Air Quality at Heathrow Airport

Q4 2015 briefing and end of year summary

Background

Heathrow Airport Ltd (HAL) began an air quality monitoring programme in 1993. Today HAL owns and operates one on-airport monitor and three other monitors around the airport. Data from HAL's four continuous monitoring stations, as well as 17 other continuous monitors operated the local authorities and DEFRA in the vicinity of the Airport, are shared and summarised on HeathrowAirwatch.org.uk. Data from the on-airport monitor and the 11 total stations located within 2km of the airport are regularly tracked are reported on within this end of year summary.

Air quality management is a key priority for HAL and we continue to work in partnership with our key stakeholders – especially local authorities and national Government – to reduce emissions from all sources in the area in order to meet the EU & UK limit values. The main pollutants of concern around Heathrow are measured at all stations –nitrogen dioxide (NO_2) and particles (measured as PM_{10} and $PM_{2.5}$).

Headlines

Key information for this quarter is:

- Data for all stations summarised in this report are still provisional and have not yet been ratified through the end of the year
- Annual average for NO_2 remained below the EU limit values at 9 of the 11 monitoring sites within 2km of Heathrow
- Only Hillingdon and Hayes stations remain above EU limits, north of M4 (airport emissions from all sources contribute 16% and 6% of total NOx at these stations, respectively)
- There was one exceedence of the daily average PM_{10} limit value at HAL's LHR2 monitoring site in Q4 2015. 35 exceedences are allowed per year before the limit value is breached for a given station; none of HAL's stations recorded more than five daily exceedences of PM_{10} in 2015
- The number of aircraft movements made by more modern aircraft (CAEP4 and newer) in 2015 was 93.6% and the percentage of the newest aircraft (CAEP8) was 56.8% (see Fig. 3).
- A summary of progress made implementing Heathrow's Blueprint for Reducing Emissions in 2015 presented in Appendix 1.

Measured concentrations

Locations of the air quality monitoring sites around Heathrow

The locations of air quality monitoring sites local to the airport are shown in Fig. 1, which also shows the provisional annual average NO_2 concentrations measured at each site in 2015 overlaid on modelled NO_2 concentrations for 2013. Table 1 provides a summary of each station within 2km of Heathrow's boundary as well as the type of source environment its measurements represent.

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Fig. 1. Provisional 2015 annual average NO2 values at monitoring sites within 2km of Heathrow showing and 2013 modelled concentrations (EU/UK annual average limit value of 40µg/m^3)

