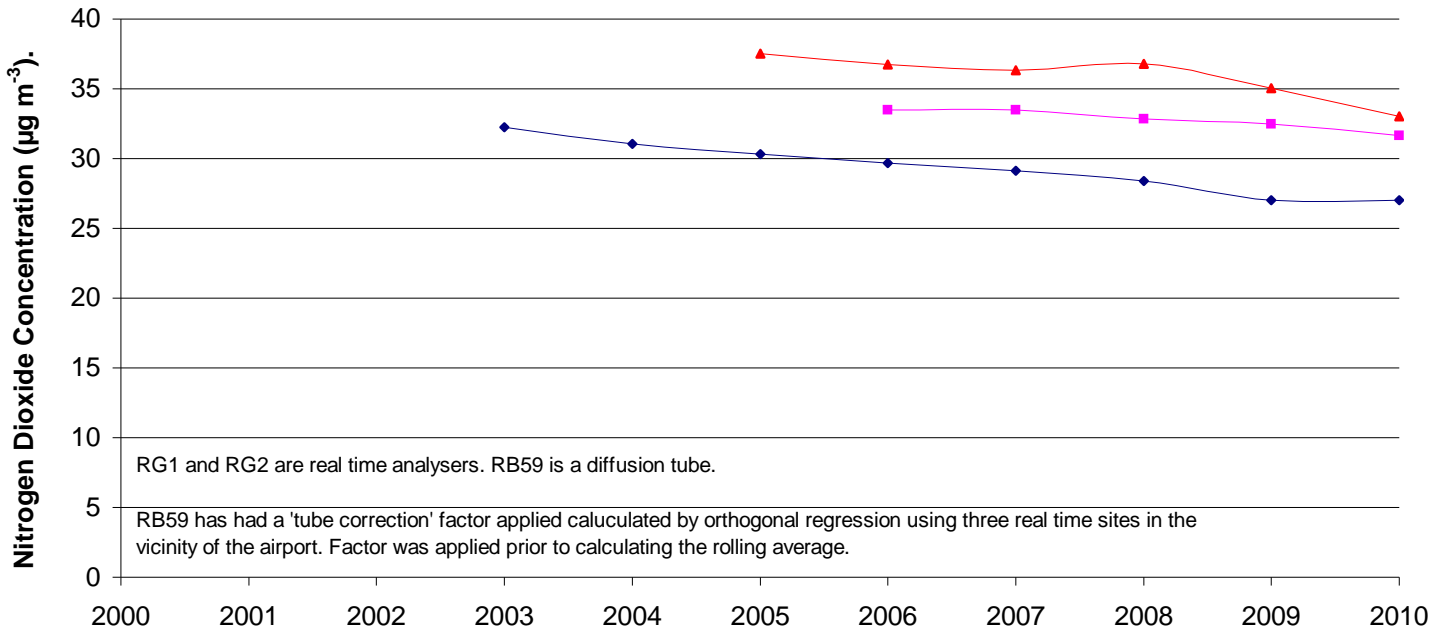
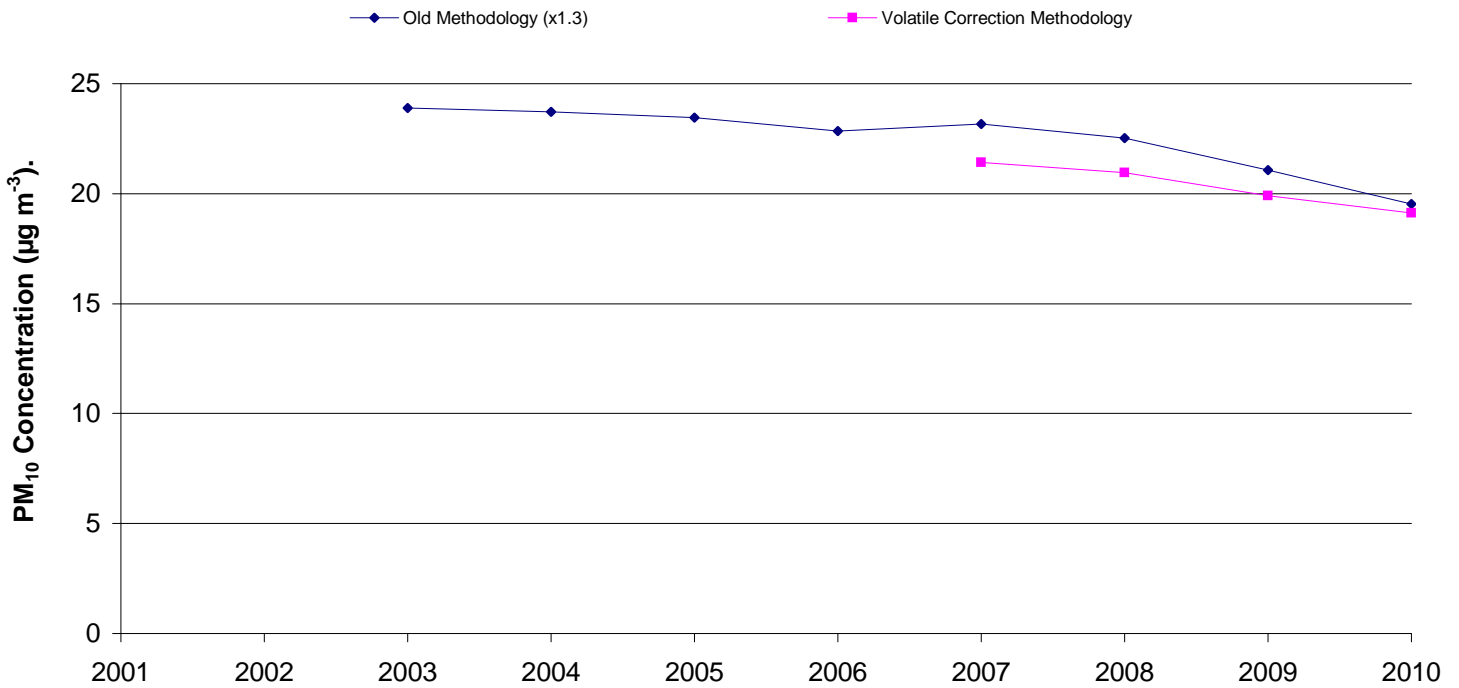


