Air Quality Monitoring: Joint Report by RBBC and GAL for 2019.

1. The following report presents the results from the 2019 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 2019 is shown in Figure 1.

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 43 µg m^{-3} in 2019 (also 43 µg m^{-3} in 2018).

5. The additional monitoring introduced on the A23 in 2016 to examine the spatial extent of the non attainment along this section of road (the four dots along the A23 NE of RB149) continue to demonstrate 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.

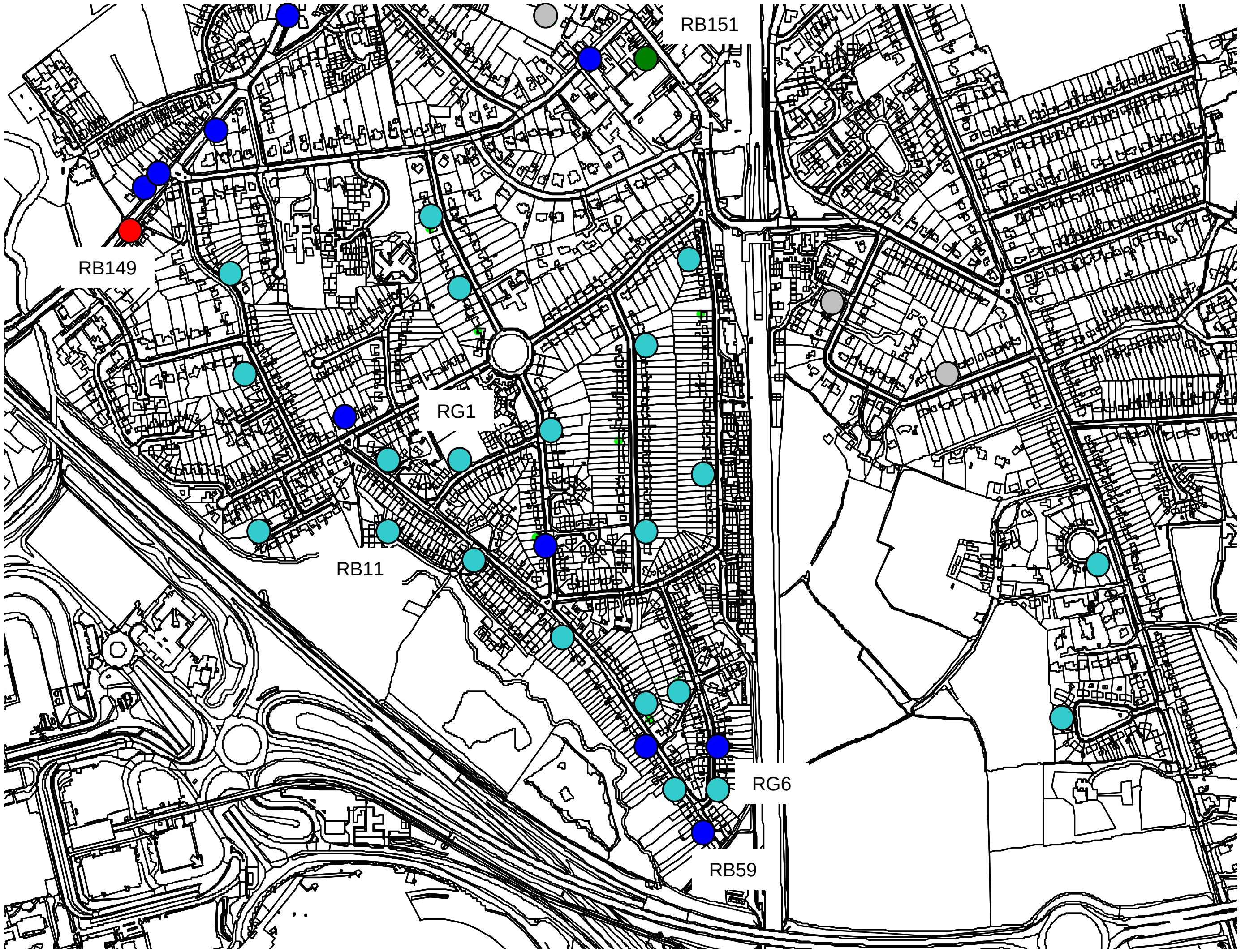
6. On Victoria Road (RB151) nitrogen dioxide concentrations were 33 µg m^{-3} (29 µg m^{-3} in 2018), while the highest concentration measured on the Horley Gardens Estate was 26 µg m^{-3} at the RB59 'worst case' receptor and at two other sites (RB58 and RB60), all located towards the southern end of The Crescent. This compares to the highest concentration in 2018 of 27 µg m^{-3} and 28 µg m^{-3} in 2016.

7. Local sources of pollution on the estate remained unchanged throughout 2019, and so the results are comparable to previous years monitoring work.

8. Data capture from all of 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 2019 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 2019 were typically unchanged or marginally down on 2018 at the 'worst' affected residential premises. Elsewhere on the estate concentrations also remained largely unchanged, in line with a lack of any real change seen elsewhere in the borough. Thus the general lack of change in air quality seen in the vicinity of the airport in 2019 reflects the natural year to year variation due to the weather and / or regional changes rather than any specific change related to the airport.

[1] Contact GATCOM Secretariat for historical reports.