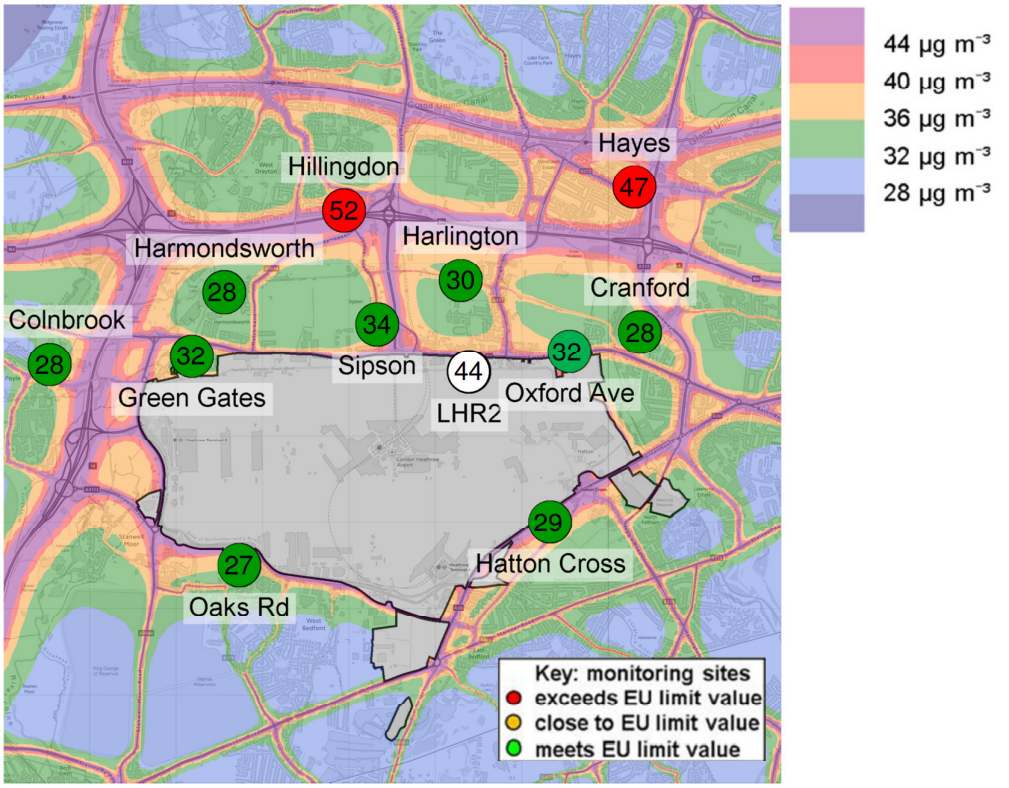


Table 1. Summary of continuous monitoring sites within 2km of Heathrow and provisional results in 2015

Monitoring station	Owner	Source Type	2015 average NO_2 (µg/m^3)	Hourly exceedences NO2 (hours)	PM exceedences (days)
Heathrow LHR2	Heathrow	Airport	44	2	3
Harlington	Heathrow	Urban industrial	30	0	5
Green Gates	Heathrow	Airport	32	0	3
Oaks Road	Heathrow	Airport	27	0	5
London Hillingdon	Defra	Urban background	52	0	N/A
Hayes	Hillingdon	Roadside	47	2	14
Harmondsworth	Hillingdon	Urban background	28	1	4
Oxford Ave	Hillingdon	Urban	32	2	3
Sipson	Hillingdon	Urban background	34	3	N/A
Hatton Cross	Hounslow	Roadside	29	0	1

Cranford	Hounslow	Suburban	28	0	1
Colnbrook	Slough	Urban background	28	0	1

*Annual statistics prior to ratification of data

Nitrogen dioxide (NO_2) monitoring trends (EU/UK annual average limit value of 40µg/m^3)

Fig. 2. Measured annual average NO_2concentrations around Heathrow since 2005 and annual air transport movements (ATMs)