Figure 3: Three Year Rolling Annual Average PM_{10} Concentration at RG1, Michael Crescent, Horley.



On Airport Monitoring.

17. In the absence of relevant receptors² at the airport monitoring sites, it is largely academic whether or not the air quality standards are breached. However the monitoring results from 2010 (Table 1) indicate that the standards were met at the LGW3 monitoring station for PM₁₀, carbon monoxide, and nitrogen dioxide.

	On Airport (LGW3)	Standard	Standard Met?
Annual Average nitrogen dioxide Concentration	36.8	40	Yes
Nitrogen Dioxide: No. of hours over 200 µg m ⁻³	0	18	Yes
Annual Average PM ₁₀ Concentration (Volatile Correction Method)	21.6 (22.0)	40	Yes
PM ₁₀ : No. of days over 50 µg m ⁻³ (Volatile Correction Method)	3 (4)	35	Yes
Carbon Monoxide (Maximum daily running 8 hour mean)	2.1	10	Yes
All concentrations are in µg m ⁻³ , except Carbon Monoxide mg m ⁻³ . Data Capture: Nitrogen Dioxide 99.2 %, PM ₁₀ 97.2 %, CO 98.9 %.			

Table 1: Nitrogen Dioxide, PM₁₀, and Carbon Monoxide Concentrations on Airport in 2010.

18. 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.

19. During 2010 there were no changes of note in on airport sources of air pollution, aside from the decrease in passenger numbers and aircraft movements, and thus the results are comparable to 2009. The eruption of the Eyjafjallajökull volcano in Iceland closed the airport from 15th to 20th April 2010, but this was too short a period to have a significant impact on any of the annual average concentrations.