Key:

- 15.1 to 20 μg m^{-3}
- 20.1 to 25 μg m^{-3}
- 25.1 to 30 μg m^{-3}
- 30.1 to 35 μg m^{-3}
- 35.1 to 40 μg m^{-3}
- 40.1 to 45 μg m^{-3}
- 45.1 to 50 μg m^{-3}

North

0 250 m

Other sites in the vicinity of the of the Airport:

Charlwood: (Russ Hill)	16 μg m^{-3}
Hookwood: (Withey Meadows)	11 μg m^{-3}
Smallfield: (Ontario Close)	19 μg m^{-3}

Comparable sites elsewhere within the Borough:

Reigate:	16 μg m^{-3}
Banstead:	16 μg m^{-3}
Redhill:	16 μg m^{-3}
Merstham:	21 μg m^{-3}

Figure 1: Monitoring Results for Nitrogen Dioxide Concentrations across the Horley Gardens Estate in 2019.
Tube Correction Factor = 0.87 (n=9 min).

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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 2017 examining 2015 suggests around 22.9 % of the NO_x pollution at this site is airport related (14.3 % airport related road traffic, 8.6 % other airport sources).

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

12. Nitrogen dioxide concentrations in Charlwood and Hookwood rose slightly in 2019 (by 2 to 3 µg m^{-3}), but are similar to levels in 2017, while concentrations in Smallfield decreased by 1 µg m^{-3} in 2019.

13. Passenger numbers at Gatwick increased by 1.1 % in 2019 compared to 2018, while aircraft movements increased by 0.4 % over the same period (Appendix A), although they remain down 0.3% on 2017 levels. However while passenger numbers now exceed pre-recession levels by 32.3 %, aircraft movements are only 6.9 % above the 2007 peak.

14. Traffic flows on the M23 spur were difficult to determine in 2019, as the only data available is for 6 months eastbound which suggests a 4.6 % increase. However a degree of caution is needed given the roadworks and diversions that were in place during 2019. Traffic levels on the spur returned to pre recession levels during 2015, and in 2018 traffic flows were 8.6 % 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 2019 with an annual average concentration at RG1 of 15.9 µg m^{-3} (VCM methodology), which is the lowest annual average concentration recorded to date. Although this was an improvement on 2018 (17.1 µg m^{-3}) levels were similar in 2017 (16.2 µg m^{-3}). Nevertheless, concentrations since 2016 have consistently remained below the range of 18 to 23 µg m^{-3} that were typical until 2015.

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 2019.

17. At the 'worst case' receptors closer to the airport (RG2, RB59) the improvement in concentrations at RG2(6) continues, while at the RB59 site the downward trend has resumed although the apparent increase (2016-18) was driven by a relatively low concentration in 2015. The cause of the general convergence of the RB59 and the RG2 concentrations by 2011 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 also initially lead to further improvements in air quality especially at the RG2/RB59 sites, although by 2016 the majority if not all of the air quality improvements had occurred from non airport sources[5].

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[2] Air Quality Assessment – 2015 Emissions Inventory and Modelling. ARUP AQ-02 - 20th November 2017.
[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)
[5] Air Quality Monitoring: Joint report by RBBC and GAL for 2016 (appendix C). Report to GATCOM steering group June 2017.

19. The position of the monitoring stations around Gatwick means that it is possible to examine the nitrogen dioxide pollution coming from the airport and the A23 Airport Way when winds are from the SW, by subtracting the readings from the RG3 station to the SW of the airport from those made at the RG2 station to the NE of the airport (Figure C.1 - Appendix C).

20. Figure C.1 demonstrates that while the airport / A23 Airport Way had delivered significant reductions in pollution by 2012, by 2016 these improvements had been lost. The relocation of the RG2 site at the end of 2016 made direct comparisons difficult in 2017 but the 2019 data suggests that the rapid increase in nitrogen dioxide from the airport / Airport Way between 2012 and 2016 is now declining, although the nitrogen dioxide concentration on this wind direction is still similar to that in 2007.

PM_{10}.

21. It is important to note that the airport is not a significant source of PM_{10}, and computer modelling[6,7] consistently indicates that the airport is responsible for no more than 1 – 2 $\mu g\ m^{-3}$ of the total PM_{10} concentration at the worst affected properties on the Horley Gardens Estate.

22. 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[8] in the longer term even where the air quality standards are met.

23. 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 $\mu g\ m^{-3}$ in 2003 and 19.5 $\mu g\ m^{-3}$ in 2010 (Figure 3), although much of this improvement in non airport PM_{10} occurred between 2007 and 2010. From 2010 the overall trend was flat to 2015, with the slight rise between 2011 and 2013 largely an artefact of the elevated concentration measured in 2011, while from 2015 the downward trend has resumed with the lowest concentrations to date recorded in 2019.

[6] Air Quality Assessment – 2015 Emissions Inventory and Modelling. ARUP - AQ-02 - 20th November 2017.
[7] Gatwick Air Quality Assessment for 2010 (AEAT/ENV/R/2795/Issue 1 – June 2009)
[8] 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).