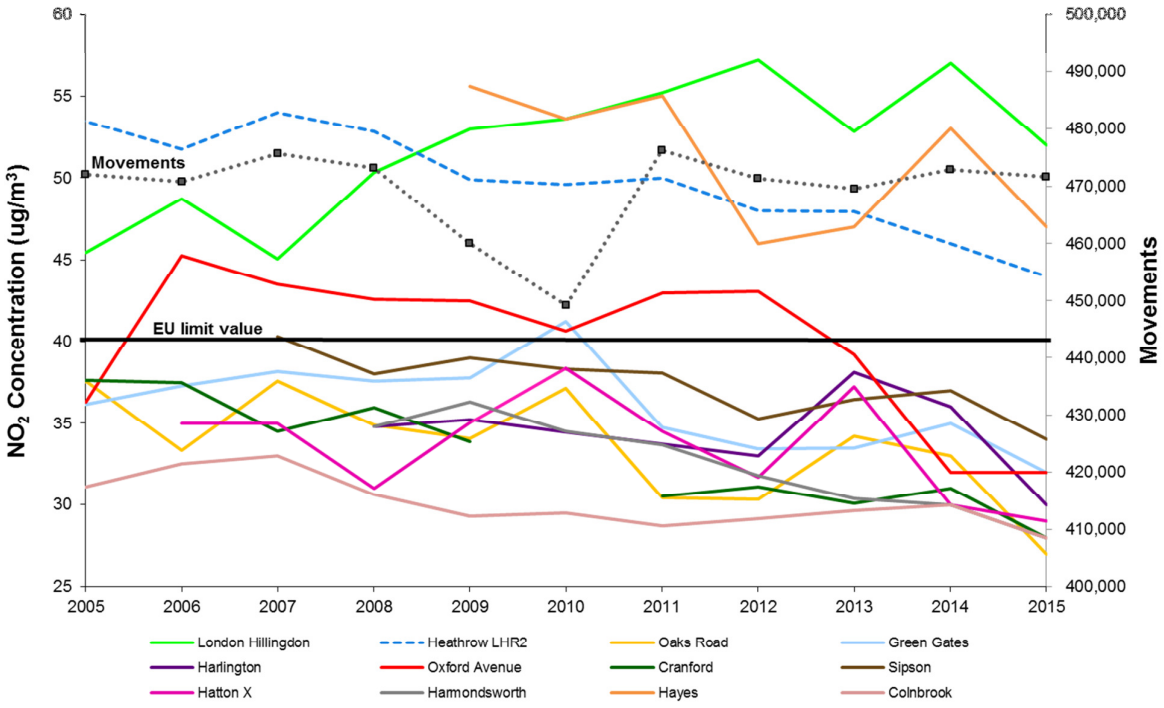


Fig. 2 presents annual average NO_2 measurement trends at sites either on or close to the airport. Key information is:

- Data for 2015 still provisional
- Two sites exceeded the limit value outside of Heathrow:
  - London Hillingdon (light green) is mainly affected by emissions from traffic on the M4. Concentrations have decreased in 2015 to approximately 52 µg/m^3. All airport-related emissions (including airport-related traffic)are approximately 16% of measured NO_X concentrations at this site.
  - Hayes (orange), located 1.9 km to the northeast of the airport, also saw a decrease from 2014 to an annual average of 47 µg/m^3 in 2015. Emissions at Hayes are also dominated by road traffic. Heathrow emissions represent less than 6% of total NOx measured at this site.
- LHR2 (blue dotted line), located on the airport next to the northern runway, has shown a steady decline in concentration since installation in 1993, even though air transport movements (ATMs) have increased over the same period. Annual average NO_2 was 44 µg/m^3 in 2015, the lowest level measured since the site's installation. The EU limit values for ambient air quality are not applicable at LHR2 as members of the pubic do not have access to the site.

Monitoring at HAL sites

NO_2, PM_{10}, and $PM_{2.5}$ are measured at all of HAL's monitoring sites. In addition, ozone is measured at the Harlington station. Data capture rates must be >90% over a calendar year in order to meet national and EU monitoring standards. The daily limit value for PM_{10} is 50µg/m^3 averaged over 24 hours, not to be exceeded on more than 35 days per calendar year. Table 2 provides a summary of measured data capture from HAL's four monitoring sites as well as year-to-date PM_{10} exceedences.

Data capture for NO_2 at the LHR2 monitoring was 89.3% in 2015 due to a power failure at the station that was corrected in Q3. Year-end data capture at HAL's three other monitoring sites remained above 90% for all pollutants monitored.

Table 2. Year to date data capture and daily PM_{10} exceedences at HAL monitoring sites

Monitoring station	NO_2 data capture	PM_{10} data capture	$PM_{2.5}$ data capture	Daily PM_{10} exceedences in Q4 (ytd)
Heathrow LHR2	89.3%	93.4%	93.0%	1 (3)
Harlington	94.9%	99% (75.8%*)	99% (86.12%*)	2 (5)
Green Gates	96.9%	96.7%	96.4%	1 (3)
Oaks Road	98.1%	95.7%	95.4%	1 (5)

*Data capture for PM at Harlington station was over 99% for the FIDAS sensors in 2015. Data capture from the outdated FDMS sensors have also been reported as the station is part of Defra's Automatic Urban and Rural Network (AURN) and Defra still require reporting of the outdated FDMS sensor data in the AURN.

Emission Reduction Efforts

Heathrow has successfully reduced annual ground-based nitrogen oxides (NOx) emissions by 430 tonnes (16%) between 2009 and 2013 as part of our commitment to playing our part in improving local air quality. These reductions have been achieved through a combination of efforts to reduce emissions from every major source, including aircraft, vehicles, and heating.