On Airport Pollutant Trends.

20. 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 in 2009 and 2010 have resumed a downward trend.

21. 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.

² '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.

22. Annual mean nitrogen dioxide concentrations increased in 2010 compared to 2008 and 2009, although the increase of $2.5 \mu\text{g m}^{-3}$ was comparable to that seen elsewhere in Reigate and Banstead, and so reflects a regional increase in pollution driven by the weather rather than an increase due to activities on the airport. While it is difficult to compare annual average nitrogen dioxide concentrations given the impact of the weather, it is surprising that concentrations in 2010 at LGW3 increased by so much given the 4.5 % fall in aircraft movements between 2009 and 2010, which at the RG2 and RB59 sites appears to have 'off set' (Appendix B) some of the weather driven increase in nitrogen dioxide.
23. 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 which has continued in 2010.

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

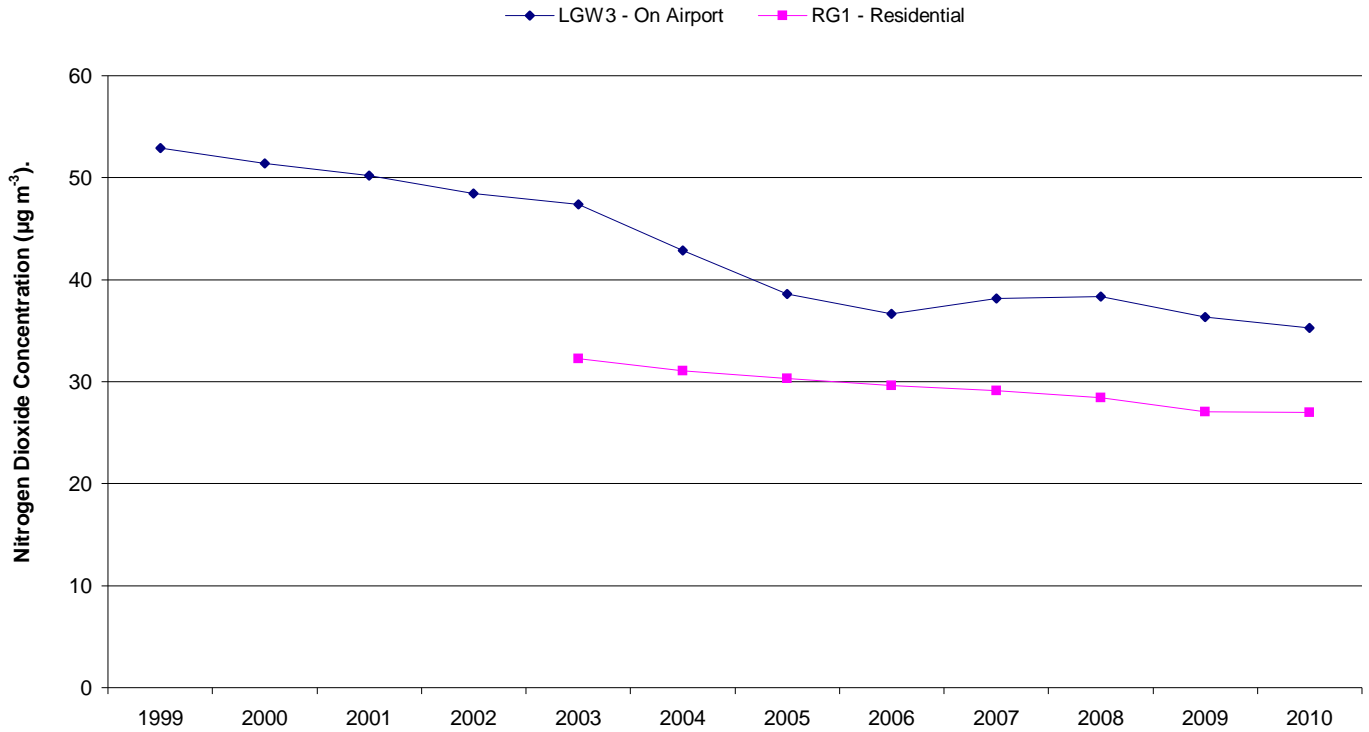
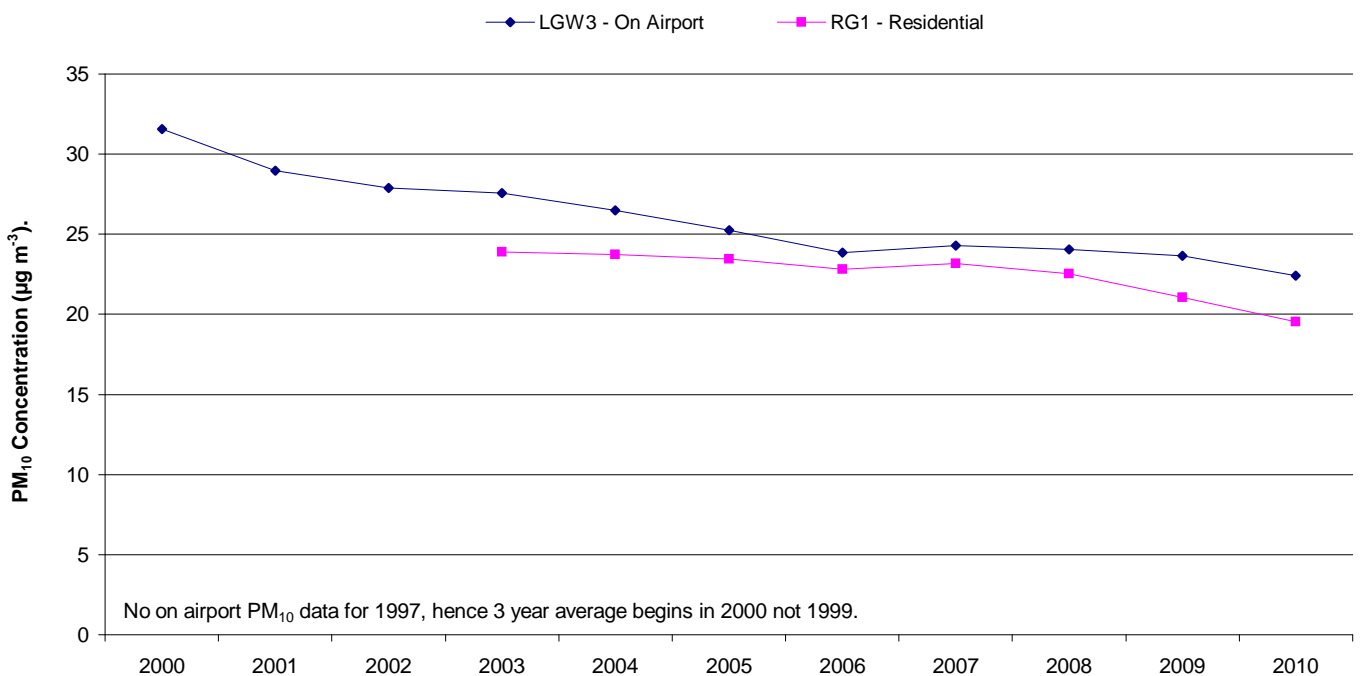


Table 2: Annual and Three Year Annual Average Nitrogen Dioxide Concentrations (µg m⁻³).

LGW3	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
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
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
Hours Over 200 µg m ⁻³	2	0	1	1	0	0	2	0	0	0	1	0	0	0
3 Year Rolling Average	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
3 Year Rolling Average	RG1						32.3	31.1	30.3	29.6	29.1	28.4	27.0	27.0

Figure 5: Three Year Rolling Annual Average PM₁₀ Concentration at LGW3, Gatwick Airport.



Benzene Monitoring Data.