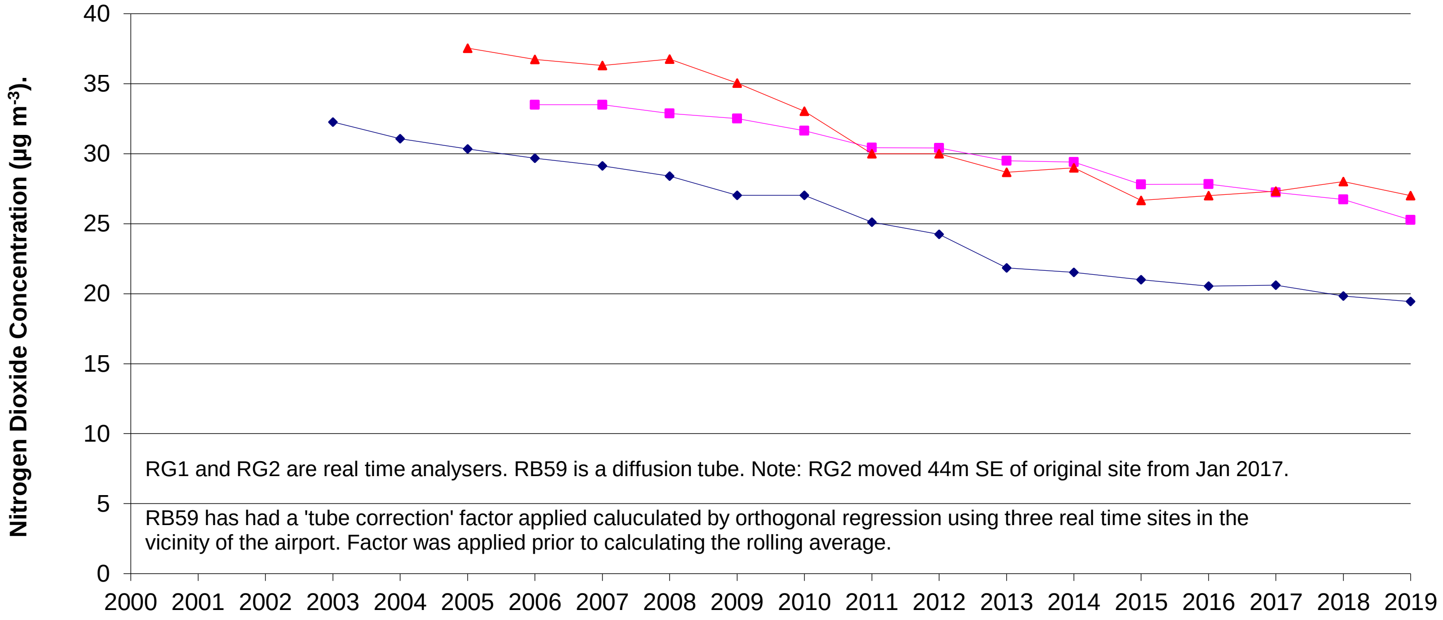
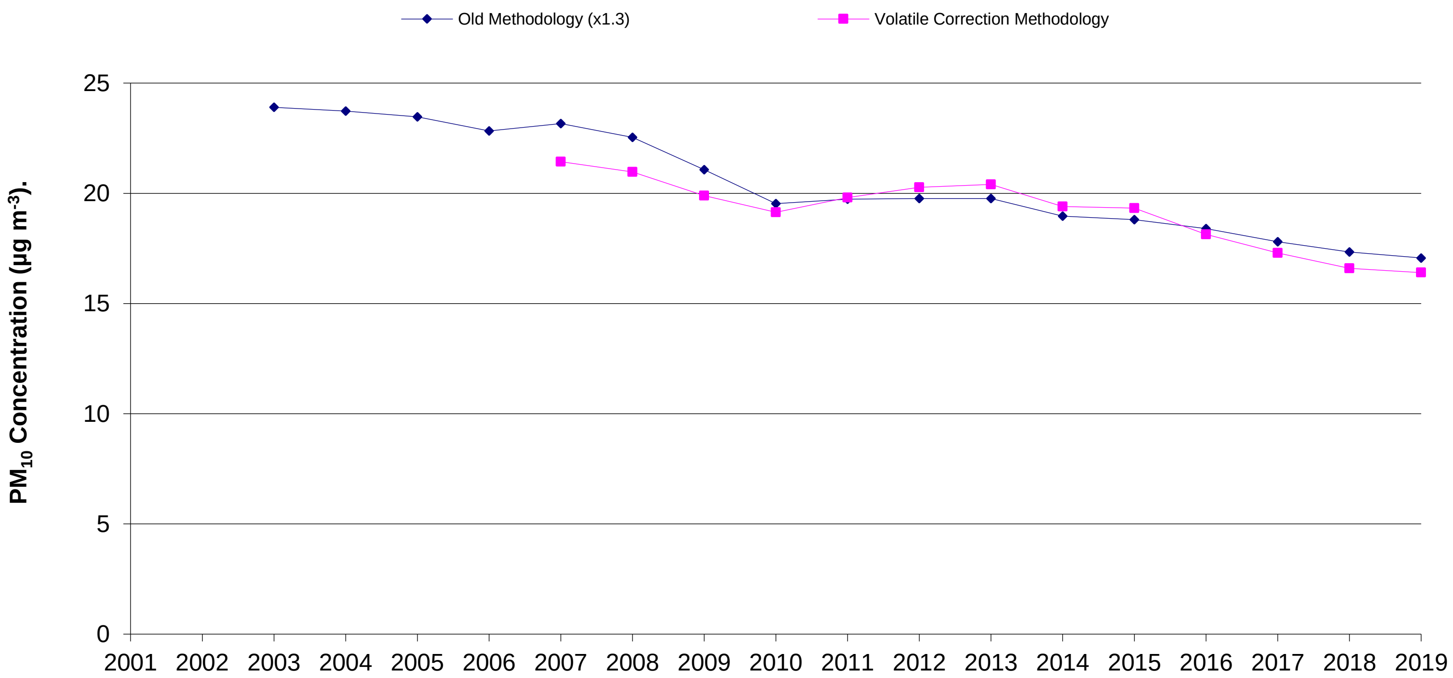