Blueprint for Reducing Emissions

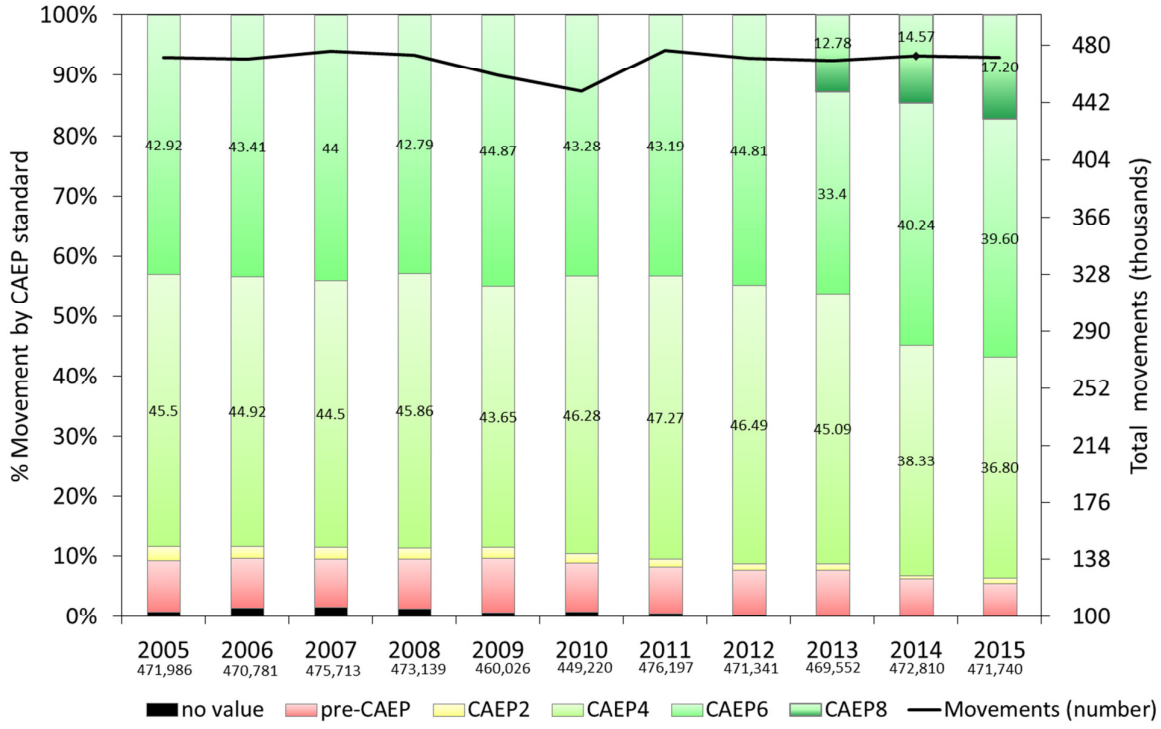
In April, we launched *Heathrow's Blueprint for Reducing Emissions*, a 10 point plan to reduce emissions from all airport sources in 2015. The Blueprint focuses on our four main sources of ground-based NOx: aircraft activity, airport traffic, airside vehicles, and heating. Appendix 1 provides a summary of progress made against the commitments and targets outlined in the Blueprint.

CAEP standard of aircraft movements

Through its Committee on Aviation Environmental Protection (CAEP), the International Civil Aviation Organization (ICAO) sets new emissions standards for aircraft engines – including for NO_x. Engine models which were certified on or after 1 January 2014 must meet CAEP8, the latest standard for NOx.

Fig. 3 shows the proportion aircraft movements at Heathrow based by CAEP standard. The proportion of flights made by newer, cleaner aircraft (CAEP4 or better) through end of 2015 remains at 93.6%, while CAEP6 and newer movements increased to 56.8%. The trend is expected to continue as airlines proceed in replacing their older, higher emission aircraft and Heathrow's NO_x emission landing charges and engagement encourages the use of best-in-class aircraft.