24. The concentration of benzene is measured at one site (RB11) on the Horley Gardens Estate. As expected measurements met the air quality standard in 2010 (Table 3), and were slightly lower than those measured in 2009.

	Concentration ($\mu\text{g m}^{-3}$)	Standard	Standard Met?
Annual Average Benzene Concentration: Residential	1.8	5	Yes

Table 3: Annual Average Benzene Concentrations on the Horley Gardens Estate at RB11 (Non pumped BTEX Tubes).

25. Benzene concentrations are no longer measured on airport, but based on measurements made in previous years it is likely that the air quality standards were met.

Additional Monitoring Data.**Ozone.**

26. 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.

27. Although the airport is not responsible for local ozone pollution, 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.

28. At present there are four and a half years of data from the ozone monitor and so the trend analysis using a three year rolling average currently only has two data points. Although this shows a flat trend (data not shown), with so few data points no meaningful conclusions can be drawn at this stage.

29. Compared to the air quality standards ozone concentrations failed to meet the UK ozone objective for the 5th consecutive year, although the EU standard (which is less strict) was met in 2010 (Table 4).

	Number of exceedences.	Standard Met?	
		UK ^a	EU ^b
RG3: Poles Lane Crawley.	22 ^a / 10 ^b	No	Yes
Standards:			
UK: Daily Max. of running 8 hour mean of $100 \mu\text{g m}^{-3}$.	10 max.	-	-
EU: Daily Max. of running 8 hour mean of $120 \mu\text{g m}^{-3}$ (averaged over 3 years).	25 max.	-	-
^a in 2009			
^b The EU standard is averaged over 3 years i.e. 2008, 2009, and 2010.			

Table 4: Number of exceedences of the Ozone standard in 2010.

Airborne Organic Compounds.

30. BAA Gatwick have undertaken a series of 'grab' samples in previous years to look at a range of organic pollutants. As samples were only taken on four days per year the results were of limited use in examining pollutant trends at the airport, and could not be used for compliance monitoring purposes. Therefore the airport ceased to collect such samples at the end of 2006.

Summary.

31. In summary:

- i) The annual average air quality standard for nitrogen dioxide was met at relevant receptors in the vicinity of the airport during 2010 (Table 5), as were the air quality standards for other pollutants under the local authority air quality management regime (Table 5).
- ii) Ozone concentrations in the vicinity of the airport did not meet the UK air quality standard for the 5th consecutive year, 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 (RB59) show a downward trend over the last three years, although the long term downward trend at the 'background' site (RG1) levelled off in 2010. The long term decrease in pollution at the background site is most likely due to improvements in road vehicle emissions, with the apparent lack of improvement in 2010 a result of the abnormally low concentrations in 2009 due to the weather, while the more recent falls at the worst case receptor(s) reflect the significant falls in aircraft movements and passenger numbers over the last three years. The long term downward trend at the RG1 site (2010 excepted) 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 2010 at LGW3 meets the UK air quality objective of $40 \mu\text{g m}^{-3}$. The concentrations of the other pollutants measured at LGW3 also met the relevant air quality standards.
- v) The three year rolling annual average trend analysis of the on airport nitrogen dioxide concentrations shows a decrease in concentrations between 2008 and 2010, with concentrations in 2010 the lowest to date.
- vi) The average PM_{10} concentration measured on airport in 2010 showed a slight decrease compared to 2009 (non VCM measurement), although this improvement is unlikely to be related to the reduction in passenger traffic at the airport as a similar improvement was seen off airport.
- vii) PM_{10} measurements made using the volatile correction methodology (VCM) in 2010 were unusual in that they did not track the measurements made using the 'old' technique as in previous years, and even showed a slight increase in concentrations from 2009. This reflected an influx of semi volatile material from Europe in 2010, which the VCM method is designed to measure.