Figure 3: Three Year Rolling Annual Average PM_{10} Concentration at RG1, Michael Crescent, Horley.



On Airport Monitoring.

24. In the absence of relevant receptors[9] at the airport monitoring site, it is largely academic whether or not the air quality objectives are breached. However the monitoring results from 2019 (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	29.0	40	Yes
Nitrogen Dioxide: No. of hours over 200 µg m^{-3}	0	18	Yes
Annual Average PM_{10} Concentration Using FIDAS instrument*	14.4*	40	Yes
PM_{10}: No. of days over 50 µg m^{-3}	4	35	Yes

All concentrations are in µg m^{-3}.
Data Capture: Nitrogen Dioxide 91.3 %, PM_{10} 96.1 %.
*GAL replaced the TEOM PM_{10} analyser with a FIDAS instrument in 2019. For comparison purposes this value should be compared to the RG1 VCM value in Appendix B.

Table 1: Nitrogen Dioxide and PM_{10} Concentrations on Airport in 2019.

25. 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.

26. 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.

27. 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, the slight increase in 2018 resulted from a relatively low concentration in 2015 (as seen in the RB59 trend data) and fairly flat concentrations over the past three years.

28. 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.

29. Annual mean nitrogen dioxide concentrations at LGW3 fell by 0.8 µg m^{-3} in 2019, and while concentrations in general across Reigate and Banstead were largely unchanged concentrations also fell slightly at RG3 to the south west of the airport and at RG2. Given the reduction in the airport contribution seen in Appendix C this suggests that at least some of the improvement seen at LGW3 in 2019 could be due to a reduction in on airport emissions.

[9] '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.