Fig.3. Total aircraft movements since 2005 by CAEP standard



Appendix 1- Heathrow's Blueprint for Reducing Emissions in 2015

Progress Report

Commitment	RAG rating	Commentary
1. Reduce emissions from aircraft at the gate		
Ensure that airlines adhere to the limits we've set on running APUs (on-board generators)	**Green**	89% of aircraft audited complied with APU running time limits against a target of 85%
Encourage airlines to regularly use ground-based air and power with a target to increase usage by 15% in 2015	**Green**	Pre-conditioned air (PCA) and gate power consumption in 2015 is 60% higher than 2014 against a target of 15%
Investigate ways to expand & upgrade our supplies and publish an investment plan by the end of the year	**Green**	We have analysed options to improve PCA coverage and usage at Heathrow. In October 2015, we agreed with airlines to invest £16.2m in upgrading our PCA systems on T2, T3 and T5 from Summer 2016
Compare our performance and standards against other leading airports	**Green**	In Summer 2015 we commissioned Helios the air traffic, airports and aerospace technology consultancy to undertake a benchmarking study into our practices to reduce emissions. The initial findings will be used to update our 2020 Air Quality Strategy and Action Plan due to be published in March 2016
2. Phase out the oldest and dirtiest aircraft		
In 2015, we propose to nearly double our NOx landing fees	**Green**	The NOx element of the total environmental charge is increasing from 15% to 20% with the price per kg of NOx increasing from £8.57 to £16.51. Following consultation with airlines the new charges will be implemented in January 2017
Work at a senior level with our airline partners to encourage an earlier phase-out of older aircraft	**Green**	CEO-level discussions between Heathrow, British Airways and Virgin Atlantic have taken place on the Emissions Blueprint and its ambition and requirements. Progress reports have been submitted and calls to action to the Heathrow Leadership Group and Heathrow Airport Operational Stakeholder Boards. The proportion of aircraft meeting the best international emissions standard (ICAO CAEP 8) at Heathrow grew by 1.5% 2013-2014 and even more new aircraft were introduced in 2015 - results will be published in Quarter 1 2016

Commitment	RAG rating	Commentary
Add the international NOx standards to our quarterly Fly Quiet league table to create a single comparison table for airline performance on noise and emissions	**Amber**	We have analysed a range of emissions-related measures for inclusion in the Fly Quiet League Table from 2016. We are currently consulting airlines on our plans for reporting and will introduce the agreed emissions measure in early 2016 in parallel with a revised Fly Quiet Programme timeline
3. Improve taxiing efficiency		
Work with NATS to record the frequency and effectiveness of reduced-engine taxiing	**Green**	During 2015 we introduced a new automatic measure of the use of reduced-engine taxiing (RET) on departure in our air traffic control tower (about 25% of eligible departures currently report use of reduced-engine taxiing). We have a plan in place to monitor RET on arrival by the end of Quarter 1 2016
Increase the frequency of reduced-engine taxiing (RET)	**Green**	There has been a marginal improvement in use of RET on departure over the year but reporting is currently inconsistent - more work will be done to make it easier for pilots to report when they're using RET
Upgrading taxiways to maximise efficiency	**Green**	Rapid exit taxiway on 27L for A380s has been completed. Works are ongoing for Bravo taxiway
Investigate other approaches such as aircraft tugs that tow aircraft to the runway	**Green**	During 2015 we undertook a detailed study into the use of "Taxibot" - a semi-robotic, pilot-controlled towing tractor that tows the aircraft close to the take off point without running engines so significantly reducing emissions on the airfield. While space constraints at Heathrow currently mean Taxibot isn't able to be immediately implemented, we are considering its use in the future. We are also working with airlines investigating the use of electric taxiing systems built into the aircraft nose wheel
4. Provide more and better electric vehicle charging points		
In 2015, maintain the existing electric charging infrastructure in our short stay car parks	**Green**	21 charging points currently installed. Electricity is provided free of charge. In 2015, 13 electric vehicle points were upgraded in Terminal 2 short stay car park. Monthly reporting shows increases in usage since October