	Measured value	Standard	Standard Met?
Nitrogen Dioxide:			
Highest measured annual average residential concentration.	34.7	40	Yes
Annual Average nitrogen dioxide concentration Airport monitor.	36.8	40	Yes
PM₁₀:			
Annual Average PM ₁₀ Concentration: Residential Monitor. (VCM value)	18.7* (19.7*)	40	Yes
PM ₁₀ : No. of days over 50 µg m ⁻³ : Residential Monitor. (VCM value)	0** (0**)	35	Yes
Annual Average PM ₁₀ Concentration: Airport Monitor. (VCM value)	21.6 (22.0)	40	Yes
PM ₁₀ : No. of days over 50 µg m ⁻³ : Airport Monitor. (VCM value)	3 (4)	35	?*
Benzene:			
Residential Benzene Monitor (Site RB 11).	1.8	5	Yes
Ozone:			
RG3 Monitor to SW of Airport (Number of exceedences).	22	10	No
All concentrations are in µg m ⁻³ . PM ₁₀ data capture was 73.1 % in 2010. ***Data capture must be over 75% (*) or 90%(**) for comparison to the air quality objective			

Table 5: Summary of Air Quality in the Vicinity of Gatwick Airport in 2010.

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

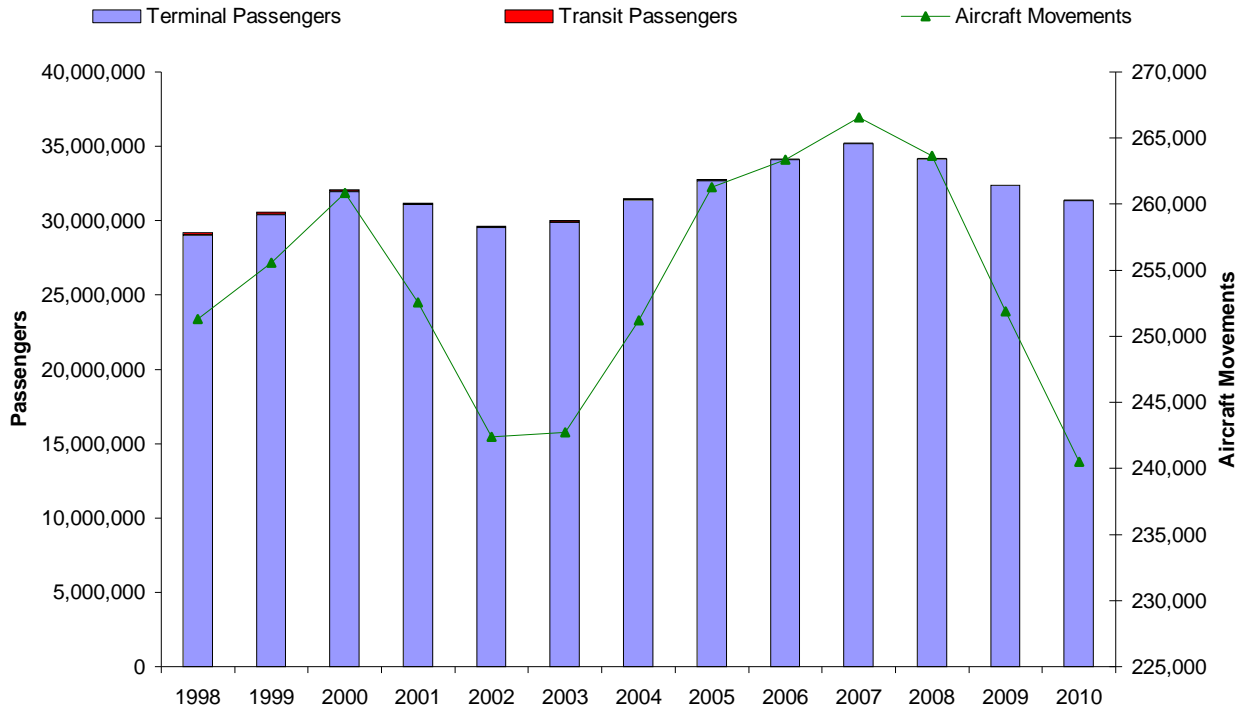


Table A.1: Annual Passenger Numbers and Aircraft Movements at Gatwick Airport.