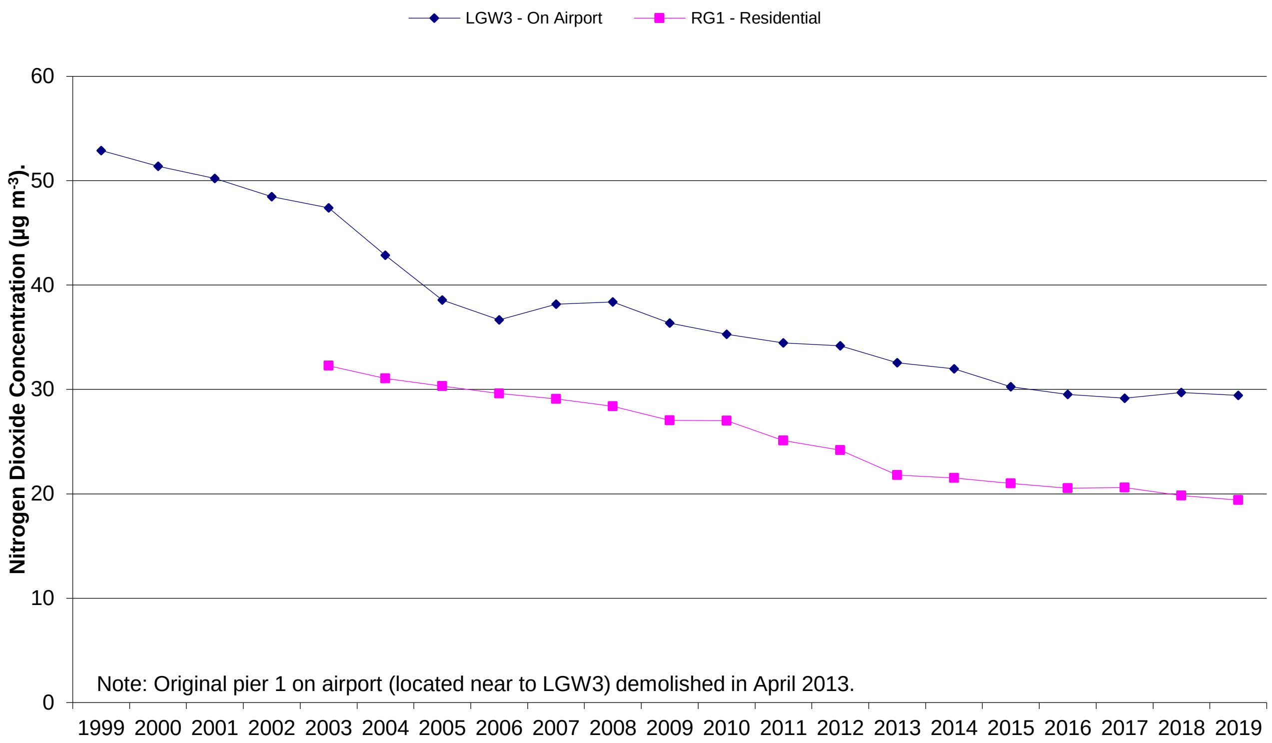
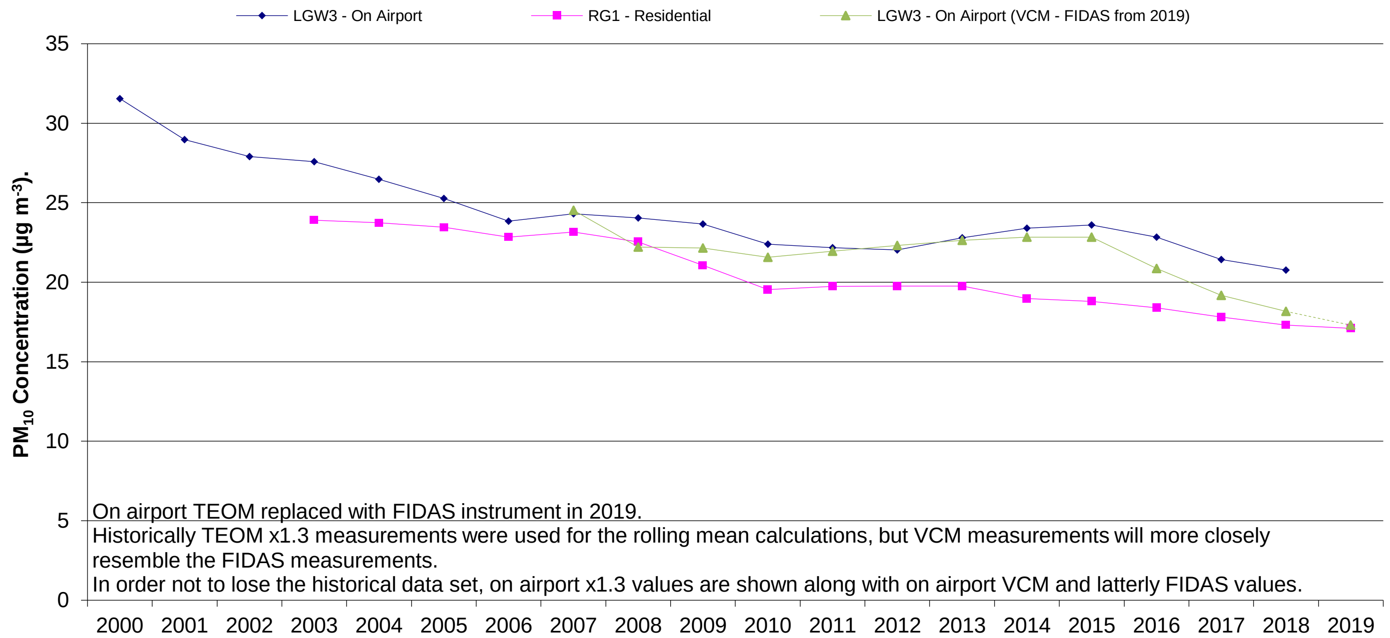


Table 2: Annual and Three Year Annual Average Nitrogen Dioxide Concentrations (µg m^{-3}).

LGW3	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ann. 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	29.5	29.8	29.0
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	99.5	98.9	91.3
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	0	0	0
3 Year Roll. 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	29.2	29.7	29.4
3 Year Roll. Av. RG1							32.3	31.1	30.3	29.6	29.1	28.4	27.0	27.0	25.1	24.2	21.8	21.5	21.0	20.5	20.6	19.8	19.4

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



30. 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 which continued in 2018.

31. In 2019 the airport replaced its existing TEOM PM_{10} monitoring equipment with a new FIDAS instrument. This new equipment uses a LED light to determine the particle mass rather than 'weighing' a filter as was previously the case. While a FIDAS instrument is a nationally recognised and approved method for PM_{10} measurement it nevertheless represents a change in how PM_{10} concentrations are measured on airport.

32. To assess the impact of the change in measurement technique the airport ran both instruments side by side for around 6 months in 2018. The results of this work (Appendix D) suggest that the new measurement technique gives a slightly lower reading than would have been the case with the old equipment. It is important to stress that the new equipment is approved for use on the UK national network, but it does mean that magnitude of the PM_{10} improvement seen at LGW3 (VCM measurement) in Figure 5 and Appendix B between 2018 and 2019 reflects both a genuine fall in PM_{10} concentrations (as also seen at the residential monitor) and also partially reflects the change in the measurement technique.

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 2019 (Table 3). Concentrations fell slightly at the residential site and were largely unchanged on airport compared to 2018. 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, levelled off from 2013 to 2016, and have fallen slightly since 2016 with the concentration in 2019 the lowest to date.

	Concentration ($\mu g\ m^{-3}$)	Objective	Objective Met?
Annual Average Benzene Concentration: Residential	0.7	5	Yes
Annual Average Benzene Concentration: On Airport	0.7*	5	Yes
*data for 4 of the 12 monthly samples collected on airport show signs of potential cross interference with another VOC compound. However, the overall annual average is in line with previous years.			