Commitment	RAG rating	Commentary
Look for best way to introduce points for our taxi feeder, long-stay passenger and colleague car parks	**Amber**	Talks have started with TfL to investigate using the Heathrow Taxi Feeder Park as a trial site for electric hybrid taxi charging (all newly registered black taxis from 2018 need to be "zero emission capable"). Charging in colleague car parks will be looked at in 2016, especially as incentives to shift to electric vehicles will be offered (see below). Long stay car parking demand for charging points will be reviewed in 2016
5. Incentivise low emission vehicles		
Develop incentive schemes for low or zero emission buses, coaches and taxis. Measures to include lower fees for better performing vehicles and priority to hybrid or electric taxis in our taxi feeder park	**Amber**	Discussions with partners are at an early stage with a trial planned in one of our coach parks. Proposals for an incentive scheme and measures as identified here have yet to be worked up
Explore priority queuing for taxis vs weighted fee in feeder park	**Amber**	Priority is given to taxis using Compressed Natural Gas (CNG) in the taxi feeder park. More work to be done here working with TfL
Review colleague incentive schemes to encourage low & zero emission cars for commuting	**Green**	Salary sacrifice scheme has been developed for Heathrow Airport Limited colleagues that incentivises ultra low emission vehicles and will be promoted and rolled-out in 2016
6. Work with partners to set up emission zones and standards		
Work with local partners to champion a joint approach to reducing emissions from road traffic in the Heathrow area. Potentially establish emissions standards for Heathrow buses and coaches aligned with the GLA's ULEZ (Ultra Low Emission Zone).	**Amber**	Work is ongoing with local partners through the Heathrow Air Quality Working Group and Heathrow Area Transport Forum
Work with bus and coach operators to increase the number of hybrid buses	**Amber**	Extensive discussions with the Heathrow Airport Transport Forum and TfL are ongoing, but in 2015 no additional hybrid buses were added to those provided in 2014
Explore establishing a geofence around Heathrow that forces hybrid vehicles to operate in electric-only mode	**Amber**	We will be observing the upcoming TfL trial of geofencing for the route 69 bus at Millbrook vehicle testing centre and then on the road first before introducing trials at Heathrow
7. Reduce emissions from our own fleet		

Commitment	RAG rating	Commentary
More than 400 companies operate around 8,500 vehicles airside at Heathrow. In 2015 review entire fleet to help plan ahead: by 2020 every car or van Heathrow Airport Limited (HAL) own or lease will be electric	**Green**	A plan is in place and being implemented to replace the current HAL fleet with electric vehicles. An initial delivery of Nissan Leaf and electric Mitsubishi vehicles were received in 2015
8. Pool vehicles to reduce numbers and emissions		
In 2015 continue pooling trials and, by the end of the year, put a contract out to tender for a single supplier of pooled equipment. Wherever practical, specify that pooled equipment should be electric	**Green**	The tender process started in 2015 as planned and is ongoing
By the end of 2015, all airside vehicles will carry tracking devices to give the airport community the data it needs to reduce vehicle numbers, emissions and costs	**Amber**	Well in train and will be completed by end Q2. 70% of companies operating vehicles airside have now installed telematics with the remainder booked in to be fitted in the first half of 2016
Start planning for the introduction by 2025 of an airside emissions zone aligned with the GLA's Ultra Low Emission Zone	**Amber**	We have developed a plan that will include engagement with airside vehicle operators throughout 2016
9. Lead the move to electric vehicles airside		
In 2015, increase investment in airside electric-charging infrastructure.	**Green**	In 2015, invested £200k in five airside charging points including one rapid charging point. £2m investment for 135 charging points approved for installation in 2016
Run trials to generate data on the costs and operational needs of a range of electric vehicles and charging facilities.	**Green**	Trials are underway with a range of airside vehicle operators and vehicle types, including ground support equipment
Look at how we can favour cleaner vehicles by adapting the pricing structure for airside vehicle passes	**Amber**	In plan for 2016
How we can insist on electric vehicles when we contract for airside bussing services	**Amber**	Met with BYD (electric bus manufacturer) and investigating how we can trial one of their full battery electric buses at Heathrow. Visited Schipol Airport to understand the operational challenges of and best practice for operating a full battery electric bus fleet at an airport; now assessing the operational suitability of electric for our

Commitment	RAG rating	Commentary
		construction worker buses
10. Modernise our heating supply		
Increases to biomass capacity already in the pipeline. Until that happens, wind down operations in one of our oldest boiler houses and replace it with low-NOx boilers	**Green**	We have turned off one of our oldest high temperature hot water and heating boilers in the Central Terminal Area while we analyse the cost benefit of connecting this area to the Heathrow Biomass Energy Centre
Upgrade Terminal 5 boilers with the same low-NOx technology	**Green**	We have fitted one of the main boilers at T5 with low-NOx burner technology and now have plans to install this on the other two boilers