	Number of Passengers			No. of Aircraft Movements
	Terminal	Transit	Total	
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

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

Appendix B: Summary of Annual Monitoring Results 1999 to 2010.

Nitrogen Dioxide

Site	Parameter	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
RG1	Ann. Average ($\mu\text{g m}^{-3}$)	-	-	34.1	31.3	31.4	30.5	29.1	29.4	28.9	26.9	25.3	28.9
RG2	Ann. Average ($\mu\text{g m}^{-3}$)	-	-	-	-	-	33.8	34.3	32.4	33.8	32.4	31.3	31.2
RG3	Ann. Average ($\mu\text{g m}^{-3}$)	-	-	-	-	-	-	-	19.4	20.9	18.9	18.2	20.5
LGW3	Ann. Average ($\mu\text{g m}^{-3}$)	52.3	49.2	49.1	47.0	46.0	35.5	34.2	40.3	40	34.8	34.3	36.8
RB59	Ann. Average ($\mu\text{g m}^{-3}$)	-	-	-	-	40	39	34	37	38	35	32	32
RG1	Data Capture (%)	-	-	99.0	100.0	99.7	99.6	98.0	98.5	99.1	99.4	100.0	91.4
RG2	Data Capture (%)	-	-	-	-	-	89.0	97.0	96.0	96.3	92.8	95.0	92.4
RG3	Data Capture (%)	-	-	-	-	-	-	-	97.8	98.8	99.2	99.0	97.5
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
RB59	Data Capture (%)	-	-	-	-	91.6	100	91.6	100	100	100	100	100
RG1	Hours Over $200 \mu\text{g m}^{-3}$	-	-	0	0	0	0	0	0	0	0	0	0
RG2	Hours Over $200 \mu\text{g m}^{-3}$	-	-	-	-	-	0	0	0	0	0	0	0
RG3	Hours Over $200 \mu\text{g m}^{-3}$	-	-	-	-	-	-	-	0	0	0	0	0
LGW3	Hours Over $200 \mu\text{g m}^{-3}$	1	1	0	0	2	0	0	0	1	0	0	0
RB59	Hours Over $200 \mu\text{g m}^{-3}$	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Particulate Matter (PM₁₀)

RG1	Ann. Average ($\mu\text{g m}^{-3}$)	-	-	22.8	23.2	25.7	22.3	22.4	23.8	23.3	20.5	19.4	18.7 ^a
	Ann. Average VCM* ($\mu\text{g m}^{-3}$)								21.2	22.0	19.7	18.0	19.7
LGW3	Ann. Average ($\mu\text{g m}^{-3}$)	31.0	28.7	27.2	27.8	27.8***	23.8***	24.2***	23.3	25.3	23.4	22.3	21.6
	Ann. Average VCM* ($\mu\text{g m}^{-3}$)								21.1	23.7	21.8	20.9	22.0
RG1	Data Capture (%)	-	-	99.7	100	99.5	100	100	99.4	99.3	99.0	100	73.1
	Data Capture VCM** (%)								96.4	98.1	99.0	99.1	73.1
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
	Data Capture VCM** (%)								93.6	93.6	93.4	85.7	97.2
RG1	No. days over $50 \mu\text{g m}^{-3}$	-	-	6	6	16	0	3	5	9	4	0	0****
	No. days over $50 \mu\text{g m}^{-3}$ (VCM)								6	18	5	2	0****
LGW3	No. days over $50 \mu\text{g m}^{-3}$	35	28	20	17	31***	10***	9***	7	18	13	0****	3
	No. days over $50 \mu\text{g m}^{-3}$ (VCM)								10	23	16	2****	4

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.

**** note this is the minimum number of days. As data capture is below 90 % these values cannot be compared to the relevant air quality standard.

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

Abbreviations and Definitions

AQMA	Air Quality Management Area.
CO	Carbon Monoxide.
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).
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.
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.
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.