Table 3: Annual Average Benzene Concentrations on the Horley Gardens Estate at RB11 and Gatwick Airport (LGW3) in 2019 (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 thirteen 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 2019 for the thirteenth time in 14 years of monitoring (the UK standard was met in 2014), while the EU standard (which is less strict) was met in 2019 (Table 4).

	Number of exceedences.	Standard Met?	
		UK[a]	EU[b]
RG3: Poles Lane Crawley.	22 / 10.7[b]	No	Yes
Standards:			
UK: Daily Max. of running 8 hour mean of 100 µg m^{-3}.	10 max.	-	-
EU: Daily Max. of running 8 hour mean of 120 µg m^{-3} (averaged over 3 years).	25 max.	-	-
[a] in 2019 [b]The EU standard is averaged over 3 years i.e. 2017, 2018, and 2019.			

Table 4: Number of exceedences of the Ozone standard in 2019.

Initial Impact of Covid 19 Lockdown Measures on Air Quality.

39. While the current report focuses on air quality data for 2019, given the significant impact of the Government's lockdown measures on aviation and road traffic and the consequential impact on air quality, some provisional data for nitrogen dioxide pollution for the period 1st April 2020 to 9th May 2020 is presented in Tables 5 and 6 below in addition to data for the same period from 2017 to 2019.

	Residential RG2(6)
2017	20.0
2018	26.2
2019	19.8
2020	9.5
All concentrations are in µg m^{-3}.	

Table 5: Nitrogen Dioxide Concentrations 2017 to 2020 (for the Period 1st April to 9th May).

40. Table 5 shows that the lockdown measures have more than halved nitrogen dioxide concentrations compared to levels in the previous three years, with concentrations at a level normally only seen in more rural areas of the south east. For comparison, elsewhere[10] concentrations have fallen 4 to 6 µg over the same period compared to the 10 µg at RG2(6) seen in Table 5 above.

41. When pollutant concentrations are examined by wind direction (Table 6), nitrogen dioxide levels are typically around 10 µg m^{-3} lower on wind directions not affected by the airport (North, East, and West winds), while Southerly winds from the airport are around 20 µg m^{-3} lower.

	Average 2017 to 2019	2020	% Reduction
North	19.4	9.7	49.8
East	19.8	9.4	52.5
West	20.6	9.7	52.7
South (off airport)	29.7	9.1	69.2
All concentrations are in µg m^{-3}, except reduction (%).			

Table 6: Nitrogen Dioxide Concentrations by Wind Direction 2017 to 2020 (1st April to 9th May).

[10] Honor Oak park & Sevenoaks - provisional data for matched period. The lack of equivalent suburban real time sites outside of London makes comparisons at this stage difficult. Local data will allow a more accurate figure to be calculated for the June '21 report.

Summary.

42. 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 2019 (Table 7), 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 7).

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 a resumption in the downward trend, with the apparent increase 2015 to 2018 due to a 'low' value in 2015, while the long term downward trend at the 'background' site (RG1) continued in 2019. The overall long term decrease in pollution at the background site is most likely due to improvements in road vehicle[11] 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 2019 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 resumption of the downward trend in 2019, after a slight rise in 2018.

vi) The average PM_{10} concentration (VCM / FIDAS measurement) measured on airport in 2019 showed a significant improvement compared to 2018, although this reflected a combination of a genuine improvement also seen of airport and changes in the PM_{10} measurement technique.

	Measured value	Objective	Objective Met?
Nitrogen Dioxide:			
Highest measured annual average residential concentration.	43	40	No
Annual Average nitrogen dioxide concentration Airport monitor.	29.0	40	Yes
PM_{10}:			
Annual Average PM_{10} Concentration: Residential Monitor. (VCM value)	16.7 (15.9)	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. (FIDAS equivalent to VCM value)	14.4	40	Yes
PM_{10}: No. of days over 50 µg m^{-3}: Airport Monitor. (FIDAS equivalent to VCM value)	4	35	Yes
Benzene:			
Residential Benzene Monitor (Site RB 11).	0.7	5	Yes
Ozone:			
RG3 Monitor to SW of Airport (Number of exccedences).	22	10	No
All concentrations are in µg m^{-3}.			

Table 7: Summary of Air Quality in the Vicinity of Gatwick Airport in 2019.

[11] 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.

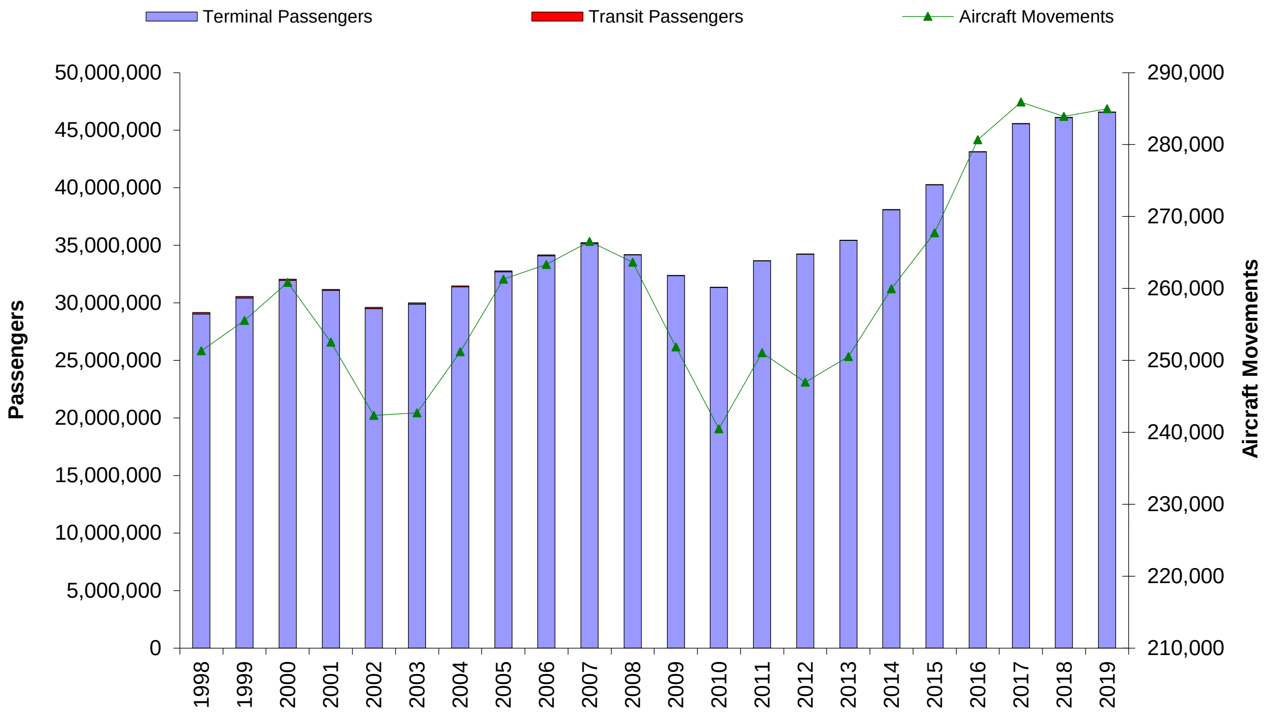


Table A.1: Annual Passenger Numbers and Aircraft Movements at Gatwick Airport.

	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
2017	45,555,837	3,062	45,556,899	285,912
2018	46,081,327	4,762	46,086,089	283,919
2019	46,574,786	1,687	46,576,473	284,987

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 2019.

Nitrogen Dioxide

Site	Parameter	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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	20.2[e]	21.1	20.3	20.4	18.8	19.1
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	26.7[d]	24.9[d]	24.2[d]
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	13.9	15.5	15.1
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]	29.5[c]	29.8[c]	29.0
RB59	Ann. Average (µg m^{-3})	-	-	-	-	40	39	34	37	38	35	32	32	26	32	28	27	25	29	28	27	26
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	98.5	99.1	99.1
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	99.4	98.3	99.2
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	98.6	99.2	97.6
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	99.5	98.9	91.3
RB59	Data Capture (%)	-	-	-	-	91.6	100	91.6	100	100	100	100	100	91.6	100	100	100	100	91.6	100	100	100
RG1	Hours Over 200 µg m^{-3}	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0[b]	0	0	0	0	0
RG2	Hours Over 200 µg m^{-3}	-	-	-	-	-	0	0	0	0	0	0	0	0[b]	0[b]	0	0	0	0	0	0	0
RG3	Hours Over 200 µg m^{-3}	-	-	-	-	-	-	-	0	0	0	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	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	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	2017	2018	2019
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	16.9	17.6	16.7
	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	16.2	17.1	15.9
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]	20.3[c]	20.5[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]	18.5[c]	19.0[c]	14.4[f]
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	98.9	100	98.1
	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	98.9	99.4	98.1
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	100	98.9	99.0	97.8	100	93.0	99.7	94.8	-
	Data Capture VCM** (%)								93.6	93.6	93.4	85.7	97.2	99.5	98.9	99.0	97.8	100	93.0	99.7	94.8	96.1[f]
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	1	0	0
	No. days over 50 µg m^{-3} (VCM)								6	18	5	2	0[b]	9	7	2	4	3[b]	3	2	0	0
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]	3[c]	0[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]	3[c]	1[c]	4[f]

Locations:

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

[d] RG2 site moved 44 m south east of original location at the start of 2017 becoming RG6. Thus data from 2017 on technically not directly comparable to pre 2017 data (see 2018 steering group report for comparison).

[e] 2014 value adjusted from 21.8 to 20.2 based on rescaling of data.

[f] LGW3 TEOM replaced with FIDAS instrument from 2019. For colocation study results see appendix D of 2020 AQ report.

Figure C.1: RG2 minus RG3 when wind on 202 to 248 degrees - Mean of hourly values.

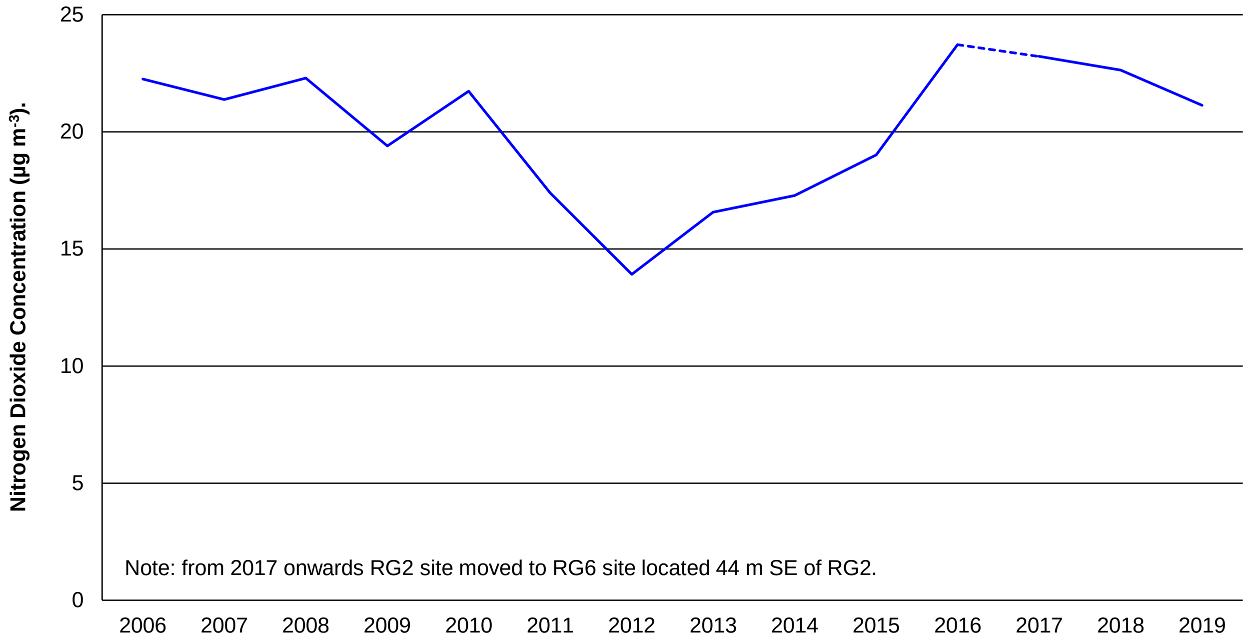


Figure D.1: Comparison of co-located TEOM and FIDAS at LGW3 (19/7/18 to 31/12/18).

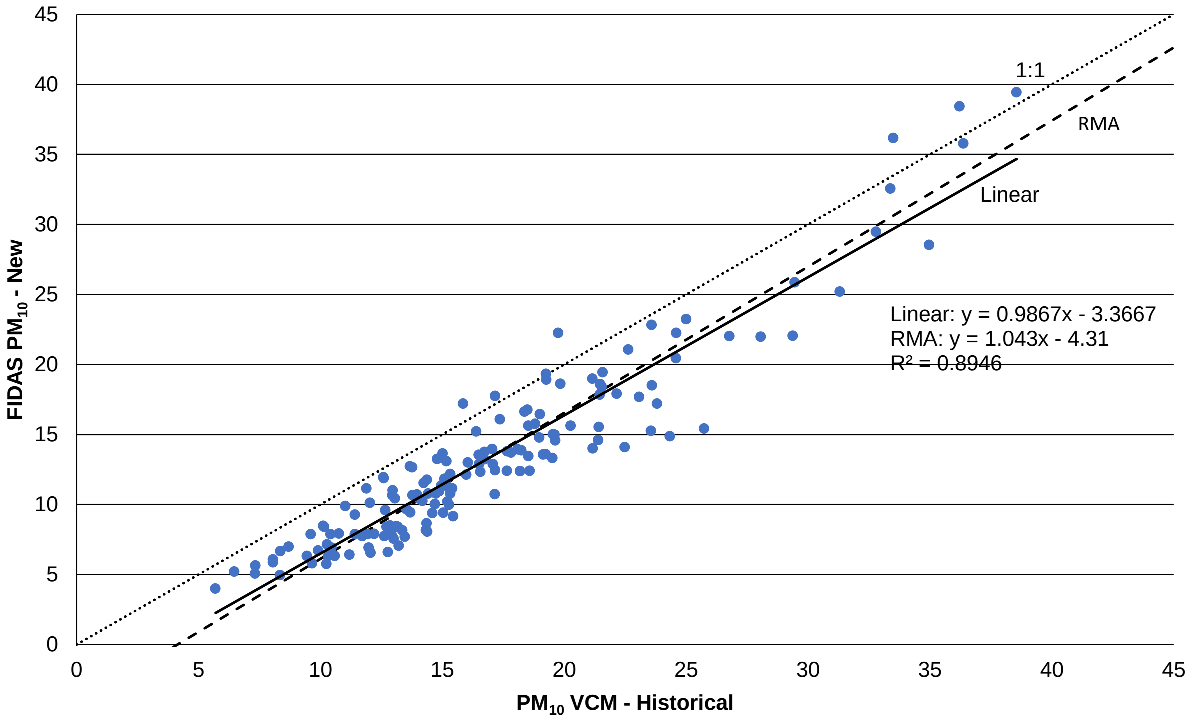


Table D.1: Summary statistics for the Matched Daily data (19th July 2018 to 31st December 2018).

	FIDAS	TEOM (VCM)
count (days)	157	157
max.	39.4	38.6
min.	4.0	5.7
median	12.0	15.3
mean	13.2	16.8
stdev.	6.5	6.3

Abbreviations and Definitions.

AQMA	Air Quality Management Area.
FIDAS	Fine Dust Analysis System. Device for measuring PM_{10} (and $PM_{2.5}$) concentrations in real time using optical light scattering.
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).